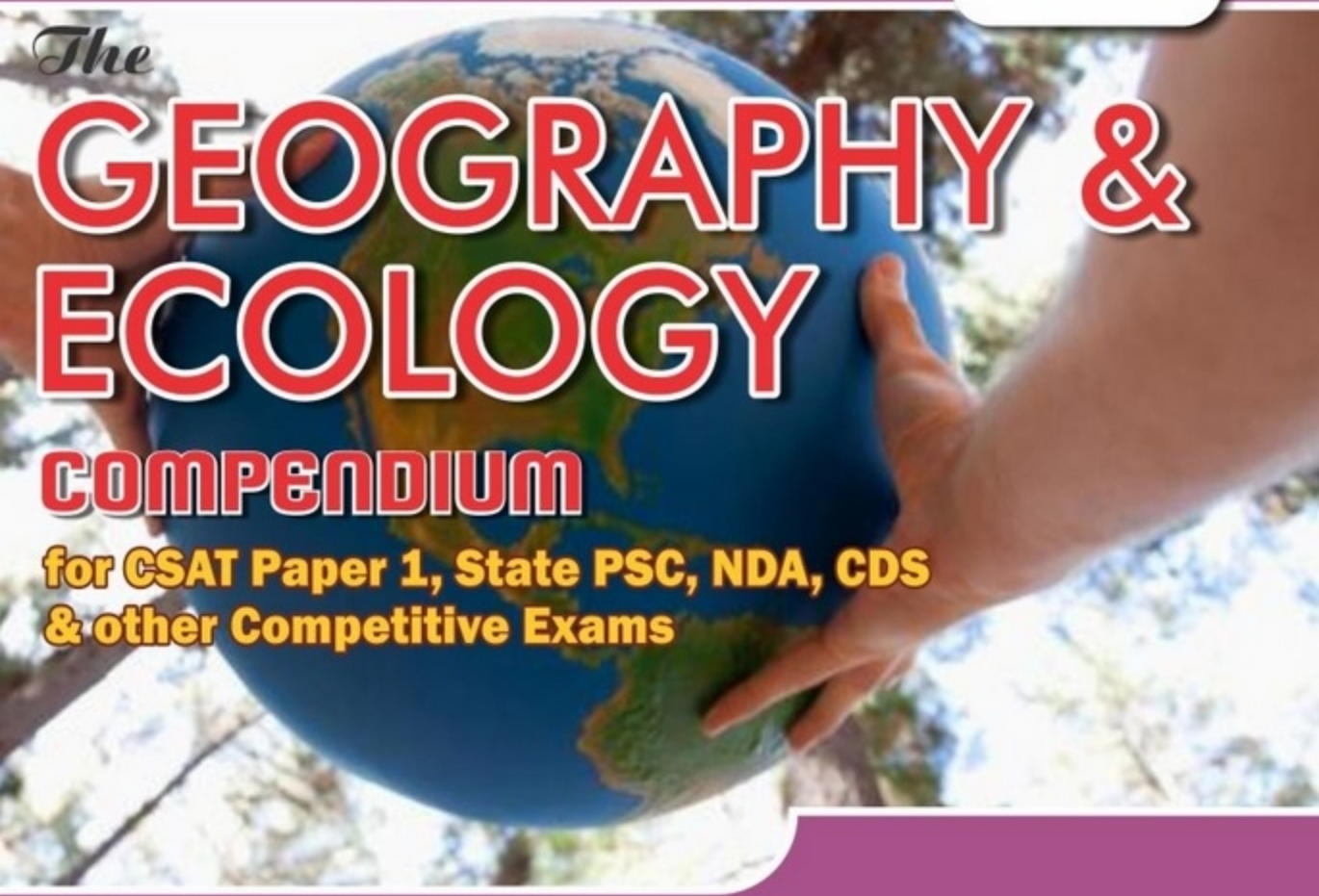
disha
Nurturing Ambitions



The

GEOGRAPHY & ECOLOGY

COMPENDIUM

for CSAT Paper 1, State PSC, NDA, CDS & other Competitive Exams

Covers :

- Nature And Scope
- Universe And Our Planet Earth
- Hydrosphere
- Atmosphere
- World Geography (Physical, Social and Economics Aspect)
- Physiography And Drainage Pattern Of India
- Soil, Nature Vegetation, Wildlife And Agriculture Of India
- Mineral Resource, Industries Population Multipurpose Projects of India
- Ecology and Environment Bio-Diversity
- Environmental Issues

- Latest Pattern
- INFOGRAPHICS
- **13** Chapters
- **26** Exercises
- **1300+** MCQs (Direct & Statement Based)
- 100% Syllabus Coverage

disha
Nurturing Ambitions

The

Geography and Ecology

Compendium

- **Head Office :** B-32, Shivalik Main Road, Malviya Nagar, New Delhi-110017
- **Sales Office :** B-48, Shivalik Main Road, Malviya Nagar, New Delhi-110017
  Tel. : 011-26691021 / 26691713

Typeset by Disha DTP Team

For further information about the books from DISHA,

Log on to **www.dishapublication.com** or email to **info@dishapublication.com**

CONTENTS

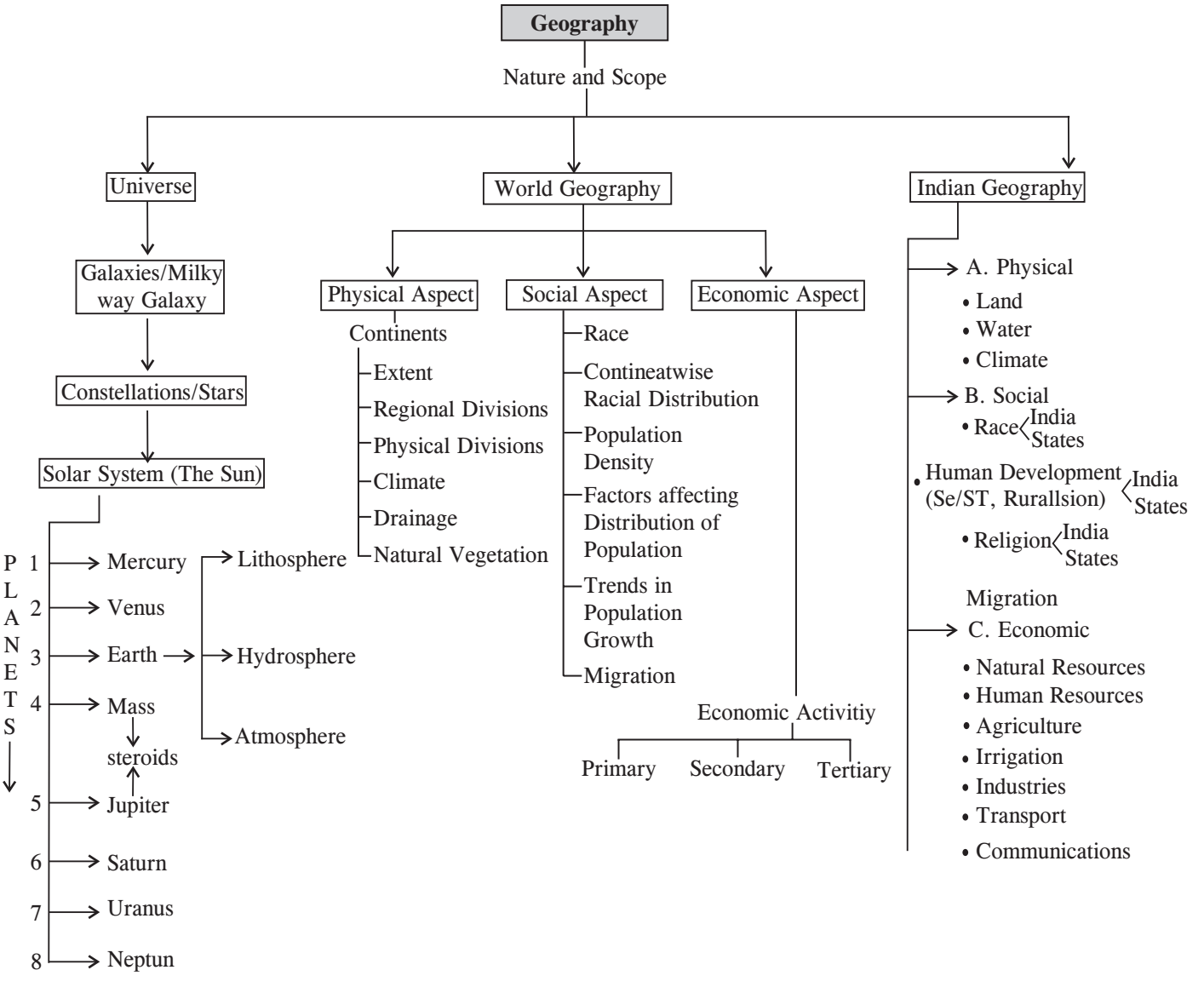
GEOGRAPHY

ECOLOGY AND ENVIRONMENT

GEOGRAPHY

1 Chapter

NATURE AND SCOPE



GEOGRAPHY

Geography is that branch of knowledge which links the study of natural world to that of society. It is the frame work of various fields of study which cover origin and development of universe, land scapes and its natural environment and pressure created over them, the global and local changes in the world and how and upto what extent the society is contributing in these changes. In this section we are going to cover all these above mentioned aspects in details.

Greek Scholar Eratosthenes is first man to discuss about Geography. It's the combination of two greek words and Geo means earth and graphy" means write. Thus geography means to write about the Earth or "earth descriptions".

Various other geographers defined Geography as follows:

In Classical Period

(i) Pythagoras, a great Greek philosopher and mathematician, was the first to say that the Earth is spherical and revolves around the sun.

(ii) Herodotus Greek historian is known as the "Father of history". He explained the deposition of silt in the Nile delta.

(iii) Aristotle (384 - 322 B.C.) another Greek philosopher explained the eclipses.

(iv) Eratosthenes (276 - 194 B.C) a Greek poet, mathematician observing the angle of the noon day Sun at Syene and at Alexandria.

(v) Hipparchus (190 - 120 B.C.) was perhaps the greatest of the Greek astronomers.

(vi) Ptolemy (2^{nd} century A.D.). He wrote the book 'Geography' and he described system of latitudes and longitudes. He was a cartographer and he evolved the science of map-making.

Modern Geography

1. Bernhardus Varenius (1622-1650) first recognised the need for organisation of geographical knowledge. He wrote Geographia Generalis, the most highly regarded treatise on geography for more than a century into two - part - general (now called systematic) and special (also called regional) which identified regions according to the interactions between human and environmental processes.
2. Immanual Kant (1724-1804) was also a German philosopher, is considered by many to be one of most influential thinkers of modern times. He tried to find a foundation for geography within the framework of other science. According to him, all knowledge can be organised into three groups according to the object of study.
3. Baron Alexander Von Humboldt (1769-1859) a German naturalist and explorer, moulded the substance of geography into a scientific form. He was interested in all aspects of natural history and has been described by Charles Darwin as "the greatest scientific traveller that ever lived".

   * He invented the "isotherms" to compare temperatures.
4. Carl Ritter (1779-1859) A German geographer is considered the founder of modern geographic study. He stressed the importance of using all the sciences in the study of geography.

   His most important work Die Erdkunde (Earth Science) emphasized the influence of physical environment on human activity. He divided the Earth into natural regions and showed each unit as a whole interrelated complex of elements. His plan of study became the model for regional study and presentation.
5. Ellsworth Huntington (1876-1947), an American geographer and explorer, was noted particularly for his study of the effects of climate on human heredity and civilization. The human aspect was neglected to a great extent. His approach to geographic study is known as determinism in which humans are passive agents while the physical environment is active.
6. Vidal de la Blache advocated the opposite theory of determinism, which is sometimes known as possiblism, in which humans are active agents, at liberty to choose between a wide range in environmental possibilities.

Branches of Geography

During the 20^{th} century, more attention has been paid to systematic studies of geographical data. Phenomena have combined to make geography one of the first disciplines to fulfil a bridging function between the natural and social science. As a result, the branches of geographical inquiry fall into three major areas, studies associated with the regional concept, the major systematic branches of human geography, and physical geography.

Physical Geography

This is the most important branch of geography. The superstructure of the discipline of geography is built upon it. It studies relief, soil and structure of the Earth.

It is divided into a number of branches making the subject matter of geography more comprehensive.

(i) **Geomorphology** studies the Earth's structure, the rocks that make up the Earth, relief features like mountains and plains and their evolution.

(ii) **Geology** is the science of the study of rocks, and is helpful in the study of glaciers.

(iii) **Glaciology** is concerned with the study of glaciers.

(iv) **Seismology** is the study of earthquakes and their bearings on the internal structure of the Earth.

(v) **Hydrology** is the study of the characteristics of rivers, lakes fluvial morphology, fluctuation of water table and underground water resources, development and change of coastal features.

(vi) **Oceanography** is the branch of hydrology. It is the study of the ocean, tides waves and the ocean floor.

(vii) **Climatology** studies the causes and distribution of temperature and winds, rainfall and runoff weather and climate.

(viii) **Pedology** is the study of soil science. Soil, which is formed due to the result of complex physical and chemical reaction of parent rock materials, needs the support of other sciences like chemistry, geology and biology.

(ix) **Biogeography** studies the distribution of flora (plant) and fauna (animal) in different parts of the world.

(x) **Paleography** is the study of physical geography in the past geological ages. It studies the distribution of land and sea through successive geological times.

Human Geography

Human geography, also known as a branch of the modern geography, deals with the evolution of human beings i.e, changing distribution and spacial organsation of a variety of human characteristics, ranging form great urban centres built by man to geographical diffusion of specific technical innovations in agriculture. By applying geographical methods and techniques of analysis to such feature the knowledge accumulated in other social studies - history, politics, economics, and sociology - may be seen in a new light and often extended considerably. It is accepted that it is not the physical environment alone that determines human ability to make the best use of the natural sources.

It is divided into following sub fields to make the study more comprehensive :

(i) **Economic Geography :** It deals with man's activities in improving his material through economic production, exchange distribution and consumption of useful goods and services, that human groups and their members need.

(ii) **Cultural Geography :** This is also known as social geography. It deals with the cultural aspects of human's habitat, clothing, food, shelter, skills, tools, language, religions, social organisation and his outlook.

(iii) **Historical Geography :** It describes geographical picture of a region or area. It gives us important clues in understanding of the regions as it is viewed at present.

(iv) **Anthrogeography :** Discuses the distribution of human communities on the Earth in contence of their geographical environment.

(v) **Demography :** Studies the different aspects of population like birth rate, death rate, age composition. It also deals with the socio-economic composition of the population and sex composition.

(vi) **Settlement Geography :** It studies about the size, form and function of settlement of human beings and define their historic growth.

(vii) **Agricultural Geography :** Studies about farms and farming systems have developed in particular areas and how they are different or similar too the farms and farming systems of other areas.

(viii) **Urban Geography :** Study of urban Geography is based on the concepts of location interaction and accessibility as well as distribution and movements of populations.

(ix) **Political Geography :** In study about the government states and countries. It studies human social activities which is concerned to the location and boundaries of cities, nations and groups of nations.

Systematic and Regional Geography

Systematic Geography

Systematic Geography, we choose any geographical factor and study its distribution for the whole world. Relief, drainage, climate, vegetation, soil, minerals wealth, agriculture, industry, transport, trade and commerce and population are some of the important geographical elements. These elements are studied separately with reference to a particular area. This method of studying geography is also known as 'Topical approach'. This is known as General Geography also.

Regional Geography

Regional Geography area as a whole first aims at identifying geographical factors or components of any area. Regional geography helps us in identifying the region. For example, if we take Ganga plain, Chhota Nagpur Platiau. or Assam Velley, rather than taking whole of India and study their location, relief, drainage, climate, soils, vegetation mineral wealth, agriculture, industry, transport, trade, population. In regional geography, the main emphasis is on the region.

Advantages of Regional Geography

(i) Study becomes easy and effective.

(ii) Basic principle becomes easy to understand.

(iii) It describes relation between man and environment.

(iv) We come to know the economic disparities among various regions.

(v) The study is intense because the area is limited.

The above discussion makes it clear that both systematic and regional geography are essential to comprehend the geographical knowledge.

Features of Systematic Geography

- Systematic geography studies a particular element over the earth or a part thereof.
- It presents an the integrated form of the area. It is based on political units.
- The study presents the facts about any particular region on the earth surface.
- In the systematic, study types and sub-types are determined on one particular factor.
- It presents isolated form of the area, and it is based on geographical units.
- This study examines the man-environment relationship.

Cartography

It is the science and art of drawing maps and charts on selected scale.

Mathematical Geography

It is almost similar of maps and interpretation and also describes statical data.

Remote Sensing and Geographic Information System (GIS)

The techniques of remote sensing and GIS plays an important role in the study of geographic problems.

Exercise -1

1. Who was the first man to discuss about geography?
   (a) Pythagoras (b) Eratosthenes
   (c) Aristotle (d) None of these
2. Who was the first man to say that the Earth is spherical and revolves around the sun?
   (a) Aristotle (b) Hipparchus
   (c) Pythagoras (d) None of these
3. Which of these was great astronomer?
   (a) Hipparchus (b) Herodotus
   (c) Ptolemy (d) Carl Ritter
4. Who wrote 'Geographia Generalis'?
   (a) Ptolemy (b) Bernhardus Varenius
   (c) Herodotus (d) None of these
5. Who is considered the founder of modern geographic study?
   (a) Humboldt (b) Hipparchus
   (c) Carl Ritter (d) None of these
6. Who invented the Isotherms?
   (a) Pythagoras (b) Homboldt
   (c) Aristotle (d) Herodotus
7. Who advocated the opposite theory of determinism?
   (a) Vidal de la Blache (b) Huntington
   (c) Ptolemy (d) None of these
8. The study of earth's structure and the rocks that make up the earth is called
   (a) Geology (b) Glaciology
   (c) Hydrology (d) Geomorphology
9. The study of earthquakes and their bearings on the internal structure of the Earth is called
   (a) Glaciology (b) Seismology
   (c) Geology (d) None of these
10. The study of soil science is called
    (a) Climatology (b) Geology
    (c) Pedology (d) Biogeography
11. Oceanography is the branch of
    (a) Geomorphology (b) Geology
    (c) Hydrology (d) Pedology
12. Human geography is also known as
    (a) Economic geography
    (b) Demography
    (c) Urban geography
    (d) Cultural geography
13. The study of physical geography in the past geological ages is called
    (a) Biogeography (b) Paleography
    (c) Climatology (d) Geology
14. The science and art of drawing maps and charts on selected scale is called
    (a) Hydrology (b) Geology
    (c) Pedology (d) Cartography
15. The approach of 'Determinism' is related with
    (a) Huntington (b) Aristotle
    (c) Herodotus (d) Hipparchus
16. The study of the distribution of human communities on the Earth in contence of their geographical environment is called
    (a) Biogeography (b) Paleography
    (c) Anthropogeography (d) Climatology
17. Who wrote the five volume book 'Kosmos'?
    (a) Pythagoras (b) Humboldt
    (c) Carl Ritter (d) Aristotle
18. Who evolved the science of map making?
    (a) Ptolemy (b) Hipparchus
    (c) Herodotus (d) Huntington
19. Who wrote the book 'Geography'?
    (a) Carl Ritter (b) Blanche
    (c) Ptolemy (d) Humboldt
20. The study of the atmosphere that focuses on weather process and forcasting is called
    (a) Biogeography (b) Glaciology
    (c) Meteorology (d) Hydrology
21. Chain of roughly adjacent metropolitan areas are called
    (a) Global city (b) Megalopolis
    (c) Metropolis (d) None of these
22. General geography was written by
    (a) Bernhardus Varenius (b) Ptolemy
    (c) Blanche (d) None of these
23. Select the correct sequence in the chronological order of the following Greeks who have contributed vastly to the evolution of geographical thought during the ancient period:
    (a) Aristotle-Eratosthenes-Anaximander-Ptolemy
    (b) Eratosthenes-Anaximander-Ptolemy-Aristotle
    (c) Anaximander-Aristotle-Eratosthenes-Ptolemy
    (d) Ptolemy-Anaximander-Aristotle-Eratosthenes
24. Which one of the following is a key concept in humanistic geography?
    (a) Development and quality of life
    (b) Spatial location
    (c) Spatial concentration
    (d) Geographical distribution
25. Which one of the following scholars was the first to divide the world landmass into three continents : Europe, Asia and Libya (Africa) ? :
    (a) Anaximander (b) Hecataeus
    (c) Herodotus (d) Eratosthenes
26. An early statement of Geography as Chorology was provided by
    (a) Kant (b) Humboldt
    (c) Ritter (d) Varenius
27. Ratzel's work was based on the concept
    (a) There is a dichotomy between physical and cultural aspects of geography
    (b) Geography is a scientific discipline
    (c) Physical environment controlled human activities
    (d) Geography is necessarily descriptive

28. Huntington is noted for describing
    (a) man as a product of the earth's surface
    (b) the evolution of landforms
    (c) the effects of climate on human life
    (d) the historical-ecological study of the cultural landscape
29. The behavioural environment is meant by
    (a) reality as it exists in nature
    (b) the decisions based on reasoned thought
    (c) man's behaviour as a function of the environment
    (d) reality as is perceived by individuals]
30. Which one of the following concepts is associated with Vidal de La Blache?
    (a) Determinism
    (b) Possibilism
    (c) Environmentalism
    (d) Probabilism

Exercise -2

Statement Based MCQ

1. With reference to the sub-tropical high pressure belt, consider the following statements
    1. It is affected by Earth's rotation and descent of winds from higher altitudes
    2. It dynamically induced and characterized with anti-cyclonic conditions. Which of the statement/ statements given above is/are correct
    (a) 1 only (b) 2 only
    (c) Both 1 and 2 (d) Neither 1 nor 2
2. Consider the following rivers :
    1. Barak 2. Lohit
    3. Subansiri
    Which of the above flows/flow through Arunachal Pradesh?
    (a) 1 only (b) 2 and 3 only
    (c) 1 and 3 only (d) 1, 2 and 3
3. With reference to 'Changpa' community of India, consider the following statements :
    1. They live mainly in the State of Uttarakhand.
    2. They rear the Pashmina goats that yield a fine wool.
    3. They are kept in the category of Scheduled Tribes.
    Which of the statements given above is/are correct?
    (a) 1 only (b) 2 and 3 only
    (c) 3 only (d) 1, 2 and 3
4. Assertion (A): In contemporary geography, there is an increasing awareness of the need for an interdisciplinary approach to the regional problems.
    Reason (R): Groups of scholars with diverse backgrounds and skills focus on specific sets of regional problems more comprehensively and scientifically.
    (a) Both A and R are individually true and R is the correct explanation of A
    (b) Both A and R are individually true but R is not the correct explanation of A
    (c) A is true but R is false
    (d) A is false but R is true
5. Consider the following statements:
    1. Human Geography covers all those aspects of Geography which are not directly concerned with Physical Geography.
    2. Human Geography is the study of interrelationship between human beings and their environment.
    3. Human Geography deals with the description and explanation of human phenomena around the variable earth surface.
    4. Human Geography does not cover technical matters of Cartography.
    Which of the above statements are correct?
    (a) 1 and 2 (b) 2 and 3
    (c) Only 3 (d) 1,2,3 & 4

Hints and Explanations

EXERCISE-1

1	(b)	2	(c)	3	(b)	4	(b)	5	(c)
6	(b)	7	(a)	8	(d)	9	(b)	10	(c)
11	(c)	12	(d)	13	(b)	14	(d)	15	(a)
16	(c)	17	(b)	18	(a)	19	(c)	20	(c)
21	(b)	22	(a)	23.	(b)	24.	(a)	25.	(c)
26.	(b)	27.	(c)	28.	(c)	29.	(a)	30.	(b)

EXERCISE-2

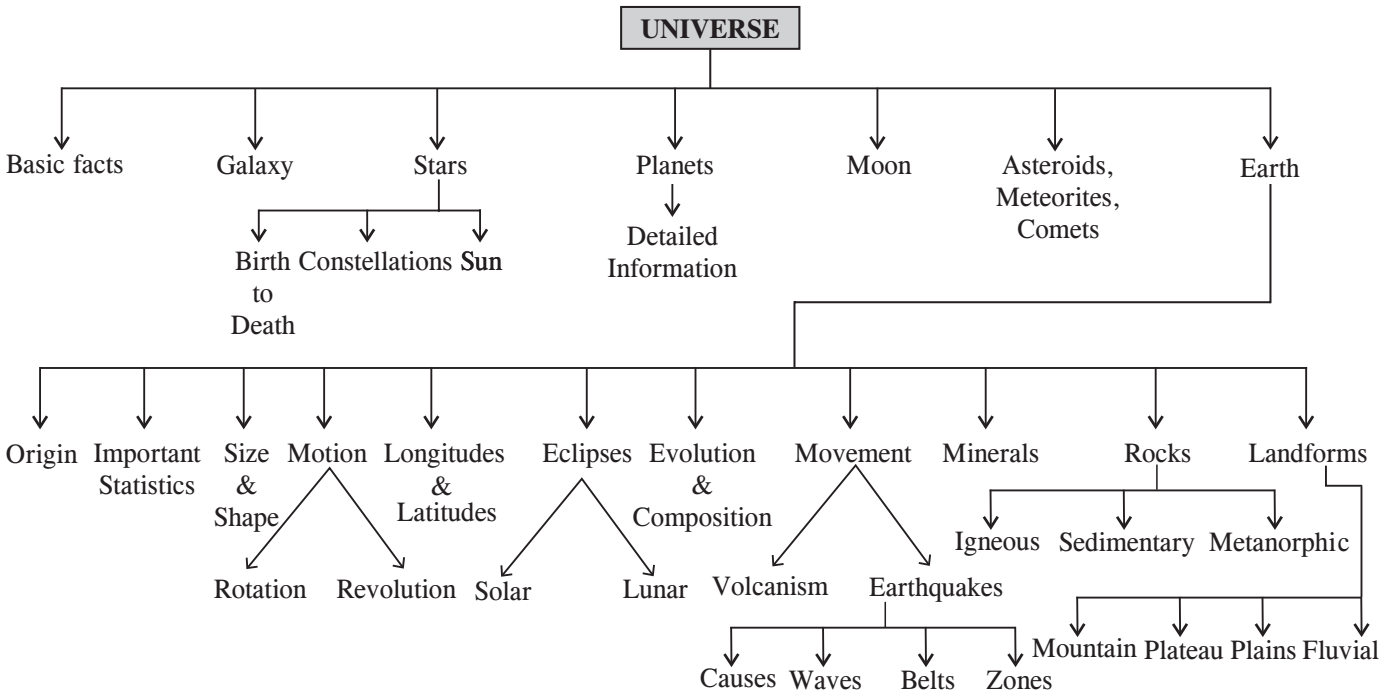
1. (c)
2. (b) Rivers Lohit and Subansiri flow through Arunachal Pradesh. River Barak flows in south Assam.
3. (b) The Changpa are a semi-nomadic Tibetan ethnic group found mainly in Zanskar region of Jammu and Kashmir. They rear the Pashmina goats that yield a fine wool. They are kept inthe category of Scheduled Tribes.
4. (a) 5. (c)

2 Chapter

UNIVERSE AND OUR PLANET EARTH

Introduction

Astronomy is a science that asks fundamental questions about the very basic of things, the universe. The **Universe** is all of time and space and its contents. The Universe includes planets, stars galaxies, the contents of intergalactic space, the smallest subatomic particles, and all matter and energy. The observable universe is about 28 billion parsecs (91 billion light-years) in diameter at the present time. The size of the whole Universe is not known and may be either finite or infinite. Observations and the development of physical theories have led to inferences about the composition and evolution of the Universe.



UNIVERSE

- Everything that exists, from the Galactic Megaclusters to the tiniest subatomic particles, comprises the **Universe**.
- As for the **age of Universe**, scientists agree that it is about 13.79 billion years old as 2015.
- The universe comprises of a number of galaxies.
- Optical and radio telescope studies indicate the existence of about 100 billion galaxies in the visible universe.
- The Big Bang Theory is most accepted for the origin of Universe in comparison to the Steady State and the Pulsating Universe Theory.

GALAXY

- Galaxy is a collection of millions or billions of stars and planets that are held together by gravitational pull.
- Milky Way is one such galaxy. The earth lies in this galaxy. It is called Milky Way, because it looks like a river of milky light flowing from one corner to another of the sky.
- It is spiral in shape.
- We call it Akash Ganga.
- The nearest galaxy to Milky Way is *Andromeda*. Andromeda is a *spiral galaxy* and approximately 2.5 million light-years from the earth.

STARS

- Luminous heavenly bodies which have their own light and other radiant energy are called star.
- They are made of extremely hot burning gases.
- **Star reflects Looks -** *Red* with low temperature, *Yellow* with higher and *blue* with very high temperature.

Star (Birth to Death)

- Star starts its life as clouds of dust and gas known as *Nebula*.
- The gaseous matter of Nebula further contracts to make dense region named *Proto Star*.
- The Proto Star further condenses to a critical stage of mass where *nuclear fusion* begins and *star* finally comes into existence.
- When all the *hydrogens* of a star are used up then its *helium* begins fusing into *carbon*. At a stage helium's fusion and energy production inside the star stops. As a result stars core contracts under its own weight to a very high density to make a white Dwarf star.
- White Dwarf star becomes *dark balls of matter* on cooling to make *Black Dwarf Star*.
- The mass of white Dwarf Star is less than 1.44 times the mass of the Sun named as *Chandrasekhar Limiting Mass*.
- White Dwarf Star is a dead star because of the end of fusion reaction and energy production.
- It shines by radiating its stored heat.
- Giant star expands into Red Supergiant after consuming its fuel (H & He). At a stage, it explodes as *Supernova* or changes into *Neutron* or *Black Holes*.
- The nearest star to the Earth is the Sun followed by Proxima and Alpha Centauri and radiant energy. (4.35 light years)

Constellations

- A *Constellation* is a group of stars that makes an imaginary shape in the sky at night.
- It helps in navigation of sea vessel during night as they are seen in a fixed direction at a particular period of time in a year.
- Orian, Big Dipper, Great Bear, Cassiopeia are some examples of constellations.
- Orion or Mriga can be seen in the late evening during winter; Cassiopeia in the Northern Sky is seen during winter.
- Great Bear consists of Ussa Minor (Laghu Saptarishi) and Ussa Major (Vrihat Saptarishi), and can be seen in early night during summer.

Sun

- It is a star made up of extremely hot gases, particularly by hydrogen (70%), Helium (26.5%) and others (3.5%) gases.
- It is 109 times bigger than the earth and weighs 2×10^{27} tonnes, and accounts for 99.83% of mass of the solar system.
- It is 150 million km away from the earth. The sun light takes 8 minutes to reach the earth's surface.
- It has immense gravitational pull which keeps the planets fixed in their orbit, revolving round the sun.
- It continuously gives off energy in the form of visible light, infra red, ultra violet, X-rays, gamma rays, radio waves and plasma gas.
- The period of revolution of the sun around the galactic centre is 250 million year. This period is called as *cosmic or galactic year*.
- Sudden flash of brightness observed near the sun's surface which is a collection of magnetic energy including electrons, protons and nuclei is called as *solar flares*. They are consized particles and are harmful for satellite communication.
- The layers of sun are divided according to their brightness level which is represented in the write features of each layer shown in the figure.

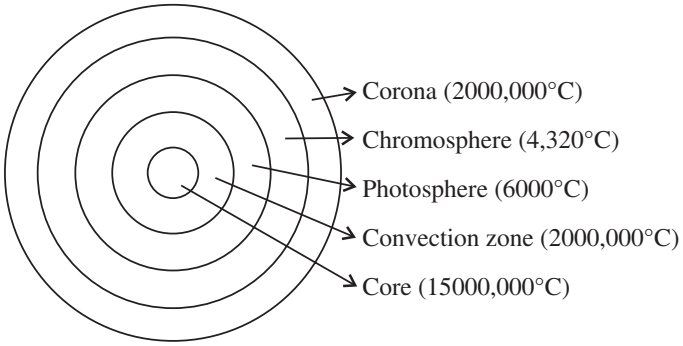


Fig. Layers of the Sun

- The core of the sun consists of hydrogen atoms which fuse together due to compression and creates helium. This is called as *nuclear fusion*.
- Nuclear fusion produces huge amount of energy. It is radiated outward to the surface, atmosphere and beyond.
- Convection zone is the next to the core of the sun. Here the temperature drops to 2 million degree C.
- Photosphere's temperature is 6,000°C.
- *Atmosphere* of the sun consists of chromosphere and corona.

- Corona is seen in a form of spectral lines emitted by iron, calcium and nickle ions. Ionization of these elements increases temperature of corona.
- Recently coronal heating puzzle has been related to magnetic carpet found in corona.
- The solar flare (wind) is a stream of charged particles released from upper atmosphere of the sun. These changed particles when get trapped by earth's magnetic field while entering in the upper atmosphere of the earth results in *auroral* (light) display.
- These auroral display in the northern hemisphere is called as *Aurora Borealis* (the Northern light) and when occurs in southern hemisphere is called as *Aurora Australis* (the Southern lights)
- *Sun-spots* are dark appearing areas present in photosphere from where solar flares originate . They are relatively a region cooler than its surrounding. It appears and disappears after every 11 years. This period is called Sun-spot Cycle.
- Plage is a brighter region in the chromosphere near to sunspot.

PLANETS

- Planets means 'wanderers'. There are eight planets in our solar system (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune).
- All these planets move around the sun in a fix orbit. Which is elongated in shape (elliptical).
- A new planet 2003 *UB 313* has been included recently in solar system. It is bigger than Pluto and farthest from the Sun.
- International Astronomical Union (IAU) recognized five dwarf planets such as : Ceres, Pluto, Haumea, Makemake, and Seden.
- The planets are grouped into two :
  (1) **Terrestrial planets:** These are dense *rocky bodies* and are called as earth like planets. Mercury, Venus, Earth, and Mars are included in it. They are also called as inner planets.
  (2) **Jovian Planets :** The outer planets which are gigantic in size and are *gaseous* in composition with large satellite are called as Jovian planets. These have similar features to that of Jupiter, thus called as Jupiter like planets.

Pluto, the Dwarf Planet

- Pluto was known as the smallest planet in the solar system and the ninth planet from the sun.
- Today Pluto is called a "dwarf planet".
- On owerage, Pluto is more than 3.6 billion miles away from the sun.
- Pluto is in a region called the kwpes Belt. One day on Pluto is about 61/2 days on Earth.
- It has five moons. Its largest moon is named charon pluto's four other moons are named kerberos, styx, Nix and Hydra.

Detail Information About The Planets

Planets/Features	Mercury	Venus	Earth	Mars	Jupiter	Saturn	Uranus	Neptune
Equatorial & Diameter (km)	4,878	12,104	12,756	6,792	142,984	120,536	51,118	49,528
Mass (kg)	3.28×10^{23}	4.867×10^{24}	5.972×10^{24}	6.39×10^{23}	1.8913×10^{27}	5.683×10^{26}	8.681×10^{25}	1.024×10^{26}
Orbital Period (in days)	88	225	365	687	4,333	10,756	30,687	60,190
Inclination to Sun's Equator	3.38°	3.86°	7.25°	5.65°	6.07°	5.51°	6.48°	6.43°
Rotational Period (in days) and Direction	58.64 East to West	–243.02 West to East	1 East to West	1.03 East to West	0.41 East to West	0.43 East to West	–0.72 West to East	0.67 East to West
Distance from Sun (km)	57.91×10^{6}	10.82×10^{7}	14.96×10^{7}	22.79×10^{7}	77.85×10^{7}	14.33×10^{8}	28.77×10^{8}	44.98×10^{8}
Gravity (m/s^2)	3.7	8.89	9.78	3.71	24.79	10.44	8.69	11.5
No. of Moons	0	0	1	2	67	62	27	14
Axis Tilt	0.04°	177.36°	23.44°	25.19°	3.13°	26.73°	97.77°	28.32°
Mean density (g/cm^3)	5.43	5.25	5.52	3.93	1.33	0.71	1.27	1.67
Rings	no	no	no	no	yes	yes	yes	yes

Mercury

- Mercury is the smallest planet in our solar system - only slightly larger than the Earth's moon.
- It is the closest planet to the sun at a distance of about 58 million km (36 million miles) or 0.39 AU.
- One day on Mercury takes 59 Earth days.
- Mercury is a rocky planet, also know as a terrestrial planet.
- Mercury's thin atmosphere, or exosphere, is composed mostly of oxygen (O_2), sodium (Na), hydrogen (H_2), helium (He), and potassium (K). Atoms that are blasted off the surface by the solar wind and micrometeoroid impacts create Mercury's exosphere.
- Only two missions have visited this rocky planet: *Mariner 10* in 1974-5 and *MESSENGER*, which flew past Mercury three times before going into orbit around Mercury in 2011.
- Daytime Temperatures can reach 430° Celsius (800° Fahrenheit) and drop to -180° Celsius (-290° Fahrenheit) at night.

Venus

- Venus is only a little smaller than the Earth.
- Venus is the second closest planet to the sun at a distance of about 108 million km (67 million miles) or 0.72 AU.
- One day on Venus lasts as long as 243 Earth days (the time it takes for Venus to rotate or spin once).
- Venus is a rocky planet, also known as terrestrial planet. Venus' solid surface is a created and volcanic landscape.
- Venus' thick and toxic atmosphere is made up mostly of carbon dioxide (CO_2) and nitrogen (N_2), with clouds of sulfuric acid (H_2SO_4) droplets.
- More than 40 spacecraft have explored Venus. The *Magellan* mission in the early 1990s mapped 98% of the planet's surface.
- The planet's extreme high temperatures of almost 480° Celsius (900° Fahrenheit) made it seem an unlikely place for life as we know it.
- Venus *spins backwards* (retrograde rotation) when compared to the other planets. This means that the *sun rises in the west and sets in the east on Venus*.

Earth

- Earth is the third planet from the sun at a distance of about 150 million km (93 million miles). That's one Astronomical Unit (AU).
- A day on Earth is 24 hours (the time it takes the Earth to rotate or spin once).
- Earth's atmosphere is 78% nitrogen (N_2), 21% oxygen (O_2) and 1% other ingredients - the perfect balance for Earthlings to breathe and live. Many planets in our solar system have atmospheres, but only Earth is breathable.
- Earth has one moon. Another name for a moon is *natural satellite*.
- Earth is the perfect place for life as we know it.
- Our atmosphere protects us from incoming meteoroids, most of which break up in our atmosphere before they can strike the surface as meteorites.

Mars

- Mars is the fourth planet from the sun at a distance of about 228 million km (142 million miles) or 1.52 AU.
- One day on Mars takes just a little over 24 hours (the time it takes for Mars to rotate or spin once).
- Mars is a rocky planet, also known as a terrestrial planet. Mars' solid surface has been altered by volcanoes, impacts, crustal movement and movement and atmospheric effects such as dust storms.
- Mars has a thin atmosphere made up mostly of carbon dioxide (CO_2), nitrogen (N_2) and argon (Ar).
- Mars has two moons named *Phobos* and *Deimos*.
- Several missions have visited this planet, from flybys and orbiters to rovers on the surface of the *Red Planet*. The first true Mars mission success was *Mariner 4 in 1965*. At this time in the planet's history, Mars' surface cannot support life as we know it. Current missions exploring Mars on the surface and from orbit are determining Mars' past and future potential for life.
- Mars is known as the *Red Planet* because *iron minerals* in the Martian soil oxidize, or rust, causing the soil and the dusty atmosphere to look red.

Jupiter

- About 1,300 Earths could fit inside Jupiter.
- Jupiter is the fifth planet from the sun at a distance of about 778 million km (484 million miles) or 5.2 Astronomical Units (AU). Earth is one AU from the sun.
- One day on Jupiter takes about 10 hours (the time it takes for Jupiter to rotate or spin once).
- Jupiter is a gas-giant planet and therefore does not have a solid surface. Jupiter may have a solid, inner core about the size of the Earth.
- Jupiter's atmosphere is made up mostly of hydrogen (H_2) and helium (He).
- Jupiter has 50 known *moons*, with an additional 17 moons awaiting confirmation of their discovery, that is a total of *67 moons*.
- Jupiter has a faint *ring system* that was discovered in 1979 by the *Voyager-1 mission*. All four giant planets in our solar system have ring systems.
- Many missions have visited Jupiter and its system of moons. *The Juno mission* will arrive at Jupiter in 2016.
- Jupiter cannot support life as we know it. However, some of Jupiter's moons have oceans underneath their crusts that might support life.

Saturn

- Saturn is the sixth planet from the sun at a distance of about 1.4 billion km (886 million miles) or 9.5 AU.
- One day on Saturn takes 10.7 hours (the time it takes for Saturn to rotate or spin once).
- Saturn is a gas-giant planet and therefore does not have a solid surface.

- Saturn's atmosphere is made up mostly of hydrogen (H_2) and helium (He).
- Saturn has 53 known moons with an additional nine moons awaiting confirmation of their discovery, that is a total of 62 moons.
- Saturn has the most spectacular ring system, which is made up of seven rings with several gaps and divisions between them.
- Only a few missions have visited Saturn: Pioneer 11, Voyager 1 and 2 and Cassini-Huygens. Since 2004, Cassini has been exploring Saturn, its moons and rings.
- Fact: When Galileo Galilei was observing the planet Saturn in the 1600s, he noticed strange objects on each side of the planet and drew in his notes a triple-bodied planet system and later a planet with arms or handles. These "handles" were in fact the *rings of Saturn*.

Uranus

- Uranus is the seventh planet from the sun at a distance of about 2.9 billion km (1.8 billion miles) or 19.19 AU.
- One day on Uranus takes about 17 hours (the time it takes for Uranus to rotate or spin once).
- Uranus is an *ice giant*. Most (80 % or more) of the planet's mass is made up of a hot dense fluid of "icy" materials – water (H_2O), methane (CH_4), and ammonia (NH_3) – above a small rocky core.
- Uranus has an atmosphere which is mostly made up of hydrogen (H_2) and helium (He), with a small amount of methane (CH_4).
- Uranus has *27 moons*. Uranus' moons are named after characters from the works of *William Shakespeare* and *Alexander Pope*.
- Uranus has *13 known rings*. The inner rings are narrow and dark and the outer rings are brightly colored.
- *Voyager 2* is the only spacecraft to have visited Uranus.
- Uranus cannot support life as we know it.
- Unlike any of the other planets, Uranus *rotates on its side*, which means it *spins horizontally*.

Neptune

- Neptune is the eighth and farthest planet from the sun at a distance of about 4.5 billion km (2.8 billion miles) or 30.07 AU.
- One day on Neptune takes about 16 hours (the time it takes for Neptune to rotate or spin once).
- Neptune is a *sister ice giant to Uranus*.
- Neptune's atmosphere is made up mostly of hydrogen (H_2), helium (He) and methane (CH_4).
- Neptune has *13 moons*. Neptune's moons are named after various *sea gods* and *nymphs* in Greek mythology.
- Neptune has *six rings*.
- *Voyager 2* is the only spacecraft to have visited Neptune.
- Neptune cannot support life as we know it.

Moon

- The moon is Earth's natural satellite and orbits the Earth at a distance of about 384 thousand km (239 thousand miles) or 0.00257 AU.
- The moon makes a complete orbit around Earth in 27 Earth days and rotates or spins at that same rate, or in that same amount of time. This causes the moon to keep the same side or face towards Earth during the course of its orbit.
- The moon is a rocky, solid-surface body, with much of its surface cratered and pitted from impacts.
- The moon has a very thin and tenuous (weak) atmosphere, called an *exosphere*.
- More than 100 spacecrafts have been launched to explore the moon. It is the only celestial body beyond Earth that has been visited by human beings.
- Twelve human beings have walked on the surface of the moon.

Asteroids

- Asteroids are minor planets especially those of the inner solar system.
- Asteroids orbit our sun in a region of space between the orbits of Mars and Jupiter known as the Asteroid Belt.
- Asteroids are solid, rocky and irregular bodies.
- Asteroids do not have atmospheres.
- More than 150 asteroids are known to have a small companion moon (some have two moons). The first discovery of an asteroid-moon system was of asteroid Ida and its moon *Dactyl* in 1993.
- Asteroids do not have rings.
- NASA space missions have flown by and observed asteroids, and one spacecraft (NEAR Shoemaker) even landed on an asteroid (*Eros*). The *Dawn* mission is the first mission to orbit (2011) a main belt asteroid (*Vesta*).
- Asteroids cannot support life as we know it.
- *Ceres*, the first and largest asteroid to be discovered (1801 by Giuseppe Piazzi), encompasses over one-third of the estimated total mass of all the asteroids in the asteroid belt.

Meteorites

- Meteorites may vary in size from tiny grains to large boulders. One of the largest meteorite found on Earth is the *Hoba* meteorite from southwest Africa, which weighs roughly 54,000 kg (119,000 pounds).
- Meteor showers are usually named after a star or constellation which is close to the radiant. Meteors and meteorites begin as meteoroids, which are little chunks of rock and debris in space.
- Most meteorites are either *iron*, *stony* or *stony-iron*.
- Leonid MAC (an airborne mission that took flight during the years 1998 - 2002) studied the interaction of meteoroids with the Earth's atmosphere.

- Meteoroids, meteors and meteorites cannot support life. However, they may have provided the Earth with a source of amino acids: the building blocks of life.
- Meteoroids become meteors or *shooting stars* when they interact with a planet's atmosphere and cause a streak of light in the sky. Debris that makes it to the surface of a planet from meteoroids are called *meteorites*.
- Meteorites may look very much like Earth rocks, or they may have a burned appearance. Some may have depression (thumbprint-like), roughened or smooth exteriors.
- Many of the meteor showers are associated with comets. The Leonids are associated with comet Tempel-Tuttle; Aquarids and Orionids with comet *Halley*, and the Taurids with comet Encke.

Comets

- Comets are cosmic snowballs of frozen gases, rock and dust.
- A comet warms up as it comes near the sun and develops an atmosphere, or coma. The coma may be hundreds of thousands of kilometers in diameter.
- Comets do not have moons.
- Comets do not have rings.
- Several missions have visited, impacted and even collected samples from comets. Two recent missions are Stardust-NExT and Deep Impact EPOXI.
- When *comets* come around the sun, they leave a dusty tail. Every year the Earth passes through the comet tails, which allows the debris to enter our atmosphere where it burns up and creates fiery and colorful streaks (meteors) in the sky.
- Comets may not be able to support life themselves, but they may have brought water and organic compounds, i.e., the building blocks of life -- through collisions with the Earth and other bodies in our solar system.
- *Comet Halley* makes an appearance in the Bayeux tapestry from the year 1066, which chronicles the overthrow of King Harold by William the Conqueror at the Battle of Hastings.

It is a short period comet visible from Earth every 75-76 years. Halley last appeared in the inner part of the solar system in 1986 and will next appear in mid - 2061.

Who is Called What	
Brightest Planet	Venus
Evening Star	Venus
Morning Star	Venus
Hottest Planet	Venus
Nearest Planet to Earth	Venus
Earth's twin	Venus
Fastest rotation in solar system	Jupiter
Slowest rotation in solar system	Venus
Green Planet	Uranus
Blue Planet	Earth
Red Planet	Mars
Smallest Planet	Mercury
Biggest Planet	Jupiter
Fastest revolution in Solar System	Mercury
Slowest revolution in Solar System	Neptune
Coldest Planet	Neptune
Closest star to the Sun	Proxima Centauri
Densest Planet	Earth
Least dense Planet	Saturn
Only satellite with an atmosphere like Earth	Titan
Smallest satellite	Deimos
Biggest Satellite	Gannymede

Venus is the hottest planet even though Mercury is the closest planet to the Sun. The reason behind it is that Venus has atmosphere made of carbon dioxide.

BLUE PLANET : THE EARTH

The Earth is the only known planet where life exists. Its surface area is covered with two-third of water that is why we call it blue planet.

Earth is the third planet from the sun, the densest planet in the solar system, the largest of the solar system's four terrestrial planets.

Origin of the Earth

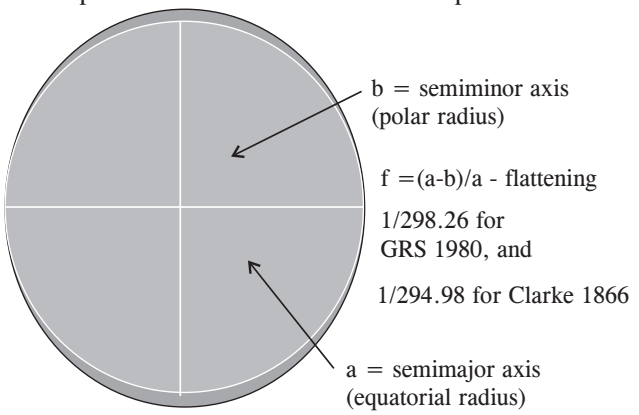
- A number of theories have been proposed by different philosophers.
- *Immanuel Kant* gave gaseous hypothesis based on Newtonian law related to gravitation and rotatory motion in 1755.
- Laplace gave Nebular hypothesis in 1786.
- Tidal hypothesis was given by James Jeans in 1929 and it was modified by Jeffrey and was called as Collision hypothesis.
- Big Bang theory was proposed by Georges Lemaitre (1927).
- According to *Big Bang theory* billion years ago cosmic matters were in highly compressed state. The expansion started with premordial explosion. It resulted in formation of superdensed balls which travelled at a speed of thousands mile per second and gave rise to galaxies.
- The expansion of universe means increase in space between galaxies and formation of new galaxies.

Earth Statistics

• Age of The Earth	:	4.5 to 4.6 billion years
• Water-land Ratio	:	70.8% Water & 29.2 % Land
• Earth's Circumference at the Equator	:	24,901.55 miles (40,075.16 km)
• Earth's Circumference between the North and South Poles	:	24,859.82 miles (40,008 km)
• Earth's Diameter at the Equator	:	7,926.41 miles (12,756.32 km)
• Average Distance from the Earth to the Sun	:	92,9555,802 miles (149,579.870 km)
• Average Distance from the Earth to the Moon	:	238,855 miles (384,400.1 km)
• Highest Elevation on Earth	:	Mt. Everest, Asia : 29,035 feet (8848 m)
• Tallest Mountain on Earth from Base to Peak	:	Mauna Kea. Hawaii: 33,480 feet, i.e 10204 m (rising to 13796 feet above sea level) (10204 m, 4205 m)
• Point Farthest from the Center of the Earth	:	The peak of the volcano chimborazo in Ecoador at 20561 feet (6269 m) is farthest from the center of the Earth due to its location near the equator and the oblateness of the Earth.
• Lowest Elevation on Land	:	Dead Sea: 1369 feet below sea level (417 m)
• Deepest Point in he Ocean	:	Challenger Deep (Mariana Trench) in Western Pacific Ocean: 36,740 feet (11022 m)
• Highest Temperature Recorded	:	136.8°F - AL Aziziyah, Libya, Sep. 13,1922 (58.4°C)
• Lowest Temperature Recorded	:	–128.6°F - Vostok, Antarction. July 21, 1983 (–89.2°C)
• Atmosphere content	:	78% nitrogen, 21% oxygen and 1% traces of argon, carbon dioxide and water.
• Rotation on Axis	:	23 hours and 56 minutes and 04.09053 second. But, it takes an additional four minutes for the earth to revolve to the same position as the day before relative to the sun (i.e. 24 hours)
• Revolution Around Sun	:	365 . 2425 day
• Chemical Composition of the Earth	:	32.1% Iron, 30.1% Oxygen, 15.1% Silicon, 13.9%, Magnesium, 2.9% Sulfur, 1.8% Nickel, 1.5% Calcium and 2.6% other.
• Standard Time zones	:	24

Size and Shape of the Earth

- Shape of the Earth is called "geoid"
- The sciences of earth measurement is called "Geodes
- "ellipsoid" - reference to the Earth shape.



The geoid bulges at the North Pole and is depressed at the South Pole

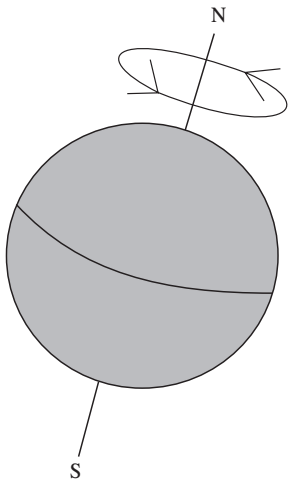
- Earth shape is affected by two main facts:
- It bulges in midriff, because of pliability of Earth's lithosphere;
- Its shape is therefore an oblate spheroid.
- It has topographical irregularities.

Motions of the Earth

The Earth is constantly in motion, revolving around the Sun and rotating on its axis. These motions account for many of the phenomenon we see as normal occurrences: night and day, changing of the seasons, and different climates in different regions. With a globe ball properly mounted and rotating on its axis, the movements of the Earth around the Sun may be illustrated accurately.

Rotation

The Earth spins on its axis from West to East (counter-clockwise). It takes the Earth 23 hours, 56 minutes, and 4.09 seconds to complete one full turn. Day and night are produced by the rotation of the Earth. The speed of rotation at any point upon the equator is at the rate of approximately 1,038 miles per hour, decreasing to zero at the poles.

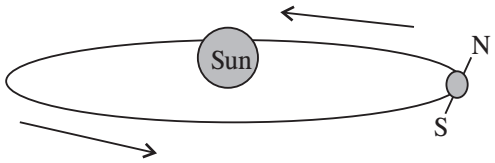


- **How rotation periods are calculated:** The period of rotation is calculated with reference to a star and with reference to the sun. When it is calculated with reference to a star, it is called a sidereal day and when it is calculated with reference to the sun, it is called a solar day.
- Solar days and sidereal days: The solar day is a time period of 24 hours, and the duration of a sidereal day is 23 hours 56 minutes. This difference of four minutes between a solar day and a sidereal day is due to the fact that the position of the Earth keeps changing with reference to the sun due to the revolution around it; while with reference to a star at infinity, it will remain unchanged. Thus, a sidereal day is the actual time taken by the planet for a rotation of exactly 360 degrees on its axis.

Revolution

While the Earth is spinning on its axis, it is revolving around the Sun in a counter-clockwise direction. It takes the Earth one full year to complete one full revolution around the Sun. This path is known as the Earth's orbit. It is very near a circle. The mean distance of the Earth from the Sun is about 93 milling miles and the distance varies by 3 million miles, forming a slightly oval path.

The revolution of the Earth around the Sun traverse a distance of 595 million miles in 365 days, 6 hours, 9 minutes and 9.5 seconds. This means a speed of 18 miles a second (or 66,000 miles per hour) while at the same time rotating once each twenty-four hours.



Earth rotates in an elliptical orbit around the Sun

The orbit of the Earth around the sun is elliptical and not circular. Due to this, the distance between the Earth and the sun keeps changing.

- When this distance is minimum, the Earth is said to be in perihelion (around January 3).
- When the distance is the maximum, it is said to be in aphelion (around July 4).

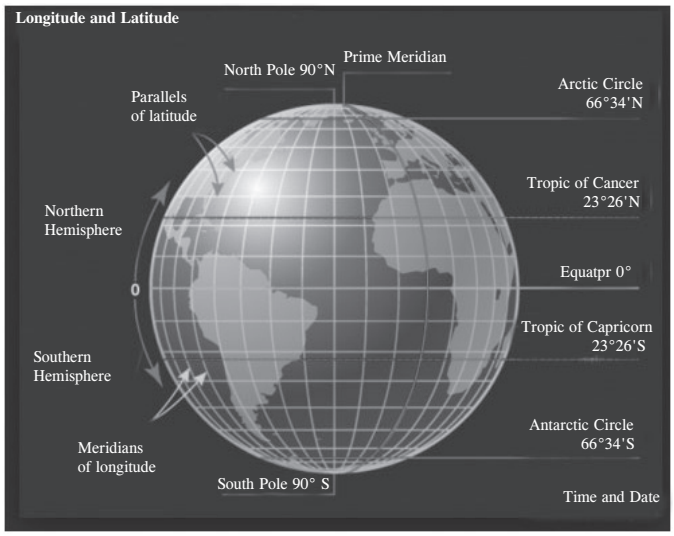
The Earth's axis points constantly to the same point (the polar star) in the celestial sphere. As a consequence the latitude on the surface of the earth at which the sun's rays fall vertically keeps changing as the earth moves it its orbit around the sun. Due to this the earth attains four critical positions with reference to the sun.

1. **The equinoxes:** On 21st March, the Earth is so positioned with reference to the sun that the sun's rays are vertical at the equator and the entire world experiences equal day and night.
2. **The autumnal equinox:** A similar situation occurs on September 23.
3. **Summer solstice:** On 21st of June the sun's rays are vertical over the Tropic of Cancer as the north pole of the Earth is inclined at its maximum towards the sun. At this time, the north pole experiences a long continuous day and the south pole a long continuous night (ergo, what we know as summer solstice). The northern hemisphere has the summer season at this time and the southern hemisphere experiences winter now. Also the days are longer than the nights in the northern hemisphere at this time.
4. **Winter solstice:** On December 22, the position of the earth with respect to the sun is such that the south pole is inclined at its maximum towards the sun and the Tropic of Cancer receives the vertical rays of the sun. This position is called the winter solstice when the sun shines continuously in the south polar region and it is a long continuous night at the north pole. This is the winter season in the northern hemisphere and the summer in the southern hemisphere. During the winter solstice, the days are longer than the nights in the southern hemisphere.

- Thus, the variation in the duration of day and night and the change of seasons are due to the earth's revolution and the inclination of the axis of the earth. Also the seasons are reversed from the northern to the southern hemisphere.

Longitudes and Latitudes

Together, longitudes and latitudes form the Earth's geographical coordinates, and represent the angular distance of any location on the Earth from the Earth's Equator. Both latitudes and longitudes are measured in degrees.



The Equator

The Earth is (almost, but not quite) a sphere that rotates around its axis. If we draw a line passing through the center of the Earth along its rotational axis, the line would pass through the North and the South Pole.

The **Equator** is an imaginary line perpendicular to this axis. It is equidistant from the two poles, and divides the globe into the Northern Hemisphere and the Southern Hemisphere.

Most locations on the Equator experience consistently high temperatures throughout the year. They also experience almost 12 hours of daylight every day during the year. On the Equinoxes –50 autumnand spring – the sun is directly overhead the Equator, resulting in exactly 12 hour days and 12 hour nights.

Latitudes

- Latitudes are imaginary circles drawn parallel to the Equator.

- They are defined by the angle created by a line connecting the latitude and the center of the Earth, and the line connecting the Equator and the center of the Earth, and are named by the angle. Latitudes specify the North-South position of a location on the globe.
- When looking at a map, latitude lines run horizontally. Latitude lines are also known as parallels since they are parallel and are an equal distant from each other

Longitudes

- Longitudes are geographical positioning markers that run from the geographical North to the geographical South Pole, intersecting the Equator. They meet at both Poles, and specify the East-West position of a location.
- Longitudes are therefore imaginary circles that intersect the North and South Poles, and the Equator. Half of a longitudinal circle is known as a **Meridian**. Meridians are perpendicular to every latitude.
- Unlike, latitudes, there is no obvious central longitude. However, in order to measure the position of a location based on the longitude, cartographers and geographers over the course of history have designated different locations as the main longitudinal reference point. Today, the meridian line through Greenwich, England is considered as the reference point for longitudes. This line is also known as the **Prime Meridian**
- The Prime Meridian is set as 0° longitude and it divides the Earth into the Eastern and the Western Hemisphere. All the other longitudes are measured, and named after the angle they make with respect to the center of the Earth from the intersection of the Meridian and the Equator.
- Since a sphere has 360 degrees, the Earth is divided into 360 longitudes. The meridian right opposite the Prime Meridian (on the other side of the Earth) is the 180° longitude.
- Modern timekeeping systems use longitudes as references to keep time. Time zones are defined by the Prime Meridian and the longitudes.

Time and Longitudes

Local Time

Local time of any place is 12 noon when the Sun is exactly overhead.

Standard Time

It is the uniform time fixed by each country. It is fixed in the relation to mean time of a certain meridian which generally passes through it.

Greenwich Mean Time (GMT)

The line at 0° longitude is called Greenwich Mean Time. It is based on local time of the meridian passing through Greenwich near London.

Indian Standard Time

It is fixed on the mean of 82°30°E. Meridian, a place near Allahabad. It is 5½ hours ahead of Greenwich Mean Time.

Solstice and Equinoxes

Equinox

It is a day of the year when the duration of day and night is equal and the position of the sun is in its zenith. In year equinoxes occurs twice.

Solstice

Like equinoxes solstice also occur twice a year. This is the time when the sun riches either its highest are lowest point at noon. It leads to the result of longest and shortest day of the year.

- **June solstice (approximately June 20-21)**. This day begins summer in the Northern hemisphere and winter in the Southern hemisphere. This day is the Longest in the year. In the Northern Hemisphere and shortest. In the Southern hemisphere. On this day, the Sun is directly overhead the tropic of Cancer (23.5 degree at moon).
- **September Equinox (approximately September 22-23):** This dry begins fall in the Northern hemisphere and spring in the Southern hemisphere. There are 12 hours of dry light and 12 hours of darkness at all points on the Earth's surface on the two equinoxes. Sunrise is at 60 m. and sunset is at 6 pm.
- **December Solstice (Approximately December 21-22):** This dry begins summer in the Southern hemisphere and is the longest dry in the Southern hemisphere. It begins winter day in Northern hemisphere and is the shortest day of the year in the Northern hemisphere. The Sun is directly overhead the Tropic of capricorn on the December.
- **March Equinox (Approximately March 21-21):** Spring solstice equinox this day begins tell in the Southern hemisphere and spring in the Norther hemisphere. There are 12 hours of day light and 12 hours of darkness at all the points on the Earth's surface on the two equinoxes. Sunrise is at 6 a.m. and Sunset is at 6 pm. local (so far) time zone most points on the Earth's surface.

ECLIPSES

When the light of the Sun or the Moon is blocked by another body, the sun or Moon is said to be in eclipse. The Sun, Earth and Moon are in a straight line Eclipses of the Sun is a solar eclipse and the Moon is a inner eclipse.

Solar Eclipse

It is caused when the moon Revolving around the Earth comes in between the Earth and the Sun, thus making a part or whole of the sun invisible from a particular part of the Earth thus, the eclipse can be partial or complete. It occurs during the day.

Type of Solar Eclipses

- **Total Eclipse :** Occurs when the Sun is completely obscured from rich. Instead, the Sun intense light is replaced by dark silhouette of the Moon that is outlined by the Sun's corona (the super heated plasma extending out from the Sun.
- **Annular Eclipse:** Occurs when the Sun and Moon are exactly in line but Moon appears smaller than the Sun. During on annular eclipse, the Sun appears as a bright ring around the Moon.

- **Partial Eclipse:** Occurs when the Sun and Moon are not completely aligned and the Sun is partially obscured.
- **Hybrid Eclipse:** is a combination of total and annular eclipse that takes place when a total eclipse changes to an annular eclipse or vice-versa along different sections of the eclipse's path.

Lunar Eclipse

- When the Earth comes between the Moon and the Sun, the shadow cast by the Earth on the Moon results in a lunar eclipse. It is occur at night.

Earth Theory

- A large number of hypothesis were put forth by different philosophers and scientists regarding the origin of the earth. One of the earlier and popular arguments was by German philosopher Immanuel Kant. Mathematician Laplace revised it in 1796. It is known as **Nebular Hypothesis**. The hypothesis considered that the planets were formed out of a cloud of material associated with a youthful sun, which was slowly rotating. Latter in 1980, Chamberlin and Moulton considered that a wandering star approached the sun. As a result, a cigar-shaped extension of material was separated from the solar surface, AS the passing star moved away, the material separated from the solar surface continued to revolve around the sun and it slowly condensed into planets. **Sir James Jeans** and later **Sir Harold Jeffrey** supported this argument. AT a later date, the arguments considered of a companion to the sun to have been consisting. These arguments are called binary hypothesis. In 1950, Otto Schmidt in Russia and Carl Weizasear in Germany somewhat revised the 'nebular' hypothesis.
- **Modern Theories :** The most popular argument regarding the origin of the universe is the **Big Bang theory**. It is also called expanding universe hypothesis. Edwin Hubble, in 1920, provided evidence that the universe is expanding. As time passes, galaxies move further and further apart.

EVOLUTION OF THE EARTH

Continental Drift theory

- It was proposed by Wegener in 1912.
- According to the theory billion years ago all continents were joined together into one big landmass called as Pangaea. On the other hand all ocean joined together were called as Panthalassa.
- Pangaea floated over Panthalassa.
- Pangaea broke into two parts due to gravitational force and buoyancy.
- The northern part was known as Laurasia and southern part was known as Gondwanaland. These landmass were further splitted into smaller landmass forming different continents.
- Tethys sea was formed when Pangaea first splitted into Laurasia and Gondwanaland.
- Jig-saw fit conventional current theory and plate tectonic theory supports it.

Plate Tectonic theory

- It was argued that the outermost part of the earth's interior consists of two layers: the **lithosphere** consists of crust, and the solidified uppermost part of the mantle. Below the lithosphere lies the **asthenosphere**, which is the inner part of the upper mantle. Asthenosphere is in semi fluid state. Lithosphere floats on the asthenosphere and is broken up into lithospheric plates.
- Plate Tectonics theory defined a tectonic plate or lithospheric plate as a massive, irregularly shaped slab of solid rock, composed of both continental and oceanic lithosphere. The plates move horizontally over the asthenosphere as rigid units. Lithosphere is divided into seven major and some minor plates. The 7 major plates are: (i) Antarctica plate, (ii) North American plate, (iii) South American plate, (iv) Pacific plate, (v) India-Australia-New Zealand plate, (vi) Africa plate and (vii) Eurasian plate. Also there are minor plates like (i) Cocos plate, (ii) Nazca plate, (iii) Arabian plate, (iv) Philippine plate, (v) Caroline plate and (vi) Fuji plate.
- Three types of plate boundaries are found :
  1. Transform boundaries occur where the plates slide or grind with each other (San Andreas fault).
  2. Divergent boundaries occur were two plates slides apart from each other (Mid-Atlantic Ridge).
  3. Convergent boundaries occur where two plates slide towards each other. Found near pacific boundary. North and South America.

Geological Time Scale

Eons	Era	Period	Epoch	Age/years Before Present	Life/Major Events
		Quaternary	Holocene	0 - 10,000	Modern Man
			Pleistocene	10,000 - 2 million	Homo Sapiens
	Cainozoic (From 65 million years to the present times)	Tertiary	Pliocene	2 - 5 million	Early Human Ancestor
			Miocene	5 - 24 million	Ape : Flowering Plants and Treees Anthropoid Ape
			Oligocene	24-37 Million	Rabbits and Hare
			Eocene	37 - 58 Million	Small Mannals :
			Palaeocene	57 - 65 Million	Rats - Mice
	Mesozoic 65 - 245 Million Mammals	Cretaceous Jurassic Trjassic		65 - 144 Million 144 - 208 Million 208 - 245 Million	Extinction of Dinosaurs Age of Dinosaurs Frogs and turtles

	Palaeozolc 245-570 Million	Permian		245-286 Million	Reptile dominate-replace amphibians
		Carboniferous		286-360 Million	First Reptiles: Vertebrates : Coal beds
		Devonian		360-408 Million	Amphibians
		Silurian		408-438 Million	First trace of life on land: plants First Fish
		Ordovician		438-505 Million	No terrestrial Life:
		Cambrian		505-570 Million	Marine Invertebrate
Proterozolc Archean Hadean	Pre-Cambrian 570 Million 4,800 Million			570-2,500 Million 2,500-3,800 Million 3,800 - 4,800 Million	Soft-bodied arthropods Blue green Algae; Unicellular Bacteria Oceans and Continents form - Ocean and Atmosphere are rich in Carbon dioxide
Origin of Stars Supernova Big Bang	5,000-13,700 Million			5,000 Million 12,000 Million 13,700 Million	Origin of the sun Origin of the universe

Composition of the earth

Earth's Interior

- Interior of the earth is composed of non-uniform material. Velocity of seismic waves proves that the earth's interior consists of three different layers; (i) crust (ii) mantle and (iii) core. These layers are distinguished on the basis of their (i) physical and chemical properties, (ii) thickness, (iii) density, (iv) temperature, (v) metallic content and (vi) rocks.

Crust

The Outermost layer of the earth is called crust. Thickness of earths crust varies from 8 to 60 km. It is divided into upper and lower crust.

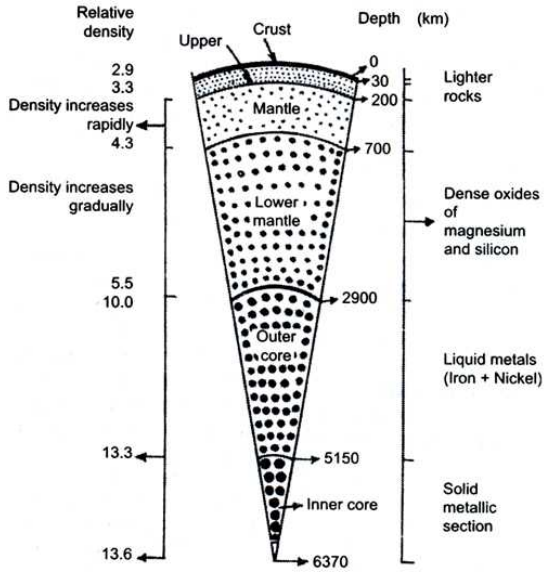
- Upper crust has the density of 2.8.
- Lower crust has the density of 3.0.
- The upper crust has lower density due to the presence of lower density minerals than in lower crust.
- It composed of variety of igneous, metamorphic and sedimentary rocks.
- Most common rock found in earth's crust is igneous rocks. It covers 90% of the earth crust's volume.
- The temperature of crust increases with depth. Near mantle its temperature is recorded between 200°C to 400°C.
- It consists of different minerals like oxygen (46.6%), silicon (27.7%), aluminium (8.1%), iron (5%), others (12.6 %).
- The continent crust is thicker than the oceanic crust.
- The boundary between crust and mantle shows sudden increase in density and velocity of sesmic wave which is called as moho-discontinuity.

Mantle

- The second of the interior of the earth.
- It extends form 60 km to 2900 km. depth.
- Divided into two layers : upper mantle (60 – 1000 km) and lower mantle (1000 – 2900 km)
- Silica and magnesium are the dominant minerals found alongwith iron.
- The upper part of the mantle is in solid state as compared to its lower part.
- There is sudden change in the composition and structure of the interior of the earth at mantle core boundary. This zone of change in average density (5.5 to 10) is called as Wichert-Guttenberg discontinuity.

Core

- Core is the inner most layer of the earth's interior.
- Its density at the boundary of mantle is 10.3 and increases with increase in depth.
- It contains 32 percent of the total mass of the earth.
- It occupies 16 percent of the total volume of the earth.
- It is divided into two sub-zones. Outer core and inner core.
- The line dividing core into inner and outer core is at 5150 km of depth from earth's crust.
- The outer case is mainly a liquid layer of nickel and iron. The inner care is in solid state mainly consiting of iron nickel alloy.



Section through Earth
(Relation between Density, Section and Depth)

EARTH MOVEMENT

Movement in earth causes vast changes. The forces affecting earth, crust is divided into two on the basis of their origin:

1. Endogenetic forces
2. Exogenetic forces

- Endogenetic forces result in sudden movement or diastrophic movement.
- Sudden movement results in volcanic eruption and earthquake.
- Diastrophic movement results in tensional and compressional forces.
- Cracks and faulting is the result of tensional force.
- Warping and folding is associated to compressional force.
- Rift valley is formed due to tensional and compressional force.
- Wave like bends in crustal rocks due to tangential compression force resulting in horizontal movement is called as fold.
- There are five major types of folds : symmetrical, asymmetrical, monoclinal, isoclinal and recumbent folds.
- Fracture in the crustal rock causing displacement of rock is called as fault.
- There are four types of faults : Normal faults, Reverse faults, Lateral or strike-ship faults and Step faults.
- Exogenetic forces are generated form the atmosphere due to varying combination of temperature and moisture.
- Exogenetic forces result in denudational processes (denudation = weathering + erosion)

Volcanism

Movement of the heated material from the interior of the earth to a towards the surface is called as volcanism. Volcano is a vent opening through which these heated material like gases, water, liquid lava and fragment of rocks are ejected causing widespread of devastation.

Distribution of Volcanic activity in world

(1) Circum-Pacific belt
(2) Mid-continental belt
(3) Mid-Atlantic belt
(4) Intra-plate volconoes

(1) Circum-Pacific belt: The 'Ring of Fire', the belt starts from Erebus Mountain of Antarctica, running through Andes and Rockies mountains reaches Alaska from where it enters Asiatic coast turning eastward spreading over volcanoes of Island arc (Sakhaline, Kamchatka, Japan, Hawaii and Aloutin etc.) It is the subduction zone.

(2) Mid-Continental belt : Convergent zone of continental plates. This belt includes the volcanoes of the Alpine mountain chain alongwith Mediterranean sea and reaches the fault zone of Africa in the east. It is formed due to collision of Eurasian plates with African and Indian plates.

(3) Mid-Atlantic belts : It is a zone of divergent where two plates split and form new landmass. Here volcanoes of fissure eruption are found. It runs across whole of mid-Atlantic stretching 11,300 km. The Hekla volcanic mountain of Iceland makes Iceland world's largest volcanic Island.

(4) Intra-Plate volcanoes : The massive eruption that occurs in north-western part of North America, Indian Peninsula, Parana, of Barazil and Paraguay sometimes in past are part of intra-plate volcanoes.

Types of Volcanoes

(1) Active Volcanoes : The volcanoes which have at least erupted one's in past 10,000 years. Etna (Sicily), Hekla (Iceland), Erta Ale (Ethiopia) Bromo (Java), Nevado del Ruiz (Colombia) etc. are in active state.

(2) Dormant Volcanoes : They are active volcanoes but are not erupting at present Mt. Fuji (Japan) and Mt. St. Helen (Washington) are such examples.

(3) Extinct Volcanoes : They are those volcanoes which have not erupted at least for 10,000 years and are not expected to erupt in future. Mt. Kilimanjaro (Tanzania) and Mt. Buninyong Australia are examples of extinct volcanoes.

2. Classification based on periodicity of eruptions

(a) Active volcano: Such volcanoes erupt frequently or at least have erupted in recent periods like barren islands in India and Mt Stromboli in Italy (Lighthouse of mediterranean sea).

(b) Dormant volcano: They are known to have erupted and show signs of possible eruption in future like Mt Kilimanjaro.

(c) Extinct volcano: They have stopped erupting but retain the features of volcanoes.

Earthquakes

- An earthquake is basically the vibration of earth produced by the rapid release of energy. This energy radiates in all directions from the source, in the form of waves. It is accompanied by a rumbling sound and tremors. The place of origin of an earthquake is its **focus**. The point on the earth's surface vertically above the focus is the **epicenter**. Intensity of vibrations is the maximum near the epicenter.
- Seismic sensors, located throughout the world can record the event.
- The magnitude or intensity of energy released by an earthquake is measured by the **Richter scale.** It ranges between 0 and 9.
- Elastic Rebound theory explains the mode and cause of earthquake.

Causes of Earthquake

- Most of the earthquakes are related with compressional or tenssional stresses built up at margins of the moving lithospheric plates.
- Plates are dynamic and often push into one another or are pulled apart at times they even slide over each other. When the stress is too much these rocks break and the beings shake causing earthquake. The process of volcanicity,

faulting and elastic rebounding, hydrostatic pressure alongwith anthropogenic and plate tectonic results in earthquake occurrence. Sometimes, the tremendous energy released by atomic explosions or by volcanic eruptions can also produce earthquakes, but these events are usually too weak and infrequent.

Earthquake Waves

Earthquakes generate pulses of energy which are called **seismic waves** that can pass through the entire Earth. There are three major types seismic waves.

- **Primary (P) waves,** of short wavelength and high frequency, are longitudinal waves which travel not only through the solid crust and mantle but also through the liquid part of the earth's core. This is compression wave. Its speed is highest so it reaches first at earth surface.
- **Secondary (S) waves,** of short wavelength and high frequency, are transverse waves which travel through all the solid parts of the Earth but not the liquid part of the core. It is also called distortional wave and shear wave.
- **Long (L) Waves,** of long wavelength and low frequency, are confined to the skin of the earth's crust, thereby, causing most of the earthquakes structural damage. Long (L) Wave is also called Long period wave. These waves cover the longest distance of all seismic waves.

Distribution of Earthquakes belts in World

I. Circum Pacific Belt accounts for 68% of total earthquakes. Circum Pacific belt runs through the west coasts of North and South America, Aleutian Islands and the island group along the eastern coast of Asia.

II. Mid-Atlantic Belt causes 21% of total earthquakes. This range causes mid-atlantic Ridge and several islands nearer the ridge. Earthquake even here are of moderate to shallow magnitude.

III. Mid Continental Belt causes 11% of total earthquakes. Mid-continental mountain belt runs through the middle of Asia from east to west and goes beyond the Mediterranean Sea. Its axis lies along the mountain belt of the Himalayas, Caucasus, and the Alps.

- The Himalayas, making the great mountain wall of the north, also happen to form the northern margin of the Indian plate and hence are marked by frequent and severe earthquakes.

IV. Others

- Seismicity may also occur away from such regions. Such seismic activities, located within the plates away from the plate margins, are called in-plate seismicity.
- They are generally confined to the weaker zones of the earth's crust.
- These weaker zones are represented by faults or fractures within the earth's crust and are generally less intense than the ones found near the plate margins.
- One such zone of in-plate seismicity is the Narmada-Son lineament, cutting across the northern plane.
- The earthquake of January 26, 2001 of Gujarat was also caused by the growing 'in-plate stress' : whole Kutch is a fault. Bhuj, lies close to the Allah bund fault.
- Hence, in-plate seismicity is due to the reactivation of concealed shields (stable parts of the Earth) and release of energy.

The Earthquake Zones in India

On the basis of intensity of the earthquakes a map of India has been published by the Meteorological Department in collaboration of the Indian Standard Institution. The map shows the five seismic zones based on modified Mercalli scale.

Zone I - Intensity V or below (feeble, slight, moderate rather strong)

Zone II - Intensity VI (strong)

Zone III - Intensity VII (very strong)

Zone IV - Intensity VIII (Destructive Zone)

Zone V - Intensity more than VIII (Disastrous, Catastrophic)

Zone I - Comprises some parts of Punjab and Haryana, plains of Uttar Pradesh, Coastal plains of Maharashta and Kerala.

Zone II - Includes Southern Punjab and Haryana, certain parts of Plains of Uttar Pradesh, Eastern Rajasthan, Coastal areas of Odisha and Tamilnadu. This is the low damage rests zone.

Zone III: Covers Southern and South Eastern parts of Rajasthan, larger parts of Madhya Pradesh, Maharashtra, Karnataka, Jharkhand and Northern and North-Western parts of Orissa.

Zone IV: Covers Jammu and Kashmir, Himachal Pradesh, Northern parts of Punjab, Haryana, Delhi, Eastern Uttar Pradesh, Tasai and Bhabhat regions, the Himalayan areas of Uttaranchal, Bihar and Sikkim

Zone V: Covers certain parts of Jammu and Kashmir, Himachal Pradesh, Uttranchal, Monghy, and Darbhanga districts of Bihar, Northern part of India and Kutchh region of Gujarat.

Some specific areas where the waves are not reported, such zone is called the 'shadow zone'.

MINERALS

Earth is composed of various elements. These are in a solid state in the outer layer of the earth and in molten state in the interior. About 98% of the total crust of the earth is composed of eight elements like oxygen, silicon, aluminum, iron, calcium, sodium, potassium and magnesium. Out of these, silicates carbonates and oxides make up a large group of them. Elements in the earth's crust are combined with other elements to form various substances. These substances are known as **minerals**. Quartz, for example, has two elements, silicon and oxygen, united together form a compound known as carbonate of lime. The basic source of all minerals is the hot magma in the interior of the earth. When magma cools down, crystals of minerals appear and a systematic series of minerals are formed in sequence so as to form rocks.

ROCKS

The earth is composed of rocks. A rock is an aggregate of one or more minerals. There are three types of rocks on the basis of their formation. (1) Igneous, (2) Sedimentary and (3) Metamorphic rocks.

Igneous Rocks

- Igneous Rock is derived from latin word 'ignis' meaning fire.
- It is formed when magma cools and solidifies either on the surface of the earth or inside the earth.
- Igneous rocks have been forming since the earth was born.
- Out of three kinds of rock – igneous, sedimentary and metamorphic- they were first to be formed and hence they are called **Primary Rocks** and even parent rock.
- It is characterised by hardness which leads to no percolation of water resulting in no chemical weathering. But the grains of igneous rocks are affected by mechanical on physical weathering.
- No fossil is formed and is associated with volcanic activities.
- Igneous rocks are classified into (1) **extrusive** – it is formed when lava gets solidified on reaching the surface of the earth and (2) **intrusive** – it is formed by solidification of magma at moderate depths beneath the earth's surface and its rate of cooling is slow.
- Intrusive rocks are of two types such as plutonic rocks and hypabyssal rocks.
- Plutonic rocks are magmas which cooled deep inside the earth with a slow speed as temperature over there is high. These rocks are of coarse grained like granite.
- Hypabyssal rocks are volcanic magma which cools and solidifies in cracks, pores and hollows beneath the earth's surface, pores, batholiths, lopoliths, phacoliths, laccoliths, sills and dykes are its examples.

Sedimentary Rocks

The word 'sedimentary' is derived from the Latin word sedimentum, meaning settling. These are formed by the sediments brought by rivers, wind and glaciers. Rocks of the earth's surface are exposed to denudational agents, and are broken into smaller fragments. Such fragments are transported by different exogenous agencies and deposited. These deposits due to pressure and compression turn into rocks. Sedimentary rocks are sandstone, shale and conglomerates. These are also formed from organic matter derived from plants or animal remains and thus are called as fossil rocks. Coal and limestone are such sedimentary rocks. Sedimentary rocks are classified into three major groups:

(i) **Mechanically formed** – Sandstone, Conglomerate, limestone, shale, loess.

(ii) **Organically formed** – e.g. geyserite, chalk, limestone, coal etc.

(iii) **Chemically formed** – like chalk, limestone, halite, potash etc.

Metamorphic Rocks

- Metamorphic means 'change of form'. Metamorphism covers all the processes by which rocks are altered in their mineralogy, texture and internal structure owing to external sources of heat, pressure and introduction of new chemical substances. Due to metamorphism, igneous and sedimentary rocks get totally changed in their physical state, chemical composition and crystallization of minerals. Granite is converted into gneiss, clay and shale are transformed into slate, and coal is transformed into graphite, limestone changes into marble. Gneiss, slate, schist and marble are examples of metamorphic rocks.

Four types of metamorphic rocks are recognized on the basis of its composition:

(1) Contact or thermal metamorphism (due to heat)

(2) Dynamic and regional metamorphism (due to pressure)

(3) Hydro-metamorphism (due to hydro-static pressure)

(4) Hydro-thermal metamorphism (due to water and heat)

LANDFORMS

- Oceans and continents are first order of relief.
- Mountains, plains and plateau are second order of relief.
- When the agent of erosion acts on these second order of relief the third order of relief is formed land forms formed by agents like river, wind and glacier etc.

Mountain

- Mountains are significant relief features of the second order on the earth's surface. A mountain may have several forms.
- **Mountain Ridge –** a system of long, narrow and high hills.
- **Mountain Range –** a system of mountain and hills with several ridges.
- **Mountain Chain –** Which have several parallel, long and narrow mountains belonging to different periods.
- **Mountain Group –** Consists of several unsystematic patterns of different mountain system.
- **Mountain System –** Consists of different mountain ranges belonging to the same period.
- **Classification based on mode of origin**

1. **Structural or Tectonic Mountain:** These mountains come into existence due to tectonic forces. They are of three types.
   - **(a) Fold Mountains:** These are created by compressive forces. Fold mountains are of three types:
     - **(i) Young Fold mountain :** Some young fold mountain are Alps in Europe, the Rockies of

North America, the Andes of South America, the Himalayas of Asia and Atlas of North Africa. These young fold mountains are still rising under the influence of the earth's tectonic forces.

(ii) **Matured Fold mountain :** The Urals, the Appalachians, the Tien Shan and the Nan Shan were formed during an earlier mountain-building period.

(iii) **Old Fold mountain :** Folded mountains which have originated before tertiary period are called old fold mountain e.g. – Caledonian and Hercynian, Vindhyachal, Aravalis. These are also called relict fold mountain because of denudation.

(b) **Block Mountains:** Originated by tensile forces leading to the formation of rift valleys e.g. Wasatch range in Utah (USA), Vosges and Black forest mountain (Europe), Salt Range (Pakistan) and Sierra Nevada mountain (USA). They are known as fault black mountains.

(c) **Dome Mountains:** Originated by magnatic intrusions and upwraping of the crustal surface e.g. Normal domes, Lava domes, Laccolithic domes, Salt domes etc.

2. **Mountain of accumulation or volcanic mountain :** Formed due to accumulation of volcanic material. Mount Mauna Loa in Hawai islands, Mt. Fuji Yoma of Japan and Mt. Popa in Central Myanmar are some of examples.

3. **Erosional or *Relict* Mountain :** These are formed due to the erosion of the earlier mountains. Its examples are the Vindhyanchal range, Aravalis, Satpura, Eastern Ghats, and Western Ghats in India.

Plateau

- Plateaus are extensive area characterized by flat and rough top surface, steep sidewalls which rise above the neighbouring ground surface at least for 300 metres.
- Causes about 33% of the total earth's area.

Classification of plateau

1. **Plateau formed by exogenetic processes**
   (i) **Glacial Plateau**, e.g. Garhwal plateau, Greenland, Antarctica.
   (ii) **Fluvial Plateau** e.g. Kaimur plateau, Bhander plateau, Rewa Plateau, Rohtas Plateau.
   (iii) **Aeolian Plateau** e.g. Potwar Plateau (Pak), Loess plateau (China)
2. **Plateau formed by endogenetic processes**
   (i) Intermontane Plateau : The plateaus which are partly or fully enclosed by mountains are known as intermontane plateaus. These are the results of the mountain-building process which was accompanied by a vertical uplift of the adjoining enclosed lands. e.g. Tibetan plateau, Bolivian plateau, Péruvien plateau, Columbian plateau and Mexican plateau.
   (ii) Piedmont Plateau : Situated at the foot of a mountain, they are bounded on the opposite side by a plain or an ocean. These are also called the plateaus of denudation because areas which were formerly high have now been reduced in elevation by various agents of erosion. e.g. Appalachian plateau, Patagonien plateau (Argentina).
   (iii) Dome Plateau : Formed when land mass is uplifted e.g. Ozark Plateau (USA), Chotanagapur plateau (Jharkhand)
   (iv) Lava Plateau : Formed due to accumulation of thick layers of basaltic lava e.g. Columbia plateau (USA), Mahabaleshwar plateau, Panchgani tableland.
   (v) Continental Plateau : They rise abruptly from the lowlands or from the sea. e.g. Deccan plateau of India, Ranchi plateau, Shillong plateau, Columbia plateau (USA), Mexican plateau etc.
   (vi) Coastal Plateau : e.g. Coromandel coastal upland of India.
   (vii) Desert Plateau : Arabian Plateau.
   (viii) Humid Plateau : e.g. Shillong Plateau, Assam Plateau, Mahabaleshwar Plateau etc.
   (ix) Young Plateau : e.g. Idaho Plateau (USA), Colorado Plateau (USA), Mahabaleshwar Plateau, Khandala Upland (Maharashtra).
   (x) Mature Plateau : e.g. Ranchi Plateau, Hazaribagh Plateau (Jharkhand), Appalachian Plateau (USA).
   (xi) Rejuvenated Plateau: e.g. Missouri Plateau (USA).

Plains

- A plain is a relatively flat and low-lying land surface with least difference between its highest and lowest points. They are formed by endogenetic forces, erosion and exogenetic deposition.

Plains have been divided into:
(1) Structural Plains
(2) Erosional Plains
(3) Depositional Plains

Structural Plains

- These plains are uplift of a part of the sea floor usually bordering a continent, that is, the continental shelf.
- Depressed areas which make up very extensive lowlands on the earth.
- The underlying horizontal beds of rocks are relatively undisturbed by the earth's crustal movements.
- Such plains include the great plains of Russian platform, the great plains of USA and the Central lowlands of Australia.
- The coastal plain lying between the Appalachian Piedmont Plateau and the Atlantic coast of south-eastern United States is an example of an uplifted coastal plain.

Erosional Plains

- These are formed when an elevated tract of land, for instance, a mountain, a hill or a plateau is worn down to a plain by the process of erosion.
- The surface almost smooth is termed as a **peneplain** river, ice and wind eroded regions.

- The plain formed by wind action is called as pediplain.
- Northern Canada, northern Europe and west Siberia are examples of such ice-eroded plains.
- Parts of Sahara in Africa are wind-eroded plain surface.
- The rivers by widening their banks and lowering the higher land between them have eroded parts of the Amazon basin into streameroded type of plains.

Depositional Plains

- The plain formed by deposition of sediments occurs due to the actions of rivers, glaciers, wind, sea wave etc. Different types of depositional plains are:

1. **River Plain :** These are formed by the alluvium brought down by the rivers. The Indo-Gangetic plain in Indian subcontinent, Hwang-ho plain of north China and Povalley in North Italy are some examples of alluvial plain. (1) Food plain (2) Deltaic plain (3) Pediment plain
2. **Lacustrine plain :** A plain that originally formed in a lacustrine environment. It is a lake basin Valley. Kashmir is its example.
3. **Lava Plain :** It is formed due to volcanic eruption.
4. **Loess Plain :** Formed due to wind deposition. Plains of N. China and Russian Turkistan is formed due to it.
5. **Marine Plain :** Develops near coast of shallow sea coastal areas of Netherlands Germany, Denmark and the Gulf of Mexico in U.S.A.
6. **Galacial Plain :** Formed due to deposition of galacial and debris.
   (a) Till plain (b) Morainic plain (c) Out wash plain

Fluvial Landforms

- Running water is the most important agent of denudation. Flow of a river or a stream is very strong. River action includes weathering and mass wasting causes fluvial denudation.

Erosion by rivers It is performed in two ways mechanical erosion and chemical erosion

They are fertile and economic, importance is dependent on the type of sediments brought by agents of denudation.

1. **Solution/Corrosion :** It is a type of chemical weathering in which most of the salts are removed from the bedrocks through the process of carbonation.
2. **Abrasion/Corrosion :** Involve the removal of loosened material of the rock of valley walls and floor by actions of erosional tools.
3. **Attrition :** Wear and tear of transported material when they roll and collide with each other.
4. **Hydraulic Action :** It involves breakdown of rocks of valley sides due to the impact of water currents. It is both mechanical and chemical process.

River Land Forms

I. **Upper Course landforms :** V-shaped valley, gorges, canyons, rapids and water fall these are mostly erosional plain of river. The river is at youth stage when it is at upper course.
II. **Middle Course landforms:** Alluvial far and cone, meanders and oxbow lake are formed in the middle course of a river. The river achieves maturity stage in this course. Depositional features are formed in this course.
III. **Lower Course landforms :** Delta is formed at the lower course of the river. It is also known as old stage for a river.

Delta

- Depositional feature of triangular shape at the mouth of a river debouching either into a lake or a sea is called a delta.

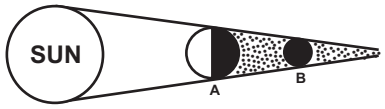
Types of Delta

(a) **Bird's foot delta**, Ex-Mississippi delta
(b) **Arccuate delta**, Ex-Nile, Ganga, Mekong.
(c) **Estuarine delta :** Amazon, Ob, Vistula, and Tapi.

Their fertility and economic importance is dependent on the type of sediments brought by agents of denudation.

Exercise -1

1. In order of their distances from the Sun, which of the following planets lie between Mars and Uranus?
   (a) Earth and Jupiter (b) Jupiter and Saturn
   (c) Saturn and Earth (d) Saturn and Neptune
2. Which one of the following planets has largest number of natural satellites or moons?
   (a) Jupiter (b) Mars
   (c) Saturn (d) Venus
3. Which one of the following statements is correct with reference to our solar system?
   (a) The earth is the densest of all the planets in our solar system
   (b) The predominant element in the composition of earth is silicon
   (c) The sun contains 75 percent of the mass of the solar system
   (d) The diameter of the sun is 190 times that of the earth
4. The group of small pieces of rock revolving round the sun between the orbits of Mars and Jupiter are called
   (a) meteors (b) comets
   (c) meteorites (d) asteroids
5. In the earth's direction of rotation is reversed, what should be the IST when it is noon at the International Date Line?
   (a) 06.30 hrs (b) 05.30 hrs
   (c) 18.30 hrs (d) 17.30 hrs
6. Which one of the following conditions is most relevant for the presence of life on Mars?
   (a) Atmospheric composition
   (b) Thermal conditions
   (c) Occurrence of ice caps and frozen water
   (d) Occurrence of ozone
7. A meteor is
   (a) a rapidly moving star
   (b) a piece of mater which has entered the earth's atmosphere from outer space
   (c) part of a constellation
   (d) a comet without a tail
8. Diamond ring is a phenomenon observed:
   (a) at the start of a total solar eclipse
   (b) at the end of a total solar eclipse
   (c) only along the peripheral regions of the totality trail
   (d) only in the central regions of the totality trail
9. An instrument to measure the amount of brightness of sunshine received at a point on Earth's surface is
   (a) Sun-dial
   (b) Sunshine recorder
   (c) Campbell - Stoke's recorder
   (d) All of the above
10. Which would you record the maximum angle of incidence of the sun's rays at the North pole ?
    (a) March 21
    (b) September 21
    (c) When the sun's rays fall vertically on the Tropic of Cancer
    (d) When the sun's rays fall vertically on the Tropic of Capricorn
11. In the following diagram, an eclipse is represented. Which statement is correct about it ?



    (a) The diagram represents a lunar eclipse, A is the moon and B is the earth
    (b) The diagram represents a solar eclipse, A is the earth and B is the moon
    (c) The diagram represents a lunar eclipse, A is the earth and B is the moon
    (d) The diagram represents a total solar eclipse
12. What can be the maximum duration of totality for a solar eclipse?
    (a) 12.5 minutes
    (b) 7 minutes 40 seconds
    (c) 1 hour 42 minutes
    (d) There is no maximum duration
13. That the earth is a sphere is not proved by
    (a) the sunrise not being visible from all places at the same time
    (b) the position of polaris as one travels from equator to North Pole
    (c) the circular shadow of earth at the time of solar eclipse
    (d) modern navigation methods
14. Which of the following statements with regard to the term 'great circle' is not correct ?
    (a) Equator is a great circle.
    (b) A ship can save fuel and time by following the great circle arc between two points.
    (c) Only one great circle can be drawn on a sphere.
    (d) A great circle results when a plane passes through the centre of a sphere.
15. The solar eclipse achieves totality only in limited geographical regions because
    (a) The size of the shadow of the moon on the earth is small as compared to the cross section of the earth
    (b) The earth is not smooth flat surface, but has elevations and depressions
    (c) The trajectories of the earth around the sun and the moon around the earth are not perfect circles
    (d) Sun rays can reach most of the peripheral regions of shadow of the moon due to atmospheric refraction
16. The axis of rotation of the earth is tilted by 23.5° to the plane of revolution around the sun. The latitude of Mumbai is less than 23.5° whereas the latitude of Delhi is more than 23.5°. Which one of the following statements in this regard is correct?
    (a) The sun can come overhead at both these places
    (b) The sun will never come overhead at either of these places
    (c) At Mumbai the sun can come overhead, but it will never do so at Delhi
    (d) At Delhi, the sun can come overhead but it will never do so at Mumbai

17. The sidereal month may be defined as
    (a) the period in which the moon completes an orbit around the Earth.
    (b) the period in which the moon completes an orbit around the Earth and returns to the same position in the sky.
    (c) the period of rotation of moon
    (d) None of these
18. Isostasy is
    (a) the property of the continental and oceanic crust, that they have the ability to rise and sink.
    (b) due to which crust floats on top of the mantle like ice cubes in water.
    (c) the phenomenon when the earth's crust gains weight due to mountain building or glaciation, it deforms and sinks deeper into the mantle.
    (d) All are correct
19. Magma that is more granitic tends to be very explosive because
    (a) of relatively higher water content
    (b) of relatively higher gases content
    (c) of relatively lower water content
    (d) of relatively lower gases content
20. Which of the statements does not prove the spherical shape of the earth?
    (a) If the earth were flat one would come across some sharp edges
    (b) The sunrise is not visible from all places at the same time
    (c) The shadow of the earth at the time of the solar eclipse is circular
    (d) The altitude of the stars from various points on the earth's surface varies
21. One Astronomical Unit is the average distance between
    (a) Earth and the Sun (b) Earth and the Moon
    (c) Jupiter and the Sun (d) Pluto and the Sun
22. On the surface of the moon, the
    (a) mass and weight become lesser
    (b) mass remains constant and only the weight is lesser
    (c) only the mass is lesser
    (d) mass and weight both remain unchanged
23. We always see the same face of the moon because
    (a) it is smaller than the earth.
    (b) it revolves on its axis in a direction opposite to that of the earth.
    (c) it takes equal time for both revolution around the earth and rotation on its own axis.
    (d) it rotates at the same speed as the earth around the sun.
24. In which region can the phenomenon of midnight sun be observed?
    (a) In the tropical zone
    (b) In warm temperate regions
    (c) In the Arctic and Antarctic regions
    (d) Anywhere at the time of solar eclipse
25. The theory suggesting that the continents of South America and Africa were once joined together was the
    (a) continental drift theory
    (b) tetrahedral theory
    (c) Kant's theory
    (d) Ritter's theory
26. When there is noon at I.S.T. meridian people another place of the Earth are taking their 6 O' clock morning tea. The longitude of the place is
    (a) 17°30' E (b) 7°30' W .
    (c) 172°30' E (d) 90° W
27. When it is 12 Noon at Allahabad, the time at Wellington (New Zealand) would be close to which one of the following?
    (a) 4:30 pm of the same day
    (b) 4:30 pm of the previous day
    (c) 6:30 pm of the same day
    (d) 6:30 pm of the previous day
28. The correct sequence of the earth's location on its orbit around the sun is
    (a) autumnal equinox, vernal equinox, summer solstice, winter solstice
    (b) vernal equinox, summer solstice, autumnal equinox, winter solstice
    (c) summer solstice, vernal equinox, winter solstice, autumnal equinox
    (d) winter solstice, summer solstice, autumnal equinox, vernal equinox
29. Beirut time is two hours ahead and Lima time is five hours behind GMT. The longitudes of Beirut and Lima are respectively:
    (a) 75° West and 30° East
    (b) 70° East and 35° West
    (c) 30° East and 75° West
    (d) 35° West and 70° East
30. If there are four place on the same meridian 500 km apart and the local time at one place is 12.00 noon, what will be the time at the three other places?
    (a) 12.00 noon
    (b) 1.00 pm
    (c) 2.00 pm
    (d) Different time at different places
31. Which one of the following is the time required for the earth to return to a given point in its orbit with reference to fixed stars called ?
    (a) Lunar year (b) Solar year
    (c) Tropical year (d) Sidereal year
32. Which one among the following explains the earthquakes of the eastern margins of Asia?
    (a) Subduction of Pacific plate under Asiatic plate
    (b) Subduction of African plate below European plate
    (c) Subduction of Indian plate under Asiatic plate
    (d) Subduction of American plate under the Pacific plate
33. Unlike other Meridians International Date Line is drawn zigzag in order to
    (a) permit certain land areas and groups of islands to have the same calendar day
    (b) facilitate the sailors to adjust time in their watch

(c) adjust the day in calendar while sailing from east to west and vice versa
(d) make 180°E and 180°W coterminous

34. The latitude is the angular distance of a point of the Earth surface, North or South, of the equator as measured from the
(a) Centre of the Earth
(b) Equator
(c) Tropic of Cancer or Capricorn
(d) Poles

35. Which one of the following pairs is not correctly matched?

	Month	Position of Sun
(a)	June	Midday Sun overhead at Tropic of Cancer
(b)	December	Midday Sun overhead at Tropic of Capricorn
(c)	March	Midday Sun overhead on Equator
(d)	September	Midday Sun overhead at Arctic Circle

36. The colour of the star is an indication of its
(a) Distance from the earth
(b) Distance from the sun
(c) Temperature
(d) Luminosity

37. The group of stars arranged in a definite pattern is called
(a) Milky way (b) Constellation
(c) Andromeda (d) Solar system

38. Which one of the following is the largest satellite in solar system?
(a) Ganymede (b) Titan
(c) Europa (d) Triton

39. The principle of Black hole was enunciated by
(a) C.V. Raman
(b) H.J. Bhabha
(c) S. Chandrashekhar
(d) H. Khurana

40. The distance of Moon from the Earth is
(a) 364 thousand kms.
(b) 300 thousand kms.
(c) 350 thousand kms.
(d) 446 thousand kms.

41. Which planet was named after the Roman God Zeus?
(a) Earth (b) Mars
(c) Venus (d) Jupiter

42. The approximate diameter of Earth is
(a) 4200 km (b) 6400 km
(c) 3400 km (d) 12800 km

43. What is the time taken by the Earth to complete one rotation on its axis?
(a) 23 hr 52 min 4 sec (b) 23 hr 56 min 4 sec
(c) 24 hr 53 min 2 sec (d) 24 hr 12 min 6 sec

44. The Blue Moon phenomenon occurs
(a) when two full moons occur in the same month.
(b) when two full moons appear in the same month thrice in a calendar year.
(c) when four full moons appear in two consecutive months of the same calendar year.
(d) None of the above

45. During the Venus transit, the planet appeared as a tiny black circle moving on the Sun. The black colour on the Sun is because the planet :
(a) Obstructed all light from the Sun.
(b) Is black in colour.
(c) Was invisible due to bright rays from the Sun.
(d) Behaved as a black hole during its transit.

46. Scientists have determined the temperature near the Earth's centre 1,000°C hotter than was reported in an experiment run 20 years ago at
(a) 6,000° Celsius
(b) 5,000° Celsius
(c) 4,000° Celsius
(d) None of these

47. Space between Earth and Moon is known as
(a) Cislunar (b) Fulalunar
(c) Nebula (d) None of these

48. Which of the following stars is known as Fossil star?
(a) Protostar (b) Dog Star
(c) Red Giant (d) White Dwarf

49. The energy of sun is produced by
(a) Nuclear fission (b) Ionisation
(c) Nuclear fusion (d) Oxidation

50. Which one of the following conditions is most relevant for the presence of life on mars?
(a) Atmospheric composition
(b) Thermal conditions
(c) Occurrence of ice cap and frozen water
(d) Occurrence of ozone

51. Lunar eclipse occurs
(a) When moon lies between earth and sun
(b) When earth lies between sun and moon
(c) When sun lies between earth and moon
(d) None of these

52. By how much degree the earth is inclined on its own Axis
(a) $23^{1/2}$ (b) $66^{1/2}$
(c) $24^{1/2}$ (d) $69^{1/2}$

53. Which of the following elements occurs the most abundantly in our universe?
(a) Hydrogen (b) Oxygen
(c) Nitrogen (d) Helium

54. The black part of the moon is always calm and dark which is called
(a) Sea of tranquility (b) Ocean of storms
(c) Area of storms (d) None of these

55. Variations in the length of daytime and nighttime from season to season are due to
(a) the earth's rotation on its axis
(b) the earth's revolution round the sun in an elliptical manner
(c) latitudinal position of the place
(d) revolution of the earth on a tilted axis.

56. Plate tectonics is a scientific theory that describes the large scale motions of Earth's lithosphere. Which one among the following statements regarding Plate tectonics is not correct?
    (a) Tectonic plates are composed of Oceanic lithosphere and thicker Continental lithosphere
    (b) Tectonic plates are able to move because the Earth's lithosphere has a higher strength than the underlying asthenosphere
    (c) The Earth's lithosphere is broken up into Tectonic Plates
    (d) Along divergent plate boundaries, subduction carries plates into the mantle
57. Albedo effect would be relatively higher in
    (a) early morning and late evening
    (b) early morning only
    (c) noon
    (d) late evening only
58. Which of the following statements regarding the duration of day and night is correct?
    (a) Difference is least near the Equator and progressively increases away from it
    (b) Difference is maximum at the Equator and progressively decreases away from it
    (c) Difference is least at the Tropics and progressively increases towards the Equator and Poles
    (d) Difference is maximum at the Tropics and progressively decreases towards the Equator and Poles
59. Which one of the following is depositional landform ?
    (a) Stalagmite (b) Lapis
    (c) Sinkhole (d) Cave
60. What explains the eastward flow of the equatorial counter-current? [CSAT 2015 - I]
    (a) The Earth's rotation on its axis
    (b) Convergence of the two equatorial currents
    (c) Difference in salinity of water
    (d) Occurrence of the belt of calm near the equator

Exercise -2

Statement Based MCQ

1. A team of scientists at Brookhaven National Laboratory including those from India created the heaviest anti-matter (anti-helium nucleus). What is/are the implication/ implications of the creation of anti-matter?
   1. It will make mineral prospecting and oil exploration easier and cheaper.
   2. It will help probe the possibility of the existence of stars and galaxies made of anti-matter.
   3. It will help understand the evolution of the universe.

   Select the correct answer using the codes given below :
   (a) 1 only (b) 2 and 3
   (c) 3 only (d) 1, 2 and 3
2. About 95 per cent of active volcanoes occur at the
   1. plate subduction zones
   2. transform faults
   3. island arcs
   4. mid-oceanic ridges

   Choose your answer from the following codes.
   (a) 1 and 2 (b) 1 only
   (c) 1 and 4 (d) All of the above
3. Which of the following is/are cited by the scientists as evidence/evidences for the continued expansion of universe?
   1. Detection of microwaves in space.
   2. Observation of redshift phenomenon in space.
   3. Movement of asteroids in space.
   4. Occurrence of supernova explosions in space.

   Select the correct answer using the codes given below :
   (a) 1 and 2
   (b) 2 only
   (c) 1, 3 and 4
   (d) None of the above can be cited as evidence
4. Consider the following statements:
   1. The Axis of the earth's magnetic field is inclined at 23 and half to the geographic axis of the earth.
   2. The earth's magnetic pole in the Northern Hemisphere is located on a Peninsula in Northern Canada.
   3. The earth's magnetic equator passes through Thumba in South India.

   Which of the statements given above is/are correct?
   (a) 1, 2 and 3 (b) 2 and 3
   (c) 2 only (d) 3 only
5. Lithosphere covers
   1. Continental crust
   2. Oceanic crust
   3 Upper solid part of mantle
   4. Upper liquid part of mantle

   Select the correct answer from the codes given below.
   (a) 2 and 3 (b) 1, 2 and 3
   (c) 1, 2 and 4 (d) 3 and 4
6. Earthquakes are important in landform studies because they can trigger catastrophic events like
   1. Landslides and mudflows
   2. Glacier surges
   3. Tsunamis causing damage and shoreline changes

   Select the correct answer from the codes given below.
   (a) 1, 2 and 3 (b) 3 only
   (c) 1 and 2 (d) 1 and 3
7. Which of the following statements is/are correct?
   1. All stars and planets in the universe shine by the reflected light of the sun.
   2. Sun is believed to be formed of condensation of gases.
   3. The sun has a surface temperature of about 20 million °C.
   4. Sun is about 30,000 times as big as the earth.

   Select the correct answer from the codes given below.
   (a) 2 only (b) 1 and 2
   (c) 3 and 4 (d) 2 and 3
8. If the earth's axis had not been inclined,
   1. temperature distribution would have been uniform.
   2. days and nights would not have occurred.
   3. seasons would not have occurred.
   4. poles would not have continuous day.
   (a) 1, 3 and 4 (b) 2 and 4
   (c) 3 and 4 (d) 2, 3 and 4
9. The permanent tilt of the earth's axis and the revolution of the earth in its orbit together cause
   1. deflection of winds and ocean currents.
   2. differences in time between places on different meridians.
   3. varying lengths of day and night at different times of the year.
   4. changes in the altitude of the mid-day sun at different times of the year.
   (a) 2, 3 and 4 (b) 1 and 4
   (c) 3 and 4 (d) 1, 2 and 3
10. Which of the following are true with respect to fold mountains?
    1. Their tops are often buried beneath snow and ice.
    2. They form rugged peaks.
    3. They are caused by contraction of the earth's crust.
    4. They contain a core composed of metamorphic and igneous rocks.
    (a) 1, 3 and 4 (b) 2, 3 and 4
    (c) 1 and 2 (d) 1 and 4
11. On which days do the spring tides occur?
    1. new moon
    2. first quarter of the moon
    3. third quarter of the moon
    4. full moon
    (a) 1, 2 and 4 (b) 2, 3 and 4
    (c) 1 and 4 (d) 2 and 3
12. Arrange the planets correctly in descending order in terms of number of their satellites.
    1. Uranus 2. Jupiter
    3. Saturn 4. Mars
    (a) 2, 3, 1, 4 (b) 4, 2, 3, 1
    (c) 2, 3, 4, 1 (d) 3, 2, 1, 4

13. The standard time of the following countries is ahead of behind Greenwich Mean Time depending on whether they are East or West of the longitude passing through Greenwich.
    1. Cuba 2. Greece
    3. Iraq 4. Costa Rica
    5. Japan
    Which one of the following sequential orders gives the correct arrangement of the countries according to their standard time from ahead to behind GMT ?
    (a) 5, 3, 2, 1, 4 (b) 2, 4, 1, 3, 5
    (c) 4, 1, 3, 2, 5 (d) 3, 5, 4, 1, 2
14. Consider the following statements :
    1. As a rock, graphite is formed from coal by thermal metamorphism.
    2. Gypsum is an example of sedimentary rock.
    Which of these statements is/are correct ?
    (a) 1 only (b) 2 only
    (c) Both 1 and 2 (d) Neither 1 nor 2
15. Consider the following statement:
    1. Mechanical weathering takes place only in sedimentary rocks.
    2. The rain-water reacts with rocks to form new chemical substances.
    Which of the statements given above is/are correct ?
    (a) 1 only (b) 2 only
    (c) Both 1 and 2 (d) Neither 1 nor 2
16. Which one of the following statements is/are correct with regard to lines of latitude?
    1. They are concentric circles numbered from 0° to 90°.
    2. They are circles on a globe which are parallel to the Equator and which are to the North and South of the Equator.
    Select the correct answer using the code given below:
    (a) 1 only (b) 2 only
    (c) Both 1 and 2 (d) Neither 1 nor 2
17. Which one of the following statements is/ are correct with regard to Milky Way?
    1. It is a spiral galaxy.
    2. The solar system resides in one of its spiral arms.
    Select the correct answer using the code given below:
    (a) 1 only (b) 2 only
    (c) Both 1 and 2 (d) Neither 1 nor 2
18. Consider the following statements.
    1. The tropical year is shorter than the sidereal year.
    2. The solar day is longer than the sidereal day.
    Which of the statements given above is/are correct?
    (a) 1 only (b) 2 only
    (c) Both 1 and 2 (d) Neither 1 nor 2
19. Which of the following statements regarding the Deccan Traps is/are correct?
    1. Intense volcanic activity in the form of fissure eruption took place towards the end of Cretaceous period.
    2. The volcanic lava spread out in horizontal sheets.
    3. The regur soil found here is rich in nitrogen.
    Select the correct answer using the codes given below
    (a) 1 and 2 (b) 1, 2 and 3
    (c) 3 only (d) 1 only
20. Which of the following statements is/ are correct?
    1. The major constituent mineral of granite rock is quartz.
    2. The major constituent mineral of sandstone rock is feldspar.
    3. The major constituent mineral of limestone rock is dolomite.
    Select the correct answer using the code given below:
    (a) 1, 2 and 3 (b) 3 only
    (c) 1 and 2 (d) 2 and 3
21. Which of the following phenomenon is/are the effect of the rotation of the Earth?
    1. Apparent movement of the Sun, the Moon and the Stars.
    2. Flatness of the poles and bulge at the equator.
    3. Occurrence of sunrise, noon and sunset.
    4. Magnetic field of the Earth.
    Select the correct answer by using the codes given below:
    (a) 1 and 2 only (b) 1 and 3 only
    (c) 2 and 3 only (d) 1, 2, 3 and 4
22. Consider the following statements:
    1. Our solar system is located in the orion arm of the Milky way galaxy, about two-third of the way out from the centre.
    2. The solar system formed from an interstellar cloud of dust and gas or nebulla about 4.6 billion years ago.
    Which of the above statements is/are correct?
    (a) 1 only (b) 2 only
    (c) Both 1 and 2 (d) Neither 1 nor 2
23. Consider the following pairs:
    1. Electromagnetic radiation
    2. Geothermal energy
    3. Gravitational force
    4. Plate movements
    5. Rotation of the earth
    6. Revolution of the earth
    Which of the above are responsible for bringing dynamic changes on the surface of the earth?
    (a) 1, 2, 3 and 4 only
    (b) 1, 3, 5 and 6 only
    (c) 2, 4, 5 and 6 only
    (d) 1, 2, 3, 4, 5 and 6
24. Which of the following phenomena might have influenced the evolution of organisms? (CSAT - 2014)
    1. Continental drift
    2. Glacial cycles
    Select the correct answer using the code given below.
    (a) 1 only (b) 2 only
    (c) Both 1 and 2 (d) Neither 1 nor 2
25. Which of the following is/are direct source(s) of information about the interior of the Earth?
    1. Earthquake wave 2. Volcano
    3. Gravitational force 4. Earth magnetism
    Select the correct answer using the codes given below
    (a) 1 and 2 (b) Only 2
    (c) 3 and 4 (d) All of these
26. Statement I : Sideral day is shorter than Solar day.
    Statement II : The motion of the Earth in its orbit around the Sun is termed as revolution. [CSAT 2015-I]
    (a) Both the statements are individually true and Statement II is the correct explanation of Statement I
    (b) Both the statements are individually true but Statement II is not the correct explanation of Statement I

(c) Statement I is true but Statement II is false
(d) Statement I is false but Statement II is true

27. Arrange the following features formed by rivers in its course starting from upstream: [CSAT 2015-I]
1. Meanders 2. Falls
3. Delta 4. Oxbow Lake
Select the correct answer using the code given below:
(a) 2 – 1 – 3 – 4 (b) 2 – 1 – 4 – 3
(c) 1 – 2 – 3 – 4 (d) 1 – 4 – 2 – 3
(a) 1 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 2 and 3

Matching Based MCQ

DIRECTIONS (Qs. 28 to 32) : Match List-I with List-II and select the correct answer using the codes given below the lists.

28.

	List I (Special (Characteristic)	**List II (Name of planet)**
(A)	Smallest planet of the solar system	(1) Mercury
(B)	Largest planet of the solar system	(2) Venus
(C)	Planet second from the Sun in the solar system	(3) Jupiter
(D)	Planet nearest to the Sun	(4) Pluto (5) Saturn

(a) A – 2 ; B – 3 ; C – 5 ; D – 1
(b) A – 3 ; B – 5 ; C – 1 ; D – 2
(c) A – 4 ; B – 1 ; C – 2 ; D – 3
(d) A – 4 ; B – 3 ; C – 2 ; D – 1

29.

	List I	**List II**
(A)	Piedmont plateau	(1) Antrim plateau
(B)	Continental plateau	(2) Potwas plateau
(C)	Intermontane plateau	(3) Bolivia plateau
(D)	Lava plateau	(4) Patagonia plateau

(a) A – 4 ; B – 1 ; C – 3 ; D – 2
(b) A – 3 ; B – 1 ; C – 4 ; D – 2
(c) A – 3 ; B – 2 ; C – 4 ; D – 1
(d) A – 4 ; B – 2 ; C – 3 ; D – 1

30.

	List-I (Volcanoes of the world)	**List-II (Countries)**
(A)	Catapoxi	(1) Indonesia
(B)	Kilimanjaro	(2) Kenya
(C)	Visuvius	(3) Japan
(D)	Krakatau	(4) Italy (5) Canada

(a) A - 3; B - 1; C - 4; D - 2
(b) A - 5; B - 2; C - 3 ; D - 1
(c) A - 3; B - 2; C - 4 ; D - 1
(d) A - 5; B - 1; C - 3 ; D - 2

31.

	List-I (Volcano)	**List-II (Country)**
(A)	Semeru	(1) Indonesia
(B)	Cotopaxi	(2) Equador
(C)	Etna	(3) Italy
(D)	Kilimanjaro	(4) Kenya (5) India

(a) A - 1; B - 2; C - 3; D - 4
(b) A - 3; B - 4; C - 5; D - 2
(c) A - 1; B - 4; C - 3; D - 2
(d) A - 3; B - 2; C - 5; D - 4

32. Match List I with List II and select the correct answer using the code given below the Lists :

	List I (Phenomenon)	List II (Date)
A.	Summer solstice	1. 21st June
B.	Winter solstice	2. 22nd December
C.	Vernal Equinox	3. 23rd September
D.	Autumnal Equinox	4. 21st March

Code :

	A	B	C	D
(a)	1	4	2	3
(b)	1	2	4	3
(c)	3	2	4	1
(d)	3	4	2	1

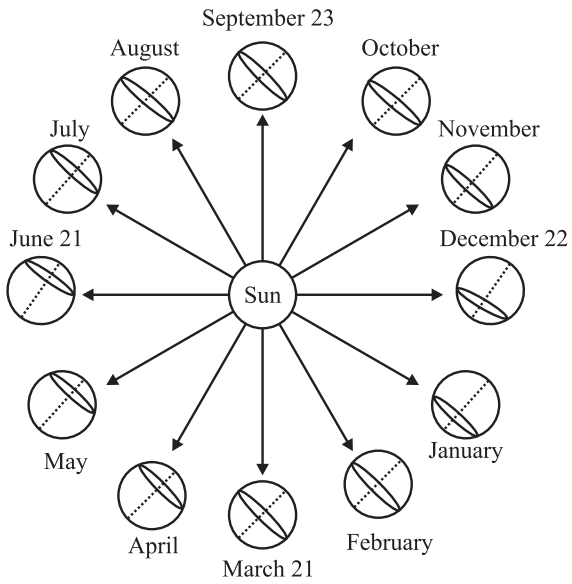
Hints and Explanations

EXERCISE-1

1. (b) Jupiter and Saturn are located between Mars and Uranus.
2. (a) Jupiter has 63 moons and Saturn has 61.
3. (a) The earth is the densest of all the planet. Density of Earth is 5.52, Venus–5.50, Mercury 5.27, Mars – 3.95, Jupiter and Saturn – 0.69, Uranus – 11.70.
4. (d) The asteroids are group of small pieces of rock revolving round the sun between the orbit of Mars and Jupiter. They are approximately 40,000 in number.
5. (a) India is a large country spanning over 30° of longitude. It is unusual in having a single time zone all over the country, 5½ hours fast.
   If the direction of rotation of earth is reversed then Indian Standard Time will be – 5½ hr.
   When it is noon the time is 12:00; that will be 6:30 A.M.in place of 17:30 P.M. or 5:30 P.M.
6. (c) Mars is the only planet with similar day time temperatures and an atmosphere similar to earth. The most relevant condition for presence of life on Mars is occurrence of ice caps and frozen water.
7. (b) Meteor is a small celestial body which has entered the earth's atmosphere by the gravitational force of earth, when they pass close to it. Meteors typically occurs in the mesosphere, and most range in altitude from 75 km to 100 km.
8. (c) Diamond ring is observed during solar eclipse, only along the peripheral regions of the totality trail.

9. (c) 10. (c) 11. (c) 12. (b) 13. (c)
14. (c) 15. (a) 16. (c) 17. (b) 18. (d)
19. (a)
20. (c) At the time of the solar eclipse it is not the shadow of the earth that is visible on the surface of the sun. The solar eclipse occurs when the moon comes between the sun and the earth. The shadow of the earth is visible during the lunar eclipse.

21. (a) 22. (b) 23. (c) 24. (c)
25. (a) 26. (b) 27. (c)
28. (b) These sequence occurred in this sequence : 21 March, 21 June, 23 Sept. and 21 December.
29. (a) Beirut is in the east of G..M.T. and Lima is five hours behind the G.M.T.
   We know that 1° is equal to four minutes i.e., 2 hours = 30° East and Beirut is 75° West of G.M.T.
30. (a) 31. (d)
32. (a) In 1906, Montessus de Bailore described the earthquakes and their characteristics within a specific region. It generally occurs by subduction of pacific plate under Asiatic plate and triggered a series of devastating Tsunamis.
33. (a) The International Date line is an imaginary line which go through the North pole to the South pole. It is 180° away from the Greenwich Meridian.
34. (b)
35. (d) The parallel at which the sun is overhead at midday is shown in the following diagram :



36. (c) The colour of the star is an indication of its temperature. The glowing is caused by something called Black-Body radiation, which has to do with the heat energy trying to radiate away in more and more energetic wavelengths. Red stars are relatively cool at only a few thousand degrees Celsius, white stars are hot at about ten thousand degrees, and blue stars are the hottest.
37. (b) The group of stars arranged in a definite pattern is called constellation. In modern astronomy, a constellation is an internationally defined area of the celestial sphere. These areas are grouped around asterisms, which are patterns formed by prominent stars within apparent proximity to one another on Earth's night sky.
38. (a) Ganymede is the largest satellite in solar system. Ganymede is a satellite of Jupiter and the largest moon in the Solar System. It is the seventh moon and third Galilean satellite outward from Jupiter. Completing an orbit in roughly seven days, Ganymede participates in a 1:2:4 orbital resonance with the moons Europa and Io, respectively. It has a diameter of 5,268 km (3,273 mi), 8% larger than that of the planet Mercury, but has only 45% of the latter's mass.
39. (c) The principle of Black hole was enunciated by S. Chandrashekhar. A Black Hole is a region of space-time from which gravity prevents anything, including light, from escaping. The theory of general relativity predicts that a sufficiently compact mass will deform spacetime to form a black hole. Around a black hole, there is a mathematically defined surface called an event horizon that marks the point of no return. The hole is called "black" because it absorbs all the light that hits the horizon, reflecting nothing, just like a perfect black body in thermodynamics.

40. (a) The distance of moon from the Earth is 364 thousands kms. The Moon is the only natural satellite of the Earth and the fifth largest moon in the Solar System. It is the largest natural satellite of a planet in the Solar System relative to the size of its primary, having 27% the diameter and 60% the density of Earth, resulting in 1/81 its mass.
41. (d) Jupiter was named on the Roman God Zeus. Zeus is the "Father of Gods and Men" who rules the Olympians of Mount Olympus as a father rules the family according to the ancient Greek religion. He is the God of sky and thunder in Greek mythology. Zeus is etymologically cognate with and, under Hellenic influence, became particularly closely identified with Roman Jupiter.
42. (d) The approximately diameter of Earth is 12800 km. The rotation of the planet has slightly flattened it out, so it has a larger diameter at the equator than at the poles. The equatorial diameter of Earth is 12,756 km, its polar diameter is 12,713 km, and its average diameter, which is referred to in common usage, is 12,742 km or 7,926 miles.
43. (b) The time taken by the Earth to complete one rotation on its axis is 23 hr-56 min 4 sec.
44. (a) 45. (d) 46. (a)
47. (a) Space between Earth and Moon is known as Cislunar. Pertaining to the space between the earth and the orbit of the moon.
48. (d) White Dwarf is known as Fossil star. They are supported by electron degeneracy pressure. It amplifies the contrast with red giants. They are both very hot and very small. They are the opposite of black holes. They are the end-products of small, low-mass stars.
49. (c) 50. (c) 51. (b) 52. (a) 53. (a)
54. (a) The black part of the moon is called sea of tranquility. Sea of tranquility is not an actual sea but rather the point at which Apollo 11 first landed on when it reached the moon. It is a lunar mare which mainly consists of basalt rock and is located on the Tranquilitatis basin which is on the Moon. The mare has a tint which is slightly blue in colour and stands out from the rest of the moon.
55. (b) Rotation of earth on its axis causes day and night but the revolution of earth in an elliptical manner around the sun causes seasons, equinoxes and solstices.
56. (d) Tectonic plates are composed of oceanic lithosphere and thicker continental lithosphere, each topped by its own kind of crust. Tectonic plates are able to move because the Earth's lithosphere has greater strength than the underlying asthenosphere. The outer shell of the earth, the lithosphere is broken up into tectonic plates. The seven major plates are the African plate, Antarctic plate, Eurasian plate, Indo-Australian plate, North American plate, Pacific plate and South American plate. Along convergent boundaries,subduction carries plates into the mantle.
57. (a) Albedo also varies according to the angle of incidence of the Sun Raysbeing higher for slating rays and lower for vertical or nearly vertical rays. From this we can derive that albedo will be relatively higher during early morning and late evening because at both times, Sun rays are slanting.
58. (a) On the equator, the day and night stay approximately the same length all year round.
59. (a) Stalagmite is a onical mineral deposit, usually calcite or aragonite, built up on the floor of a cavern,formed from the dripping of mineral-rich water.
60. (a) The Earth's rotation on its axis explains the eastward flow of the equatorial counter-current. The earth would have been rotating east to west, the piled up water would have come down on the west side. Therefore, essentially it's the earth's rotation that explains the eastward flow of equatorial counter current.

EXERCISE-2

1. (b) It will help probe the possibility of the existence of stars and galaxies made of anti-mater. It will also help in understanding the evolution of the universe.
2. (c)
3. (a) Only 1st and 2nd are correct.
4. (b)
5. (b) 6. (a) 7. (a) 8. (c) 9. (c)
10. (a) 11. (c) 12. (a)
13. (a) Greenwich Mean Time is the standard time for time assessment in different countries of earth. The countries which lies east of the Greenwich line is ahead of Greenwich Mean Time while the countries which lies west of Greenwich has their standard time behind the Greenwich Mean Time. So, the correct sequence of the countries are Japan, Iraq, Greece, Cuba and Costa Rica.
14. (c) 15. (b)
16. (c) The latitude of a place defined as the arc, measured in degree, north or south of the meridian between the place and the equator. The equator is given the value of 0°. The latitudes thus range from 0° at the equator to 90° north or south at the poles.
17. (c) The Milky Way galaxy is the home of our solar system. It is very difficult to study this glaxy because the solar system is located within it. It seems to be a spiral galaxy.
18. (a) 1 Sidereal year = 365.2564 days;
1 Tropical year = 365.2422 days;
So difference is 0.0142 days.
19. (b)
20. (c) Limestone is composed of mineral calcite and aragonite which are different forms of calcium carbonate. Limestones may be formed from skeletons of corals and foraminifera. It is a sedimentary rock easily soluble in water.

21. (d) All the given phenomena are the effect of the rotation of the earth. The Earth rotates from the west towards the east. As viewed from the North Star or polestar Polaris, the Earth turns counter-clockwise.

22. (c) Our solar system is located in the orion arm of the milky way galaxy, about two-third of the way out from the centre. The sun is about 26,000 light-years from the center of the Milky Way Galaxy, which is about 80,000 to 120,000 light-years across (and less than 7,000 light-years thick). We are located on one of its spiral arms, out towards the edge. It takes the sun (and our solar system) roughly 200-250 million years to orbit once around the Milky Way. In this orbit, we (and the rest of the Solar System) are traveling at a velocity of about 155 miles/sec (250 km/sec).

23. (d) From electromagnetic radiation to revolution of the earth, everything is responsible for bringing dynamic changes on the surface of the earth. For example: Electromagnetic radiation brings changes in the field of microwaves, wavelengths of radio, UV rays, infra red rays, X rays and gamma rays. Geothermal energy is the heat received from the earth's core. This heat continuously flows outward. It transfers to the surrounding layers of rock, the mantle. When temperature and pressure becomes very high some mantle rocks melt becoming magma. It then either comes out as lava or heat up the nearby rocks and water which comes out as hot springs or geysers. Gravitational force is constantly working on all physical bodies. It is giving weights to objects with mass and causes them to fall to the ground when dropped. Plate movement is a dynamic change on the surface of the earth. It explains many aspects of the interrelationship of volcanoes, earthquakes, climate change, and the evolution of life itself. Everything about our planet is related either directly or indirectly to plate tectonic. Rotation causes day and night. Revolution causes seasons, change in the length of day and night.

24. (c) Continental Drift and Glacial Cycles have influenced the evolution of organisms. Continental drift is the movement of the Earth's continents relative to each other by appearing to drift across the ocean bed. A glacial period is an interval of time within an ice age that is marked by glacier advances.

25 (a) Earthquake waves are propagating vibrations that carry energy from the source of the shaking outward in all directions. It is of four types:
P (for primary) S (for secondary)
Love Rayleigh
A volcano is a mountain that opens downward to a pool of molten rock below the surface of the earth. When pressure builds up, eruptions occur.

26. (b) The sidereal day is the time it takes for the Earth to complete one rotation about its axis with respect to the 'fixed' stars. By fixed, we mean that we treat the stars as if they were attached to an imaginary celestial sphere at a very large distance from the Earth. A measurement of the sidereal day is made by noting the time at which a particular star passes the celestial meridian (i.e. directly overhead) on two successive nights. On Earth, a sidereal day lasts for 23 hours 56 minutes 4.091 seconds, which is slightly shorter than the solar day measured from noon to noon. At the same time that the Earth spins on its axis, it also orbits or revolves around the Sun. This movement is called revolution.

27. (b) Falls are possible only when a river is losing height suddenly. Next comes meanders. When a river reaches flatter land,flow is slowed down and meanders are formed through erosion of the river banks and deposition on the inside of bends.
Oxbow lake is formed when a wide meander is cut off from the main river, creating a free-standing body of water.
Delta is formed at the mouth of a river, where the river flows into an ocean, sea, estuary, lake, or reservoir.

28. (d) A. The smallest planet of the solar system is–Pluto
B. The largest planet of the solar system is–Jupiter
C. The planet second from the Sun in the solar system is–Venus
D. Planet nearest to the Sun is – Mercury.

29. (d) 30. (c)

31. (a) A. Semeru Volcano is situated in Indonesia.
B. Cotopaxi Volcano is situated in Equador.
C. Etma Voplcano is situated in Italy.
D. Kilomanjaro Vaolcano is situated in Kenya.

32. (b) The correct match is as follows:
Summer Solstice- 21st June
Winter solstice- 22nd December
Vernal Equinox- 21st March
Autumnal Equinox- 23rd September
June 21 is called the summer solstice in the Northern Hemisphere. In the Northern Hemisphere, the winter solstice occurs either December 21 or 22.
Vernal Equinox is the time when the sun crosses the plane of the earth's equator,making night and day of approximately equal length all over the earth and occurring about March 21. The Autumn Equinox is the first day of the autumn season and occurs when the sun passes the equator moving from the northern to the southern hemisphere. It occurs on 23 September.

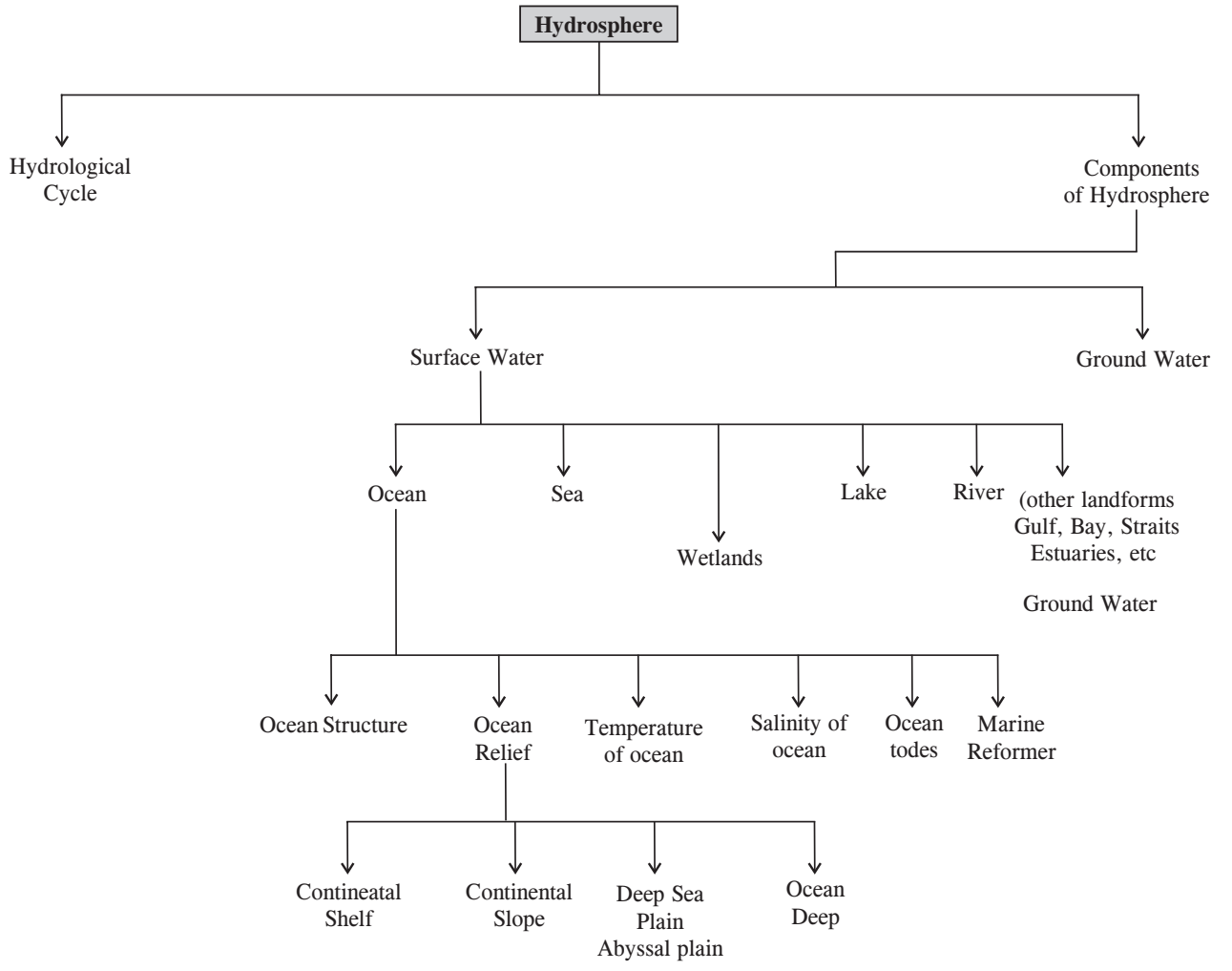
3 Chapter

HYDROSPHERE

Introduction

Hydrosphere refers to the total amount of water present on or under the surface of a planet. Around 70% of the earth surface is covered by water and it is present in all the three state of matter, i.e. solid as glaciers and ice caps, liquid in the form of oceans, seas, lakes and rivers and gas in the form of cloud, and water vapour. Hydrosphere plays significant role in the biosphere as :

- It has the ability to dissolve almost everything.
- It has the potential to store heat for quite a long period of time.
- It nourishes the organism.
- It helps to maintain the flow of elements in the biosphere.



HYDROLOGICAL CYCLE

Commonly known as the water cycle. It is the circular flow of water within earth's atmosphere, involving all the three forms of matter such as solid, liquid and gaseous forms. It also refers to the continuous exchange of water from the one form to another with the application of external energy. Through various process of physical action such as evaporation, condensation, precipitation, interception, infiltration, runoff, surface flow.

Evaporation is the process of transformation of water from the water bodies to water vapour in the atmosphere.

Condensation is the process of changing the state from water vapour to water in the upper air. It generally takes the form of cloud.

Precipitation is the downpour of condensed cloud mostly in the form of rainfall, and sometimes as snow, hails, fog, drop, etc.

Infiltration is the process of penetration of water into underground strata of earth's crust.

Interception is the precipitation trapped by vegetation instead of falling on ground.

Run off is the movement of water on the earth, surface through different channels such as river, streams, etc.

Subsurface Flow is the movement of water within the earth's crust after infiltration which eventually either come up through artesian well or seep to the ocean.

Fishes are the important members of there community. They are further categorised into

Pelagic fish - who leaves neither too close to share nor to the bottom.

Demersal fish - On the contrary these fishes occupy the bottom area of the sea.

Other than fishes this community is also famous for marine mammals which are again divided into two categories

The mammals who can stay both in water and land for example seal

The second category of mammals spend their entire life in side the sea.

COMPONENTS OF HYDROSPHERE

There are four major components of Hydrosphere.

- Oceans
- Fresh water
- Glacial water
- Atmospheric water vapour
  - (a) Surface water
  - (b) Ground water

(a) **Surface water:** Oceans, seas, lakes, ponds, rivers and streams are main examples of surface water.

(b) **Ground water:** Ground water is found in soil pores, rocks, aquifers and springs. The water percolates through pores in rock and soil filling all the available spaces.

Distribution of water through different Sources (in %)

Oceans	97.3	Saline Water
Ice-cap and glaciers	2.05	
Ground water	0.68	
Fresh water lake	0.009	Fresh Water
Inland sea and salt lakes	0.009	
Atmosphere	0.0019	
Rivers	0.0001	

Oceans

As major portion of Earth's Hydrosphere is covered by ocean we are now going to discuss. Ocean and its various features.

An ocean (from Ancient Greek Okeanos,) is a body of saline water that composes much of a planet's hydrosphere. One Earth, an ocean is one of the major conventional divisions of the world Ocean, which covers almost 71% of its surface. These are, in descending order by area, the pacific, Atlantic, Indian, Southern and Arctic Oceans. The word sea is often used interchangeably with "ocean" in American English but, strictly speaking, a sea is a body of saline water (generally a division of the world ocean) partly or fully enclosed by land.

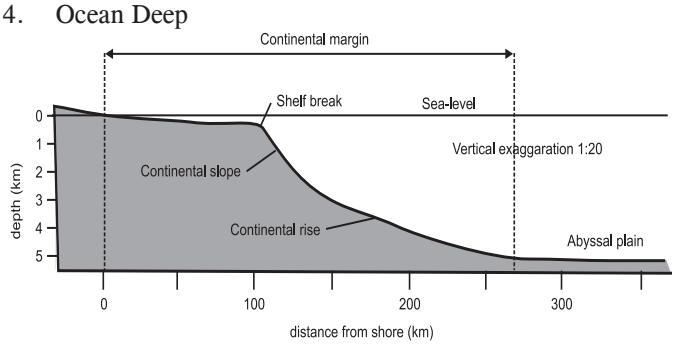
Ocean Structure

- 39.3% of the northern hemisphere comprises of landmass and 60.7% is covered by sea and oceans. This share in the southern hemisphere is of 19.1% and 80.9% between land and water.
- Ocean has been divided into two main groups:
  - (i) the ocean
  - (ii) the sea.
- Ocean contains more than 97% of total water on earth.
- Ocean has the average depth of about 4 km.
- Geographically ocean has been divided into (i) the Pacific (ii) the Atlantic (iii) the Indian (iv) the Arctic.
- Pacific Ocean is the largest and oldest followed by Atlantic (25%), Indian (21%) and Arctic (2.83).
- Arctic is strictly not an ocean and not navigable.

Ocean Relief

Ocean floor is characterized by four relief zone which are as follows:

1. Continental Shelf
2. Continental Slope
3. Deep Sea Plain / Abyssal Plain
4. Ocean Deep



1. Continental Shelf

The continental shelf is margin of continent are submerged under ocean water upto 100 fathoms (600 feet).

- Its slope varies from 1° to 3°.
  - It is determined by the coastal reliefs. Narrow shelf is found where a high mountain runs parallel to coast.
  - In Atlantic Ocean it is 2 km to 80 km wide. The continental shelf in Pacific Ocean varies between 160 km to 1600 km of width.
  - On an average continental shelf of Indian ocean in the west is 640 km wide and in the east near Java and Sumatra is as narrow as 160 km and further narrower along the coast of Antarctic.
  - The point where a mark increase in slope angle occurs is called as shelf break.
  - About 20% of oil and gas production is extracted from them.
  - They support productive fishing ground and are good source of marine food (Dogger bank, Grand bank).

Origin

- Marine waves and currents erode the continental margin continuously.
- Prolong deposition of detritus brought by rivers is found only in the region where sea is calm.
- The compression force acting as thermal convective current formed beneath continental and oceanic plates.
- Generation of parallel faults along the continental plates
- Rise and fall in sea level due to glaciations.
- Submergence and emergence of the continent.

2. Continental Slope

- Continental slope has a steep slope, beyond continental shelf towards ocean.
- Its slope varies from 2° to 5°.
- Depth of water is 200 m to 2,000 m.
- Occupies 8.5% of the total area of ocean basin

Origin

Continental slope is formed due to erosion, tectonic and aggradations (increase in land elevation).

3. Deep Sea Plain / Abyssal Plain

- It is most extensive relief, covering 75.9% of the total area of ocean basin.
- It is flat and rolling submarine.
- Its depth varies between 3000 m to 6000 m.

4. Ocean Deep

- It is made of depression and trenches.
- It runs parallel to coast generally.
- Grouped into two according to size
  - **(i) Deep** – It has great depth and is less extensive depression.
  - **(ii) Trenches** – It is a long and narrow linear depression.

Submarine Canyon

It is long, narrow and very deep valley or trenches. It is located on the continent shelf and slope with vertical walls. It is at maximum 16 km long. Morphogenetic classification:

(i) Glacially eroded and
(ii) Non-glacial eroded

Continental Rise
It is a depositional feature made up of thick sequences of continental material that accumulate between the continental slope and the abyssal plain.

Sea Mount
Mountain within ocean does not reaches the water surface is called sea mount. When the top of this mount is eroded by currents making its top flat, it is known as ***guyot***.

Ocean Ridge

It is a continuous submarine mountain chain extending to thousands of kilometers. The ridges rise from depths near 5 km (3 miles) to an essentially uniform depth of about 2.6 km (1.6 miles) and are roughly symmetrical in cross section. It is formed across transform faults within fracture zones.

Major Trenches and Ridges in World

- **Mariana Trench**
  The cavity located near the Mariana Islands, where the Pacific Plate and the Philippine Plate converge; it is the *world's deepest trench* (about 36,000 feet).
- **Puerto Rico Trench**
  It is located off the coast of Puerto Rico, on the boundary between the South American and Caribbean plates; it features the deepest point in the Atlantic Ocean (27,493 feet).
- **Peru-Chile Trench**
  The trench (26,460 feet) borders South America and it is the *world's longest trench* (3,700 mi), located on the boundary between the Nazca Plate and the South American Plate.
- **Pacific-Antarctic Ridge**
  Mountain range separating the Pacific and Antarctic plates; it joins the eastern Pacific Ridge off the coast of South America.
- **East Pacific Ridge**
  Ridge that marks the boundary between the Pacific and Cocos Islands plates to the north, and the Pacific and Nazca plates to the south.
- **Aleutian Trench**
  Trench (25,600 feet) extending from Alaska to the Kamchatka Peninsula; it results from the Pacific Plate sliding beneath the North American Plate.
- **North America**
  Its area (9.3 million sq. mi) represents about 16% of the world's land; the Central American isthmus is an extension of North America.
- **Mid-Indian Ridge**
  Mountain range in the middle of the Indian Ocean that separates the African and Australian-Indian plates.
- **Southwest Indian Ridge**
  Ridge separating the African and Antarctic plates; it joins the Mid-Indian and Southeast Indian ridges off the coast of Madagascar.

- **South America**
  Represents about 12% of the world's land and is linked to North America by Central America; its features include the Andes in the west and plains and plateaus in east and central regions.
- **Mid-Atlantic Ridge**
  Ridge about 7,000 miles long, located in the middle of the Atlantic Ocean; some of its mountains reach the surface, forming islands such as Iceland.
- **Ryukyu Trench**
  Trench (24,629 feet) located near the Ryukyu Islands; it marks the boundary between the Philippine Plate and the Eurasian Plate.
- **Japan Trench**
  Trench (27,929 feet) located east of Japan, on the boundary between the Pacific Plate and the Eurasian Plate; this zone is marked by intense seismic activity.
- **Kuril Trench**
  Trench (34,587 feet) located northeast of Japan; it results from the Pacific Plate sliding beneath the Eurasian Plate.
- **Philippine Trench**
  Trench bordering the eastern Philippines, reaching depths of 34,578 feet; it results from the Philippine Plate sinking beneath the Eurasian Plate.
- **Kermadec-Tonga Trench**
  Cavity located north of New Zealand, where the Pacific Plate meets the Australian-Indian Plate; it reaches depths of 35,702 feet.
- **Southeast Indian Ridge**
  Ridge separating the Antarctic Plate from the Australian-Indian Plate; its topography is more regular than the topography of the Southwest Indian and Mid-Indian ridges.
- **Java Trench**
  Trench located south of Indonesia, between the Australian-Indian and the Eurasian Plates; it is the *deepest point in the Indian Ocean* (24,440 ft).

Temperature of Ocean

- Temperature of the ocean is important for both marine organisms and coastal animals as it affects coastal climate.
- Standard thermometer with accuracy upto $\pm$ 0.02°C is used for its measurement.
- Ocean is divided into three layers according to temperature.
  (i) **Epilimnion Layer** is the first layer which is upto 500 m from top having temperature of 20° - 25°C.
  (ii) **Thermocline Layer** is below 500 m to 1000 m where temperature decreases at a rapid rate with the increase in depth.
  (iii) **Hypolimnion Layer** is the third layer, very cold in nature and extend upto deep ocean floor from 1000 m. Only Polar region has this layer starting from surface to deep ocean form.

Daily Range of temperature is the difference of maximum and minimum temperature of a day

- At low latitudes it is usually 0.3°C and 0.2° to 0.3°C at higher latitudes.
- Sky condition, stability or instability of air and stratification of seawater decides daily range of temperature.
- The minimum and maximum temperature is recorded at 5 a.m. and 2 p.m. respectively.

Annual Range of Temperature

- Maximum temperature is recorded in the month of August and minimum in the month of February in northern hemisphere.
- Variation in the temperature is mainly due to insolation, nature of sea, prevailing and location of sea, etc.

Mean Annual Temperature of Water	
Ocean	**Mean Temperature (in ^{o}C)**
Pacific	19.1
Atlantic	16.9
Indian	17.0
Average	17.4

Factors affecting Distribution of Temperature

- Latitude
- Unequal distribution of land and sea.
- Prevailing wind
- Ocean current

Minor factors include: Submarine ridges, local weather, location and shape of sea.

Horizontal distribution

- Average temperature of the ocean is 26.7°C
- Gradual decrease from equator towards poles is 0.5° F per latitude.
- Variation of temperature in the northern and southern hemispheres is mainly due to unequal distribution of land and ocean water.

Vertical Distribution

- Surface of ocean has highest temperature due to insolation and heat transmitted from below through conduction process.
- Solar energy effectively penetrates 20m and seldomly reaches beyond 200 m depth.
- Increase in depth decrease the temperature. Rapid fall in temperature upto 200 m.
- 200 m divides the ocean floor into two vertically-
  (i) **Photic/ Euphotic zone** is the upper surface upto the depth of 200 m and receives solar radiation.
  (ii) **Alphatic zone** goes beyond 200 m depth to the bottom and receives no solar ray.

Density of Ocean

- Amount of mass per unit volume of substance, measured in g/cm^3 is called as density of ocean water.
- Density of pure water is 1 g/cm^3 at 4°C and of ocean water is 1.0278 g/cm^3 (2-3% higher than water) at 4°C.
- It increases with lowering of temperature of ocean. Highest density is recorded at -1.3°C.

Factors controlling density

Temperature is inversely proportional to density, whereas pressure and salinity are directly related to it.

Density stratification of Ocean

- Density wise Ocean is a three layered structure i) Surface layer, ii) Pychocline layer and iii) Deep layer
  (i) **Surface layer**
  It has lowest density, having thickness of 100 to 200 m and is called as photic zone. Only 2% of seawater is found there. The zone is important for the growth of phytoplankton through the process of photosynthesis. Phytoplankton is eaten by zooplankton, it initiates food chain process.
  (ii) **Pycocline layer**
  It is a transition zone characterized by rapid change of density. It is found between 300 m - 1000 m depth of ocean water. 18% of the total volume of the ocean water lies in this zone.
  (iii) **Deep layer**
  It has high density. Water mass beyond 1000 m depth to the ocean floor contain 80% of the total volume of ocean water. It denotes high density and low temperature.

Salinity of the Ocean

- Ratio between the weight of dissolve matter and sample sea water (part of salt per thousand part of water) is called as salinity of ocean water.
- Average salinity of ocean water is 35%.
- Salinity of ocean water is affected by marine organism, plant community and physical properties of ocean such as temperature, density, waves, pressure and currents.
- Highest salinity is observed between 20° - 40° N (36%).
- Boiling point of saline water is higher than pure water.
- The instrument used for measurement of salinity of water is called salinometer.
- The line with same salinity is joined by Isohalines.
- Halocline indicates sharp increase in salinity.
- Salts brought by rivers are the main source of salinity. It contains 60% of calcium sulphate, 2% of sodium chloride.

(Salts in Ocean Water)	
Name of Salts	**In %**
Sodium Chloride	77.8
Magnesium Chloride	10.9
Magnesium Sulphate	04.7
Calcium Sulphate	03.6
Potassium Sulphate	02.5
Calcium Carbonate	00.3
Magnesium Bromide	00.2

Factors controlling salinity

- Evaporation is positively related to the salinity level.
- Precipitation has a negative relation with it.
- Influx of river water has inverse relation with salinity level.
- Atmospheric pressure and wind are of directional help in the redistribution of water salinity.
- Circulation of ocean water is the controlling factor of salinity in a region.

Distribution

- Latitudinal decline in salinity is seen with the increase in distance from equator.
- The equator does not have highest salinity due to heavy rainfall, through temperature and evaporation are high.
- Middle latitudes between 20° to 40° N and 10° to 30°S has high temperature and evaporation but low rainfall.
- The zone between 40° - 60° latitude in both hemisphere record low salinity 31% and 35% respectively in Northern and Southern hemisphere.
- Sub-polar and polar zone has minimum salinity whereas tropics (20°-30°) has maximum.
- Low salinity of the northern part of Caspian is 14% due to the influx of water brought by rivers (Volga, Ural, etc.). On the other hand there is high salinity in the southern part near Gulf of Karabugas (170%). Red sea has 220%, Lake Van has 330% and Dead sea has 238% of salinity.

Ocean Deposits

- Loose materials in the form of sediments derived from various sources, found at ocean floor are called as **ocean deposits.**
- It consists of both organic and inorganic matters.
- Weathering and erosion of continental rocks are transported by river and wind.
- Volcanic eruption, decay and decomposition of marine organisms also contribute to ocean deposits.

Sources and Types of Marine Deposits

On the basis of origin Marine deposits can be classified into the following groups:

(1) Terrigenous deposits
(2) Volcanic deposits
(3) Biotic matter/ Organic deposits
(4) Abiotic matter/ Inorganic deposits

(1) Terrigenous deposits

- They have continental origin and due to weathering and erosional factors fine to coarse grains are formed.
- They consist of gravel, sound, silt, clay and mud (blue mud, green mud, red mud).
- Gravel range from 2 mm to 256 mm, and mud, clay and silt has the diameter of 1/32 mm to 1/8192 mm. Mud is the finest with 1/ 8192 mm of diametric.

(2) Volcanic deposits

Derived from two sources:
(i) Volcanic eruption on level (land) and
(ii) Volcanic eruption in the ocean.

(3) Organic deposits

Skeleton of marine organism divided into two:
(i) *Neretic matter:* Skeletons of organism.
(ii) *Pelagic matter:* Remains of algae found in liquid mud, generally called as *ooze*.

Oozes are divided into two

(a) **Calcareous oozes** contain lime and are of two types:
(i) *Pteropod oozes* are formed of floating shells of pteropod molluscs. These shells are conical in shape and ½ inches in diameter. Contain 80% of calcium and found in tropics at depth of 300-1000 fathoms of water and disappears at 2000 fathoms.

(ii) *Globigerina oozes* are formed from the shells of foraminifera. They contain 64% of calcium, 1.64% of silica and 3.3% of mineral. Usually found in topics and temperate zone of Atlantic Ocean, west coast of Indian Ocean and in eastern Pacific oceans continental shelves.

(b) **Siliceous oozes:** Derive from a group of protozoa or radiolarian and benthic animals (sponges). These oozes do not dissolve unlike calcareous oozes. They are found in both warm and cold water at great depth and are of two types such as:

(i) *Radiolarian oozes* are formed by shells of radiolarian and foraminifera. Silica dominates and lime content increases with increasing depth. 2000 to 5000 fathoms is the depth between which they are found.

(ii) *Diatom oozes* are formed of shells of very microscopic plants rich in silica. They are blue near land and yellow or cream away from land.

(4) Inorganic deposits

- They come from land by various agencies which include dolomites, amorphous silica, iron, manganese oxide, phosphate, barite, glauconitic, phosphorite, feldspar phillipsite and clay.

Coral Reefs and Atoll

- They are accumulated and compact skeleton of lime secreting organisms known as **coral polyps,** confined between 25°N - 25°S latitude.
- They line on lime and in colony form.
- **Corals are called as rain forests of the oceans.**

Condition for Growth

- High mean annual temperature between 68°F to 70°F (20°C - 21°C) is required for their growth.
- Do not survive in deep water, *i.e.* should not be more than 250 feet (60-77 m).
- Oxygen and sunlight is required for their growth.
- Sediment free water is needed.
- Fresh water is harmful for corals.
- Very high oceanic salinity is injurious for the growth of coral.
- Ocean current and waves are good for the growth of coral as they bring food for them and determine their shape.
- They grow in open sea.
- Extensive submarine platforms are required for the development of coral colonies.
- Human economic activity like deforestation and industrialization, etc. cause global warming which adversely affect corals growth.

Types of Coral Reef

The submarine reefs are classified on the basis of nature, shape and mode of occurrence: (i) fringing reef, (ii) barrier reef, and (iii) atoll.

(i) Fringing Reef

- Develops along the continents in shallow water.
- It has steep slope on seaward side and gentle slope land ward side.

Fringing Reefs are found in *Sakau island* southern florida, mehetia island, etc.

(ii) Barrier Reef

- It is the *largest*, *highest* and *widest* of all reefs.
- It runs parallel to coastal platform.
- It has average slope of 45° but on an average it has 15° to 25° slope.
- Shallow lagoons are formed in between land and barrier reef.

Great Barrier rief located parallel to the east coast of Africa is the *largest* barrier reef.

(iii) Atoll

- A ring of narrow corals growing in a form of rim encircling a lagoon partially or completely.
- It is horseshoe shape.
- Atoll are found in Antilles sea, red sea, China sea Australian sea, Indonesian sea.
- Fun futti Atoll of Ellice Island is the world famous at all

Some Famous Coral Reefs in the World

The Great Barrier Reef

It is the large coral reef in the world. It is located in eastern coast of Queensland in Australia. It has 2,900 individual reefs, and 900 islands stretching for over 2,300 kilometers within an area of approximately 344,400 square kilometers.

The Belize Barrier Reef

The coastal area of Belize consists of the largest barrier reef in the northern hemisphere, offshore atolls, several hundred sand cays, mangrove forests, coastal lagoons and estuaries. It is habitat for threatened species, including marine turtles, manatees and the American marine crocodile.

The Red Sea Reef

It is found on the coast of Red sea and is the northern most reef found in Indian ocean, extending 2,000 km. Fringing reef systems is developed enormously over here.

The Pulley Reef

It is located on the coast of Florida, USA. The corals *Agaricia sp.* is found here in tan-brown shade largely.

Coral Bleaching

Scientifically it is the process of loss of intracellular endosymbionts or zoonanthellae either through expulsion or lost of algae pigmentation. In general it can be viewed as the indicative death of corals with the increase in ocean temperature the coral starts expelling the algae living in their tissue and as a result the corals get completely white.

Causes

Global warming which leads to increase in the temperature of ocean water.

Near share corals bleach due to storm generated precipitation which carry pollutants and contaminate ocean water.

Over exposure to sunlight leads to the increase in temperature of ocean water and hence result into coral bleaching.

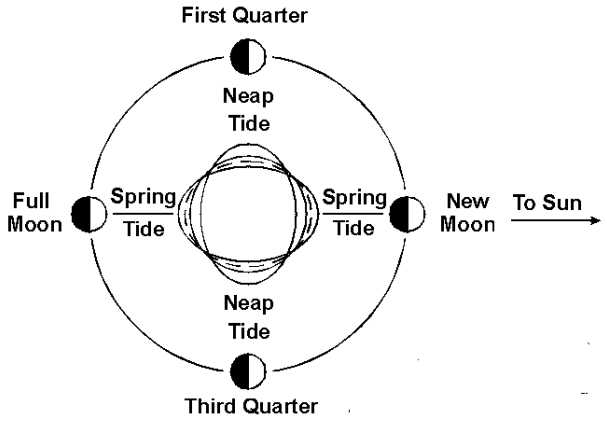
Expocure to air due to extreame lowtides.

Ocean Tide

- The periodic rise and fall of sea water than the average sea level is a **tide.**

- The fall of seawater and movement towards sea is called **ebb.** This generates low water level and called as low tide.
- The difference between high and low tide is called as **tidal range.**
- The variation in the height of both low and high tide can be seen from place to place.
- This variation depends on depth of ocean water
- Configuration of sea coasts and coastlines and openness or closeness of the sea.

Interchanging position of Sun, moon and earth and the associated tides



Origin

- Primarily occurs due to gravitational forces of the sun and moon.
- The revolution of the earth around the sun in an elliptical path and that of moon around earth from west to east. There is change in distance between earth and moon during different time in every month.
- The period of the farthest distance between the moon and the earth (407,000 km) is called as **apogee** and when nearest distance (356,000 km) is called as **perigee.**

The tidal force of moon is maximum during perigee as the distance is less. The resultant tide is known as perigean tide which is 15-20%. higher than normal tides.

On the contrary during Apoge, due to maximum distance of moon from earth the tidal force is less hence resulting into Apogean tides 20% lesser than normal tides.

Types of Tide

(i) Spring Tide
(ii) Neap tide
(iii) Apogean and Pengean tide
(iv) Tropical and Equatorial tide
(v) Daily and semi durinal tide
(vi) Equenoctical tide

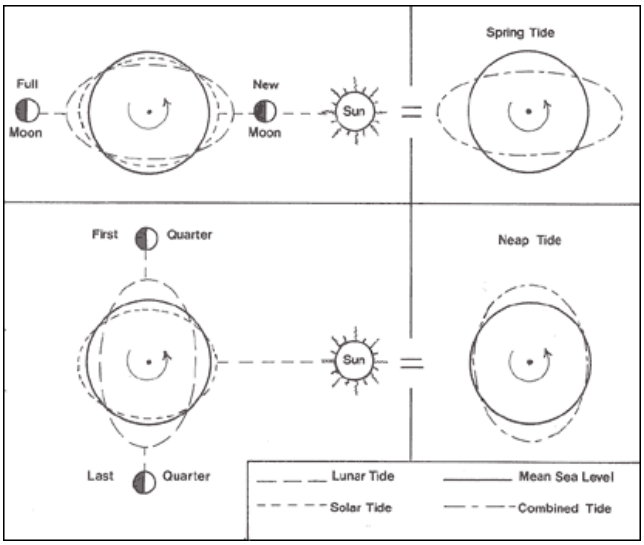
Apogean & Perigean Tides

(i) Spring tide

When the sun, the moon and the earth are in the same line, there is formation of spring tide.

- The position when all three are in a straight line is called **syzygy.**
- When the sun, moon and earth are in one side of the earth in a straight line, this position is called **conjuction** (solar eclipse).
- When they are placed at 90°, the position is called **quadrature.**
- When the sun, the moon and the earth are in sequential order in a straight line is called as conjunction. It is when solar eclipse occurs. It occurs on new or full moon day.
- When the earth is in between the moon and the sun are called as opposition. It occurs on new or full moon day.

Types of Tide



(ii) Neap tide

It is a quadrature position between the earth, the sun and the moon on seventh or eighth day of the fortnight. During this time the forces of the sun and the moon acts in opposite direction. It is 20% lower than normal tide.

Tides clear the sediments brought by rivers, retarding the development of delta and clean the coast.

(iii) Perigean and Apogean Tides

When the moon is nearest to the earth in its orbit (at perigee), its tide-producing power is greater than average, resulting in perigean tides. These are 15-20% greater than average. When the moon is farthest from the earth (apogee), the tides are called apogean tide, which are about 15-20% less than average. Coincidence of spring and perigean tides results in an abnormally great tidal range, while when neap and apogean tides coincide the range is abnormally small.

(iv) Tropical and Equatorial Tides

Like the sun moon also undergoes the process of north and southward declination and to complete it. Moon requires 27.5 days of time, which is known as *synodie month*.

During mainmum declination the moon rays are vertical on the tide centre and results into formation of spring tides near Tropic of cancer in northward position and tropic of Capricorn in southward position.

When the moon is vertical on the equator there is no such diurnal change between the neap and spring tides in terms of their height. These types of tides are called as *Equatorial tides*.

(v) Daily & Semi-diurnal Tides

The tides only variy in terms of time duration Daily tides occure in an interval of 24 hrs and 52 min where on semi-diurnal tides occur in 12 hours and 26 min.

(vi) Equinoctical Spring tides

These are forms of spring tides which occurs in a time interval of 6 months.

Ocean Currents

The movement of a mass of oceanic water parallel to the coast is called as ocean current.

Currents are of two types on the basis of temperature.

(i) Warm current
(ii) Cold current

On the bases of velocity, dimension and direction.

Drift : It is slow movement of the ocean current under the influence of prevailing wind.

Current : Movement or circulation of ocean water in a definite path having great velocity.

Stream : Movement of ocean water involving large volume in a definite direction with velocity. It is a continuous flow.

Origin

Origin of ocean current occurs due to following factors:

(i) Rotation of earth
(ii) Temperature difference in ocean
(iii) Salinity difference in ocean
(iv) Density Difference
(v) Air pressure and wind
(vi) Rainfall and Evaporation
(vii) Direction, shape and configuration of coast
(viii) Bottom relief
(ix) Seasonal variation

Distribution of Currents

Atlantic Ocean

North Equatorial Current (warm)
South Equatorial Current (warm)
Counter Equatorial Current (warm)
Gulf stream (warm)
Gulf stream
North Atlantic Current
Canary Current (Cold)
Labrador Current (Cold)
Brazil Current (warm)
Falkland Current (Cold)
South Atlantic Drift (Cold)
Benguela Current (Cold)

Pacific Ocean

1. North Equatorial Current (Warm)
2. South Equatorial Current (Warm)
3. Counter Equatorial Current (Warm)
4. Kuroshio System (warm)
   (i) Kuroshio Current
   (ii) Kuroshio extension
   (iii) North Pacific Drift
   (iv) Tsushima Current
   (v) Counter Kuroshio Current
5. Oyashio Current (Cold)
6. California Current (Cold)
7. Peru Current (Cold)
8. El Nino or Counter Current (warm)
9. Eastern Australian Current (warm)
10. West Wind Drift (Cold)

Indian Ocean

1. North-east Monsoon Current (warm)
2. Indian Counter Current (warm)
3. South West Monsoon (warm)
4. Indian Equatorial Current (warm)
5. Mozambiqe Current (warm)
6. West Wind Drift (cold)

Seas of Ocean

Pacific ocean

Arafura sea, Bering sea, Celebes sea, Coral sea, java sea, Gulf of Carpentria, Yellow sea, Japan sea, Bohol sea, Gulf of Alaska, Molucca sea and South China sea.

Indian ocean

Arabian sea, Andaman sea, Bay of Bengal, Timor sea, Red sea, Laccadive sea, Gulf of Oman, Gulf of Aden, Mozambique Channel.

Atlantic ocean

Caribbean sea, Celtic sea, Labrador sea, Marmara sea, Norwegian sea, Bothnia sea, Gulf of Finlang, Bay of Fundy, Barents sea, Beaufort sea, Amunden sea, Baffin Bay, Laptev sea, White sea, Pechora sea, Kara sea, East Siberian sea, Greenland sea, Prince Gustav Adolf sea.

Inland Seas

Caspian sea, Aral sea, Salton sea, Dead sea and Black sea.

Strait is a narrow passage of water connecting two seas or two other large areas of water.
Strait of Malacca is a funnel-shaped narrow waterway of 800 km long that connects the South China & Andaman Sea.
Bass strait is the widest (240 km). The narrowest strait in world used for international navigation, the **Bosporus** connects the Black Sea with the Sea of Marmara.

Major Strait of the World

Name	Joins	Location
Malacca Strait	Andaman Sea & South China Sea	Indonesia - Malaysia
Palk Strait	Palk Bay & Bay of Bengal	India-Sri Lanka
Sunda Strait	Java Sea & Indian Ocean	Indonesia
Yucatan Strait	Gulf of Mexico and Caribbean Sea	Mexico-Cuba
Messina Strait	Mediterranean Sea	Italy-Sicily
Otranto Strait	Adriatic Sea & Ionian Sea	Italy-Albania

Bab-el-Mandeb Strait	Red Sea & Gulf of Aden	Yemen-Djibouti
Cook Strait	South Pacific Ocean	New Zealand (N & S islands)
Mozambique Strait	Indian Ocean	Mozambique - Malagasy
North Channel	Irish Sea & Atlantic Ocean	Ireland-England
Taurus Strait	Arafura Sea & Gulf of Papua	Papua New Guinea - Australia
Bass strait	Tasman Sea & South Sea	Australia
Bering Strait	Bering Sea & Chukchi Sea	Alaska-Russia
Bonne-Fasio Strait	Mediterranean Sea	Corsika-Sardinia
Bosphorus Strait	Black Sea and Marmara Sea	Turkey
Dardanelle Strait	Marmara Sea and Aegean Sea	Turkey
Davis strait	Baffin Bay & Atlantic Ocean	Greenland-Canada
Denmark strait	North Atlantic and Arctic Ocean	Greenland-Iceland
Dover strait	English Channel & North Sea	England-France
Florida Strait	Gulf of Mexico and Atlantic Ocean	USA-Cuba
Hormuz strait	Gulf of Persia & Gulf of Oman	Oman-Iran
Hudson strait	Gulf of Hudson & Atlantic Ocean	Canada
Gibraltar Strait	Mediterranean Sea & Atlantic Ocean	Spain-Morocco
Magellan strait	Pacific and South Atlantic Ocean	Chile
Makassar Strait	Java Sea & Celebeze Sea	Indonesia
Tsugaru Strait	Japan Sea and Pacific Ocean	Japan (Hokkaido-Honshu island)
Tatar Strait	Japan Sea & Okhotsk Sea	Russia (E Russia-Sakhalin Island)

Gulf

A large area of a sea or ocean partially enclosed by land, especially a long landlocked portion of sea opening through a strait. Gulf and Bay are of economic importance as they serve as excellent harbor in most of the cases. Many important trading centers are located on gulfs. It forms a good fishing ground and oil deposits.

- The Gulf of Mexico, bordering United States, Mexico, and the island nation of Cuba, is the world's largest gulf. It has a coastline of about 5,000 kilometers (3,100 miles).
- The *Persian Gulf* in Arabian Sea borders Iran, Iraq, Kuwait, Saudi Arabia, Qatar, Bahrain, the United Arab Emirates, and Oman. There a vast deposit of petroleum is found.
- The Gulf of Carpentaria, on northeast coast of Australia, is an inlet of the Arafura Sea.

Bay

A bay is a small body of water or a broad inlet that is set off from a larger body of water generally where the land curves inward. Examples of bays include the *Bay of Pigs* (Cuba), *Hudson Bay* (Canada), *Chesapeake Bay* (Maryland and Virginia), and Bay of Bengal (near India).

When a body of water such as a strait is capable of being blocked or even closed in order to control transportation routes, the body is called a **"choke point."**

Estuaries

Estuaries are bodies of water and their surrounding coastal habitats typically found where rivers meet the sea. It becomes the home of numerous unique plant and animal communities because their waters are brackish. Brackish is a mixture of fresh water draining from the land and salty seawater.

Coastal Plain

Melting of snow in past rose the sea level as the stream and rivers got flooded with water. The Chesapeake Bay in Maryland and Narragansett Bay in Rhode Island are examples of such estuaries that were once river valleys.

Bar-built

Sandbars or barrier islands built up by ocean currents and waves in coastal areas created a protected area fed by small streams or rivers. The barrier islands off the Atlantic coastline of North Carolina and Massachusetts enclose bar-built estuaries.

Delta system

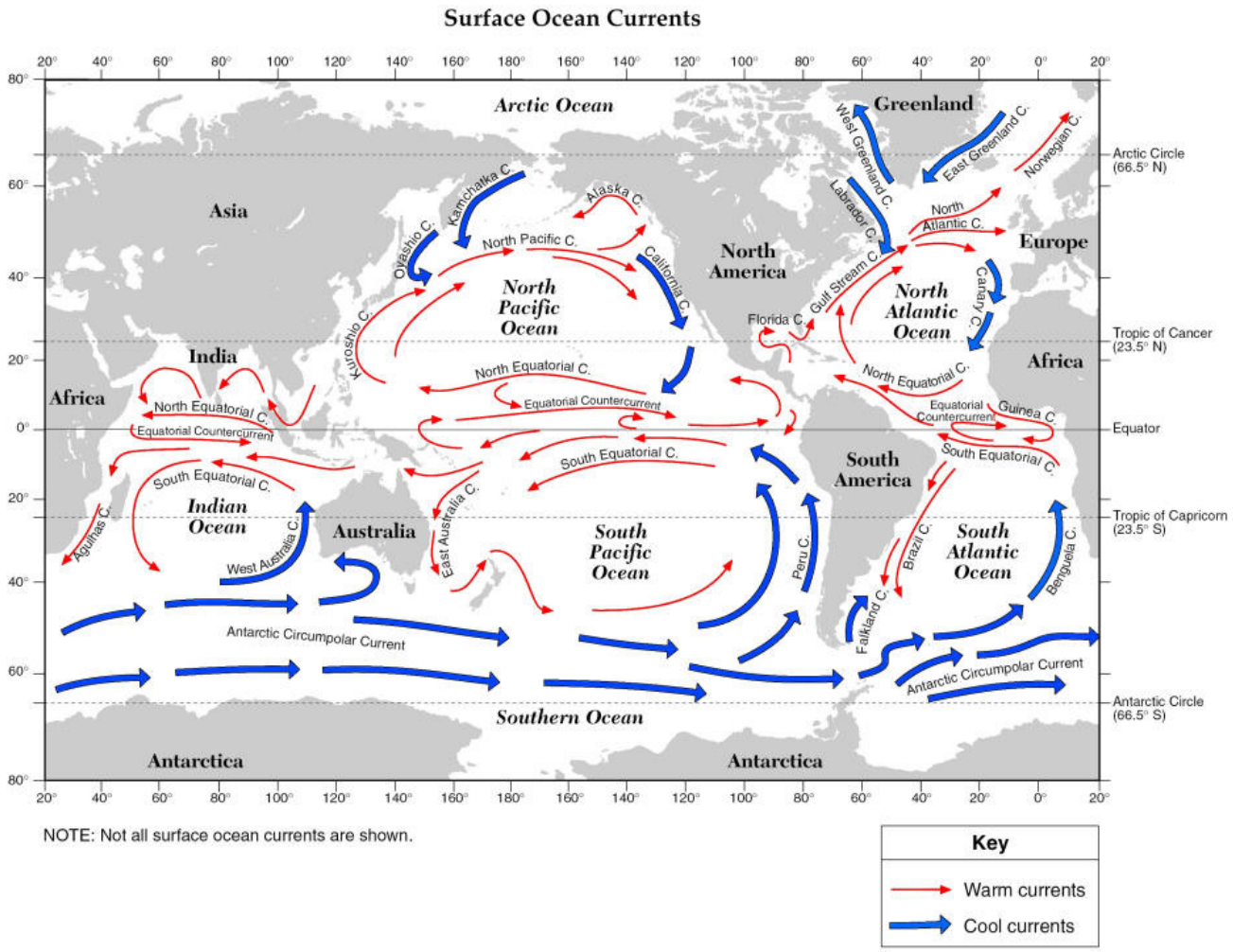
Deltas are formed at the mouths of large rivers from sediment and silt depositing. When the river flow is restricted by the delta, an estuary may form. The Nile River in Egypt and the Mississippi River in Louisiana forms delta systems estuaries.

Tectonic

it is created when a major crack or a large landmass sink, often caused by earthquakes, produced a basin below sea level that fills with water. This type of estuaries usually occurs along fault lines. San Francisco Bay in California is an example of an estuary created by tectonics.

Fjords

Advancing glaciers ground out long, narrow valleys with steep sides. Then when glaciers melted, seawater flooded in. Glacier Bay in Alaska is an example of a fjord.



Major Gulfs and their Location
Gulf of Aden of the southwestern corner of the Arabian Peninsula
Gulf of Alaska in the Pacific Ocean south of the state of Alaska
Amundsen Gulf in the Arctic Ocean northwest of Canada
Gulf of Aqaba in the northern end of the Red Sea, leading to Israel and Jordan
Gulf of Bahrain, part of the Persian Gulf
Gulf of Bothnia, part of the Baltic Sea between Sweden and Finland
Gulf of Cádiz, part of the Atlantic Ocean off the southern border of Spain and Portugal
Gulf of California in the Pacific Ocean in northwestern Mexico
Gulf of Carpentaria a large bay off northern Australia
Gulf of Cazones a large gulf in southern Cuba
Gulf of Corinth, which extends into Greece from the Mediterranean
Davao Gulf in the Philippines
Gulf of the Farallones, westward from the opening of the San Francisco Bay and Drakes Bay to the Farallon Islands
Gulf of Finland, between the southern coast of Finland and the northern coast of Estonia in the Baltic Sea.

Gulf of Genoa inside the Ligurian Sea on the northwestern coast of Italy
Gulf of Guinea in the Atlantic Ocean off the coast of Equatorial Africa
Gulf of İzmir in the Aegean Sea between Turkey and Greece. It was formerly called the Gulf of Smyrna
Gulf of Khambhat in the Arabian Sea, formerly known as the Gulf of Cambay
Gulf of Kutch in the Arabian Sea
Lingayen Gulf off western Luzon, the Philippines, in the South China Sea
Gulf of Lion, a bay on the Mediterranean coastline of Languedoc-Roussillon and Provence in France
Gulf of Maine, off the State of Maine, New Brunswick, and Nova Scotia in the Atlantic Ocean
Gulf of Mannar, between India and Sri Lanka
Gulf of Mexico, between Mexico, the United States, and Cuba
Gulf of Morbihan, a natural harbor on the coast of the Département of Morbihan in the south of Brittany
Gulf of Nicoya, in Costa Rica. Central America.
Gulf of Oman, between the southeastern Arabian Peninsula, Iran, Pakistan and Arabian Sea.
Gulf of Oristano, near Oristano on the Western Sardinian coast

Gulf of Panama in the Pacific Ocean south of Panama
Persian Gulf between Iran and the Arabian Peninsula
Gulf of Roses, the most northeastern bay on the Catalan coast
Gulf of Saint Lawrence, the world's largest estuary and the outlet of the Saint Lawrence River into the Atlantic Ocean
Gulf St Vincent, Separated from Spencer Gulf by the Yorke Peninsula
Gulf of Sidra, just north of Libya in the Mediterranean
Spencer Gulf, near Port Lincoln, South Australia
Gulf of Suez in the northern end of the Red Sea, leading to the Suez Canal
Gulf of Thailand just south of Thailand in the Indian Ocean
Gulf of Tonkin just east of North Vietnam in the Pacific Ocean
Gulf of Tunis in the Mediterranean off the coast of Tunisia

Marine Resources

The biotic and abiotic resources found in the oceanic water and bolloms are called as Marine resources. It includes marine water, inherent energy in ocean water (e.g. wave and tidal energy) biotic life (plants and animals), marine deposits and abiotic elements (minerals, fossils fuels, etc).

Marine Zone

(i) Territoral Sea
It is a region lying between base line and 12 nautical miles towards sea. 12 nautical mile is the seaward limit of territoral sea and called as contiguous zone.

(ii) Exclusive Economic Zone
This zone extends upto a 200 nautical miles from the base line. The coastal state has the right of survey, exploitation, conservation and management of mineral resources of ocean deposits, ocean floor, marine water energy, water and ocean organisms with exclusive economic zone. No other country can venture without the permission of the concern state.

(iii) High Sea
It extends beyond sea limit of the exclusive economic zone and includes the vast ocean area.

Marine Biological Resources

Those marine - related biological resources such as flora, fauna and micro organism whose inter-community behaviour and action affect or get affected by the piece of marine ecosystem they are living in.

Plankton Community

Planktons are floating and drifting micro plants and animals in photic zone. These are divided into phytoplankton (plant planktons) and zooplanktons (animal planktons). Phytoplankton produces food through the process of photosynthesis with the help of sunlight, water and atmosphere. *Algae* and *Diatoms* are most important member of this community. This community grows very fast and covers the large sea surface in no time. This cover of algae and diatom are called as **marine pasture**. The over production of red – gray microscopic plant produces **red tide.** They are eaten by zooplanktons. Zooplanktons act as a bridge between marine pasture of phytoplankton of photic zone and large sea animals.

The zooplanktons are divided into three types
(i) Herbivore zooplanktons
(ii) Carnivore zooplanktons
(iii) Detrivore zooplanktons

Nekton Community

It is the collection of actively swimming aquatic organisms in a body of water which are independently moveable without the help of water currents. Most of the animal of this community are vertebrate. Sea fishes are divided into groups:

Fishes are the important members of these community. They are further categorised into –

Pelagie fish - who leaves neither too close to share nor to the bottom.

Demersal fish - On the contrary these fishes occupy the bottom area of the sea.

Other than fishes of this community is also famous for marine mammals which are again divided into two categories :
(i) The manmals who can stay both in water and land for example *seal*.
(ii) The second category of mammals who spend their entire life in the sea.

Benthos Community

It includes the plants and animals which live on the sea bottoms right from littoral marine biomes to the open sea biome. Benthos includes worms, clams, crabs, lobsters, sharks, sponges, and other tiny organisms that live in the bottom sediments. Remineralization of organic matter is an important source of nutrients to the ocean which is done by benthos community as they pump a large amount of water through their body thus distributing the organic matter and sediments of the ocean floor.

Marine food resources

According to the uses marine food resources are divided into two types:

(i) Protein rich food resources for the use as food for human being: Fishes are the rich source of protein and aminoacid along with vitamin B12 and small amount of saturated fat and cholesterol. It helps in reducing high blood pressure and heart diseases.

(ii) Animal feed mainly for domesticated animals: Fishes are used for feeding other animals also.

Fishing Zone of the World

A large share of world's annual income comes from trade and transport of fishes. 90% of world's total fish catches are of Fin fishes and remaining 10% is contributed by whales, lobster, molluscs and several invertebrate animals. There are five major fishing regions in the world according to the degree of development of fishing areas.

North-east Pacific region

This region extends from Aleutians and crossing Russia, China, S. Korea, Japan reaches south Philippines. Most of the catches include salmon, crab, herring, Pollock, halibut and cod.

North-east Atlantic region

This region extends along the European coasts from Iceland to Portugal. Herring and haddock are the important catches from this region.

North-west Atlantic region

It includes the New England region of USA, Newbrunswick, Novascotia and Newfoundland of Canada, Grand Bank and George Bank. Cod is the major catch here.

South-east Pacific region

Peruvian and Chilean coastal area are included in this region.

West central Pacific region

this region extends from Philippines to eastern coast of Australia. Major catches here are mackerel, tuna, mullet, redfish, bass, oyster, crab etc.

Conservation of Marine Resources

Marine conservation focuses on limiting human-caused damage to marine ecosystems, and on restoring damaged marine ecosystems. Marine conservation also focuses on preserving vulnerable marine species. Marine resources conservation is the protection and preservation of ecosystems in oceans and seas. It is the need of an hour to lay down step for the exploitation, utilization, conservation and preservation. Strategies and techniques for marine conservation combine theoretical disciplines (population biology with practical conservation strategies) such as setting up protected areas, as with marine protected areas (MPAs) or Voluntary Marine Conservation Areas. National Ocean and Atmospheric Administration (NOAA) created the Damage Assessment, Remediation and Restoration Program (DARRP) to carry out the three steps such as **Preliminary Assessment, Injury Assessment/Restoration Planning** and **Restoration Implementation**

Restoration actions fall into following categories:

- **Primary restoration** returns the impacted resources to the condition that would have existed if the incident had not occurred.
- **Compensatory restoration** addresses losses from the date of injury until recovery is completed. While the resource is impaired, it is unable to provide services on which other parts of the ecosystem and the public rely (such as fish nursery habitat or recreational use). Restoration projects address the period from injury until recovery.
- **Emergency restoration** includes actions taken prior to the completion of the damage assessment and restoration planning process to prevent or reduce continuing natural resource impacts and prevent potential irreversible loss of natural resources.
- **Early restoration** is a form of compensatory restoration. If the responsible party agrees, it can be implemented prior to the completion of the Natural Resource Damage Assessment (NRDA) process to achieve restoration more quickly.

Marine Mineral Resources

Marine ecosystem is the store house of variety of minerals both metallic and non-metallic which generally found in two form, mineral dissolved in sea water and minerals deposited on different landforms of sea.

Minerals dissolved in Sea water

Minerals such as salt, bromine, gold, zinc, uranium and thorium, etc. are present in sea water in soluble form. Approximately percent of salt dissolved in sea water constituted by sodium and chloride. The salt can be separated from sea water and thus it can be transformed into fresh water like salt all other minerals can be separated through different methods. The commercial value of such minerals depend upon the cost of refinement and real market place.

Minerals of sea Deposits

Location plays a vital role in categorizing the nature of mineral deposits which can be further divided into 3 categories:

(1) Mineral deposits of continental shelves
(2) Mineral deposits of deep sea bottom
(3) Sub surface minerals

(1) **Mineral deposits on continental shelves** are zircon, monazite, magnetite, gold places, diamond, platinum, sulphur, phosphorite and several types of building material.

(2) **Minerals deposits on deep sea bottom :** Pacific ocean is considered to have the largest deposits of manganese which is present upto a depth of 4000 m. Other than manganese many mineral such as nickel, copper, cobalt, lead, zine, iron, silicon, iron are found in deep sea bottom.

(3) **Subsurface Deposits:** The mineral stored in oceanic crust of continental shelves are mineral oils and natural gas. They are the most developed mineral resources and contribute around 90% of all marine resources. They provide sample of apportunity to the economic development of any country of shore oil field have developed in the continental shelves of mexican gulf, North sea, North Alaska, Mexico, South California Arctic, Sea, India, Brazil, Australia, Taiwan and Japan.

Marine Energy Resources

Like minerals Ocean is also considered as the supplier of huge amount of energy resources, both *renewable* and *non renewable*.The non renewable sources of energy are petroleum and natural gas whereas the renewable sources are tide, wave and biomass.

The main sources of generation of electricity from ocean tide, sea waves and thermal variation between upper warm surface of sea and lower cold water mass, etc. Tidal energy is produced in two sources firstly by tidal current and the other by tidal range. Sea waves energy is processed by three methods

(i) vertical displacement methods,
(ii) salter device, and
(iii) dam atoll method.

Marine Resources Depletion

Along with other resources marine resources are also in the impact zone of depletion. Which leads to many catastrophic consequences such as extinction of major species, imbalance in marine ecosystems, etc. As oceans are the largest source of water on the earth surface its depletion is also quite noticeable. Increasing human activities play a major role in the polluting marine environment and the possible cares of marine pollution

are spreading of harmful substances such as oil, plastics, industrial and agricultural wastes, etc. The impact of such degradation can be felt through various environmental prospect such as damage of estuaries due to human interventions, negative impacts on coral reef which leads to its continuous decay. These issues are gaining concerns of environmentalists as the loss once done can not be recovered with due course of time.

Causes of Marine Depletion

The threat to marine depletion are the result of variety of factor such as:

Over exploitation of Marine species

The intensity and the magnitude of marine resource exploitation have increased the pressure due to over population. Some marine biological resources (fishes) are over exploited while abiotic (physical) resources (mineral, energy, building material) still await their exploitation. Some of the fishing regions have shown decreases in the Fish population due to over fishing. Most mammals, birds and reptiles in estuaries were depleted by 1900 and declined further by 1950 as a result of the ineresinag demand for food, oil, and luxury items (such as furs, feathers and ivory). Among fish, the highly desirable and easily accessible salmon and sturgeon were depleted first, followed by tuna and sharks, cod and halibut, and herring and sardines. *Oysters* were the first invertebrate resource to degrade because of their value and accessibility as well as destructive harvesting methods.

Accurate estimate and prediction of future demand of fishes for human food and animal feed. Proper arrangement of canning and refrigeration for storage of fishes as it's a perishable good. This would to some extent reduce the catches. In New Zealand, fisheries are managed by a quota system that sets catch limits for commercially important species and aims at sustainable management of our fish stocks.

Pollution

Water bodies have been used as the universal dumping ground since ages be it lake, pond, river, sea or ocean. Land waste brought to ocean including sewage, industrial run-off and chemicals. The accident occurs due to Oil spilling in oceans threatens marine life at all levels. Indirect pollutants brought via storms and rivers also affect them. Some effects may not be immediately obvious, for example, bioaccumulation, and levels of toxic chemicals in organisms increase with successive trophic level in the food web. Marine pollution has the potential to seriously damage marine habitats and life there.

Eutrophication

Eutrophication is the result of a particular type of marine pollution. It is caused by the release of excess nutrients into coastal areas *via* streams and rivers. These nutrients come from fertilizers used in intensive farming practices on land. Additional nutrients in the sea can lead to excessive phytoplankton growth which results in "blooms". Death of these over populated phytoplankton leads to the sharp increase in decomposition of the dead organisms by oxygen-using bacteria depletes oxygen levels. It may result in the death by oxygen starvation of large numbers of other organisms such as fish.

Ocean acidification

The amount of carbon dioxide in atmosphere has rise dramatically mainly due to human activities. Increase in carbon dioxide in the atmosphere will result in higher levels of dissolved CO_2 in seawater. Recent discovery reveals that even small changes in water pH can have big impacts on marine biology. Ocean acidification is a worldwide issue, but as CO_2 is more soluble in colder water, it is of particular concern in New Zealand's temperate oceans. It is difficult to predict the overall impact on the marine ecosystem but many scientists fear that ocean acidification has the potential to decrease marine biodiversity on a very large scale.

Excessive Human Interference.

The interference of Human being due to coastal tourism and industrial development has been increased to a great extent. It contributes to the degradation of local marine ecosystem in number of countries such as Kenya, Tanzania, etc.

Medical Researches also added to the list of major polluting agent. These kind of researches focuses on the major ingredients of sea for possible cures of various desease of Sponges, raft corals and tunicates are used extensively for producing medicine to some of the rare diseases. The researches are otherwise known as bio- prospecting which has started using coral reef of eastern Africa which is a store house of such species.

Various Ocean Development Programmes in India

Department of Ocean Development (DOD) was created as a nodal and independent department in July 1981 for organising, co-ordinating and promoting ocean development activities. The Ocean Policy Statement is primarily aimed at utilising the marine living and non-living resources for societal benefits in a sustainable manner.

Salient features of the Policy Statement and thrust areas include:

- Exploratory survey, assessment and sustainable utilisation/ harnessing of the ocean resources.
- Technological Development to gear utilisation and preservation. Technology relating to instrumentation, diving systems, position fixing, materials development, oceanic data collecting devices, submersibles, etc.
- Developmental activities related to integrated coastal and marine area management and coastal community development.
- Establishment of an ocean related information system using indigenous and foreign sources; International cooperation in Ocean Science and Technology.
- Development of technologies relating to seabed mining, extractive metallurgy and conducting Environmental Impact Assessment studies.
- Contribution towards basic and applied research in Ocean Science and Technology, Human Resource Management, creation of Centers of Excellence in academic institutions and public awareness on the potential and uses of ocean.

Integrated Coastal and Marine Area Management

United Nations Conference on Environment and Development (UNCED) in 1992, adopted the Agenda 21 which emphasized on the need to adopt the concept of Integrated Coastal Zone Management (ICZM) for sustainable utilisation of coastal and marine resources and prevention of degradation of marine environment. The Ministry of Earth Sciences established it on 2 January, 1998 at Chennai with following objectives:

- Developing capacity towards accomplishing the coastal and ocean related objectives of UNCED and
- To carry out R&D on application of scientific tools and techniques which are helpful in the development of integrated management solutions to address the issues and problems prevalent in the coastal marine areas.

It has established a strong database system related to coastal and marine resources and prevention of degradation of marine environment.

Coastal Ocean Monitoring and Prediction System

Extensive monitoring of marine pollution along the coastal waters was carried out at 70 locations and it has been found that the disposal of untreated sewage from towns, cities and villages cause decrease of dissolved oxygen and increase of nitrate and pathogenic bacteria in the sea close to the shore.

The study also concluded that –

From 120 class I and class A cites toward of coastal areas rearly 6835 ml of waste water being generated out of which on 1492 ml undergoes the process of various level of treatment

The solid waste generated by these 120 coastal cities are not that much harmful as they can be used as dumping material in large dumping ground.

In case of coastal agriculture suspended solid and nutrient contents are causing harmful effect to coast.

Model to predict the movement of oil during oil spills has been developed for the coasts of Mumbai and Chennai. Works to develop similar models for the coasts of Goa, Kerala and Visakhapatnam have been undertaken.

The National Institute of Ocean Technology (NIOT)

The National Institute of Ocean Technology (NIOT) was established in November 1993 as an autonomous society under the Ministry of Earth Sciences, Government of India. The major aim of NIOT is to develop reliable indigenous technology to solve the various engineering problems associated with harvesting of non-living and living resources in the Indian Exclusive Economic Zone (EEZ), which are about two-thirds of the land area of India.

- To develop world class technologies and their applications for sustainable utilization of ocean resources.
- To provide competitive, value added technical services and solutions to organizations working in the oceans.
- To develop a knowledge base and institutional capabilities in India for management of ocean resources and environment.

Indian Antarctic Program

The Indian Antarctic Program is a multi-disciplinary, multi-institutional program under the control of the National Centre for Antarctic and Ocean Research, Ministry of Earth Sciences, Government of India (1981). The program gained global acceptance with India's signing of the Antarctic Treaty and subsequent construction of the *Dakshin Gangotri Antarctic* research base in 1983. *Maitri* is India's second permanent research station in Antarctica. It was built in 1989. Larsemann hill area became India's third station under the XXX Antarctic Treaty in 2007.

Indian Tsunami Warning System was established in 2006 by National Institute of Ocean Technology (NIOT), Chennai, Ministry of Earth Sciences, Government of India. It comprises of **Data Buoys** with **Bottom Pressure Recorders** in the deep seabed and **Acoustic Tide Gauge Network** in the coastal areas. For Tsunami monitoring applications India uses **Acoustic Tide Gauge**.

Wetlands

- Wetlands are lands which, due to geological or ecological factors, have a natural supply of water – either from tidal flows, flooding rivers, connections with groundwater, or because they are perched above aquifers.
- Wetlands are coverd or soaked for at least a part, and often all, of the year and thus are intermediaries between terrestrial and aquatic ecosystems.
- The periodicity of water level fluctuations is termed as *hydroperiod* and it is the key factor that determines the productivity and species composition of the wetland community.
- Generally low lying areas, covered by shallow water and have charachteristic soils and water tolerant vegetation.
- Wetlands occupy only 2% of the surface area of earth and they are estimatted to contain 10 to 14% of carbon.
- They may be either freshwater or salt water (coastal).
- **Man made wetlands :** paddy fields, fishery ponds, Trapa and Euryale cultivation ponds and other aquaculture habitats.

Significance of Wetlands

- Nutrient rich and have high primary productivity.
- Since they have both aquatic and semi-aquatic environmental conditions to support specialized vegetation and fauna. Often a prime breeding habitat for waterfowl, many migratory birds and other aquatic or semi aquatic vertebrates.

- Helps in controlling flood by holding excess water, and the flood water stored in wetlands then drains slowly back into the rivers, providing a steady flow of water throughout the year.
- Serve as groundwater recharging areas.
- Provide important commercial products, including wild rice and various types of berries (such as black berries, blue berries, etc.).

- Hold sediments and accumulate soils along the shoreline.
- National Wetland Conservation Programme(NWCP) has been initiated for indentified wetland which are at present 66 covering 21 states.

Types of Wetland

(i) Marshes

Marshes are defined as palustrine wetlands because they are often or continually inundated with water, characterized by emergent soft-stemmed vegetation adapted to saturated soil conditions. Nutrients are plentiful and the pH is usually neutral to alkaline. We have divided marshes into two primary categories: non-tidal and tidal.

Non-Tidal marshes are highly organic, and mineral rich soils of sand, silt, and clay underlie these wetlands. It provides excellent habitat for waterfowl and other small mammals, such as Red-winged Blackbirds, Great Blue Herons, otters and muskrats. Prairie potholes, playa lakes, vernal pools and wet meadows are all examples of non-tidal marshes.

Tidal marshes are saline. The lower marsh is normally covered and exposed daily by the tide. The saline marsh is characterized by Short Smooth Cord grass, Spike Grass and Salt meadow Rush (*Juncus gerardii*). Saline marshes support a highly specialized set of life adapted for saline conditions. These marshes generally harbour great biological diversity

(ii) Swamp

Swamps are the low lying uncultivated ground which generally collect water. There are many different kinds of swamps, ranging from the forested Red Maple, (*Acer rubrum*), swamps of the Northeast to the extensive bottomland hardwood forests found along the sluggish rivers of the Southeast. Swamps are characterized by saturated soils during the growing season and standing water during certain times of the year. The highly organic soils of swamps form a thick, black, nutrient-rich environment for the growth of water-tolerant trees such as Cypress (*Taxodium* spp.), Atlantic White Cedar (*Chamaecyparis thyoides*), and Tupelo (*Nyssa aquatica*). Some swamps are dominated by shrubs, such as Buttonbush or Smooth Alder. Plants, birds, fish, and invertebrates such as freshwater shrimp, crayfish, and clams require the habitats provided by swamps. Many rare species, such as the endangered American Crocodile, depend on these ecosystems as well. Swamps may be divided into two major classes, depending on the type of vegetation present: *shrub swamps* and *forested swamps*.

(iii) Bogs

Bogs are most distinctive kinds of wetlands. They are characterized by spongy peat deposits, acidic waters and a floor covered by a thick carpet of sphagnum moss. Bogs receive all or most of their water from precipitation rather than from runoff, groundwater or streams. As a result, bogs are low in the nutrients needed for plant growth, a condition that is enhanced by acid forming peat mosses. Bogs develop primary in two ways: as sphagnum moss grows over a lake or pond and slowly fills it (terrestrialization), or as sphagnum moss blankets dry land and prevents water from leaving the surface (paludification). Over time, many feet of acidic peat deposits build up in bogs of either origin. The unique and demanding physical and chemical characteristics of bogs result in the presence of plant and animal communities that demonstrate many special adaptations to low nutrient levels, waterlogged conditions, and acidic waters, such as carnivorous plants. Nevertheless, bogs support a number of species of plants in addition to the characteristic Sphagnum Moss, including Cotton Grass, Cranberry, Blueberry, Pine, Labrador Tea and Tamarack. Moose, deer, and lynx are a few of the animals that can be found in northern bogs. The Greater Sand hill Crane, the Sora Rail, and the Great Gray Owl depend on bogs for survival.

(iv) Fens

Fens are *peat-forming wetlands* that receive nutrients from sources other than precipitation, usually from upslope sources through drainage from surrounding mineral soils and from groundwater movement. As fens are less acidic and have higher nutrient levels than blog it supports diverse plant and animal community. These systems are often covered by grasses, sedges, rushes and wildflowers. Some fens are characterized by parallel ridges of vegetation separated by less productive hollows. The ridges of these patterned fens form perpendicular to the down slope direction of water movement. Over time, peat may build up and separate the fen from its groundwater supply. When this happens, the fen receives fewer nutrients and may become a bog.

Distribution of Wetlands in World

Major Wetland Regions of the World

South America

(i) The Orinoco River delta of Venezuela

It is dominated by brackish shoreline mangrove forests.

(ii) The Llanos

It is located on the western part of the Orinoco River found in western Venezuela and northern Colombia. It's one of the largest inland wetland areas of South America. Here winters are wet (yearly flood occurs) and summers are dry. It is dominated by savanna grasslands and scattered palms. It is important wading-bird habitat and is rich with caiman and red piranha.

(iii) The Amazon River

It is 3,000 km long and floods 5-15 meters high every year. It is *world's largest river*, with a flow that results in about one-sixth to one-fifth of all the fresh water in the world. It creates its own weather patterns.

(iv) The Pantonal

One of the largest wetlands in world located in southwestern Brazil. It covers four times the size of the Florida Everglades, with about 131,000 km^2 of that area flooded annually. It's a haven for 650 to 700 species of birds.

Europe

(i) Mediterranean Sea Deltas

The Rhone River Delta created France's most important wetland, the Camargue. It is highly affected by a hot, dry summer and cool, wet winters. It is home to world's 25 major flamingo nesting sites.

(ii) Coastal Marshes of Northern Europe

Extensive salt marshes and mud flats are found along the Atlantic Ocean and the North Sea coastlines of Europe. Most of the grasses are of type marshes. Rhine River Delta is a major transportation artery in Europe. Much of the Netherlands is on the Rhine River Delta.

(iii) Peatlands

Northern boreal and subarctic are peat land. It is more than half of the world wetlands. Predominately found in Ireland, Scandinavia, Finland, and Russia. It is mostly made up of decomposed sphagnum moss.

Africa

An abundance of wetlands is found in sub-Saharan Africa such as the Congo River Swamps, inner Niger Delta, Sudd of the Upper Nile, and the Okavango Delta.

(i) Northern Africa

Sudd of the Upper Nile: Rainforest where the Blue and White Nile meet in the southern Sudan.

Nile Delta: It is used to be a huge delta; the land has been converted to farm land, no longer affected by floods due to Aswan Dam.

(ii) Okavango Delta

A vast number of rivers, channels, island and lagoons are diverted to the Okavango Delta. Along the coast there are many mangrove forests. Zambezi River system and Etosha Pan in Angola are also included in it.

(iii) Zaire and Congo Rivers and Floodplains of the Senegal, Nile, Lake Chad; in arid Sahel.

Australia

Wetlands are distinctive due to seasonal dryness from high evaporation rates and low rainfall. Saline wetlands and lakes are common as a result of the high evaporation rates.

New Zealand: One location in North Island has all seven types of wetlands. It has lost 90% of its wetlands. South Island receives 2-10 meters annually of rain, several types of wetlands.

Asia

(i) Northern Asia

Ob-Irtysh basin, mountains of N. Central Asia (Lake Baikal), Tundra and internally drained seas: Caspian, Aral.

(ii) South and Southeast Asia:

South and Southeast Asia has the biggest wetlands. Some of the major rivers are the Indus, Ganges, Chao Praya and Mekong. The Mekong begins at the Tibet Plateau and runs through China, Laos, Cambodia and Vietnam draining 625,000 km^2. It is estimated that 20 million people receive their protein from fishing in these areas.

(iii) China

It has approximately 650,000 km^2 of wetlands, Pearl, and Yangtze River Deltas. Of that 250,000 km^2 have been reserved, and 400,000 km^2 have been used for rice paddies, fish ponds, and other functions.

Major Wetland of the world as ranked by World Heritage Site

Country	Wetland Name	Area
Canada	Wood Buffalo National Park	44,807 km^2
USA	Everglades National Park	6,110 km^2
USA	Olympic National Park	3,734 km^2
USA	Yellowstone National Park	8,983 km^2
Bulgaria	Srébarna Nature Reserve	6 km^2
Romania and Ukraine	Danube Delta	4,152 km^2
Russian Federation	Lake Baikal	31,722 km^2
Russian Federation	Volcanoes of Kamchatka	43781 km^2
Spain	Doñana National Park	543 km^2
Tunisia	Ichkeul National Park	85 km^2
Malawi	Lake Malawi National Park	94 km^2
Senegal	Djoudj National Bird Sanctuary	160 km^2
Dem. Republic of Congo	Virunga National Park	7,800 km^2
India	Kaziranga National Park	430 km^2
India	Keoladeo National Park	28 km^2
India	Manas National Park	950 km^2
Australia	Fraser Island	1,840 km^2
Australia	Kakadu National Park	19,804 km^2
New Zealand	Te Wahipounamu	26000 km^2
Honduras	Río Platano Biosphere Reserve	5250 km^2
Mexico	Sian Ka'an	3,157 km^2
Panama	Darien National Parks	720 km^2
Colombia	Los Katios National Parks	5,970 km^2
PERU	Manu National Park	17,163 km^2

Lakes

Lakes are static bodies of water on the land surface which is surrounded by land on all side. They are always located to land surface. They are variable and changes with time and can be found at heights also (Tso Sekuru lake). Some of the lakes have greater depth (Baykal lake). It can be of varying size.

Types of Lakes

On the basis of salinity there are two types of lakes

(i) Fresh water lake
(ii) Saline water lake

On the basis of Origin there are following types of lakes:

1. **Tectonic lake** is formed by uplifting of marine sediments and is often large and shallow such Lake Okeechobee, Lake Baikal, Lake Tanganyika, Lake Tahoe, Pyramid Lake (Nevada), Lake Ohrid (Yugoslavia), Dead Sea, Lake Kinneret (Sea of Galilee), Abert Lake, Lake Kioga, Lake Victoria, Reelfoot Lake.

2. **Volcanic lake** is formed due to volcanic eruption. Crater lake is the most common type of lake found. Crater Lake, Tagus Lake, Eifel Lake District (Black Forest of Germany) and Lake Kivu are the few examples of this type of lake.
3. **Diastrophic lake** is formed by landslides, mudflow and slump of land, e.g. Quake Lake, Yellowstone.
4. **Aeoline lake** formed when the low-lying land among the dunes in the desert is lower than the groundwater level, the water gathers there and forms the aeolian lake, *e.g.* Ghost lake.
5. **Fluvial lake** results from development of river and river course.
6. **Glacier** lake formed by **glaciers** and ice movement like cirque lake and rock-basin lake. The Great Slave Lake, Laurentian Great Lakes, Finger Lakes and Lake Mendota are examples such lake.
8. **Shoreline lake** is associated with on-shores lakes. It is large lake. It is of two types: **deltaic lake and coastal lake. Deltaic lake** is formed by sedimentation as river currents slow when they enter a large lake or the ocean *e.g.* Wax Lake. **Coastal lake** is related to movement of sand in spits and bars may enclose basins, *e.g.* Lake Eyre.
9. Lakes formed by falling of **meteor,** *e.g.* Chubb Crater.
10. **Anthropogenic lake** it is formed by man and even is called as man-made lake, *e.g.* Kopalińskie Lake.

Lakes facts:
***Plitvice Lakes** (Croatia)*: Sixteen Lakes interconnected by Spectacular Waterfalls.
***Boiling Lake** (Dominica)*: A Flooded Fumarole.
***Red Lagoon** (Bolivia)*: Red (algae) + White (borax).
***Five-Flower Lake** (China)*: Beautiful Multi-Coloured Lake with Fallen Tree Trunks.
***Dead Sea** (Israel and Jordan)*: Lowest Point on Earth.
***Lake Baikal** (Russia)*: Deepest and Oldest Lake in the World.
***Lake Titicaca** (Bolivia and Peru)*: World's Highest Navigable Lake.
***Caspian Sea** (Russia)*: World's Largest Lake.
***Crater Lake** (USA)*: Its water is considered one of the World's most clearest.
***Lake Karachay** (Russia)*: Most Polluted Spot on the Earth.

Rivers

It's running water which usually empties itself into a sea or ocean, generally flowing with respect to the slope. According to the adjustment to the geological structure the streams or river drainage pattern has been divided into two categories such as:

Generic Classification of Stream

On the basis of the course through which streams generally flow, they can be divided into five basic types.

- **Consequent stream** having a direct consequence of the original slope of the surface on which it is flowing.
- **Subsequent Stream** has a head word erosion along the weak strata of the bed rock. They generally flow along original streams independent of the original relief of the land.
- **Resequent Streams** flow along side the original stream but the level is lower than the original slope. These streams are generally known as the tributaries of subsequent stream.
- **Obsequent Streams** : Generally flow in the opposite direction of consequent stream.
- **Insequent Stream** : Don't have any fixed pattern hence they form dendrite pattern of drainage. They are generally independent of original slope of the surface its structure, or type of rock.

Types of Rivers

(i) Seasonal Rivers

The rivers which have water in them at a particular period of the year and are rainfed (Godavari, Krishna, Cauveri, Narmada, Tapi and Tungabhadra)

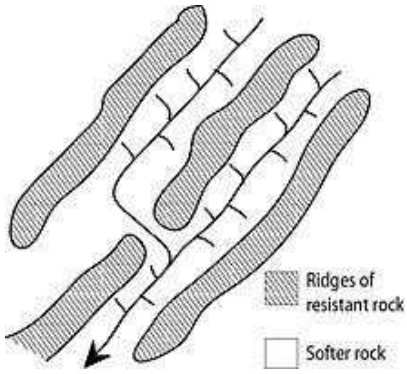
(ii) Perennial Rivers

The rivers which have water throughout the year. It is usually glacier fed (Indus, Sutlej, Ganga and Brahmaputra).

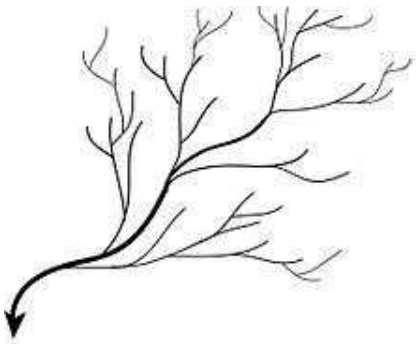
Drainage Pattern of the river

Rivers when flow, form a pattern which are generally divided into following:

(i) Trellis Drainage Pattern: As the river flows along a strike valley, smaller tributaries feed into it from the steep slopes on the sides of mountains. They are formed by consequent stream which follows regional slope and geological structure. Trellis drainage is characteristic of folded mountains, such as the Appalachian Mountains in North America and in the north part of Trinidad.



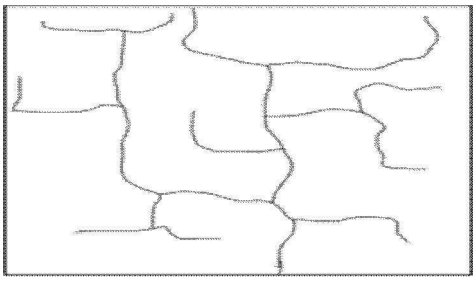
Trellis Drainage Pattern



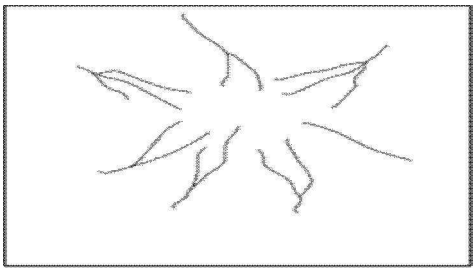
Dendritic Drainage Pattern

(ii) **Dendritic Drainage Pattern:** The tree like pattern formed by the river as they flow is called as dendritic drainage pattern.

(iii) **Rectangular Drainage Pattern:** This type of pattern is formed when streams from two directions of joining at approximately right angles. Rectangular drainage develops on rocks that are of approximately uniform resistance to erosion.



Rectangular Drainage Pattern



Radial Drainage Pattern

(iv) **Radial Drainage Pattern:** When the streams radiate outwards from a central high point they form radial drainage pattern.

(v) **Centripetal Drainage Pattern:** When the streams flow towards a common depression they form centripetal force. This pattern is opposite of radial pattern.

(vi) **Annular Drainage Pattern:** The tributaries of consequent stream develop in a form of circle. This pattern is found over a mature and dissected dome mountain characterized by soft and hard rock alternatively. Angles of the streams meeting are both more and less than 90 degrees.

(vii) **Barbed Drainage Pattern:** It is formed when the tributaries of a river runs in the opposite direction to its master steam.

(viii) **Herringbone Drainage Pattern:** It is also known as rib pattern. It resembles the rib bones of human being (upper Jhelum, Tamar Kosi, upper Rapti and left bank of Gandak).

(ix) **Parallel Drainage Pattern:** It follows the regional slope and develops on uniformly sloping landmass. The western coastal plain of India has such type of pattern.

Exercise -1

1. Which one of the following factors is responsible for the change in the regular direction of the ocean currents in the Indian Ocean?
   (a) Indian Ocean is half an ocean
   (b) Indian Ocean has monsoon drift
   (c) Indian Ocean is a land-locked ocean
   (d) Indian Ocean has greater variation in salinity
2. Maximum thickness of sediments is found over
   (a) Abyssal floor
   (b) Continental shelves and slopes
   (c) Continental slopes and rises
   (d) Oceanic ridges
3. Which one of the following ocean currents is associated with the 'EL NINO' Phenomenon?
   (a) Humboldt (b) Benguela
   (c) Canaries (d) Kurushio
4. A submarine mountain or peak rising more than 1000 m above the ocean floor is known as
   (a) Guyots (b) Seamounts
   (c) Abyssal hills (d) Trenches
5. Dolphin Challenger Ridge is located in
   (a) Atlantic Ocean (b) Pacific Ocean
   (c) Arctic Ocean (d) Indian Ocean
6. When water freezes in the polar seas the salts
   (a) form a layer on top
   (b) remain in the sub-surface water that does not freeze
   (c) sink to the bottom
   (d) partly freeze and partly sink to the bottom
7. The winter temperatures of north-western Europe are higher than those of eastern Europe in the same latitudinal zone because
   (a) it is on the western side of the continent
   (b) it is near the sea
   (c) it receives only light falls of snow
   (d) it lies under westerly winds which blow over the Gulf Stream Drift
8. Arrange parts of ocean floor according to increasing distance from the coast.
   (a) continental slope, continental shelf, continental rise, deep sea plain
   (b) continental shelf, continental rise, deep sea plain, continental slope
   (c) continental shelf, continental slope, continental rise, deep sea plain
   (d) continental rise, continental shelf, continental slope, deep sea plain
9. What is Gulf Stream?
   (a) A cold current in the Atlantic Ocean
   (b) A cold current in the Pacific Ocean
   (c) A warm current in the Atlantic Ocean
   (d) A warm current in the Pacific Ocean
10. One of the warm currents in the Indian Ocean is the
    (a) Labrador Current (b) Agulhas Current
    (c) Curoshio Current (d) Humboldt Current
11. The Red Sea is an example of a
    (a) folded structure (b) faulted structure
    (c) lava structure (d) residual structure
12. What is the triangular landmass that forms at its mouth when a river splits into several branches just before entering the sea?
    (a) Cape (b) Island
    (c) Estuary (d) Delta
13. From west to east, what are the three main island groups in the Pacific called ?
    (a) Melanesia, Micronesia and Polynesia
    (b) Polynesia, Micronesia and Melanesia
    (c) Melanesia Polynesia and Micronesia
    (d) Micronesia, Polynesia and Melanesia
14. What is the difference between a lake and a tank?
    (a) A lake is small and a tank is big
    (b) A lake has flowing water, a tank has still water
    (c) A lake is a geographical feature, a tank is not
    (d) Both are land-enclosed water bodies, but the latter is manmade.
15. The direction of ocean currents is reversed with season in
    (a) the Indian Ocean (b) the Pacific Ocean
    (c) the Atlantic Ocean (d) no area on earth
16. The term 'Apogee' refers to which one of the following?
    (a) A point in the orbit of the moon at which it is farthest from the earth.
    (b) A point in the orbit of the moon at which it is nearest to the earth.
    (c) Portion of surface of the moon opposite to the earth.
    (d) Portion of surface of the moon facing the earth.
17. Where is the ocean current called the 'Gulf Stream' found?
    (a) Atlantic Ocean (b) Indian Ocean
    (c) North Pacific Ocean (d) South Pacific Ocean
18. Sunda Trench lies in
    (a) Atlantic Ocean (b) Pacific Ocean
    (c) Indian Ocean (d) Antarctic Ocean
19. The exceptionally high and low tides that occur at the time of the new moon or the full moon when the Sun, the Moon and the Earth are approximately aligned is called
    (a) Spring (b) Fall
    (c) Neap (d) Diurnal
20. The current produced by upwelling of cold water off the coast of Chile and Peru is known as
    (a) EI Nino (b) Humboldt current
    (c) Agulhas current (d) Canary current
21. On the planet earth, most of the freshwater exists as ice caps and glaciers. Out of the remaining freshwater, the largest proportion
    (a) is found in atmosphere as moisture and clouds
    (b) is found in freshwater lakes and rivers
    (c) exists as groundwater
    (d) exists as soil moisture

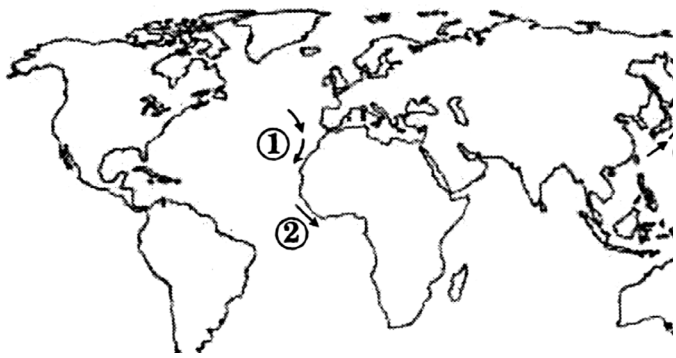
22. Consider the following statements :
    1. The Labrador current is a cold current in the North Atlantic Ocean.
    2. The Falkland current is a warm current that flows along the Chile coast of South Pacific Ocean.

    Which of the statements given above is/are correct ?
    (a) Only 1 (b) Only 2
    (c) Both 1 and 2 (d) Neither 1 nor 2
23. Which one of the following pairs is not correctly matched?
    (a) Kuroshio : Warm ocean current
    (b) Labrador : Warm ocean current
    (c) Benguela : Cold ocean current
    (d) Oyashio : Cold ocean current
24. Which one among the following is a sea without having a coastline?
    (a) North sea (b) Sargasso sea
    (c) Baltic sea (d) Bering sea
25. Match List I with List II and select the correct answer using the code given below the Lists :

List I
(Ocean current)

A. Guinea current
B. Oyashio current
C. Canaries current
D. Kuroshio current

List II
(Location in Map)



Code :
(a) A-4; B-3; C-1; D-2 (b) A-2; B-3; C-1; D-4
(c) A-2; B-1; C-3; D-4 (d) A-4; B-1; C-3; D-2

26. The most important fishing grounds of the world are found in the regions where
    (a) warm and cold atmospheric currents meet
    (b) rivers drain out large amounts of freshwater into the sea
    (c) warm and cold oceanic currents meet
    (d) continental shelf is undulating
27. Read the following statements and select the correct answer from the codes given below:
    1. Corals are mainly found in the tropical oceans.
    2. Corals need clean sediment free water.
    3. Corals are mainly found in deeper parts of the ocean.
    4. Rain water promotes the growth of corals.

    Codes:
    (a) 1 and 2 (b) 2 and 3
    (c) 3 and 4 (d) 2 and 4
28. The horizontal distribution of temperature of ocean water is largely affected by
    1. Depth of water in the ocean
    2. Ocean current
    3. Prevailing winds
    4. Latitudes

    Which of the following is correct?
    (a) 1, 2 and 3 (b) 1, 2 and 4
    (c) 2, 3 and 4 (d) 1, 2, 3 and 4
29. Which one of the following is correctly matched?
    (a) Gulf of Carpentaria — Italy
    (b) Gulf of Sidra — Libya
    (c) Gulf of Po hai — Thailand
    (d) Gulf of Tonking — Malaysia

Exercise -2

Statement Based MCQ

1. Consider the following statements:
   1. Annual range of temperature is greater in the Pacific Ocean than that in the Atlantic Ocean.
   2. Annual range of temperature is greater in the Northern Hemisphere than that in the Southern Hemisphere.

   Which of the statements given above is/are correct?
   (a) 1 only (b) 2 only
   (c) Both 1 and 2 (d) Neither 1 nor 2
2. A new type of El Nino called El Nino Modoki appeared in the news. In this context, consider the following statements:
   1. Normal El Nino forms in the Central Pacific Ocean whereas El Nino Modoki forms in Eastern Pacific Ocean
   2. Normal El Nino results in diminished hurricanes in the Atlantic Ocean but El Nino Modoki results in a greater number of hurricanes with greater frequency.

   Which of the statements given above is/are correct?
   (a) 1 only (b) 2 only
   (c) Both 1 and 2 (d) Neither 1 nor 2
3. Consider the following statements:
   1. Tides are of great help in navigation and fishing.
   2. High tide enables big ships to enter or leave the harbour safely.
   3. Tide prevents siltation in the harbours.
   4. Kandla and Diamond Harbour are tidal ports.

   Which of these statements are correct?
   (a) 1 and 4 (b) 2, 3 and 4
   (c) 1, 2 and 3 (d) 1, 2, 3 and 4
4. Consider the following statements:
   1. Ocean crusts are denser than the continental crust.
   2. Oceanic crusts are made up of granitic rocks whose composition is silicon and aluminium.
   3. Granitic rocks are lighter in colour than basaltic.
   4. Crust extends upto 70 km under mountains, in contrast to oceans which are about 5 km.

   Which of the above statements are true?
   (a) 1, 3 and 4 (b) 1, 2 and 4
   (c) 2, 3 and 4 (d) 1, 2, 3 and 4
5. Which of the following conditions for the survival of corals are correct?
   1. The water temperature must not fall below 20°C
   2. The depth of water should not exceed 30 fathoms
   3. The salinity should be less than 10%
   4. The water should be free from sediments

   Select the correct answer from the codes given below:
   (a) 1 and 2 (b) 3 and 4
   (c) 1, 2 and 3 (d) 1, 2 and 4
6. The chief fishing grounds of the world occur where cold and warm currents meet. This is because.
   1. cold currents are rich in nitrates and phosphates which feed plankton.
   2. Such areas cause the water to become well-aerated.
   3. the warm current brings the right temperature for marine life.

   (a) 1 only (b) 2 only
   (c) 1, and 2 (d) 1, 2, and 3
7. Which among the following statements about the North Atlantic Drift is/are correct?
   1. It keeps the west coast of Northern Europe ice free.
   2. It is responsible for the warm air mass which interacts with the cold air mass from the Polar region and causes rainfall in Western Europe.
   3. It meets the Labrador current near Vancouver Island and causes dense fog.

   Select the correct answer using the code given below
   (a) 1, 2 and 3 (b) 1 and 2
   (c) 2 only (d) 1 and 3
8. Consider the following statements :
   1. The Labrador current is a cold current in the North Atlantic Ocean.
   2. The Falkland current is a warm current that flows along the Chile coast of South Pacific Ocean.

   Which of the statements given above is/are correct?
   (a) Only 1 (b) Only 2
   (c) Both 1 and 2 (d) Neither 1 nor 2

Matching Based MCQ

DIRECTIONS (Q. 9 to 10) : Match List-I with List-II and select the correct answer using the codes given below the lists.

9.

List-I (Current)	**List-II (Ocean)**
(A) Agulhas	(1) North Atlantic
(B) Aleutian	(2) South Pacific
(C) Canaries	(3) South Indian
(D) Humboldt	(4) North Pacific

(a) A - 2; B - 1; C - 4; D - 3
(b) A - 2; B - 4; C - 1; D - 3
(c) A - 3; B - 1; C - 4; D - 2
(d) A - 3; B - 4; C - 1; D - 2

10. Match List-I with List-II and select the correct answer using the code given below:

List-I (Current)	**List-II (Feature)**
A. Kuroshio current	1. Warm current in Atlantic Ocean
B. Peru current	2. Cold current in the Atlantic Ocean
C. Labrador current	3. Warm current in the Pacific Ocean
D. Florida current	4. Cold current in the Pacific Ocean

Codes:

	A	B	C	D
(a)	3	4	2	1
(b)	3	2	4	1
(c)	1	4	2	3
(d)	1	2	4	3

Hints and Explanations

EXERCISE-1

1. (b) Due to the monsoon drift of Indian ocean, its regular direction of the ocean currents changes twice an year.

2. (b) 3. (a) 4. (b) 5. (a) 6. (b)
7. (d) 8. (c) 9. (c) 10. (b) 11. (b)
12. (d) 13. (a) 14. (d) 15. (a) 16. (a)
17. (a) 18. (c)

19. (a) Spring tides occur when the sun and moon are directly in line with the earth and their gravitational pulls reinforce each other, consequently a great flood or rush as of emotion.

20. (a) El Nino is a cold water current which runs along the coast of Peru and Chile. It is also a climate pattern which occurs every five years.

21. (c) The percentage of freshwater that exists on earth is 3% out of which almost 70% is icecaps and glaciers. And the remaining 30% is the ground water. Lakes, rivers and swamps are approximately 10% of that 30% of ground water.

22. (a) The Falkand current is a cold current. It flows along the Argentina's coast in South Atlantic Ocean.

23. (b) The Labrador Current is a cold current in the North Atlantic Ocean.

24. (b) While all other seas in the world are defined at least in part by land boundaries, the Sargasso Sea is defined only by ocean currents. The Sargasso Sea does not have a coastline as it is located in the middle of the Atlantic Ocean.

25. (b) A- 2, B- 3, C- 1, D- 4
The Guinea Current is a slow warm water current that flows to the east along the Guinea coast of West Africa. Oyashio Current is a cold subarctic ocean current that flows south and circulates counter-clockwise in the western North Pacific Ocean. The Canary Current is a wind-driven surface current that is part of the North Atlantic Gyre. The Kuroshio is a north-flowing ocean current on the west side of the North Pacific Ocean.

26. (c) The mixing of warm and cold current in the region where planktons are found, is food for fishes. The temperature is just right for them to survive.
The temperature is just right for the growth of firsh food called planktons.

27. (a) Corals are mainly found in the tropical oceans. Corals need clean sediment free water. A coral polyp has a sack like body and an opening encircled by stinging tentacles called cnidae. The coral polyp uses calcium carbonate from seawater to build itself a hard skeleton and it is this limestone skeleton that protects the soft coral polyp.

28. (c) The horizontal distribution of temperature of ocean water is largely affected by ocean current, prevailing winds and latitudes.

29. (b) Gulf of Carpentaria – Australia
Gulf of Sidra – Libya
Gulf of Po hai – China
Gulf of Tonking – Vietnam
All these are names of gulfs associated with the following countries.

EXERCISE-2

1. (b) Climates in the Southern Hemisphere tends to be milder than those in the Northern Hemisphere. Southern Hemisphere has significantly more ocean and less land. The water heats up and cools down more slowly than land.

2. (b) Normal El Nino forms in south–eastern Pacific whereas as El Nino Modoki forms in central Pacific and causes greater number of hurricanes.

3. (b) Statement '1' is wrong because tides are not good for navigation. Tide may cause sinking of boats and ships. High tide helps ships for enter or leave the harbour safely. Kandla and Diamond harbour are tidal ports, Diamond harbour is located on river Hugli, whereas Kandla port is at the eastern part of Gulf of Kutch, which is a natural port.

4. (a) 5. (d) 6. (c)

7. (b) The North Atlantic current or Drift or sea movement is a powerful warm ocean current that continues the gulf stream northeast, which stretches from Florida to north- western Europe. It moderates the chilled climate of western Europe.

8. (a) The Falkand current is a cold current. It flows along the Argentina's coast in South Atlantic Ocean.

9. (d) There are ocean currents which are found in given ocean. Agulhas is the warm current, Humboldt is cold current and Kanaries is cold current.

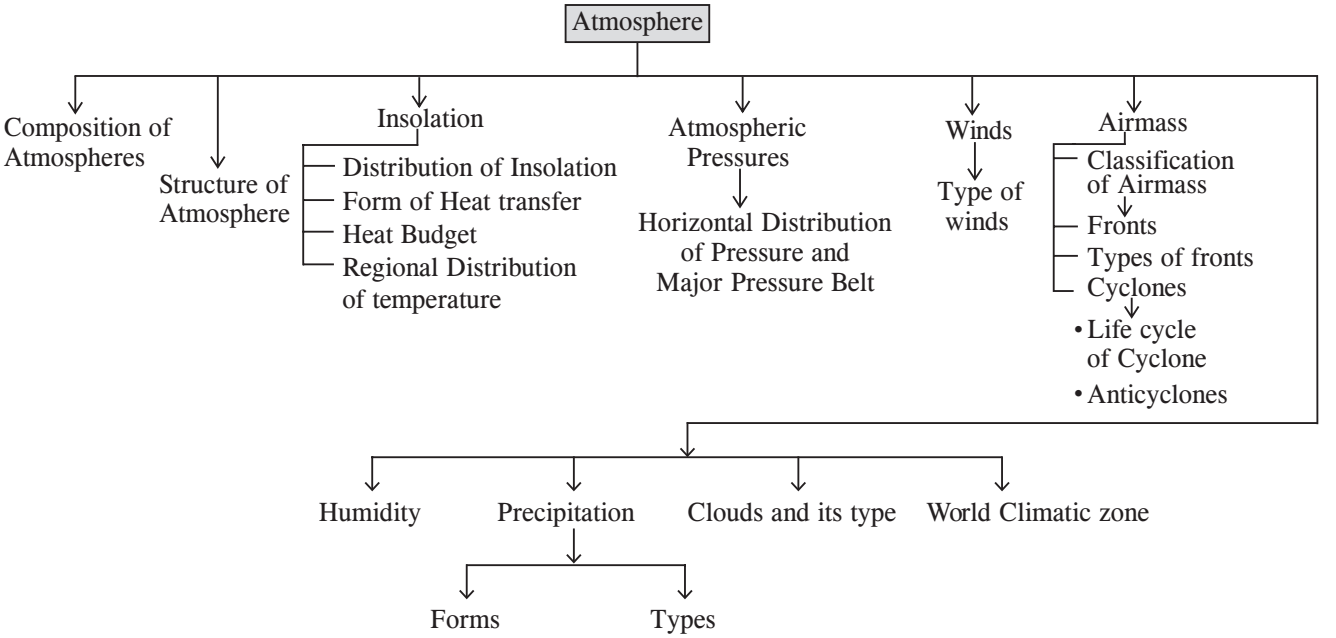
10. (a) A. Kuroshio current - warm Pacific current
B. Peru current - cold current in Pacific ocean
C. Labrador current - cold current in Atlantic ocean
D. Florida current - Warm current in Atlantic ocean

4 Chapter

ATMOSPHERE

Introduction

Atmosphere is a gaseous envelope surrounding the earth extending thousands of kilometers above the earth's surface. Life on earth exists at the bottom of the atmosphere where it meets with the lithosphere and the hydrosphere. The atmosphere directly or indirectly influences the vegetation pattern, soil type and topography of earth .Of the total mass of the atmosphere, 99% is found within 32 km from earth's surface. The atmosphere is held close to earth because of the earth's gravity and is energized by the sun.



COMPOSITION OF THE ATMOSPHERE

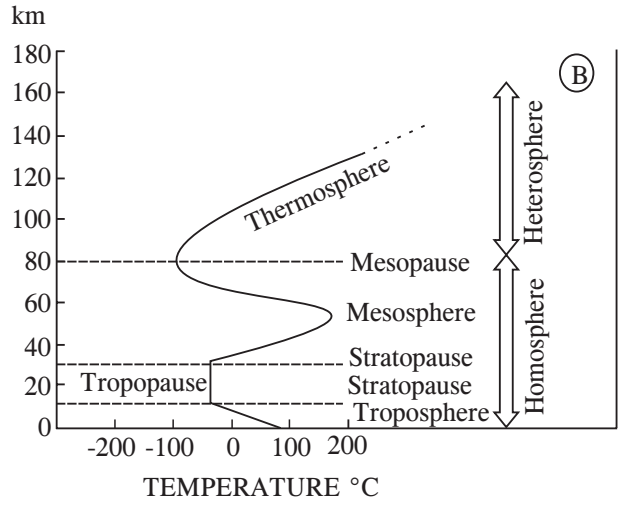
- Atmosphere is a mixture of gases containing huge amount of solid and liquid particles collectively known as aerosols. Pure dry air consists of nitrogen, oxygen, argon, carbon dioxide, hydrogen, helium and ozone. Besides them, water vapour, dust particles, smoke, salts, etc. are also present in the air.
- Nitrogen and oxygen comprise 99% of the total volume of the atmosphere. Nitrogen does not form a chemical union with other substances. It is an agent of dilution and regulates combustion.
- Oxygen combines well with all other in the atmosphere elements. It is easily combustible.
- Carbon dioxide exists in a very small percentage in the atmosphere.
- It absorbs most of radiant energy emitted by earth and reradiates it back to the earth, creating green house effect. This increased the temperature of lower atmosphere.
- It is also called as green house gas effect.

- The percentage of carbon dioxide in atmosphere increased due to burning of fossil fuels (coal, petroleum and natural gas) and deforestation.
- Water vapour and dust particles are crucial to weather and climate. They create condensation and absorb the heat received from the sun and radiated from the earth. Water vapour comprises 3-4% of the total volume of air.
- The amount of water vapour present in the atmosphere decreases from the equator towards the poles. Nearly 90% of the total water vapour lies below 6 km of the atmosphere.

Component	Percent by Volume
Nitrogen	78.08 %
Oxygen	20.94 %
Argon	0.93%
Carbon dioxide	0.03%
Neon	0.0018%
Helium	0.0005%
Ozone	0.00006%
Hydrogen	0.00005%

STRUCTURE OF THE ATMOSPHERE

The atmosphere consists of concentric layers of gases, with varying density and temperature. On the basis of chemical composition, the atmosphere is divided into: **Homosphere** and **Heterosphere.**



1. Homosphere

This extends up to the height of 90 km and is characterized by uniformity in chemical composition. It consists of three thermal layers – troposphere, stratosphere and mesosphere.

(a) Troposphere

Lowest layer of the atmosphere.

- Height of troposphere is 16 km at the equator and 10 km at the poles.
- Temperature decreases with height in this layer roughly at the rate of 1°C per 165 metres, which is known as **normal lapse rate.**
- Upper limit of the troposphere is called **tropopause**.
- All weather phenomena are restricted to troposphere.

(b) Stratosphere

- It lies above tropopause between 25-30 kms on an average over middle latitutde. 50 km is considered to be its upper limit on an average.
- At 50 km of altitude the temperature becomes 0°C.
- Stratosphere is more or less devoid of major weather phenomena but there is circulation of feable winds and cirrus cloud in its lower layer.
- Bacteria is found to be surviving here. This is mainly due to presence of ozone (15-35 km) in lower stratosphere.
- Ozone is blue irritating gas with pungent odour.
- Upper limit of stratosphere is called as stratopause.
- Commercial airlines cruise in lower stratosphere mostly due to low temperature, which results in optimum fuel burn and low density of air reduces parasitic drag on airframe. This layer even provide smooth movement as this layer has very less weather turbulence.

(c) Mesosphere

- It lies above the stratopause.
- Mesosphere extends to 50-80 km.
- The upper limit is called **mesopause**.
- Temperature decreases with height and reaches a minimum of –110°C at 80-90 km in the mesopause.

2. Heterosphere

Proportions of gases are not constant in this layer.

(a) Thermosphere

It lies beyond 80 km above mesopause. Here the temperature increases rapidly with increase in height.

The gases become very light due to extremely low density.

It divides into two layers: inosphere and exosphere.

(i) ***Ionosphere*** lies between 80 km to 640 km above the sea level. There are number of ionic layers in the sphere, e.g. D layer, E layer, F layer and G layer.

- D layer disappears with sunset as it is associated with solar radiation.
- E layer is known as Kennelly-Heaviside, confined to the height between 99 km - 130 km.
- It reflects the medium and high frequency radiowaves.
- F_2 layer is called as appleton layer, lying between 150 km-380 km.

  F_1 and F_2 area the two sub layers of E_2 layer combinedly known as Appleton Layer.
- G layer is beyond 400 km.

(ii) **Exosphere** lies between 640 km above the sea level. Density becomes extremely low here and the atmosphere resembles as nebula because it is highly rarefied.

INSOLATION

- There are three major sources of heat energy through which earth is warmed up, i.e.
  - **(i) Solar radiation**
  - **(ii) Gravity**
  - **(iii) Endogenetic**
- Out of these three sources of heat enterergy solar radiation is the most significant source of terresterial heat energy.
- The radiant energy received from the sun is transmitted in the form of short waves. It travels at the rate of 1,86,000 miles per second and is called as (*insolation*) or Incoming Solar radiation
- Solar energy received in the form of solar radiation heats the earth's surface and the atmosphere, resulting in change of pressure gradient. It initiating hydrological cycle, recycle nutrients and chemical elements in biosphere.
- There are two basic laws which govern the nature and flow of radiation such as
  - **(i)** ***Wien's displacement law:*** According to this law wave length of the radiation is inversely proportional to the absolute temperature of the emitting body.
  - **(ii)** ***Stefan-Boltzman law:*** This law states that flow or influx, of radiation is proportional to the fourth power of the absolute temperature of radiating body.
- Continuous emission of photons from the sun causes bonds of radiations with certain wavelength.
- The radiation is mostly emitted in the form of electromagnetic waves and is known as electromagnetic radiation.
- The electromagnetic radiation radiated from the outer surface of the sun, consisting of four spectrums which are as follows:
  - **(i) The first spectrum** includes, gama rays, hard x-rays, soft x-rays and ultra violet rays. Measured in angstrom (10^{-8} cm) and have short wave lengths.
  - **(ii) The second spectrum** consists of visible rays. It is measured in micron and ranges between 0.4 to 0.07 micron.
  - **(iii) The third spectrum** of electromagnetic waves covers infrared spectrum. It ranges between 0.7 to 300 microns.
  - **(iv) The fourth spectrum** consists of longwaves which include micro-waves, radar waves and radiowaves. These waves are measured in cm and m.

Distribution of Insolation

- The amount of insolation received at the earth's surface decreases from equator towards poles.
- There are also temporal variation of insolation received at different latitudes at different period of a year.
- There is very little variation of insolation during winter and summer season from equator upto tropics.
- At middle latitude (23.5° to 66° latitudes), both the hemisphere receive maximum sunlight during summer solstice (in northern hemisphere) and winter solstice (in southern hemisphere).
- Polar zone between 66° to 90° latitudes in both the hemisphere receives maximum and minimum insolation once a year only. No direct ray of the sun is received beyond 66° latitude throughout the year.

Factors affecting the Distribution of Insolation

The variation in the amount of insolation received by the earth's surface is mostly due to following factors:

(i) **Angle of inclination** of the sun's rays depends on the latitude of a place. Higher the latitude less is the angle it makes with the surface of the earth causing slanting rays. The area covered by slanting rays is larger than vertical rays. The energy is distributed over a larger area. The net energy received per unit area decreases. Also slanted rays pass through a greater depth of the atmosphere resulting in more absorption, scattering and diffusion.

(ii) **Length of the day** : During summer days are longer than nights. The situation is reversed with winter. Longer the day, greater will be the insolation.

(iii) **Distance between the earth and the sun:** The distance between the earth and the sun is not uniform throughout the year. It is nearest to the sun (147 million km) on 3rd January and farthest (152 million km) on 4th July. The reason behind this is mainly to the orbit of the earth which is elliptical in shape. When the earth is nearest to the sun it is called as *perihelion* and when farthest is called as *aphelion*.

(iv) **Sunspots:** Sunspots created on the outer surface due to periodic disturbance and explosions. The number of sunspots varies from year to year. Its cycle is completed in 11 years. The energy radiated from the sun increases. When the number of sunspots increases and therefore the amount of insolation received by the earth surface is also increases.

(v) **Effect of the Atmosphere:** The amount of heat energy absorbed by the atmosphere while on its way to earth's surface. This absorption depends on the composition of gases present in atmosphere. Scattering of solar radiation takes place during sunrise and sunset. The oblique rays pass through the longest path of the atmosphere.

Forms of transfer of heat

Radiation

The process of heat transfer in the form of emitted electromagnetic waves is known as *thermal radiation*. The process of radiation of heat energy back from ground is known as ground radiation.

When part of ground radiation is radiated back to earth after getting absorbed by earth's atmosphere is known as *counter-radiation*.

Convection

The transfer of heat energy from one place to another through a medium of fluids as gaseous substances is known as convection.

Conduction

The transfer of heat through molecules of an object is known as conduction. Which can be accomplished via two ways:

1. From one part of the body to another part of the same body.
2. From one body to the other body.

Advection

Advection is the lateral or horizontal transfer of heat. It generally takes place in the ocean in the form of currents.

Heat Budget

- The earth as a unit does not accumulate or loose heat. It maintains its temperature. This is so as the amount of heat received as insolation equals the amount lost through terrestrial radiation. This is the heat budget of the earth.
- It is estimated that out of 100 units of incoming solar energy. The 35 units received at the outer limit of the atmosphere is reflected and scattered back into space by clouds (27 units), dust particles (6 units) and by surface of the earth (4 units) in its original short wave form.
- Remaining 65 units enters atmosphere out of which 51 units are received by the earth's surface and 14 units are absorbed by atmospheric gases alongwith water vapour.
- The 51 units which are received by the earth surface are received through direct radiation (34 unit) and rest 17 units is received as diffuse day light. This is called as heat budget of earth.
- 34 units are returned to atmosphere in the form of outgoing terresterial radiation (long wave) out of which 6 unit absorbed by the atmosphere, 9 units are spent in convection and turbulance and 19 units are spent through evaporation.
- Heat budget of atmosphere includes absorption of incoming solar radiation (14 units) and heat received from terresterial radiation (34 units). This is equal to 48 units together.
- The energy sent back to space = 35 units (through direct radiation) + 17 units (through radiation from earth) + 48 units (through radiation from the atmosphere)

Regional Distribution of Temperature

The three major heat zones of the Earth are temperate zone, the torrid zone and the frigid zone. These are based on the distance they have from Equator.

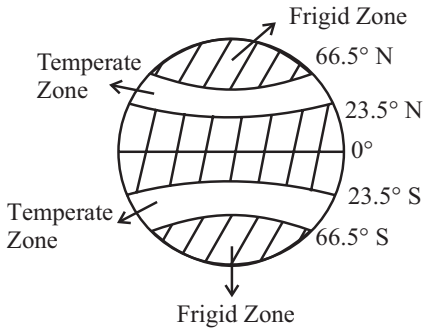
Torrid Zone (Tropical Zone)

This is the hottest zone of the Earth. The region that lies from the Tropic of Cancer (23.5°N), across Equator (0°) to the Tropic of Capricorn (23.5°S) is considered the torrid zone (Tropical Zone). The Sun's ray falls directly at least once a year.

Frigid Zone

This is the coldest zone of the Earth. This area lies to the north of Arctic circle (66.6°N) and to the south of the Antarctic circle (66.5°S) and is permanently frozen. There is no sunlight for most of the months is of the year in this zone.

Temperate Zone



- This is the habitable heat zone of the Earth. There are two temperate zones lie in between in both 23½° to 66½° the hemisphere.
- These regions have moderate, tolerable temperature.

Importance of the Heat Zones

This division of the Earth into different heat zones helps in understanding the climate changes and to study weather conditions acners the world.

ATMOSPHERIC PRESSURE

Air pressure is defined as total weight of a mass of column of air above per unit area at sea level. Air pressure is maximum at sea level. Pressure exerted by air at a particular point is determined by temperature and density.

There is inverse relation between temperature and pressure.

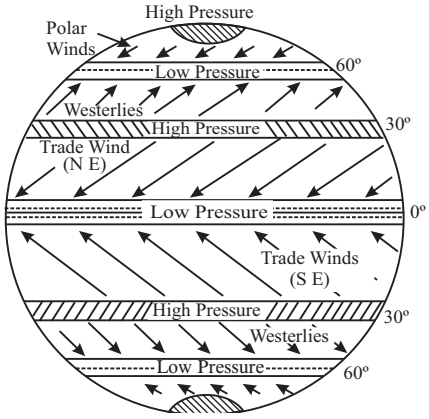
Air pressure is measured as a force per unit area. The unit of air pressure is **milibar or mb** measured by a **barometer**.

The distribution of atmospheric pressure is shown on a map by **isobars**. An isobar is an imaginary line drawn through points of equal atmospheric pressure at the sea level. The spacing of isobars expresses the rate and direction of pressure change and is called pressure gradients.

Major Pressure Belts

- At the equator heated air rises creating a low-pressure area at the surface. This is called the **equatorial low pressure**. It is also known as **doldrums**. Reaching the troposphere the warm air bends towards the pole and descends at 30-35° latitude or the tropics creating a belt of **sub-tropical high pressure**.
- Subtropical high pressure zone is also known as **horse latitude**. Sub-tropical highs are the source of air moving along the surface towards the poles.
- At 60-65° latitudes surface air streams coming from polar high pressure and sub-tropical high pressure converge and move up. This upward movement of air creates a low pressure system at the surface which is the **sub-polar low pressure**.

- At the poles, the low temperature makes air contract and creates a zone of high pressure. This thermally created high pressure system is called **polar high pressure**. This dense cold air flows equator-wards away from the area of high pressure.



The planetary System of Pressure and Winds at the Equlnoxes

Shifting of Pressure Belts

By late June, sun is overhead at the tropic of cancer. The doldrum (low pressure belt) moves northward from the equator with other belts also shifting in the northern hemisphere. In late December, when the sun is overhead at the tropic of Capricorn, the belts move southwards in the same way.

WIND

Wind is air in motion which can be in any direction. Wind is caused by spatial differences in atmospheric pressure and flows from areas of high pressure to those of low pressure. These differences are caused by uneven absorption of solar radiation at earth's surface. Wind speed is at its greatest during daytime when the greatest spatial extremes in atmospheric temperature and pressure exist. Wind direction is measured as the direction from where a wind comes from.

- Direction is measured by a **wind vane**. Wind speed can be measured using the **Beaufort wind scale**.

Coriolis Force

Rotation of Earth creates Coriolis force. The consequence of Coriolis force is that the moving air changes direction. Instead of wind blowing directly from high to low pressure, rotation of the earth causes wind to deflect. In the northern hemisphere, wind is deflected to wards right, while in the southern hemisphere it is deflected towards left. Magnitude of the Coriolis force varies with the velocity and the latitude of the object. Coriolis force is absent at the equator but its strength increases towards pole gradually.

Geostrophic Wind

Air under the influence of both the pressure gradient and Coriolis force moves parallel to isobars in conditions where friction is low (1000 meters above the surface of the earth) and isobars are straight. Such winds are called **geostrophic winds**.

Gradient Wind

Wind above the earth's surface do not travel in straight lines. The winds blow along the curved isobars of a high (anticyclone) or low (cyclone) pressure center. A wind that blows around curved isobars above the level of friction is called a *gradient wind*.

Types of Winds

- Winds can occur on a large scale.
- On the bases of their area of influence they are divided into two types:
  - (1) **Planetary winds:**
    - (i) Trade wind
    - (ii) Westerlies
    - (iii) Polar wind
  - (2) **Periodic winds:**
    - (i) Seasonal wind
    - (ii) Local wind
    - (iii) Land and sea breeze

Local Winds		
Nature	**Nature**	**Region**
Fohn	Warm	Alps
Chinook (snow eater)	Warm	Rockies
Kalbaisakhi	Warm	North India
Berg	Warm	S. Africa
Zonda	Warm	Andes
Loo	Warm	Indian subcontinent
Santa Ana	Warm	Coastal Southern California
Southerly	Cold	New South Wales Burster
Khamsin	Warm	Egypt
Harmattan (Doctor)	Warm	Guinea Coast
Mistral	Cold	S.E. France
Samun	Warm	Iran
Purga	Cold	Russia
Levanter	Cold	France
Pampero	Cold	S. America
Norwester	Warm, dry	New Zealand
Harmattan	Warm, dry	Eastern part of Sahara

1. Planetary Winds

They are a major part of general global circulation of air. They occur due to temperature and pressure variance existing throughout the world. They are of following types :

(i) Trade winds (ii) Westerlies (iii) Polar winds

(i) Trade Winds

Blowing from the subtropical highs or horse latitudes (between 30°N and 30°S) towards the equatorial low pressure are the trade wind.

- In the northern hemisphere, the trade wind blowing from the northeast and is known as the Northeast trade wind in the southern hemisphere, the wind blowing from the southeast and are called the southeast trade wind.

(ii) Westerlies Winds

Prevailing wind in the middle latitudes between 35° and 65° latitude, blowing from high pressure area in the horse latitudes towards the poles are called as Westerlies wind.

- The winds are predominantly from the southwest in the northern hemisphere and from the northwest in the southern hemisphere and bring extra-tropical cyclones with them.
- In southern hemisphere they are stronger and more constant in direction than those of the northern hemisphere because of the vast expanse of water.
- They are best developed between 40° and 65° south latitudes. These latitudes are hence often called Roaring forties, furious fifties and shrieking sixties.

(iii) Polar Wind

Winds blowing in the arctic and the antarctic latitudes are polar winds. They blow from polar high pressure towards sub-polar low pressure belt. In the northern hemisphere, they blow from north-east, and are called the north-east polar winds. In the southern hemisphere, they blow from south-east and are called south-east polar winds. As these winds blow from ice-capped landmass, they are very cold.

2. Periodic Winds

Land and sea breezes local and monsoon winds are periodic winds. They are of the following types:

(i) Seasonal Winds

- **Monsoon Winds:** Monsoons are regional wind systems that predictably change direction with the passing of the seasons. Monsoons occur over distances of thousands of kilometers, and their two dominant patterns of wind flow act over an annual time scale.
- **South-West Monsoon:** During summers, monsoon winds blow from cooler ocean surfaces onto the warmer continents during April to September. The continents become warmer than the oceans due to:

(i) Specific heat differences between land and water.
(ii) Greater evaporation over water surfaces.
(iii) Subsurface mixing in ocean basins, which redistributes heat energy to a deeper layer.

Precipitation is associated with summer monsoons. Onshore winds blowing inland from the warm ocean have very high in humidity. Upon cooling these air masses causes condensation and rain. Some highland in Asia receives more than 10 meters of rain during the summers.

- **North-West Monsoon:** In the month of October and November the wind patterns reverses, as ocean surfaces are now warmer. With little solar energy available, continents begin cooling as long wave radiation is emitted to space. Ocean surface retains its heat longer as water has high specific heat and subsurface mixing. Winter monsoons bring clear dry weather and winds that flow from land to sea. It brings rain to A.P and T.N as they pick moisture from Ocean.
- **Monsoon Winds of SE Asia:** Asiatic monsoon is caused by a complex climatic interaction between distribution of land, water, topography, and tropical and mid-latitudinal circulation.
  - During summer, a low-pressure forms over northern part of India and Southeast Asia because of high solar insolation.
  - Warm moist air is drawn into the thermal lows from air masses over the Indian Ocean.
  - Summer heat creates a strong latitudinal pressure gradient and development of an easterly jet stream (15 km) at the latitude of 25°N.
  - The jet stream enhances rainfall in Southeast Asia, Arabian Sea, and South Africa. When autumn returns to Asia, thermal extremes between land and ocean decrease. Westerlies of the mid-latitudes move in. Easterly jet stream is replaced with strong westerly winds in the upper atmosphere. Subsidence from an upper atmosphere cold low above the Himalayas produces outflow that creates a surface high-pressure system that dominates the weather in India and Southeast Asia.

    Besides, Asian continent, monsoon wind systems exist in Australia, Africa, South America, and North America.

(ii) Local winds: Winds flow in comparatively small area and have special characteristics. They are generated by purely local factors (local temperature differences) and their zone of influence is quite limited. They play an important role in the weather of a particular locality.

(iii) Land and Sea Breezes: Sometimes local conditions may set air in continuous motion. Even in calm days in summer, heated air rising from land surface may cause strong breezes to move in from over the cooler sea. By night, land cools more rapidly than the sea, cool air may move seawards as land breeze, usually a gentle flow. In some countries, if hot deserts border the seas, strong winds may develop. Sea breeze will be felt miles inland.

Jet Streams: These are strong, rapid and narrow air currents circumpolar westerlies blowing in upper atmosphere or into troposphere.

- Blow from west to east spreading over a few hundred kilometers at the height of 7.5-14 km
- Found between poles and 20° latitude in both the hemisphere.

  The minimum velocity is 108 km/hr and the average summer velocity is 130 km/hr and average winter velocity is 65 km/hr. The maximum velocity is 480 km/hr.

AIR MASS, FRONTS, CYCLONE AND ANTI-CYCLONE

Air Mass

An air mass is defined as a large body of air, relatively having similar physical properties (especially temperature and humidity) spreading over hundreds of kilometers.

- In order to acquire the similar physical properties air mass must be stagnate for a longer period of time on the source region.
- The notable centre for the development is anticyclone area which is characterised by high pressure and low pressure.

Classification of Air mass

Generally the air mass is classified into 4 types:

(1) **Polar Air mass (P) -** It originates in polar region between 60° N and S.

(2) **Tropical Air mass (T) -** It originates between 25°N and S upto equator.

(3) **Continental Air mass (C) -** It originates over continents (land mass) and is dry in nature.

(4) **Marine Air mass (M) -** It originates over the oceans and in moist in nature.

These four air masses are combined with one other to form four principal air masses such as:

(1) Continental polar mass air (CP) - Cold, air and stable.

(2) Maritime polar mass air (MP) - Cold, air and unstable.

(3) Continental Tropical air mass air (CT) - hot, dry, stable (at height) and at surface Instable.

(4) Maritime Tropical air mass air (MT) - warm, moist and unstable.

Front

It is the transition zone between two air masses with different properties (temperature, humidity, density, pressure and wind direction). An extensive transitional zone between two converging air masses is called as frontal zone on frontal surface. The process associated with the creation of new fronts or the regeneration decaying fronts is called *frontogenesis*. The process of destruction or dying of fronts is called *frontolysis*.

Types of Fronts

Fronts are of four principal types on the basis of their different characteristic features such as

(1) Warm front (2) Cold front

(3) Occluded front (4) Stationary front

(1) Warm front

It has gentle sloping frontal surface alongwith warm and light air. As they are warm and light they rise up slowly over cold and dense air. This warm air is cooled adiabatically. It saturated and gets condensed resulting in precipitation over a larger area for several hours. The precipitation varies from moderate to gentle. It is associated with Ci, Cs, As, Ns, St and fog.

(2) Cold front

It can be defined as boundary between warm and cool air masses wherein cold air displaces warm air. It has a steep edge and move aggressively to invade the warm air territory. As they are denser remain at the ground, forcing the warm air to rise. The cold air mass is associated with bad weather-thick clouds, heavy downpour with thunderstorms and lightning. At times it results in snowfall and hailstorms. Clouds associated with this type of front is Ci, Cs and Cb.

(3) Occluded front

When the cold front completely overtakes warm front, displacing the warm air by cold air from the ground system.

(4) Stationary front

It is the stage when the two contrasting air masses become parallel to each other and there is no ascenstet of air.

Cyclones

Cyclone in centre of low pressure surrounded by closed isobars. The pressure increases outward and the air move inward as the centre has low pressure. In the northern hemisphere it has anticlockwise movement and clockwise in the southern hemisphere.

It can be circular, elliptical or 'V' shape.

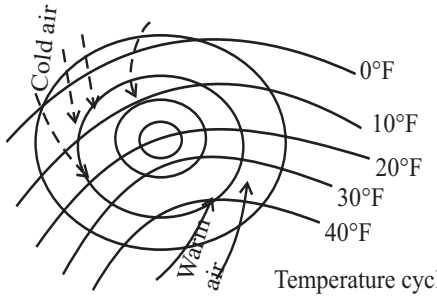
It is of two types

(1) Extratropical/Temperature cyclone

(2) Tropical cyclone

(1) Extratropical/Temperate cyclone

It is a simple depression or atmospheric disturbance having low pressure in the centre and pressure increases outward. It is found in the middle latitude (35°-65°) in both opposing air masses (warm, moist and light tropical air mass, front is created where these two air masses converge and lead to the development of temperate cyclone. The size of cyclones varies from 150 km to 3000 km. On an average vertical extent is 10-12 km. Its average summers velocity is 32 km per hours for winter it is 48 km per hour.



Temperature cyclone in Northerm hemisphere

Life Cycle of Cyclone

The period of cyclone from its inception (cyclogenesis) to its termination (eyclolysis) is called as *life cycle of cyclone*. There are six stages in a life cyclone of a cyclone

1. **First stage** involves the convergence of two air masses of contrasting physical properties and direction.
2. **Second stage** is a stage when the warm and cold air masses penetrate into the territories of one other, and a wave-life front is formed. It is also called incipient stage.
3. **Third stage** is the mature stage when the cyclone is fully developed and the isobars are almost circular in shape.
4. **Fourth stage** in this stage where warm air mass is narrowed by the cold air mass.
5. **Fifth stage** is related with the starting of occlusion of cyclone. Here, the cold front fully overtake the warm front.
6. **Sixth stage** warm sector completely disappears and occluded front is eliminated and ultimately cyclone dies out.

(2) Tropical Cyclone

The development of the cyclone over the tropical region lying between tropic of cancer to capricorn are called as Tropical Cyclones.

- Its average diameter varies between 80 km to 300 km. At times it is restricted to 50 km or even less in diameter.
- Velocity varies between 32 km/hr to 180 km/hr or more when it is coverted into a hurricane.
- Tropical cyclone becomes more vigorous and move with high velocity over ocean but over land it becomes feeble as it reaches interior portion of the continents.
- There are less number of isobars and are more or less in circular shape. This results in rapid rush of wind towards the centre.
- Every year it occurs at a particular period of a year, mainly during summer season.
- It is not generated near equator as the coriolis force is negligible at equator.

Types of Tropical Cyclone

Tropical cyclone are divided into 4 major types:

(1) Tropical disturbance (2) Tropical depression
(3) Tropical storms (4) Hurricane or typhoon

1. Tropical disturbance

It is associated with easterly trade wind. The easterly wave develops between 5° to 20° N latitude in the western part of the oceans. It is associated with large amount of cumulus or cumulonimbus cloud. These clouds bring heavy to moderate rainfall.

2. Tropical Depression

This region is the centre of low pressure and characterised by closed isobars, which are small in size. The wind velocity at the centre is 40-50 km/hr. It is usually influenced by summer weather of India and Australia. Sometimes, it becomes strong and give heavy rainfall, after resulting in floods.

3. Tropical Storm

Tropical storm is related with low pressure centre, closed isobars which rushes towards the centre with the velocity ranging between 40 to 120 km/hr. It developes over Caribbean sea, near Philippines and Bay of Bengal causing devastation of lives and properties.

4. Hurricane or Typhoon

It is a form of massive tropical cyclone surrounded by several closed isobars. It moves with an average speed of 120 km/hr. Hurricane has more symmetrical and circular isobar. The pressure increases sharply from centre towards the outer margin, resulting in presure gradient. Heavy downpour occurs, which is often uniformly distributed over a larger area as compared to other types of tropical cyclones.

Tropical Cyclones are known by different names :
Hurricanes - Carbbean and Pacific coast of Mexico.
Typhoons - Sea of China and Japan
Cyclones - India / Australia
Willy-Willies - North Australia
Tornado - South and Eastern USA.
Bagguio - Philippines

Comparison between Temperature and Tropical cyclones.

Tropical Cyclone	Extra-tropical cyclone
The tropical cyclone have a thermal origin, exclusively over the tropical seas.	Formed in middle or high latitudes, due to the development of front (35°-65° N and S)
The size of the tropical cyclone is 1/3 of temperate cyclone	It is much extensive size.
Strongest winds of tropical cyclones take place at surface.	Strongest winds of mid-latitude cyclones are higher up in atmosphere.
It is associated with single eye	There is more than one place where wind and rain is active.
Wind velocity is very high	It is low in comparison to tropical cyclone.
Its relation with upper level air is not clear	It has a distinct relation with upper level of air.

Anticyclones

The air mass in which pressure is high at the centre but decreases outwards is anti-cyclone. Winds move in a clockwise out-spiral in the northern hemisphre but in an anticlockwise out-spiral in the southern hemisphere.

- They have a circular shape usually but at times assume V shape.
- They are larger in size than temperate cyclone. 75 times the size of temperate cyclone.
- It has the average velocity of 30-50 km/hour.
- The high pressure at the centre causes the wind to move outward.
- The wind descend from above at the centre and thus weather becomes clear and rainless.
- It has no fronts.

HUMIDITY

It is the amount of water vapour present in the air at a particular period of time and place. Humidity of a place can be expressed in three ways:

Absolute Humidity
The measure of water vapour content of the atmosphere which may be expressed as the actual quantity of water vapour present in a given volume of air is called absolute humidity. This is measured as gms per cubic meter air. Absolute humidity changes with place and time. The capacity of air to hold water vapour depends on temperature. Warm air holds more moisture than cold air.

Specific Humidity
Another way to express humidity as the mass of water vapour per unit weight of air or the proportion of the mass of water vapour to the total mass of air is called the specific humidity. Specific humidity is not affected by changes in pressure or temperature.

Relative Humidity
This is a ratio expressed between actual quantity of water vapour present in the air at a given temperature absolute humidity and the maximum quantity of water vapour that the atmosphere can hold at that temperature. Relative humidity determines the amount and rate of evaporation.

- **Hygrometer** is the instrument used for measuring relative humidity. It comprises of wet and dry bulb thermometer.

$$\text{Relative humidity} = \frac{\text{Absolute humidity}}{\text{Humidity capacity}} \times 100$$

- Temperature and evaporation are directly proportional to humidity.
- The process of transformation of liquid into gaseous form is called as *evaporation*.
- Oceanic and coastal regions record higher humidity capacity of air than the remote continental regions.
- Humidity capacity decreases from equator to polewards as the temperature also decreases.
- The air having moisture content equal to its humidity capacity is called as **saturated air**.

It balances the energy flow of the earth in the form of clouds. The process of evaporation and condensation are major means by which transfer of energy takes place from earth to atmosphere, which is the basis of precipitation.

PRECIPITATION

Condensation of atmospheric water vapour that falls under the gravity is called as precipitation. This could be in the form of rain, snow or hail etc. Its form depend on the temperature at which water vapour condenses.

Forms of Precipitation

Hail

It is a form of solid precipitation consisting of large pellets or spheres of ice balls with the diameter varing between 5 to 50 mm. The falling of hail on the ground surface is called *hailstorm*. It is destructive as it destroys agricultural crops and claim human and animal lives.

Snowfall

It is the fall of large snowflakes from clouds on the ground surface. The dew point should be below freezing point for receiving snowfall. It is a result of sublimation.

Sleet

It is a mixture of snow and rain. It is a small pellets formed by freezing of raindrops or melting snowflakes.

Rainfall

It is the most common form of precipitation. It is a process wherein warm air ascends, saturates and condenses. Adiabatic cooling takes place when the relative humidity becomes 100 per cent. The condensation of water vapour takes place where large hygroscopic nuclei (salt and dust) is formed. Such droplets are called as cloud droplets shade. Rainfall occurs when cloud droplets change to raindrops which involves two processes:

1. The warm and moist air ascends to such a height that the process of condensation beings below freezing point. Both the waterdroplets and ice droplets are formed. The condensation takes place as the water droplets evaporates around ice droplets due to difference in vapour pressure. These ice droplets become large and fall when finally they are not able to be held back in the condensed icedroplets.
2. The suspended cloud droplets in the cloud are of varrying sizes. They collide among themselves at different rate as their size varies. They combine to form a large droplet. In this process several cloud droplets are coalesced to form raindrops. When these cloud droplets are large enough that they are unable to hold by ascending air they being to fall.

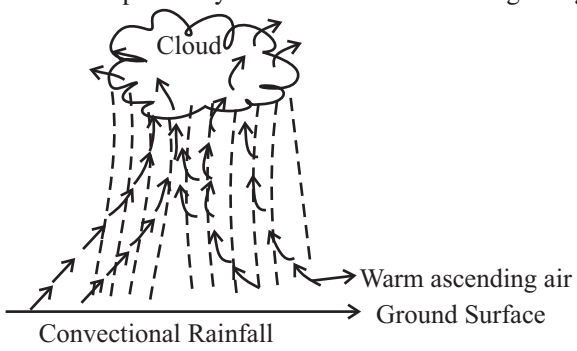
Types of Rainfall
Rainfall can be classified into three types:
1. Convectional Rainfall
2. Orographic Rainfall
3. Cyclonic or Frontal Rainfall

1. Convectional Rainfall
The thermal heating of the ground surface through the process of insolation leads to rise of air as they become warm and light. The process of convectional rainfall mainly depends on two factors.
(i) The supply of moisture through evaporation should be abundant so that its relative humidity becomes high.
(ii) There should be intense heating through insolation process.

The process of convectional rainfall involves intense heating of ground surface though solar radiation. As the warm air rises, the vacant shape is filled by surrounding air which too warm up when come in contact with already warm air. Ascending warm and moist air cools according to dry adiabatic lapse rate (10°C per 1000 metres) increasing the relative humidity. The moist air becomes saturated soon (relative humidity becomes 100 percent) and futher rising of saturated air causes condensation and cloud formation cumulo-nimbus clouds. The air further rises and cools with moist adiabatic lapse rate

(5°C per 1000 metre). When the air reaches the temperature of its surrounding cumulo-nimbus cloud is formed and there is instantaneous heavy rainfall.

- It occurs daily in afternoon in the equatorial regions.
- It is for short duration but point down heavily.
- Occurs through thick dark and extensive cumulo-nimbus clouds.
- It is accompanied by number of thunder and lightning.

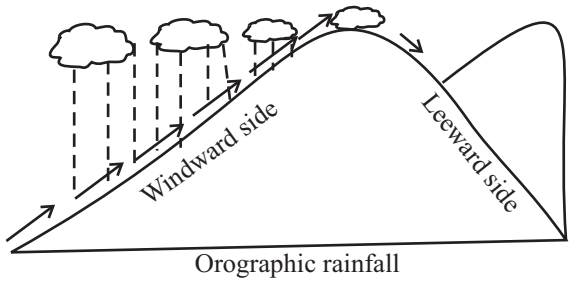


Convectional Rainfall

2. Orographic Rainfall

When the warm and moist air is obstructed by any hill or mountain, it starts ascending along the slope of the hill or mountain and get saturated after reaching a height. As a result condenses around hygroscopic nuclei. The presence of hill or mountain triggers the process of ascending of moist air, becoming cool and unstable. The slope of the mountain facing the wind is called as windward side and the other side of that mountain is known as Leeward side. Windward side receives maximum rain and leeward side receives no or little rain. The leeward side is also known as rainshadow region. This type of rainfall is called as orographic rainfall.

- The mountain should be acting as a barrier across the wind direction.
- Mountain or hill should be running parallel to the coast.
- The height of the mountain too determines



Orographic rainfall

- the amount of orographic rainfall.

3. Cyclone or Frontal Rainfall

Cyclonic or frontal rainfall occurs due to ascending of moist air and adiabatic cooling caused by convergence of two extensive air mass.

CLOUDS

They are mass of very fine water droplets, ice particles or mixture suspended in the atmosphere. Clouds are formed by the adiabatic cooling of air when it is below its dew point. Cooling process is created by upward movement of light and warm moist air which reduces pressure, expands and reaches its dew point. There is further cooling below dew point causing condensation. Adiabatic process involves change in temperature of an ascending or descending air. The air which ascends (due to expansion of volume) results in cooling of air, whereas the air which descends results in warming a air at the rate of 10°C per 1000 meters. This rate of shade change is called as adiabatic lapse rate. 10° per 1000 meters change is only before dew point (condensation level) and after dew point is achieved the rate of change in 5°C per 1000 m.

Types of Cloud

Usually clouds are classified in terms of their vertical arrangement in the atmosphere of high, middle and low clouds.

1. High clouds: 6000 to 12000 meters above sea level.
- **Cirrus** : Wispy, fibrous-looking cloud which indicate fair weather.
- **Cirrocumulus** : A thin cloud, often globular and rippled.
- **Cirrostratus** : Thin white sheet type which gives the sun and moon their haloes.

2. Medium clouds : 2000 to 6000 meter above sea level.
- **Altocumulus** : Globular, bumpy looking clouds with a flat base covering entire sky..
- **Altostratus** : greyish, watery looking and a wool pack cloud..

3. Low clouds: below 2000 meters above sea level.
- **Stratocumulus** : Low rolling, bumpy clouds.
- **Nimbostratus** : Fog-like low cloud causes dull weather with drizzle. It is also associated with lightning thunder and hailstorm.
- **Stratus** : These clouds are low, grey and layered, almost fog-like in appearance, bring dull weather and often accompanied by drizzle air or snowfall.

4. Clouds of great Vertical extent: 1500 to 9000 m.
- **Cumulus** : A round-topped and flat based cloud, which form a whitish grey globular mass. It some times becomes thunder cloud.
- **Cumulonimbus** : Cumulus cloud which reaches up to 9000 meters, often indicates convectional rain, lightning and thunder storm.

Distribution of precipitation across different regions of world.

1. Regions of Heavy Precipitation: Rainfall more than 150 cm per year are:

(i) ***Equatorial regions*:** Amazon and Congo Basins, Malaysia, Indonesia and New Guinea.

(ii) ***Tropical Monsoon regions*:** Parts of India, South-east Asia and South China.

(iii) ***Mid-latitude West Margin regions*:** Coastal regions of British Columbia, North-west Europe, South Chile and South Island of New Zealand.

2. **Moderate rainfall** (100 to 150 cm per year)
   (i) Eastern margins of continents in the trade-wind belt e.g. eastern margin of China, U.S.A., Brazil, South Africa and Australia.

3. **Regions of very low rainfall** (less than 25 cm.)
   (i) Tropical deserts – Western margins of continents in the trade wind belt, Californian desert (USA), Atacama (South America), Kalahari (Southern Africa), Sahara, Arabian Desert and West Australian desert.
   (ii) Mid-latitude desert – Interiors of large continents like Asia and North America.
   (iii) Polar Regions – Arctic and Antarctic.

WORLD CLIMATIC ZONES

1. Equatorial Climate or Tropical Rain Forest Climate

Location

- It is found between 5°N to 10°N and S of equator.
- The equatorial climate is found in the following

South America : Largest area is in the Amazon lowlands. It also occurs along the coast of Guianas.

Africa : Part of the Congo basin and Guinea coast Africa.

Southern Asia : Malaysia, Indonesia, New Guinea and parts of Philippines.

Climate

- It is warm round the year as the sun's rays are always fall vertically. Annual average temperature is uniform at 27°C. The daily range of temperature is in between 10°C and 25°C. The annual range is less than 5°C.
- This region has no dry season. Average annual rainfall is 200 cm to 250 cm. The driest mouth in this region receives 6 cm of rainfall.
- Thermally included low pressure belt due to the uniform high temperature throughout the year.
- Convection current is formed and results in rainfall in this zone.
- The convergence of trade winds coming from sub-tropical high pressure belt forms intertropical convergence (ITC). ITC is associated with atmospheric distribution (cyclone).

Vegetation

High temperature and year round rain produce most luxuriant vegetation in the region which are tropical rainforest or Selvas in South America.

2. Savanna or Sudan type of climate

Location

This transitional type of climate is bounded between equatorial rainforest and semi-arid and subtropical humid climate. This lies between 5° to 20° north and south of equator.

- **South America:** Columbia and Venezuela.

Africa : Sudan, parts of Senegal, Mali, Guinea, Niger, Chad, Ghana, Togo, Kenya, Zimbabwe, Tanzania, Angola and Uganda.

Australia : Queensland.

Climate

- This zone has distinct wet and dry season.
- The mean temperature varies between 24°C to 27°C.
- Annual precipitation of 100 cm to 150 cm is received From December to February there is no rainfall at all.
- 80% to 90% of the rain occurs in rainy season only.

Vegetation

- Seasonal rains allow grass to grow. These are natural grasslands. Rainfall is not sufficient to support tall trees but grass grows well. Elephant grass grows up to 4.5 metres. As we move towards the equator, trees grow along the banks of the streams, are of broad-leaf and umbrella shaped.
- **Fauna:** Elephants, giraffe, zebra, rhinoceros along with varieties of carnivores animals (lion, leopards, tiger, cheeta, hyena etc.) are found.

3. Hot Desert Climate

Location

Arid deserts lie close to the tropic of cancer and tropic of capricorn in the western margins of continents, between 15°-30° in both the hemisphere.

- Sahara, Arabia, Thar, Mohave and Sonoran (U.S.A.), Kalahari and Namib (Africa), Simpson, Gibson, Great Sandy (Australia). These lie in western part of the continents.

Climate

- Climate is dominated by subsidence of air masses and sub tropical anti cyclones.
- Average summer temperature is between 30°C to 35°C. Mid-day temperature is recorded to be 40°C.
- Daily range of temperature is great varrying between 22°C to 28°C
- Annual range of temperature varies between 17°C to 22 °C.
- These areas are nearly rainless or receive lowest annual rainfall (Less than 12).

Vegetation

- Normal vegetation is cactus, thorny plants, shrubs and herbs.

4. Steppe (Temperate continental) Climate Underline

Location

These are also called **mid-latitude grasslands.** They are far away from any influence of the sea as they are in the heart of the continents.

Prairies (North America), Pampas (South America), Velds (South Africa), Canterbury (Newzeland), Downs (Australia) and Steppes (Russia).

Climate

- Their climate is continental with extremes of temperature. Summers are very warm and winters are very cold. In northern hemisphere where as in southern hemisphere the temperature variation is mild.
- These are dry lands as they are located in the deep interiors of large land masses away from the oceans. Temperature in summer varies from 18°C to 24°C and in winter from – 4°C to 2°C. Such range of temperature is large. Rain fall occurs in spring and early summer and varies between 25 cm. and 75 cm. Rain is of convectional type and light.

Vegetation

Short grass grows everywhere. Trees are found only on mountain slopes.

5. Mediterranean Climate

Location

- The zone lies between 30°-40°N and S latitudes on the western edge of the continents.
- Mediterranean type of climate is found near the Mediterranean sea in the northern hemisphere (Portugal to Turkey, Morocco, Northern Algeria, Tunissia and libya) alongwith southern California coast.
- In the southern hemisphere central chile, Cape town area of South America, South and Southwest coast of Australia.
- Average winter temperature is 5°C to 10°C whereas that of summer it is 20°C to 27°C.
- Mean annual range of temperature is recorded to be between 15°C to 17°C.
- The zone experiences season shift of pressure belt
- Winter rainfall is received through cyclonic storms.
- More than 75° of the rainfall is in winter season.
- The mean annual rainfall varies between 37 cm to 65 cm.
- Summer winds are generally dry and hot.

Vegetation

- Woodland, dwarf forest and scrubs are found in this region.
- The leaves are thick and shiny resisting moisture loss.
- The trees like pine, oak, cedar, madrone, walnut and chestnuts growhere.
- Citrus fruits are grown in this zone.

6. Sub-Tropical Humid Climate/ China type

Location

- It is found in the eastern boundary of the continent between 25°C to 40° N and S latitude.
- It is found in south-east China, PO Basin, Danube Basin, South-east USA; south-east Brazil, Paraguay, Uraguay and north-eastern Argentina and Africa alongwith the east coast of Africa.

Climate

- Mean annual summer temperature lies between 24°C to 26° and during winter it is 6.6°C to 10°C.
- The temperature do not varies spatially.
- Rainfall varies between 75 cm to 150 cm
- Rain decreases as we move inland from coast.
- Tropical cyclone is found and results in rainfall. Even winter cyclones are found here as it is associated with Westerlies.

Vegetation

- Dense evergreen forests are found alongwith decidoous sparse forest and grassland. They have broad leaves.

7. West European type Climate

Location

- The zone lies between 40° and 65° latitude in both the hemisphere along the west coast of the continents.
- North-Western Europe, British Columbia of Canada, Washington and Oregon states of the USA, south-west coast of Chile, south-east coast of Australia and Tasmania and New Zealand.

Climate

- Average temperature during summer ranges between 15°C to 21°C.
- Polar front causes the development of temperate cyclone in this region under the influence of westerlies.
- Annual range of temperature varies between 50 cm to 75 cm.

Vegetation

- Broad-leaf deciduous forest (oak, birch, walnut, maple, elm, chestnut, etc).
- Needle-leaf (coniferous) forest like pine, fir etc are found.
- Mixed forest is also found here.

8. Monsoon Climate

Location

Monsoon region includes the eastern margins of continents which lies between 5° to 30° N and S latitude of equator.

- Eastern Brazil (S. America), Central American countries, Natal coast (S. Africa), Indian subcontinent, South East Asia, Myanmar, Thailand, Vietnam, Philippines, etc. Parts of East Africa including Malagasy, North Australia.

Climate

- Temperature variation results in season formation.
- During the months of summer (March to June) the average temperature is ranging between 27°C to 32°C.
- During the months of winter the average temperature recorded is 10° to 27°C.
- The temperature in this zone is controlled by nearness or remotness of the sea, latitudinal and altitudinal also influence it.
- The region receives cyclonic rainfall mostly alongwith orographic rain.
- On an average annual rainfall received in around 150 cm. Rainfall shows temporal variation.
- 80% of the rainfall is received within 3 months (July, August and September).
- Some parts of Indian sub-continent receives winter rainfall (Tamil Nadu and Andhra Pradesh) from north-east monsoons.
- Monsoon rainfall is basically cyclonic in character.
- Dry season is found here

Vegetation

- Trees are mostly deciduous. The forests are open and less luxuriant. Most of the forests yield valuable timber like teak. Other kinds of timber are sal, acacia and eucalyptus.

9. Taiga /Boreal/ Sub-Arctic Climate

Location

This climate type is named after the coniferous forest cover found in the region.

- This region lies between 55° and 70° in northern hemisphere. It forms a continuous belt across southern Canada, northern Europe and Russia.
- South Alaska, Southern Canada, parts of Norway, Sweden, Finland, Northern Russia, Northern Siberia, and Sakhalin Island.

Climate

- Winters are very cold and severe lasting for 6 to 7 months . This region has Verkhoyansk the “cold pole” colder than the arctic region. Summers are short lasting for 3 or 4 months and days are long; at 60°N the sun shines for 18 hours.
- Rainfall varies from 25 to 100 cm. There is more rainfall near the coast.
- Most of the rain comes from cyclonic weather. It falls throughout the year but maximum in summer as frequent showers.
- In winter it is in the form of snow which remains on the ground for 5 to 7 months.

Vegetation

- Vegetation in this climate type is softwood coniferous forests (Spruce, fir, pine).
- Fauna like reindeer, deer, elk, moose and wild cat are found here.

10. Tundra Climate

Location

- The northern most parts of Asia, Europe and North America (include Alaska and Canadian Islands).

Climate

- Average annual temperature is – 12°C.
- Long, bitterly cold and severe winter are experienced.
- Summers are short but cool.
- Precipitation is below 40 cm and as snowfall.

Vegetation

- Very short growing season.
- Dwarf willows and birches grow here.
- Fauna like reindeer, polar bear, fox, musk, ox and arctic hare are commonly found here.

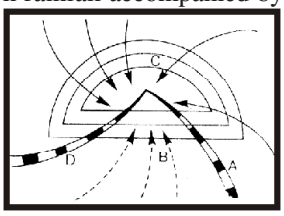
Isolines

It represents the equal value on the map.

- Isobar: A line representing points of equal atmospheric pressure.
- Isobath: A line representing points of equal depths.
- Isobathytherm: A line representing depth of water with equal temperature.
- Isocheim: A line representing points of equal mean winter temperature.
- Isochrone: A line representing points of equal time-distance from a point, such as the transportation time from a particular point.

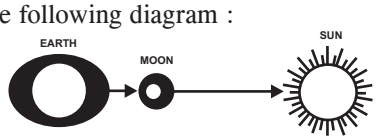
Exercise -1

1. Which one of the areas marked as A, B, C and D in the given figure of the cyclone, witnesses heavy torrential short duration rainfall accompanied by thunderstorms?



(a) A (b) B
(c) C (d) D

2. Which among the following represents the correct sequence in increasing height, of different types of cloud formation?
   (a) Cirrus, cumulonimbus, stratus, cumulus
   (b) Stratus, cumulus, cirrus, cumulonimbus
   (c) Cumulonimbus, cumulus, stratus, cirrus
   (d) Cirrus, cumulus, cumulonimbus, stratus
3. Which of the following clouds are more commonly formed in the equatorial rainforests?
   (a) Cumulonimbus (b) Stratocumulus
   (c) Nimbostratus (d) Alto cumulus
4. The tropical cyclones do not occur close to the equator because of
   (a) Excessive heat
   (b) Calm air
   (c) Weak coriolis force
   (d) The winds are too wet and heavy
5. As per Ferrel's law
   (a) in the northern hemisphere, the north blowing winds are deflected westward
   (b) in the southern hemisphere, the north blowing winds are deflected eastward
   (c) in the northern hemisphere, the south blowing winds are deflected eastward
   (d) in the southern hemisphere the south blowing winds are deflected eastward
6. Spring tides occur when
   (a) the moon, the sun and the earth are in the same line
   (b) the moon, the sun and the earth are the right angles, with the earth at the apex
   (c) the moon is nearest to the earth
   (d) the moon is farthest from the earth
7. Study the following diagram :



The diagram represents
   (a) high tide
   (b) spring tide at new moon
   (c) spring tide at full moon
   (d) neap tide at half moon
8. Which of the following statements is not true of Trade Winds?
   (a) They blow from the Horse latitudes to the Doldrums.
   (b) They are deflected to the right to become South-East Trades in the southern hemisphere.
   (c) They are constant in strength and direction.
   (d) The sometimes contain intense depression.
9. Perpendicular rays are usually more heating than oblique rays. Therefore, south-facing slopes are warmer than north-facing slopes in the summer
   (a) in the northern hemisphere
   (b) in the southern hemisphere
   (c) everywhere
   (d) nowhere
10. Which of the following is wrongly matched?
   (a) Rainfall caused by mountain standing in the way of moisture-laden winds-relief rainfall.
   (b) Rain caused by vertical circulation of air currents-orographic rainfall.
   (c) Rain caused by a warm moist air mass moving upward over cold air mass- cyclonic rain-fall.
   (d) An area sheltered from rain bearing winds by a hill-rain shadow area.
11. Some large lakes in temperate latitudes have a moderating influence upon the climate of adjacent land surfaces. Such an influence may develop when
   (a) the water is shallow
   (b) the lake is high above sea level
   (c) prevailing outblowing winds cross the lake in water
   (d) the lake is a basin of inland drainage
12. What causes snowfall?
   (a) When condensation takes place below 0°C and precipitation occurs in the form of flakes.
   (b) When rain freezes into snow flakes while passing through the atmosphere.
   (c) When condensation takes place in the form of fog and precipitation occurs as flakes.
   (d) When the air temperature is much lower than surface temperature.
13. Heat gain through insolation and heat loss through terrestrial radiation are equal approximately at which latitude ?
   (a) 22½° North and South
   (b) 40½° North and South
   (c) 42½° North and South
   (d) 66½° North and South
14. Which of the following is the annual precipitation of an area?
   (a) All forms of precipitation converted to the quantity of liquid water
   (b) The total actual amount of rain, snow, hail and sleet
   (c) The total amount of rain per year, irrespective of snow, hail and sleet
   (d) All forms of precipitation measure after conversion to equal quantity of ice

15. Although hot deserts have a very low annual rainfall, occasional heavy rain storms do occur and these sometimes produce steep-sided, flat-floored valleys called
(a) gorges (b) wadi
(c) canyons (d) barchan
16. Winter temperature ranging from –29°C to –40°C, summer temperature about 10°C, total annual precipitation about 25 cm, and low humidity. These characterise the ..... climate.
(a) Taiga (b) Tundra
(c) Mountain (d) West European
17. Atmosphere with excess of carbon dioxide as a result of pollution could result in
(a) fall in temperature
(b) rise in temperature
(c) no change of temperature
(d) excess of ultraviolet rays reaching the earth
18. Upto a height of 50 km from Earth, the atmosphere is composed of
(a) nitrogen, oxygen, argon, minor gases
(b) only nitrogen and oxygen
(c) only minor gases such as carbon dioxide, hydrogen, neon, helium, methane, etc.
(d) None of these
19. The order of the layers in the atmosphere, upwards from below, is
(a) stratosphere, troposphere, ionosphere and exosphere.
(b) exosphere, ionosphere, troposphere and stratosphere.
(c) troposphere, stratosphere, ionosphere and exosphere.
(d) troposphere, magnetosphere, stratosphere and exosphere.
20. The most prominent gases in the atmosphere, in terms of volume, are
(a) nitrogen and methane
(b) nitrogen and oxygen
(c) oxygen and carbon dioxide
(d) hydrogen and nitrogen
21. What is the name given to winds blowing from subtropical high pressure regions, to the equator?
(a) Westerlies (b) Tropical easterlies
(c) High latitude easterlies (d) Doldrums
22. 'Horse latitudes' is the term applied to the
(a) 0° – 5° Nand S latitudes
(b) polar circles
(c) 30° – 40° Nand S latitudes
(d) 40°– 60° Nand S latitudes
23. The stratosphere is said to be ideal for flying jet aircraft. This is because
(a) this layer is rich in ozone which reduces fuel consumption
(b) the temperature is constant and ideal for aircraft engine efficiency
(c) this layer is out of the firing range of anti-aircraft guns
(d) of the absence of clouds and other weather phenomena
24. The velocity of winds is governed by
(a) pressure gradient (b) Farrel's Law
(c) rotation of the earth (d) temperature
25. Over which region is the temperature the highest near the tropopause?
(a) Around the equator
(b) Over the Arctic region
(c) Near the Tropic of Capricorn
(d) Near the Tropic of Cancer
26. Which of the following are not a planetary wind?
(a) Easterlies (b) Westerlies
(c) Drainage winds (d) Trade winds
27. The water content in the atmosphere
(a) is not dependent on temperature
(b) increases as temperature increase
(c) remains unchanged with change in temperature
(d) cannot be measured
28. What will happen if the temperature of water is lowered from 8 °C to 3°C?
(a) Water will freeze
(b) Water will not change in volume
(c) The volume will first increase, then decrease
(d) The volume will first decrease, then increase
29. What is the importance of ozone in the atmosphere?
(a) It provides protection against ultraviolet radiation.
(b) It provides condensation nuclei.
(c) It creates the greenhouse effect on earth.
(d) It helps scatter blue light.
30. Which one is an anticyclone?
(a) Low pressure system with clockwise winds in the northern hemisphere.
(b) High pressure system with clockwise winds in the northern hemisphere.
(c) Low pressure system with clockwise winds in southern hemisphere.
(d) High pressure system with clockwise winds in southern hemisphere.
31. The process of change of state of water from solid directly into vapour is called
(a) condensation (b) snow fall
(c) sublimation (d) precipitation
32. What is the vapour pressure?
(a) The presence of vapour in air
(b) Barometric pressure
(c) Pressure only due to vapour in the air
(d) Pressure in the clouds
33. What is stated in terms of grams of water vapour per kilogram of moist air?
(a) Specific humidity (b) Relative humidity
(c) Vapour pressure (d) Absolute humidity
34. The temperature at which an air parcel will become saturated with the present amount of water vapour is called
(a) critical temperature (b) saturation point
(c) dew point (d) condensation point
35. The leeward side of a mountain which does not receive rain is known as the
(a) dry zone (b) desert area
(c) rain-shadow area (d) adiabatically dry area

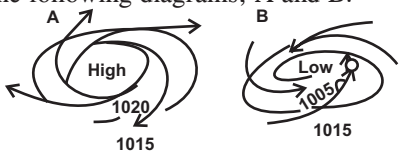
36. Dew is caused when
(a) humid air condenses on cool surface
(b) the air is colder than the earth's surface
(c) the sky is overcast at night
(d) the wind is too dry to cause rainfall

37. Which of the pedogenic regimes is associated with hot, dry climates?
(a) Podzolisation (b) Gleisation
(c) Laterisation (d) Calcification

38. With what type of climate is the pedogenic regime of podzolisation associated?
(a) Hot and dry (b) Humid temperate
(c) Equatorial (d) Cool and dry

39. Which of the following statement is/are correct?
(a) Halo is produced by diffraction in ice crystals.
(b) Corona is produced by refraction by water droplets.
(c) Halo is an indication of approaching bad weather.
(d) Though corona and halo is produced by different phenomena, the colour sequence produced in them remains the same.

40. Study the following diagrams, A and B.



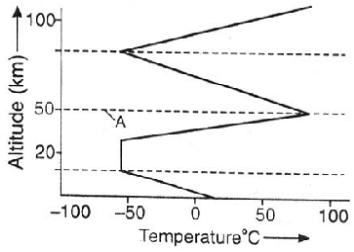
(a) A is cyclone in the southern hemisphere
(b) A is an anti-cyclone in the southern hemisphere
(c) B is a cyclone in the northern hemisphere
(d) B is an anti-cyclone in the northern hemisphere

41. Of the main constituents, which of the following have great influence in earth's climatic conditions?
(a) Oxygen (b) Nitrogen
(c) Carbon dioxide (d) Water Vapour

42. Winter rains in North and North-West India are generally associated with the phenomenon of :
(a) retreating monsoon
(b) temperate cyclones
(c) local thunderstorms
(d) shift in jet stream movement

43. Which one of the following characteristics is NOT found in the Mediterranean climate ?
(a) Temperatures range from 21° C in summer to l0°Cl or below in the winter
(b) Off-shore trade winds blow in the summer
(c) On-shore westerly winds blow in the winter bringing cyclonic rain
(d) The annual rainfall ranges from 1500 mm to 2000 mm

44. The layers of the atmosphere are given in the figure. The layer marked 'A' refers to :



(a) Troposphere (b) Mesosphere
(c) Stratosphere (d) Ionosphere

45. Which of the following latitudinal extents relate to 'horse latitudes'?
(a) 20° – 30° North and South
(b) 30° – 40° North and South
(c) 40° – 50° North and South
(d) 50° – 60° North and South

46. Which region of the Earth's surface is called doldrums?
(a) Equatorial low pressure belt
(b) Sub-tropical high pressure belt
(c) Between 10° to 23.5° North and South Latitudes
(d) Sub-polar low pressure belt

47. Which one of the following is a low cloud?
(a) Cirrocumulus (b) Cirrostratus
(c) Altocumulus (d) Nimbostratus

48. Injurious ultraviolet radiations are mostly prevented from reaching the land surface as these are absorbed mostly by which one of the following?
(a) Stratosphere (b) Troposphere
(c) Ionosphere (d) Mesosphere

49. The earth's reflectivity of solar radiation, termed albedo, is highest in which one of the following?
(a) Cropland (b) Forest area
(c) Sand desert (d) Snow area

50. Which one of the following regions on the surface of Earth has Horse Latitudes?
(a) Equatorial low pressure belt
(b) Sub-tropical high pressure belt
(c) Sub-polar low pressure belt
(d) Polar high pressure belt

51. Which one of the following is produced by rain water action?
(a) Gorge (b) Cliff
(c) Gully (d) Dome

52. What is the general direction of cyclones formed in the Bay of Bengal?
(a) East to West (b) West to East
(c) West to South (d) North to South

53. Which one among the following statements relating to an anticyclone is correct ?
(a) Anticyclone is a wind system with a high pressure centre
(b) In anticyclone the movement of wind is inward
(c) The contribution of an anticyclone towards determining weather of an area is quite significant
(d) The movement of wind is clockwise in an anticyclone of southern hemisphere

54. Doldrums is a
(a) Tropical wind belt
(b) Tropical wind deflection belt
(c) Sub-tropical wind belt
(d) Tropical no-wind belt

55. The most important fishing grounds of the world are found in the regions where
(a) warm and cold atmospheric currents meet
(b) rivers drain out large amounts of freshwater into the sea
(c) warm and cold oceanic currents meet
(d) continental shelf is undulating

56. What is the term used to denote the temperature at which the water vapour present in the atmosphere is sufficient to saturate?
(a) Condensation point (b) Dew point
(c) Sublimation point (d) Saturation point

57. Tropical cyclone of Philippines is termed as
(a) Typhoon (b) Willy-willy
(c) Hurricane (d) Baguio

58. Cloudy nights are warmer than clear nights because of
(a) greenhouse effect
(b) depletion of ozone layer
(c) insolation
(d) terrestrial radiation

59. As we proceed from equator to poles, the daily range of temperature tends to
(a) decrease (b) increase
(c) be constant (d) fluctuate

60. Doldrums are characterized by
(a) uniform low pressure
(b) uniform high pressure
(c) high wind velocity
(d) low humidity

61. Which of the following statements are correct?
1. In a cyclone, the area of low pressure is at the centre surrounded by the areas of high pressure
2. In a cyclone, the areas of low pressure surround the area of high pressure
3. In an anti-cyclone, the area of high pressure is surrounded by the areas of low pressure
4. In an anti-cyclone, the area of low pressure is surrounded by the areas of high pressure

Select the correct answer using the code given below:
Code:
(a) 1 and 2 (b) 1and 3
(c) 1 and 4 (d) 2 and 4

62. Jet streams are usually found in the
(a) ozonosphere (b) mesosphere
(c) tropopause (d) ionosphere

63. What is the general direction of cyclones formed in the Bay of Bengal?
(a) East to West (b) West to East
(c) West to South (d) North to South

64. Hot deserts like Sahara, Arabia, etc, receive very negligible amount of rainfall. This is because they
(a) do not receive moisture-bearing wind from the oceans
(b) are the most rocky and barren areas of the Earth
(c) are located on the tropical high pressure belt of the atmosphere
(d) are not on the path of the monsoons

65. Sirocco is a name used to mean
(a) a local wind (b) a volcano
(c) an island (d) an ocean current

66. The intensity of insolation depends on
(a) Altitude (b) Nature of terrain
(c) Wind (d) Latitude

67. When the winds blow from all sides to the central low in an anticlockwise direction, then this phenomenon is known as
(a) anti-tropical cyclones of southern hemisphere
(b) temperate cyclones of northern hemisphere
(c) tropical cyclones of northern hemisphere
(d) tropical cyclones of southern hemisphere

68. Chinook is a
(a) cold wind in Europe
(b) tropical desert storm in West Asia
(c) warm wind in North-America
(d) depression to South Africa

69. Mist is a result of which one of the following
(a) Condensation (b) Evaporation
(c) Sublimation (d) Saturation

Exercise -2

Statement Based MCQ

1. Consider the following statements regarding the cumulonimbus clouds
   1. This cloud is also referred to as thunder clouds.
   2. This brings convectional rain.
   3. This is frequently seen in tropical afternoons.
   4. These are woolly, bumpy clouds arranged in layers appearing like waves in blue sky.

   Which of the above statements is/are not correct?
   (a) 2 only (b) 3 only
   (c) 1 and 4 (d) 4 only
2. Westerlies in southern hemisphere are stronger and persistent than in northern hemisphere. Why ?
   1. Southern hemisphere has less landmass as compared to northern hemisphere.
   2. Coriolis force is higher in southern hemisphere as compared to northern hemisphere.

   Which of the statements given above is/are correct ?
   (a) 1 only (b) 2 only
   (c) Both 1 and 2 (d) Neither 1 nor 2
3. The jet aircrafts fly very easily and smoothly in the lower stratosphere. What could be the appropriate explanation ?
   1. There are no clouds or water vapour in the lower stratosphere.
   2. There are no vertical winds in the lower stratosphere.

   Which of the statements given above is/are correct in this context ?
   (a) 1 only (b) 2 only
   (c) Both 1 and 2 (d) Neither 1 nor 2
4. Normally, the temperature decreases with the increase in height from the Earth's surface, because
   1. the atmosphere can be heated upwards only from the Earth's surface.
   2. there is more moisture in the upper atmosphere.
   3. the air is less dense in the upper atmosphere.

   Select the correct answer using the codes given below :
   (a) 1 only (b) 2 and 3
   (c) 1 and 3 (d) 1, 2 and 3
5. A layer in the Earth's atmosphere called ionosphere facilities radio communication. Why?
   1. The presence of ozone causes the reflection of radio waves to earth.
   2. Radio waves have a very long wavelength.

   Which of the statements given above is/are correct?
   (a) 1 only (b) 2 only
   (c) Both 1 and 2 (d) Neither 1 nor 2
6. Which of the following is/are not correct?
   1. The unit of measurement of Sun's radiation is Langley.
   2. The incoming solar radiation to earth is 2 cal/cm^2-min.
   3. The mean sea level pressure of atmosphere is 1013.2 bar.
   4. We are normally not aware of atmosphere pressure because it acts in all directions.

   Select the correct answer from the codes given below:
   (a) 1, 2, 3 and 4 (b) 2, 3 and 4
   (c) 3 only (d) None of these
7. Consider the following statements:
   1. Clouds generally reflects some of the sunlight in different directions and the rest is absorbed.
   2. Nearly 90% of the water vapour lies below 12 km of the atmosphere.
   3. Water vapour does not exceed 3 percent to 4 percent of total volume of air.
   4. Nitrogen serves mainly as dilutant and dissolver.

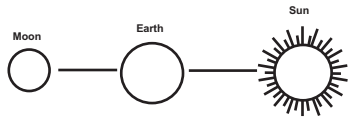
   Which of the above statements is/are not correct?
   (a) 1 and 2 (b) 2 and 3
   (c) 3 only (d) 3 and 4
8. Which of the following is/are correct?
   1. The Northern Pacific is the deepest part of the Ocean.
   2. The South-West Pacific is devoid of marginal seas.
   3. The South-East Pacific has broad submarine ridges and plateaus.
   4. The ocean floor of the Pacific Ocean is fairly uniform with broad rises and depressions.

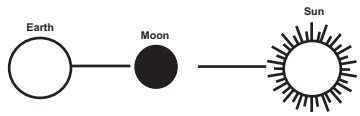
   Select the correct answer from the codes given below:
   (a) 1, 2, 3, 4 (b) 1 and 4
   (c) 2 and 3 (d) 1, 3 and 4
9. The absence of which among the following causes the temperature of the atmosphere to decrease with ascent along with decreasing density of air ?
   1. Vegetation 2. Water
   3. Carbon dioxide 4. Oxygen
   5. Nitrogen
   (a) 1 and 2 (b) 3 and 4
   (c) 2 and 3 (d) 2 and 5
10. Land masses are heated and cooled much faster than water bodies. Identify the true statements in this regard.
    1. Land gets heated by conduction
    2. Water has a higher specific heat
    3. Only the surface layers of water are heated
    4. Water gets heated by convection
    (a) 1, 2 and 3 (b) 2 and 3
    (c) 1 and 4 (d) 1, 2 and 4
11. Which of the following are true with regard to temperature control of the atmosphere of a given place ?
    1. The major temperature contrasts on earth's surface are between land masses and oceans.
    2. During night, the water surface cools more rapidly than the land surface.
    3. Temperature generally decreases with latitude on either side of the equator.
    4. Temperature rises to a maximum during summer and falls to a minimum during winter.
    (a) 1, 3 and 4 (b) 2, 3 and 4
    (c) 1 and 2 (d) 3 and 4

12. Which of the following statements are true with regard to trophical monsoon climate?
    1. Temperatures range from 32°C in the hot season to about 15°C in the cool season.
    2. Annual rainfall varies greatly.
    3. The climate is best developed in the southern continents.
    4. It consists of three main seasons, i.e., cool, dry season; hot, dry season; hot, wet season.

    (a) 1 and 4 (b) 2, 3 and 4
    (c) 2 and 3 (d) 1, 2 and 4
13. An anti-cyclone
    1. is an intense low pressure system.
    2. has winds blowing clockwise in the southern hemisphere.
    3. is accompanied by clear and settled weather conditions.
    4. is more extensive, slower-moving and more persistent than a depression.

    (a) 1, 2 and 4 (b) 2, 3 and 4
    (c) 3 and 4 (d) 1 and 2
14. Consider the diagrams below and say which one represents neap tide :

    1. 

    2. 

    Choose the correct option
    (a) 1 only (b) 2 only
    (c) Both 1 and 2 (d) Neither 1 nor 2
15. Consider the following climatic characteristics:
    1. Temperatures range from 21°C in the summer to 10°C or below in the winter.
    2. Off-shore trade winds blow during the summer.
    3. The summers are hot and dry; and winters are cool and moist.
    4. The annual rainfall ranges from 500 mm to 760 mm.

    Select the correct climatic type which possesses the above characteristics using the codes given below:
    (a) Tropical Monsoon (b) Mediterranean
    (c) China type (d) West European type
16. Consider the following statements :
    1. Troposphere varies in its thickness between equator and poles.
    2. Stratosphere does not experience Normal Lapse Rate.
    3. Ozone layer occurs in the Mesosphere.
    4. Ionosphere lies between Stratosphere and Mesosphere.

    Which of these statements are correct ?
    (a) 1 and 2 (b) 2 and 3
    (c) 3 and 4 (d) 1, 2 and 4
17. Consider the following statements :
    1. Half the water vapour in the air in atmosphere lies below an altitude of 1000 m.
    2. The amount of precipitable water in the atmosphere increases from the equator to the poles.

    Which of the statements given above is/are correct ?
    (a) 1 only (b) 2 only
    (c) Both 1 and 2 (d) Neither 1 nor 2
18. Consider the following statements:
    1. The approach of a cyclone is characterised by a rise in baromenic reading.
    2. In the cyclones of the southern hemisphere, the winds circulate in anticlockwise direction.

    Which of the statements given above is/are correct?
    (a) 1 only (b) 2 only
    (c) Both1 and 2 (d) Neither 1 nor 2
19. Consider the following statements:
    1. In tropical grassland regions, rainfall mainly occurs in the short summer season with a long dry season.
    2. In Mediterranean region, the winter rainfall is caused by the passage of cyclones in the westerly wind belt which lies over this area.

    Which of the statements given above is/are correct?
    (a) 1 only (b) 2 only
    (c) Both 1 and 2 (d) Neither 1 nor 2
20. Consider the following statements:
    1. In a cyclone, the direction of wind flow is counter clockwise in the northern hemisphere.
    2. The tropical cyclone fades away when it reaches land because there is no large supply of warm moist air.

    Which of the statements given above is/are correct?
    (a) 1 only (b) 2 only
    (c) Both 1 and 2 (d) Neither 1 nor 2
21. The annual range of temperature in the interior of the continents is high as compared to coastal areas. What is/ are the reason/reasons?
    1. Thermal difference between land and water
    2. Variation in altitude between continents and oceans
    3. Presence of strong winds in the interior
    4. Heavy rains in the interior as compared to coasts

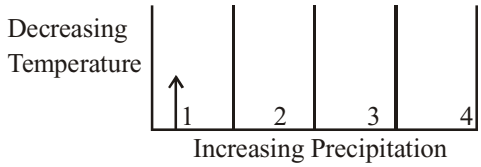
    Select the correct answer using the codes given below.
    (a) 1 only (b) 1 and 2 only
    (c) 2 and 3 only (d) 1, 2, 3 and 4
22. Which among the following statements characterized EI Nino?
    I. It occurs at irregular intervals
    II. It carriers warmer water
    III. It carries less saline water
    IV. Its atmospheric equivalent is southern oscillation.

    Select the correct, answer using the code given below
    (a) I and II only (b) II and III only
    (c) III and IV only (d) I, II, III and IV
23. Which of the following statements is/are correct?
    1. Cyclone is a low pressure system.
    2. The wind movement is clockwise in the cyclone of northern hemisphere.

    Select the correct answer using the code given below:
    (a) 1 only (b) 2 only
    (c) Both 1 and 2 (d) Neither 1 nor 2
24. Which of the following statements regarding hurricanes is/are correct?
    1. They develop over the ocean between 8° – 15° N.
    2. They are almost absent in the South Atlantic Ocean.
    3. They do not develop close to the equator.

    Select the correct answer using the code given below.
    (a) 1 only (b) 2 and 3 only
    (c) 1 and 3 only (d) 1, 2 and 3

25. The diagram given below shows the schematic relations of temperature and precipitation of tropical climatic type over land:



Arrange the climatic types in the correct sequence from left to right:

1. Monsoon topics
2. Wet and dry tropics
3. Arid and semiarid
4. Rainy tropics

Select the correct answer using the code given below.

(a) 1-4-3-3 (b) 4-3-2-1
(c) 2-1-3-4 (d) 3-2-1-4

Matching Based MCQ

DIRECTIONS (Qs. 26 to 27) : Match List-I with List-II and select the correct answer using the codes given below the lists.

26.

	List-I	**List-II**
(A)	Fog	(1) A mass of minute droplets of water or tiny crystals of ice formed by the condensation of water vapour in free air at considerable elevations.
(B)	Cloud	(2) Condensation at a dew point which is at or below freezing point.
(C)	White Frost	(3) Moisture deposited in the form of water droplets on cooler surface of solid objects such as stones, grass blades etc.
(D)	Dew	(4) A mass of minute droplets of water formed by the condensation of water vapour in free air with its base at or near ground.

(a) A – 4 ; B – 2 ; C – 1 ; D – 3
(b) A – 3 ; B – 2 ; C – 1 ; D – 4
(c) A – 3 ; B – 1 ; C – 2 ; D – 4
(d) A – 4 ; B – 1 ; C – 2 ; D – 3

27.

	List-I	**List-II**
(A)	Cloudiness and heavy precipitation unfavourble	(1) Equatorial region
(B)	Westerlies throughout the year and mild winteres	(2) Meditterranean region
(C)	Famous for game park land type of vegetation	(3) Savanna region
(D)	Dry summers, wet winters and orchard farming	(4) West Eurpoean region

(a) A – 1 ; B – 4 ; C – 3 ; D – 2
(b) A – 4 ; B – 1 ; C – 3 ; D – 2
(c) A – 1 ; B – 4 ; C – 2 ; D – 3
(d) A – 4 ; B – 1 ; C – 2 ; D – 3

Hints and Explanations

EXERCISE-1

1. (b) In the given figure 'B' lies between two cyclone zone 'A' and 'D'. At the 'B' marked region rainfall would be accompanied by thunder storms.
2. (c) 3. (a) 4. (c)
5. (d) 6. (a) 7. (b)
8. (b) They deflect to the left in the southern hemisphere.
9. (a) 10. (b) 11. (c) 12. (a) 13. (b)
14. (a) 15. (b) 16. (b) 17. (b) 18. (a)
19. (c) 20. (b) 21. (b) 22. (c) 23. (d)
24. (a) 25. (b) 26. (c) 27. (b) 28. (d)
29. (a) 30. (b) 31. (c) 32. (c) 33. (a)
34. (b) 35. (c) 36. (a) 37. (d) 38. (b)
39. (c) 40. (c) 41. (b)
42. (b) In the winter season temperature cyclon occured in Arabean sea. This phenomenon led a rain in the North-West India.
43. (d) The option (d) is incorrect. The annual rainfall ranges from 400-600 mm. not 1500-2000 mm.
44. (c) Stratosphere is the second layer of the atmosphere, extends to a height of 50 km above the earth.
45. (b) Two regions, found at latitude 30°-35° north and 35°-30° south of the equator, where there is steady movement of air is known as horse latitudes.
46. (a) The air at the equator is generally rising. For this reason, there is little wind in the region. This region of light shifting winds near the equator is called the doldrums.
47. (d) Low cloud group includes clouds occupying height of up to 2100 metres. This group consists the stratus, the nimbostratus and the stratocumulus types.
48. (a) Injurious ultraviolet radiations are mostly prevented from reaching the land surface as these are mostly absorbed by ozone which are formed in stratosphere.
49. (d) The percentage of radiant energy reflected back by a surface is called the albedo. The total amount of energy lost by scattering and reflection of various kinds and returned to space is called earth's albedo.
50. (b) Horse Latitudes are the subtropical belts of variable winds and columns that is between the latitudes 25° and 35° south and north. They coincide with sub-tropical high-pressure belts.
51. (c)
52. (a) Bay of Bengal is the largest bay in the world. It finds a triangle in a shape and its bordered mostly by the eastern coast of India, Southern west of Bangladesh and Sri Lanka to the west and Burma and the Andaman and Nicobar Islands to the east.
53. (d) An anticyclone is a large scale circulation of wind around a central region of high atmospheric pressure. It is clockwise in northern hemisphere but anticlockwise in the Southern Hemisphere.
54. (d) Doldrums are noted for their calm periods when winds disappear totally. They are a low pressure area around the equator.
55. (c) The temperature is just right for them to survive.
56. (b) Dew point is the temperature at which the air is fully saturated and below which condensation normally occurs, water vapour starts to condense to form water droplets.
57. (a) The tropical cyclone of Philippines is known as Typhoon.
58. (c) Cloudy nights are warmer than clear nights because of insolation.
59. (a) The daily range of temperature decreases on proceeding equator to poles.
60. (a) Doldrums is the name for the equatorial belt of low pressure lying between 5° south and 5° North latitude.
61. (b) In a cyclone, the area of low pressure is at the centre surrounded by the areas of high pressure. In an anti-cyclone, the area of high pressure is surrounded by the areas of high pressure.
62. (c) Jet streams are fast flowing, narrow air current found in the atmospheres of some planets including Earth. The main jet streams are located near the tropopause, the transition between the tropopause, the transition between the troposphere and the stratosphere.
63. (a) Bay of Bengal is the largest bay in the world. It finds a triangle in a shape and its bordered mostly by the eastern coast of India, Southern west of Bangladesh and Sri Lanka to the west and Burma and the Andaman and Nicobar Islands to the east.
64. (a)
65. (a) Sirocco is a local Mediterranean wind that comes from Sahara and can achieve Hurricane speed in North Africa and Europe. Its Arabic name is Quibli.
66. (d) Insolation is the measure of solar radiation energy recieved on a given surface area in a given time. Some of the solar radiation is absorbed and the rest is reflected. Insolation is largest when the surface faces the sun.
67. (d)
68. (c) Chinook is a warm, dry, gusty, westerly wind that blows down the Rocky Mountains in North America.
69. (a) Mist is a thin fog resulting from condensation in the air near the earth's surface.

EXERCISE-2

1. (d)
2. (a) The higher speed and greater persistence of the westerlies in the Southern Hemisphere are caused by the difference in the atmospheric pressure patterns as well as its variation from that of the Northern hemisphere. The landmass in the southern hemisphere is comparatively less and average annual pressure decreases much more rapidly on the pole ward side of the high pressure belt. Statement 1 is correct. As far as coriolis force is concerned,

it is strongest in the polar regions and zero at the equator. At the intermediate levels it varies directly as the sine of the latitude.

3. (b) The idea is to optimize fuel burn reason is the low air density that reduces parasitic drag on the airframe. It also allows them to stay above any hard weather (extreme turbulence). Air flow in the stratosphere is much lesser turbulent than in the troposphere and this is the reason that jet aircraft like to cruise at stratospheric altitudes for, the flight is less "bumpy." So statement 2 is correct. Majority of clouds form in the Earth's troposphere, but there are occasions where clouds in the stratosphere and mesosphere are formed and have been observed. The statement 1 which says that There are no clouds or water vapour in the lower stratosphere, is not a correct statement, to the extent that it does not explain the flight of jets in lower stratosphere.

4. (c) 1.The atmosphere can be heated upwards only from the Earth's surface.
2.There is more moisture in the upper atmosphere.
3.The air is less dense in the upper atmosphere.

5. (d) 6. (c) 7. (a) 8. (d) 9. (c)
10. (d) 11. (a) 12. (d) 13. (c) 14. (d)
15. (b) 16. (a)

17. (d) Half of the water vapour in the air in atmosphere lies below an altitude of 2 kilometer and 90 per cent of water vapour lies below an altitude of 5 kilometer. Amount of precipitable water in atmosphere increases from the poles to the equator.

18. (c) Cyclone is a mass of air whose isobars form an oval or circular shape, with low pressure at the centre. The air converge at the centre and rises to disposed off. In a dipression, the winds rotate anticlockwise in northern hemisphere. While in the southern hemisphere, the circular movement of winds is in clockwise direction.

19. (c) Tropical grassland located mainly in the continental areas of tropical latitudes where rains fall during the summer season which lasts for about five months. In Mediterranean region, the winter rainfall due to middle latitude fronts and cyclones.

20. (c) Cyclone is the synonym of Hurricane. The air moves in the cyclone inwards in an anti-clock wise direction in the northern hemisphere and clock-wise in the southern hemisphere. Cyclones are divided as -
1. Extra tropical cyclones or temperate cyclones
2. Tropical cyclones

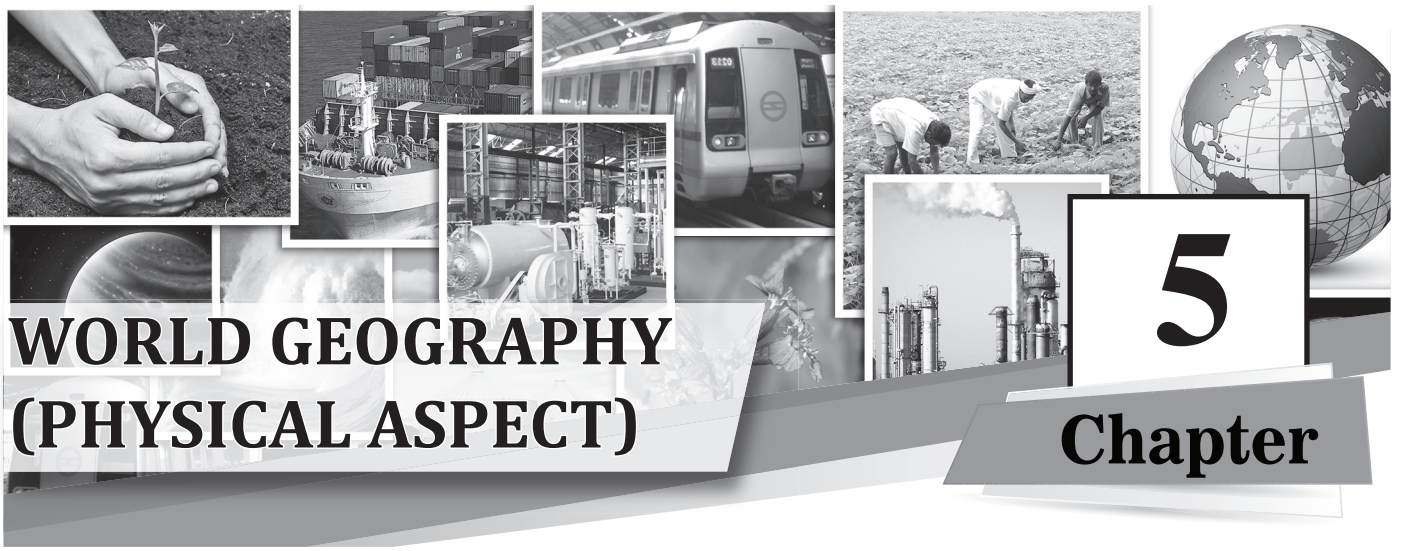
21. (a) The first statement is correct as we all know. One major factor affecting the distribution of the temperature of Earth is distribution of Land and Oceans. Since there is more land in Northern Hemisphere and more waters in Southern hemisphere and there is a big difference between the specific heat of land and water; the loss of heat from the continents is bigger than the oceans. The continents get heated faster and get cooled faster in comparison to the Oceans. This is the reason that the temperatures of the Oceans are moderate while that of continents is extreme. The moderating effect on temperature of the land due to proximity of the seas is called Maritime influence. The increasing effect on temperature of the land at interior of the continents is called Continental Influence.

22. (d) EL Nino, an unusual warning of surface ocean waters in the eastern tropical Pacific is the part of southern oscillation. Scientists do not know exactly how El Nino forms. It is said that El Nino may have contributed to the 1993 Mississipi and 1995 California floods. The average period length of EL Nino is 5 years.

23. (a) Cyclones are moving bodies of air in an enclosed area rotating in the same direction as earth. The air inside the cyclone moves anticlockwise in the Northern Hemisphere.

24. (a) Hurricanes develop over the oceans between 8°-15° N. The term "tropical" refers to the geographical origin of these systems, which usually form over the tropical oceans. The term "cyclone" refers to their cyclonic nature, with wind blowing counterclockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere. The opposite direction of circulation is due to the Coriolis force. Depending on its location and strength, a tropical cyclone is referred to by names such as hurricane, typhoon, tropical storm, cyclonic storm, tropical depression and simply cyclone.

25. (d) 26. (d) 27. (c)



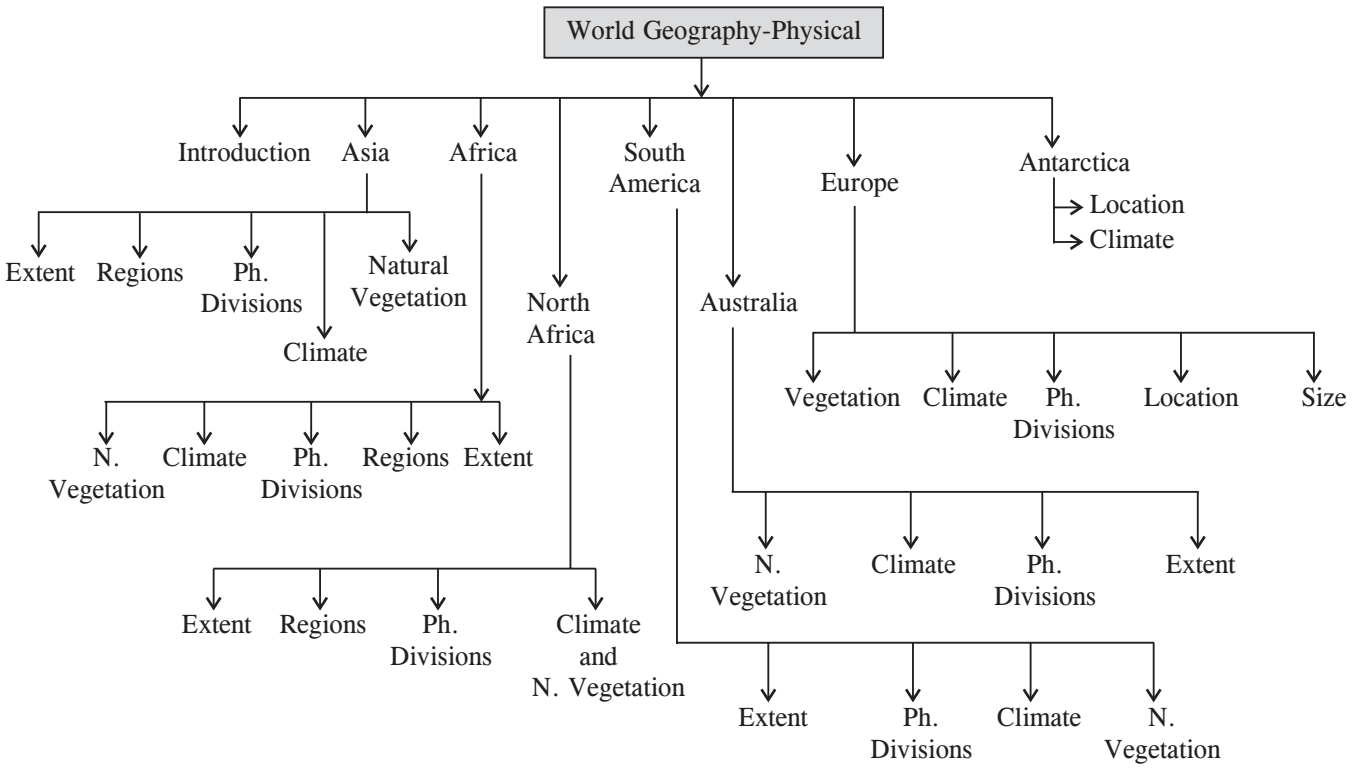
5 Chapter

WORLD GEOGRAPHY (PHYSICAL ASPECT)

Introduction

In the previous chapters we have discussed the basic elements of Geography which in general deals with nature and scope of Geography, the Universe, the solar system, and its various branches of Geography. In this special branch of Geography we have also discussed development of earth, its lithosphere, hydrosphere and atmosphere in details.

Moving on to next important branch of Geography, we are now going to discuss Regional Geography which deals with the studies of the world's regions. In general it is called as World Geography which can be further categorised into three important segments such as **physical segment** dealing with unique characteristics of earth's relief, their spatial extent, drainage, climate, natural vegetation; **social segment** that deals with human development, their race and ethnicity and the relationship with their own physical environment; and finally the ***economic segment*** which deals with the natural resources, livelihood, transport, communications, etc. Let's start with physical segment.



World Geography Physical

On the basis of major physical characteristics the earth can be divided into large continuous land masses known as Continents and the surrounding water bodies known as Ocean. Major continents of the world are **Asia, Africa, Europe, North America, South America, Antarctica,** and **Australia.**

ASIA

Extent

Asia is the world largest continent, having an area of 44,444,100 sq km. It covers 8.8% of the Earth's total surface area with the population of 4.4 billion which is 60 % of the world's total population. It is a continent of contrast in relief, temperature, vegetation and people also. Asia is to the east of the Suez Canal, the Ural River, and the Ural Mountains, and south of the Caucasus Mountains and the Caspian and Black Seas. It is bounded on the east by the Pacific Ocean, on the south by the Indian Ocean and on the north by the Arctic Ocean.

Regional Divisions

Asia can be divided into six physiographic divisions:

1. **Central Asia:** Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan
2. **Eastern Asia:** China, Hong Kong, Japan, North Korea, South Korea, Macau, Mongolia, Taiwan
   Northern Asia: Russia
3. **South-eastern Asia:** Brunei, Myanmar, Cambodia, Indonesia, Laos, Malaysia, Philippines, Singapore, Thailand, Timor-Leste, Vietnam.
4. **Southern Asia:** Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka.
5. **Western Asia:** Armenia, Azerbaijana, Bahrain, Cyprus, Georgia, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, State of Palestine, Qatar, Saudi Arabia, Syria, Turkey, United Arab Emirates, Yemen.

Major Physical Divisions

The major physical divisions of Asian continent are:

1. The Northern Lowlands
2. The Central Mountains
3. The Central and Southern Plateaus
4. The Peninsulas, the Deserts
5. The Great River Plains, the Island Groups

1. The Northern Lowlands

The Northern Lowlands are the extensive plain areas which comprise of several patch of lowlands of this large continent. The major lowlands are:

Great Siberian plain

It extends between the Ural Mountains in the west and river Lena in the east. It is the largest lowland in the world covering an area of 1,200,000 square miles approx.

Manchurian Plain

It is the area adjoining Amur river and its tributaries of northern part of China with an area of 135,000 square miles approx.

Great Plains of China

It is contributed by two major rivers of China, Hwang Ho and Yangtze river which covers an area of 158,000 square miles approx.

Tigris-Euphrates plains

These are formed by river Ganga 984,000 sq. miles approx.

2. The Central Mountains

These are the prominent and extensive mountain ranges which covers the parts of Central Asia. They consist of Pamir and Tian Shan ranges, and extending across portions of Afghanistan, China, Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan. These mountain ranges are designated as biodiversity hot spot by Conservation International which covers several montane and alpine ecoregions of Central Asia. It encompasses several habitat types, including montane grasslands and shrublands, temperate coniferous forests, and alpine tundra.

A *mountain knot* is a junction of two or more mountain ranges. The two main mountain knots in Asia are:

- The **Pamir Knot** is the junction of five mountain ranges they are the Sulaiman, the Hindu Kush, the Kunlun, the Karakoram and the Himalayan ranges. Mount Everest, the highest peak in the world in the Himalayan range.
- The **Armenian Knot** is connected to the Pamir Knot by the Elburz and the Zagros Ranges that originate in the Armenian Knot. The Tien Shan and the Altai are other mountain ranges in Asia.

3. The Central and Southern Plateaus

Plateaus are the land areas having a relatively that surface considerably raised above adjoining land on at least one side, and often cut by deep canyon.

Major Plateaus of Asian Continent

Plateau	Location	Types
Ladakh	Between Karakoram and Himalaya mountain ranges	Intermontane
Tibet	Between Kulun and Himalayan Mountain range	Intermontane
Yunan	Situated on the south east of the Tibet Plateau and separated from Szechuan Basin extensive fertile land by the range of Mountains	Piedmont
Pamir	Well connected to the range of mountains such as Himalayas with the Tian Shan, Karakoram, Kunlun, and Hindu Kush ranges on all sides	Intermontane
Armenian	Present in between Caspian and Black Sea	Piedmont
Iranian	Present in between Zagros Mountains, Caspian Sea, Turkmen-Khorasan Mountain Range	Piedmont

Mongolian	Surrounded by the Greater Hinggan Mountains in the east, the Yin Mountains to the south, the Altai Mountains to the west, and the Sayan and Khentii mountains to the north	Intermontane
Shan	Stretched in the Pegu Yoma and Arkan Yoma in the eastern part of Myanmar,	Intermontane
Deccan	Extended in between the Western Ghats in west and the Eastern Ghats in the east of Indian Subcontinent , it almost touches the southern tip of India and in north covered by the Satpura and Vindhya Ranges	Intermontane
Anatoilan	Enclosed between Pontic mountain ranges in the South and and Taurus in the south west	Volcanic

4. Peninsulas Deserts

A peninsula is a mass of land surrounded by water, but attached to the mainland. The Deccan plateau region is also a peninsula. The major peninsulas of Arabia, India and Malay are in southern Asia. The Kamchatka peninsula lies in north-eastern Asia.

Asia has some big deserts such as the Gobi, the Takla Makan, the Thar, the Kara-kum and the Rub-al-Khali Deserts.

5. (a) Islands of Asia

Asia also has a cluster of islands, also called an archipelago. An archipelago sometimes called an island group or island chain, which are formed close to each other in large clusters. Indonesia, Philippines, Japan, Andaman and Nicobar are some examples of archipelagos.

5. (b) Drainage of Asia

The drainage of Asia consists of mighty oceans, extensive seas, lengthy rivers and their tributaries and distributaries, major lakes, etc.

Oceans: Asian continent is surrounded by three major ocean from three sides such as

- **The Pacific Ocean**
  It covers the eastern part of Asia where major rivers of eastern Asia drain, such as Menam Mekong, Xi Jiang, Chang Xiang, Huang Ho and Amur.
- **The Indian Ocean**
  It covers the southern part of Asia and the major rivers flow into Indian Ocean are Tigris, Euprates, the Indus, the Ganga, Brahmaputra, Irrawaddy, Salween.
- **The Arctic Ocean**
  It covers the Noth east part of Asia and consists of three major rivers such as Ob, Yenisey and Lena.

Seas

As the continent is covered by sea from its three sides, It has also characterised by long stretch of bay and gulf. Major seas contributing Asian Drainage are Sea of Galilee, Andaman Sea, Arabian Sea, Banda Sea, Barents Sea, Bering Sea, Black Sea, Caspian Sea, East Siberian Sea, Java Sea, Kara Sea, Laccadive Sea, Sea of Japan, Sea of Okhotsk. South China Sea and Yellow Sea.

Lakes

Major lakes of Asia are Lake Baikal, Onega, Ladoga, and Peipus in Russia; Lake Akan, Mashu, Biwa, Shikotsu in Japan; Qinghai Lake, Lake Khanka in China; Dal Lake, Chilka, Vembanada, Pullicat and Sukhna in India; Lake Matano and Toba in Indonesia, etc.

Climate

As a land of Contrast Asia is characterized by varied climatic type on the basis of the temperature and rainfall condition. The rainfall across the continent is highly influenced by Monsoon winds the Asia can be divided into three major climatic zones such as:

Monsoon Climate

The Monsoon Asia is the zone including south and south east Asia and east Asia where the effect of monsoon is prominent. Hence the climatic condition varies according to monsoonal wind flow. After the onset the wind starts moving in the north west direction, hence causing rain over the eastern coast of Indian subcontinent, and parts of south east and east Asia. Moreover the summer spell in India is very hot and dry which trigger the occurrence of additional heavy precipitation owing to tropical cyclones.

In winters the central land mass of Asia gets cool more rapidly than the surrounding ocean. This climatic phenomenon starts the flow of cold descending air current in the central Asia which results into generation of high pressure in the heart of Asia. The high pressure starts chasing the low pressure zone present over Indian and Pacific Ocean due to comparatively high temperature. This is called as *retreating monsoon or season of winter monsoon*. As a result of these phenomena of both onset and retreat of monsoon there is marked difference in the climate of Northern and Southern part of Asia.

Dry Climate

The Dry Asia consists of South West Asia, Central Asia and Mongolia. Latitudinally it varies from tropical desert of Arabian Peninsular to subtropical steppe in Afghanistan and further to mid latitude steppe and desert of Mongolia and Northern China. As compared to other parts of the continent the rainfall is also very less, *i.e*. 2.5 cms to 20 cms and it is very unpredictable throughout the region. Moreover a Mediterannean climate is experienced over the coastal region which receives winter rainfall.

Cold Climate

The Cold Asia is experienced in maximum part of Russia as an influence of sub-arctic climate. The summer is comparatively mild and lasts for only for four month. The rainfall is also less as compared to other parts of the continent. The annual rainfall accounts for only 50 cms in the coastal areas whereas towards interior, it decreases up to 25 cms.

Natural Vegetation

There are various types of vegetation found in Asia. For examples:

Tundra

The Tundra extends to 70°N and with further south extensions on high altitudes (Chersk, Verkhoyansk and Kamachatka mountains). The region is covered by cold, treeless plains with permanently frozen subsoil.

The Taiga

The Taiga found in south of tundra is a belt of coniferous forests running across whole of Siberia from west to east reaching Pacific and northern part of Japan. The trees have small leaves, deep roots and thick bark. The species (pine, spruce and fir, etc.) are growing successfully in cold and dry environment.

Temperate Grasslands

Temperate Grasslands

These are elongated, unbroken stretch of the Steppes from Ukraine to Manchuria, which further stretches to several thousand miles in southern Siberia. Region gets low precipitation although cold winters with warm summer. High elevated mountains here are covered with forests.

Mediterranean Scrubland is an area of dry land with small bushes and trees

In this region summers are hot and dry; the winters mild and moist. Thus vegetations grown here are of small size, short leaves, deep roots, and thick barks to retain moisture. It includes countries of Israel, Lebanon, Syria, Iraq, and the plateaus of Turkey and Iran.

Desert Vegetation

Desert Vegetation types are found in the Arabian Peninsula, the deserts of Tibet, Mongolia, and the desert-like steppe-lands bordering the Caspian Sea. The region is sparsely populated by vegetation. Moisture-combating plants, waxy, deep-rooted or thorny shrubs and sporadic stunted trees grow here.

Monsoon Vegetation

Monsoon Region vegetation varies with the amount of annual rainfall each year in this region. The average range of rainfall varies between 40 inches and 80 inches annually. Mostly, tropical deciduous (shedding leaves seasonally) forests, and those which receive less than 40 inches have savanna and steppe-like vegetation are seen. The monsoon lands have been extensively modified by human settlement and put to cultivation, and little trace of the original vegetation survives.

Tropical Rainforest

Tropical Rainforest is the region where evergreen, broad-leafed tall and high-crowned trees are found in this region. Several species having a dense canopy above the floor due to the heavy rainfall received all round the year. The savannas and deciduous trees cover the ground, the subequatorial and the areas that lie in the rain shadow on the leeward slopes. Malaysia and Indonesia, southern Sri Lanka and Java have such vegetation. Plantation tea, rubber, coffee, cocoa, etc. are found here.

Mountainous Vegetation

Vegetation in the Mountain area is found on southern and eastern Asia. The higher elevated part is snow covered by meadows. Lower parts are covered by broad-leafed deciduous forests, and on higher ground the coniferous trees occur.

Peaks of Asia

- Mount Everest (8848 m), Nepal-Tibet, China border
- K2 (8,61,1 m), Pakistan-China
- Kangchenjunga (8,586 m), Nepal-Sikkim (India).
- Lhotse (8,516 m), Nepal-Tibet, China
- Makalu (8,462 m), Nepal-Tibet, China
- Cho Oyu (8,201 m), Nepal-Tibet, China
- Dhaulagiri (8,167 m), Nepal

AFRICA

Extent

Africa is the second largest continent in area (30,330,000 sq Km) which covers 6% of Earth's total surface area and 20.4 % of its total land area. *Algeria* is Africa's largest country by area, and *Nigeria* by population. Separated from Europe by the Mediterranean Sea, it is joined with Asia at its northeast extreme end by the *Isthmus of Suez* 163 Km wide. It is bounded by Red Sea along the Sinai Peninsula to the northeast, the Indian Ocean to the southeast, and the Atlantic Ocean to the west. With fully recognized 54 sovereign states, nine territories and two de facto independent states.

Regional Divisions

The physiographic divisions of Africa are into the following six regions:

Northern Africa

It extends from Algeria in the north, through, Canary Islands, Santa Cruz de Tenerife, Ceuta, Egypt, Libya, Madeira, Melilla, Morocco, Sudan and Tunisia, It reaches upto Western Sahara.

Northeast Africa

It is also called the horn of Africa which extends several hundred kilometers into the Arabian Sea and lies along the southern side of the Gulf of Aden. It contains countries such as Djibouti, Eritrea, Ethiopia, and Somalia.

Eastern Africa

The extensive area stretches from Red Sea and horn of Africa to Mozambique including Burundi, Comoros, Kenya, Madagascar, Malawi, Mauritius, Mayotte, Mozambique, Réunion, Rwanda, Seychelles, South Sudan, Tanzania, Uganda, Zambia, Zimbabwe.

Central Africa

It is the large land mass situated exactly in the middle of the continent covering Angola, Cameroon, Central African Republic, Chad, Republic of the Congo, Democratic Republic of the Congo, Equatorial Guinea, Gabon, São Tomé and Príncipe.

Southern Africa

It is the southern most part of the continent and covers the countries such as Botswana, Lesotho, Namibia, South Africa, and Swaziland.

Western Africa

It is situated roughly at 100° E longitude covering countries like Benin, Burkina Faso, Cape Verde, Gambia, Guinea, Guinea-Bissau, Ivory Coast, Liberia, Mali, Mauritania, Niger, Nigeria, Saint Helena, Senegal, Sierra Leone and Togo.

Major Physical Divisions

The major physical divisions of African continent are:
The Plateau
The Fold Mountains
Deserts
Islands
Rivers

The Plateaus

The vast African continents are famous for its saucer shaped and steep edged plateaus which are facing towards the coast and extending from Guinea coast to Somali Land and north Sahara to the Cape Province. These are divided into three groups:

South African plateau

- The South African plateau as far as about 12°S, bounded east, west and south by bands of high ground which fall steeply to the coasts. The South African plateau is connected towards the north-east with the East African plateau.

East African plateau

- The East African plateau, with probably a slightly greater average elevation, and marked by some distinct features. It is formed by a widening out of the eastern axis of high ground, which becomes subdivided into a number of zones running north and south and consisting in turn of ranges, tablelands and depressions.

Ethiopian Highlands

- The third division of the higher region of Africa is formed by the Ethiopian Highlands, a rugged mass of mountains forming the largest continuous area of its altitude in the whole continent.

The Fold Mountains

Africa is famous for its newly formed folded mountains. Prominent mountain ranges with some of the very high raised mountain peaks are the specialty of African Continents. Some of the well known mountain ranges are:

Atlas Mountains

- It is situated on the north western part of the continent stretching over an area of 2400 km towards the south west direction across Morocco, Algeria and Tunisia.
- The range is again sub divided into high , medium and Anti – Atlas group. The *Jebel Toubkal* is among such highlands or mountain whose height is 4165 m from sea level.
- It is a physical separator between the extensive coasts of Mediterranean and Atlantic Sea and the Sahara Desert.

Ruwenzori Mountains

- Stretching over an area of 240 sq. miles the range borders Uganda and Congo (Kinshasa) and thought to be the "Mountains of the Moon.
- Mount Stanley at Margherita Peak (5,119 m is the highest pick of this mountain system.
- It is a gigantic horst of six separate glaciated masses which falls steeply westward to the Western Rift Valley.

Mount Elgon:

- It is an extinct volcanic mountain situated at the north east part of lake Victoria on the Uganda – Kenya border.
- The height is about 4,321 km from the mean sea level.
- As a volcanic mountain it has a crater which is 610 m deep and 8 km across.

The Tibesti Mountains

- These are mostly situated in the northern part of **Chad** and spread west into northern Niger and the Southern border area of Libya.
- They have a volcanic origin.
- The highest peak is 3,415 m. from mean sea level.

Ahaggar Mountains

- The Ahaggar Mountains, also known as the Hoggar, are a highland region in central Sahara, or southern Algeria near the Tropic of Cancer. They are located about 1,500 km south of the capital , Algiers. Mount Tahat is the highest peak (2, 918 m).
- It has a volcanic formation.

The Drakensberg

These mountains are the highest in Southern Africa rising up at Thabana Ntlenyana at 3,482 m (11,422 ft) in height. They are located in the eastern part of South Africa, running from some 1,000 km. The highest peak is Thabana Ntlenyana at 3,482 m (11,422 ft). It is also the highest peak of Lesotho.

Mount Kenya

Mount Kenya is the highest mountain in Kenya, and the second highest in Africa (after Mount Kilimanjaro). The highest peaks of the mountain are Batian (5,199m - 17,058 ft), Nelion (5, 188m - 17,022 ft) and Lenana (4,958 - 16,355 ft). Mount Kenya is located in central Kenya, just south of the equator, around 150 km (95 miles) north-northeast of Nairobi.

Kilimanjaro

Kilimanjaro with its three volcanic cones, Kibo, Mawensi and Shira, is an inactive stratovolcano in north-eastern Tanzania. Kilimanjaro is the tallest free-standing mountain rise in the world rising 4,600 m (15,100 ft) from its base, and includes the highest peak in Africa at 5,895 meters (19,340 ft).

The Deserts

- The Sahara, the largest hot desert in the world, stretches across the entire width of North Africa. It covers an area of approx. 3,320,000 sq. miles. The major countries contributing their lead to Sahara deserts are Libya, Algeria, Egypt, Tunisia, Chad, Morocco, Eritea, Niger, Mauritania, Mali and Sudan.

- The Kalahari Desert lies in the south and the Namib Desert is along the south-west shore of Africa. It covers an area of 3,50,000 sq. miles and eneroachig parts of Botswana, Namibia, Zambia, Angola and Zimbabwe.
- The Nubian Desert is the eastern region of the Sahara desert, between the Nile and the Red Sea. There is virtually no rainfall here, and there are no oases. It is in Egypt. It covers an area of 1,54,000 sq. miles approx.

Karoo : The **Karoo** is a semi-desert region of South Africa. It has two main sub-regions - The *Great Karoo* in the north and the *Little Karoo* in the south. The Great Karoo has an area of more than 400,000 sq. Km. Currently sheep farming is the economic backbone of the Karoo, with other forms of agriculture established in areas where irrigation is possible. Lately game farms and tourism have also started to make an economic impact. The Little Karoo is the smaller (and more southerly) of the two Karoo sub-regions. Locally, it is usually called the Klein Karoo Geographically it is a fertile valley.

The Islands

- There are very few islands near Africa.
- Madagascar (Malagasay) in the Indian Ocean is the largest island in Africa.
- To the north-west, in the Atlantic Ocean are the Canary Islands.
- West of Africa in the South Atlantic Ocean is the island of Saint Helena where Napoleon died in exile.
- Zanzibar belongs to Tanzania and is closer to the Indian Ocean.

The Rivers of Africa

The most important ones are the Nile, the Congo, the Niger and the Zambezi.

River Nile

- This is the **longest river** in the world.
- It starts from many streams in the equatorial rainforest of the Lake Victoria and Ruwenzori Mountain (the mountains of the moon) region.
- From Lake Albert, it flows as the White Nile.
- At Khartoum, it is joined by the Blue Nile which starts from Lake Tana on the Ethiopian Highlands.
- The Nile flows from 3,000 kilometres through the dry Sahara Desert of Egypt and enters the Mediterranean Sea.
- Egypt is called **the gift of the Nile** because without the river it would have been a desert.

River Congo or Zaire

- The Congo is the **second longest river** of Africa.
- It starts from the south-west of Lake Tanganyika and flows into the Atlantic Ocean.
- The Zaire basin is one of the wettest regions of the Earth and is covered with dense impenetrable jungle.
- The river and its network of tributaries are not navigable because of rapids and waterfalls caused by the descent from the plateau to the coast.

River Niger

- This river is the chief river of West Africa.
- It rises from the Fouta Djllon Mountain quite close to the sea but flows north and then turns south again to form a wide arc.
- Finally it joins the Gulf of Guinea on the Atlantic Ocean.

River Zambezi

- River Zambezi flows into the Indian Ocean.
- The famous Victoria Falls at the head of a long gorge is on this river.

River Limpopo

River Limpopo also flows into the Indian Oceans, which crosses the Tropic of Capricorn twice.

River Orange

This flows from the Drakensberg Mountains into the Atlantic Ocean.

The Lakes of Africa

- **Lake Victoria** is the second largest fresh water lake in the world. It is the largest lake of Africa. It is situated on the block mountain between the two branches of the Great Rift Valley. The Equator passes through it. It is the source of white Nile.
- The lakes of the rift valley. There is a string of lakes in the rift valley. **Lake Tanganyika** and **Lake Nyasa** (Malawi) are the larger ones.
- **Lake Tana** is on the Ethiopian Plateau. It is the source of Blue Nile.
- **Lake Chad** at the southern edge in the Sahara Desert is in a region of inland drainage. Streams start from the surrounding hills and flow into this lake instead of the sea. River Charl is the largest river of this area.
- *Lake Nasser* is on river Nile. It is a man made lake located between Egypt and Sudan
- **Lake Kariba** is situated on the southern most part of Africa an Zambezi river. It is one of the biggest look man-made like and it is the largest producer of hydro electricity in Africa.
- **Lake Assal** is situated in Djibouti and the lowest point in Africa

Famous Lakes of Africa

Lake	Elevation	Lake Type
Victoria	11.33 m	Tropical Lake
Trnganyika	773 m	Rift Valley Lake
Malawi	—	African Rift Valley
Turkana	360 m	Alkaline Lake
Lake Albert	615 m	Western Rift
Lake Edward	912 m	Drain North into Lake Albert
Lake Kivu	1460 m	Ruzizi River

Important Dams and Waterfalls

Dam/Falls	River	Country
Aswan Dam	Nile	Egypt
Kariba Dam	Zambezi	Zimbabwe and Zambia
Kainji Dam	Niger	Nigeria
Cobora Bassa Dam	Zambezi	Mozambique
Victoria Fall	Zambezi	Zambia- Zimbabwe
Boyoma Fall	Zaire	Democratic Republic of Congo

Climate

It is quite obvious that as a large continent Africa experiences a highly variable climate. Keeping in view the prevailing weather conditions such as temperature, rainfall, humidity etc the climatic zones of Africa are:

Tropical Monsoon Climate

- It is associated with high mean annual rain fall and temperature. average annual temperature is 27.05°C and the Annual average rainfall vary from 50-150 cm.
- Mostly the central of Africa and eastern cost of Madagascar experience this type of Climate such as Lagos, Kinshasa, Abidjan, Dar es Salaam and Ibadan.
- The hot Summer is generally due to the nearness of equator as the zone is present 10° to 20° on either side of the equator and it brings good amount of rainfall to this region.

Humid and Sub humid tropical climate

- This type of climate is characterised by hot, usually humid summers and mild to cool winters. Although the temperature is relatively high but the rain fall is evenly distributed.
- The average annual temperature varies between -30°C 180°C in the coolest month whereas it is above 220°c in the warmest month.
- The climate occupies comparatively a large part of African continent like Kwa Zulu-Natal and the Eastern Cape provinces of South Africa, north eastern Zimbabwe, Niassa, Manica and Tete provinces of Mozambique, southern Congo provinces, Malawi, and Zambia, Ethiopian Highlands.

Mediterranean Hot Summer:

- This type of climate is associated with high temperature and they generally get precipitation during autumn, winter and spring.
- The temperature reaches to 48°c in summer and the rainfall is almost nil during this period of 4-6 months.
- The winter is also mild as the rainfall is scanty.
- This type of climate is more common around the Mediterranean Sea, southwestern Australia, southwestern South Africa, sections of Central Asia, the Rogue River Valley region of southwestern Oregon, and in the interior of northern California west of the Sierra Nevada.

Hot Desert Climate:

- It is typically a very hot and dry zone where the temperature ranges between 40°C to 45°C throughout the year.
- They are more common in the deserts of North Africa such as the wide Sahara Desert, the Libyan Desert or the Nubian Desert; deserts of the Horn of Africa such as the Danakil Desert or the Grand Bara Desert; deserts of Southern Africa such as the Namib Desert or the Kalahari Desert.

Tropical Wet/Dry (Savanna) Climate

- This is a typical climate experienced in between 5° -10° and 15°C to 20°C in both the latitude.
- Spatially they are found north and south central part of Africa, Campos of Brazil.
- Diurnal temperature ranges of 10°C to 15°C during winter are not uncommon. The Summers are hot and humid which provide an uncomfortable living environment.

Natural Vegetation

There are extensive areas in Africa where few people live and where natural vegetation and wild animals have not been disrupted by such activities as farming or the raising of livestock. In some parts of the continent large forest reserves have been established, like.

Tropical Rain Forests

Large area of Africa is covered by tropical rain forests, or *selvas* type of vegetation covering less than a tenth of the continent with heavy rain throughout the year. These forests contain several layers of vegetation. The top layer consists of the crowns of trees rising 125 to 250 feet (38 to 76 m) in height; the lower layers are arranged according to their height like shorter trees, shrubs, and vines respectively. Most of the trees are broad-leaved evergreens, along with few conifers ones. They yield pulp, timber, and such cabinet woods as mahogany, ebony, and teak. Oil palms, rubber-producing trees and vines, orchids, and lilies are among the numerous kinds of plants found in these forests.

Tropical Savannas

Savannas, covering perhaps one third of the continent, consist of areas mainly growing grass. There are spots of woodlands, scattered trees, or shrubs, depending on the length of the dry season. Coarse grasses upto 12 feet (3.7 m) high and large woodlands of deciduous trees are found near the border of Tropical forest. They even include many evergreens found in tropical rain forests, such as oil palms, rubber trees, and African ebony trees. There are also shea trees (whose seeds yield an edible fat), baobabs, flat-topped acacias, kapok, and many trees that bear edible fruit. As the dry season becomes pronounced grass grows shorter rarely reaching the height of five feet (1.5 m) high. Palms, baobabs, acacias, and such brightly flowering trees as cassias and erythrinas grow in small clumps or are scattered singly over the grassy areas.

- Away from the Equator to the north and south, rainfall decreases and there is a zone where there is a definite dry season unlike the equatorial region where it rains always.
- This is the **Sudan type of climate** and has tropical Grassland or Savanna vegetation.
- This region continues over the Eastern Highlands and forms a wide area around the equatorial forests.
- The grass is thick and coarse. In some places there is the tall elephant grass.

Tropical Steppes and Deserts

Increased aridity and longer dry seasons are the main features of tropical steppes. These are regions grow short grasses only.

Thorny acacias, euphorbias, dwarf palms, and jujube trees are found here. Steppes bordering on deserts no trees are spotted, rather widely scattered bunches of grasses grow. Rain here brings flowering plants and variety of grasses springs up and thrives. True deserts, of the Sahara and the Namib, are virtually featured with no vegetation except at oases (places watered by springs or wells). Vegetation at oases includes date palms, fig trees, willows, poplars, and tamarisks.

Mediterranean Forests

Mediterranean type of vegetation in Africa is found along the northern and southern coast. Different variety of shrubs and small trees, both deciduous and evergreen are grown. The plants are able to withstand long, dry summers with waxy, leathery leaves and long taproots develop here. The northern region raises cork oak, olive trees, cedars, and pines; in the south, laurels, cedars, and ironwood. Grasses and low flowering plants grow only during the rainy months.

Montane Forests

African vegetation system has localized characters. The Montane vegetation of highlands, particularly in Ethiopia and the mountains of the Great Rift Valley are such example. Depending on elevation, latitude, and direction of the winds vegetation grows. The region under Montane forests yield valuable timber and cabinet woods along with bamboo and wild varieties of coffee and banana. The slopes of mountain are covered with thick evergreen forest. At higher elevations, grasses and colorful, low-growing plants are typical. The High Veld of southern Africa is temperate grassland between 3,500 and 11,000 feet (1,070 and 3,350 m) above sea level.

Mangrove Forests

Mostly found along the African coast, but are most extensive along the Gulf of Guinea. A variety of other trees tailored to life in muddy estuaries and tidal flats are found other than Mangrove. Swamp and marsh also occur along the larger rivers and lakes of western and central Africa. *Papyrus*, tall grasses, and *lotus* are the most common plants. The *Sudd region of the White Nile River is one of the largest marshes in the world*.

NORTH AMERICA

Extent

North America is the **third largest continent** after Asia and Africa. It covers an area of nearly 24 million square kilometers.

From south to north, it extends from *7°N to 85°N* latitude and east to west from *20°W to 179°* W.

In other words, its northern boundary is only about 500 kilometers away from the North Pole and its western boundary only 10 kilometres away from the *International Date Line*.

There are five time zones in North America.

The Tropic of Cancer and the Arctic Circle pass through the continent and the 100°W longitude cuts through the centre of the continent.

This huge landmass includes three large countries – Canada, United States of America and Mexico, seven small states of Central America and the islands of the West Indies.

The Atlantic, Pacific and Arctic oceans surround North America in the east, west and north respectively.

In the north-west the *Bering Strait* separates it from Asia and in the south-east the *Isthmus of Panama* joins it to South America.

North America has a smooth coastline except for the existing in the north-west. Fiord (fiord) is a long, narrow winding inlet from the sea between steep slopes of a mountainous coast. It usually occurs where ocean water flows into valleys near the coast by glaciers.

Regional Divisions

Region wise North America can be classified into 5 parts which are listed below:

Western Region

Young mountains rise in the west. The most familiar of these mountains are probably the *Rockies*, North America's largest chain. They stretch from the province of British Columbia, Canada, to the U.S. state of New Mexico.

Great Plains

In the middle of the continent lies the Great Plain. Deep, rich soil blankets is large areas of the plains in Canada and the United States. Grain grown in this region, called the "*Breadbasket of North America*," feeds a large part of the world. The Great Plains are also home to rich deposits of oil and natural gas.

Canadian Shield

The Canadian Shield is a raised but relatively flat plateau. It extends over eastern, central, and northwestern Canada. The Canadian Shield is characterized by a rocky landscape pocked by an astounding number of lakes.

Eastern Region

This varied region includes the Appalachian Mountains and the Atlantic coastal plain. North America's older mountain ranges, including the Appalachians, rise near the east coast of the United States and Canada. These areas have been mined for rich deposits of coal and other minerals for hundreds of years.

Physical Division

North America can be divided into three physical regions:

1. The Western Cordilleras
2. The Central Lowlands
3. The Eastern Highlands

The Western Cordilleras

- The parallel ranges of young fold mountains run from Alaska and extend into South America as the Andes.
- As they resemble twisted cords they are known as Cordilleras.
- Fold mountains are formed when tectonic plates push the Earth's crust and force it to form ridges and valleys.
- Volcanic rocks form the base of fold mountains.
- The Cordilleras are part of the Pacific Ring of Fire. Mount St. Helena is in the USA.
- The snow-covered Cordilleras act as a barrier to moisture laden winds and cause relief rainfall.
- Some of the rivers flow westwards and some eastwards with the Cordilleras acting as the water divide between them.

- Rocky Mountains, Alaska Range, Cascades, Sierra Nevada and Sierra Madre are the chief ranges of the Western Cordilleras.

The Central Lowlands

- These stretch from around the Arctic Shores and Hudson Bay to the Gulf of Mexico.
- They are hemmed in by the Cordilleras in the west and the highlands in the east.
- In the west, they are known as high plains because of the greater altitudes.
- In the north, they form the Canadian Shield.
- The *Canadian Shield* is a peneplain with a number of lakes. They are large enough to be called seas. They are the five *Great lakes* - Superior, Michigan, Huron, Erie and Ontario.
- Lake Winnipeg, Great Bear Lake and Lake Athabaska are also on the Canadian Shield.
- South of the Canadian Shield, the Central Lowlands are covered with layers of sediment brought by glaciers and rivers. It is a very fertile region.

The Eastern Highlands

- They are old fold mountains that stretch from the valley of River St. Lawrence to Southern USA.
- They are not a high or as continuous as the Cordilleras.
- The highlands are also known as the *Laurentian* highlands in Canada and the *Appalachians* in the USA and are less than 2,000 metres in height.
- There eastern slopes facing the Atlantic Ocean are very steep causing waterfalls in the streams that flow to the coast.
- The Grand Canyon is a network of deep narrow valley cuts into the dry Colorado Plateau.
- *The Old Faithful*" is a natural geyser (a hot waterspout). Once in every 90 minutes, the water from the geyser comes out roaring upto 60 metres high. It is found in Yellowstone National Park.

Gulfs of North America

A *gulf* is a portion of the ocean that penetrates land which is very large in size, shape, and depth. They are generally larger and more deeply indented than bays and often make excellent harbors. Many important trading centers are located on gulfs. Some of the important bays those surrounds North America from all sides are

Gulf of Mexico

It is an important economic site for three countries and surrounded by United States, Mexico, and the island nation of Cuba. As one of the biggest gulf it has the coast line of 5000 kilometers.

Gulf of Alaska

It is situated on the north western part of North America where two types of water run into each other, a light, almost electric blue merging with a darker slate-blue.

Gulf of California

It separates the Baja California Peninsula from the Mexican mainland. It has a coast line of 4000 km(2600 miles). It is considered to be one of the most diversified seas on the planet, and is home to more than 5,000 species of micro-invertebrates.

Gulf of St. Lawrence

It is an water outlet of the North American Great Lakes via Saint Lawrence river. It's a semi enclosed sea which covers 236,000 square kilometres (91,000 sq mi) and containing about 35,000 cubic kilometres (8,400 cu mi) of water, which results in an average depth of 148 meters (486 ft).

Islands

The world famous islands of North America are:

Vancouver Island

It is situated on Canada's Pacific Coast, is known for its mild climate and thriving arts community. It is separated from British Columbia mainland by the Strait of Georgia and Queen Charlotte Strait and from Washington by the Juan De Fuca Strait.

Greenland

It is a massive island situated between Atlantic and Arctic oceans and 80% of its land is covered by ice.

Prince of Wales Island

It is one of the islands of the Alexander Archipelago in the Alaska Panhandle. This ranks four among the island in size.

Hawaii Island

It is otherwise known as the *Big Island* provides a vast canvas of natural environment and it is the largest island of the Hawaiian archipelago in the Central Pacific.

Cuba Islands of Antilles

It is known as the *sugar bowl* of the World and its vast source of metallic resources include cobalt, nickel, iron ore, chromium and copper. Other resources include timber, petroleum, silica, salt, and arable land.

Bermuda Island

It is the territory of British Islands in North Atlantic and famous for its Pink sand beaches such as *Elbow* and *Horseshoe Bay*.

Drainage Pattern

There are many rivers in North America. River of North America can be grouped according to the seas they drain into, like

1. **The rivers draining into the Gulf of Mexico**
   These are the Mississippi, Missouri and their tributaries drain the whole of the lower Central Lowlands. They start from the Western Cordilleras. The Ohino and Tennesse. Rivers which are also tributaries of the Mississippi but have their source in the Appalachians are exceptions.
2. **Rivers draining into the Atlantic Ocean**
   River St. Lawrence is the large river of this group. In this group the smaller rivers of the Fall Line can also be included.
3. **Arctic Ocean drainage**
   River Mackenzie which has many shallow lakes on the Canadian Shield. River Nelson flow into the Hudson Bay.
4. **Pacific Ocean Drainage**
   River Yukon in Alaska, Columbia, Fraser and the Colorado along the west coast. The Colorado river cuts across the Colorado plateau and forms the world's most famous and attractive deep gorges, known as **grand canons** having nearly one km depth. Among the other rivers, the Yukon, the Skena, the Fraser, the Snake, the Humboldt, the Sacramento, the San Joaguin, etc. are well known.

Seas in North America

Caribbean Sea

It is a sub-oceanic basin bordered by coasts of Venezuela, Colombia, and Panama; to the west by Costa Rica, Nicaragua, Honduras, Guatemala, Belize, and the Yucatán Peninsula of Mexico; to the north by the Greater Antilles islands of Cuba, Hispaniola, Jamaica, and Puerto Rico; and to the east by the north-south chain of the Lesser Antilles, consisting of the island arc that extends from the Virgin Islands in the north east to Trinidad.

Beaufort Sea

It is situated on the north of Canada and Alaska is known to be the marginal sea of Arctic Ocean covering an area of 184,000 sq. miles and the average depth of 3,239 ft (1,004 m).

Hudson Bay

It is known as the *second largest bay in the world* which encompasses an area of 1,230,000 square kilometer (470,000mi) and large body of Salt water.

Labrador Sea

It is bordered by continental shelves and separates Canada from Green Land.

Bering Sea

It is situated on the extreme North of North America separating the continents of Asia and north America.

Inland Drainage System

- The Great Basin area in the Rocky Mountains (Middle) has rivers which do not reach the coast, but terminate in the land. This is the Inland Drainage System.
- The rivers are small, seasonal and end up in saline lakes.
- The *Humboldt* river ends up in Carson Sink - a saline lake. The area is studded with bolsons.

Lakes in North America

- The Lakes of the Canadian Shield are fresh water bodies.
- The Great Salt Lake between the Rockies and the Sierra Nevada has a high salt content and is an area of 'Inland drainage'.
- Lake Champlain in Quebec, Canada and New York, Vermont in the USA.
- Lake Erie in Ontario, Canada and Michigan, New York, Ohio, Pennsylvania in the USA.
- Lake Huron in Ontario, Canada and Michigan in the USA.
- Lake Memphramagog is a 40-mile long glacial lake that extends from Vermont into Canada.
- Lake Ontario in Ontario, and New York in the USA.
- Lake St Clair in Ontario, and Michigan in the USA.
- Lake Superior in Michigan, Minnesota, Wisconsin in the USA.
- Lake of the Woods in Minnesota, USA; Manitoba, Ontario, Canada.
- Rainy Lake in Minnesota, USA; Ontario, Canada.

Climate and Natural Vegetation

- North America extends from roughly 700 kilometres north of the Equator to about 600 kilometres south of the North Pole, spreading over all the temperature zones.
- It is so wide that the central regions are thousands of kilometers away from oceanic influence.

The climatic regions are:

Tundra or Polar Climate

- The regions within the Arctic Circle along the shores of the Arctic Ocean and the Hudson Bay have extremely cold, long winters. The sun does not rise from many weeks here.
- The winter sky is lit sometimes by the Northern Lights or **Aurora Borealis**.
- In summer, the days are long and cool. The sun shines weakly, is low in the sky and does not set for weeks.
- These are lands of the **mid-night sun**. Rainfall is very low. Precipitation is in the form of snow.
- Its soil called the **permafrost** is permanently frozen and extremely hard.
- In summer, the surface ice melts. Lichens, mosses and low berry bearing bushes appear.
- Along the southern borders, there are stunted willow and birch trees.
- The tundra is the ice desert.

The Taiga or the Coniferous Forest Belt

- This is a broad belt of coniferous forest that stretches from Newfoundland in the east to Alaska in the west and southwards along the slopes of the Cordilleras.
- The winters are long and cold.
- The summers are short and warm. Precipitation is in the form of snow and is more than tundra.
- The trees have many adaptations to withstand the heavy snowfall and lack of water.
- They are cone-shaped, evergreen and *xerophytic* (in nature).
- Pine, fir, larch and spruce are some of the trees.
- In British Columbia and California, there are the giant sequoias, douglas, firs and cedars.

The Temperate East Margin Type

- This stretches from the Great Lakes along the Appalachians and the coastal areas.
- The northern part of this region is influenced by the Cold Labrador Current. It is known as the Laurentian Type or Cool Temperate East Margin Type.
- The southern part known as the Warm Temperate East Margin or China Type lies in the Trade Wind belt.
- This region lies in the track of hurricanes and tornadoes.
- The trees are deciduous.
- They have hardwood and broad leaves which are shed in autumn called "fall" in America.
- Maple, oak, elm and ash are the common trees.
- Many places have mixed forests of evergreen and deciduous trees.
- There is very heavy rainfall in Florida resulting in temperate swamps called '*Everglades*'.
- Cypress is the predominant tree and alligator is the common reptile of the swamps.

Cool Temperate West Margin Type or British Type

- This type is found along the west of Canada and North California in USA.

- The Warm Alaska Current makes this region warm and the Westerlies bring rain throughout the year.
- It has warm summers and mild winters. There is heavy rainfall because of Rockies block the Westerlies.
- Vegetation consists of coniferous trees.
- The world's oldest, largest and tallest trees grow here. Douglas fir, redwood and giant sequoias are some of them.

The Prairies Grasslands

- From the south of the taiga, between the Great lakes and Rockies, to the Mississippi-Missouri Basin stretches the largest expanse of temperature grasslands.
- These treesless plains are the Prairies.
- Closer to the Rocky Mountains, where the rainfall is less lies the 'shorter grass prairie'.
- Cattle ranching is carried out here.
- The moderate rainfall is not enough to support tree growth.

The Mediterranean Type of Climate

- This climate is found in Central California on the west coast of North America.
- It lies between 30°N and 40°N latitude.
- The trade winds blow in summer as off-shore land winds.
- The hot dry summers make it difficult for plants to grow.
- The plants have adapted to store water from the winter rains in waxy leaves and bark.
- The original vegetation is scrub like and is called the *chaparral*.
- In wetter parts there are huge trees like cedars, cypress and the giant sequoia or red wood.
- This region is ideal for fruit growing.

Hot Desert

- The Mohave and Sonora are deserts on the southwestern part of North America because the mountains to the east act as a rain shadow for the Trade Winds.
- While the Cool California Current in the west prevents sea winds from bringing rain.
- Only very small parts of the desert are without any type of vegetation.
- Cactii, sage and thorn bushes and coarse grasses are common. The Joshua tree is a taller cactus.

Tropical Rain Forests

- This forest is found in Central America and the West Indies.
- There is heavy rainfall and high temperature
- The equatorial jungles of the Amazon and Orinoco of South America have extended to this region.

Storms

- **Hurricanes** - These are destructive cyclones which blow in from the Gulf of Mexico. It is caused by depressions originating over the sea.
- **Tornadoes** or **twisters** form over land in the southern states of the USA. This is a black cloud which possesses a funnel shaped tail which twists as it rushes past. There is complete destruction wherever the tail passes because of the vacuum effect. Everything in its path is sucked in. It is the most destructive of cyclones.

SOUTH AMERICA

Extent

South America is a long triangular shaped continent.
It stretched from 12°N to 55°S latitude. The Equator passes through the northern part of the continent and the Tropic of Capricorn runs roughly through the middle. Because of its tapering shape, a major part of the landmass is in the tropics. South America lies on the west of the *Prime Meridian*. So the time at any place on this continent will be some hours less than or behind the *Greenwich Mean Time*. The 60° meridian divides the continent lengthwise into two halves. It is more to the east compared to North America and is therefore closer to Europe and Africa. South America is the **fourth largest continent** after Asia, Africa and North America. It is two-third the size of Africa and six times the size of India. The coastline of South America is smooth with very few inlets except in the extreme south-west where there are **fiords** and many small islands. Fiords are deep inlets of the sea into mountains land. There are a few large islands off the coast of South America. The Galapagos Islands near the Equator and the Juan Ferandez Islands near Central Chile are in the Pacific Ocean. The Tierra del Fuego is in the Southern Ocean and the Falkland Islands in the South Atlantic Ocean. The island of Trinidad is near Venezuela in the North Atlantic Ocean. *The Andes is the longest mountain range in the world*. South America's three southern countries – Argentina, Chile and Uruguay – constitute a region sometimes referred to as the *Southern Cone* because of its pointed, ice-cream-cone-like shaped.

Physical Divisions

South America can be divided into four physical regions:

1. **The Pacific coastal strip**
   It lies in the west, between the ocean and the Andes. It is the longest coastal plain in the Atlantic world. In most places it is about 80 kilometres wide but in some it is as narrow as 8 metres. The coastline of South America is smooth and regular. At the river mouths there are inlets which are used as harbours. The south-western coast of the continent has fiords or deep inlets of the sea into mountainous land.
2. **Mountain Ranges**
   The Andes stretches through entire continent, running in north-south direction from Isthmus of Panama to Strait of Magellan. They are the continuous range of folded mountain systems which covers the entire western coast of South America. The Andes is the longest mountain range in the world. The highest mountain of this mountain range is Aconcagua, stands at 6,962 meters (22,841 feet) and straddles the Argentina-Chile border.
   They form a chain of ranges and knots with enclosed intermontane plateaus namely in Ecuador and Bolivia. Being part of the Pacific Ring of Fire, there are many volcanoes and frequent earthquakes along this region. Mount Cotopaxi and Mount Chimborazo are active volcanic peak, is the highest peak in South America.

Some Mountains of South America

Mountain	Country	Height (In Meters)
Aconcagua	Argentina	6962
Ojos del Sulado	Chile	6891
Monte Pissis	Argentina	6793
Llullaillaco	Argentina/Chile	6738
Cesro Mercedario	Argentina	6720
Neado Sajama	Bolivia	6542
Illinani	Bolivia	6438
Jang'u Uma	Bolivia	6427
Illampu	Bolivia	6368
Cesro El Plomo	Chile	5424

3. The Central Lowlands

The are formed by two great river systems – the Amazon-Orinoco and the Parana-Paraguay. The vegetation of the lowlands are given special names.

The Orinoco Basin has dense tropical forests. The northern part is a plain covered with savanna grass called the **Llanos**. The equatorial jungle of the Amazon Basin is called the **selvas**, a typical tropical rain forest. The rich temperate grasslands around the mouth of the Parana-Paraguay is the **pampas**. At the source of these rivers is a region scrub forest called the **Gran Chaco**.

4. The Eastern Highlands

These are plateaus made up of hard old rocks. The River Amazon separates them into the Guiana Highland to the north and the Brazilian Highland to the south. They have been worn down by wind, rain and rivers. They have steep cliffs along the east coast and slope gently towards the Central Plains. The savanna grasslands of Brazilian Highlands is the **compos**. Towards the Central Lowlands, it is known as the plateau of Matogrosso. Patagonia is a cold, wind swept plateau at the southern end of the tapering continent.

(a) **Guiana Highlands:** It is a geographically stunning part of Planet Earth, over 1,000 miles in length, the Highlands stretch from southern Venezuela across the northern edge of South America to the tip of Brazil. It consists of a vast plateau, one marked by deep gorges, tropical rain forests, numerous rivers and waterfalls. It's famed for the *highest waterfall* in the world (*Angel Falls*) at 3,212 ft (979 m) high. The highest point is Mt. Roraima on the borders of Brazil, Guyana and Venezuela at 2,810 m.

(b) **Brazilian Highlands:** This highlands region is about 800 miles in length and runs through the Brazilian states of Minas Gerais, Goias, Bahia and Sao Paulo is southeastern Brazil. The magnificent landscape includes varied mountain ranges, namely the Serra de Mantiquiera, Serra do Paranapiataba, Serra Geral, and Serra do Mar.

(c) Patagonia: It is located between the Andes and the Atlantic Ocean, and about 1,000 miles in length; Patagonia stretches south from the Rio Negro river in southern Argentina to Tierra del Fuego and the Strait of Magellan. It's mostly rugged, barren land, famed for its beauty and striking scenery.

Deserts of South America

- **Patagonian Desert –** the largest desert by area located in Argentina
- **La Guajira Desert –** a desert in northern Colombia and some of northwestern Venezuela
- **Atacama –** a desert in Chile, the *driest place on Earth*.
- **Sechura Desert –** a desert located along a portion of the northwestern coast of South America
- **Monte Desert –** in Argentina, a smaller desert above the Patagonian desert.

Drainage System

The drainage system of south America consists of:

(a) The Amazon Basin
(b) The Rio de Plata Basin
(c) The Orinoco Basin
(d) The Sao Francisco Basin

The Amazon basin

- It is the basin of River Amazon.
- Its length is second to that of the Nile river of Africa.
- It has the largest flow of water in the world.
- The river drains nearly 40 per cent of area of South America.
- The major tributaries of the Amazon river are the Caqueta, the Jurua, the Madeira, the Negro, etc.

The Rio de Plata basin

- This basin is second in size to that of the Amazon.
- The main rivers which form the Basin of Rio de Plata are the river Paraguay, the Parana and the river Uruguay.
- River Parana (4,879 km) rises from Minas Gerais from a water divide Carino de Paranaiba.

The Orinoco basin

- This is considered to be the third largest drainage system of South America.
- It rises in the Southern end of Sierra Parima near Mount Delgado Chalboud at a height of 1000 metres.
- It traverse 2,740 km to meet the Atlantic Ocean.
- The word Orinoco means '*a place to paddle*', i.e. a river where navigation is possible.
- In the North, the Orinoco river passes through a zone called 'Region of Rapids' where there are enormous granite boulders.
- The world's highest waterfall Angel (979 m) is situated on river Churun which is a tributary of river Caroni which is further a tributary of river Orinoco.
- The Orinoco flows through the llanos (savanna grasslands) of Venezuela into the (North Atlantic Ocean).

The Sao Fancisco basin

- The fourth largest river system of South America is the river Sao Francisco which is about 2,914 km in length. It flows within Brazil.
- It originates North-west of the city of Belo Horizonte on the Eastern slope of Sierra da Canostra.

Climate

The climate of South America is influenced by the following factors:

- South America stretches through many degrees of latitudes and through all the temperature zones of the Earth.
- The high Andes cover the full length of the continent. Mountains lower the temperature and form rain shadow regions on their leeward side.
- The Cool Peru current flows along the west coast making the shore very dry.
- The Warm Brazil current on the east coast brings good rainfall.
- The South East Trade Winds bring rain to the east coast in the tropics. Thus beyond the Andes on the west coast, deserts are formed.
- Further south from 30°S latitude to the tip of the continent, westerly winds bring rain.

1. The hot wet equatorial climate

- This is found in the Amazon basin.
- The Equator cuts through this region but on the high Andes rain is less because of the height.
- Quito, the capital, is said to have 'eternal spring', while the Amazon Lowlands are very hot and wet throughout the year.
- Dense impenetrable rainforests called the selvas or Amazon rainforest or amazon are found here.

Amazon Rainforest

It is located within nine nations: Brazil (with 60 percent of the rainforest) Colombia, Peru, Venezuela, Equador, Bolivia, Guyana, Suriname and French Guiana.

The Amazon represents over half of the planet's remaining rainforests and comprises the largest and most species-rich tract of tropical rainforest in the world.

- The trees are very tall and head wooded like ebony and mahogany.
- Some valuable trees found here are cinchona from which quinine, the medicine for malaria is made; chicle, the tree which gives chewing gum; the hevea tree which gives rubber; the plant coca from which cocaine, the painkiller is extracted.
- The wildlife consists mostly of tree-top dwellers like monkeys, birds, insects and spiders. There are snakes and giant pythons called anacondas, ant eaters and armadillos; crocodiles and alligators in the marshes.

2. Summer rain climate on the eastern side within the tropics

- These are regions of summer rain brought by the trade winds. The Warm Brazil Current increases the rain.
- The rest of the year is dry.

Campos

- North of the Equator along River Orinoco they are called **llanos** and in the Brazillian highlands south of the Equator they are known as **campos**.

The Gran Chaco

This lies between the Brazilian Highlands and the Andes. Being for inland, the trade winds lose their moisture. There is very little rainfall.

3. The Pacific Coastlands

Between the Andes and the Pacific Ocean lies the long narrow plain which passes through the following regions.

- The northern part of this plain lies in Colombia. There are equatorial forests and swamps.
- In Peru and Northern Chile is the Atacama Desert. The Andes block the trade winds from bringing rain. The Cool Peru Current adds to the dryness of the desert.
- In Central Chile, the plains form a fertile area enjoying the Mediterranean climate. The westerlies bring rain in winter. There is summer drought. Citrus fruits, grapes, almonds and walnuts are cultivated here.
- South of 40°S latitude lies the fiorded coast of Southern Chile.

  There is rain throughout the year from the westerly winds. The sea flows into the valleys to form a 1,000 kilometres stretch of cold, rainy islands and fiords. Evergreen temperate forests grow here. Some of the conifers like the Chilean pine are found only in South America. Some have leaves instead of needles.

Natural Vegetation

Equatorial Forest

The high temperature and heavy rainfall produce luxuriant vegetation, generally composed of broad-leaved trees is found in wet tropical uplands and lowlands around the Equator. Found in Amazon Basin and coastal lowlands of North-eastern Brazil, coastal Colombia and parts of adjoining Ecuador. Spices of rubber, mahogany, ebony, Cieba and Brazil nuts are commonly found. These forests are also called 'Selvas' lies 0° to 10° north and south.

Temperate Forests

These are characteristics by more or less continuous canopy with wide leaves, big and tall trees along with non seasonal vegetation. Warm temperate forests are found in Brazilian Highlands, Paraguay, Uruguay, Southern Brazil and cool temperate forest are found in upper slopes of Andes and S.W. Chile. Species like Beech, conifers, Parana Pines, Quebracho – source of tannic acid and Yerba mate grows here. This type of biome is found in regions where there is cold winter and warm summer. Regions with such climate are common in the mid-latitudes, far from both the equator and the poles. Temperate forests are almost always made of two types of trees, deciduous and evergreen.

Mediterranean Forests

These are characterized by dry summers and rainy winters, generally composed of broadleaf trees. Evergreen laurels and acacias are found in wetter areas where as thorny shrubs and cacti are found in drier north. They are vulnerable to

degradation by human activities such as logging, overgrazing, conversion to agriculture, urbanization, and introduction of exotic and invasive species as the region is semi-arid, and often have poor soils. Fire, both natural and human-caused, has played a large role in shaping its ecology

Savanna Grasslands

These are widely spaced, scattered trees, tall grass, found in Orinoco basin, Paraguay, northern Argentina and Brazil. Chief species like Acacias, tall coarse grass and patches of scrub are found in drier areas whereas shorter grass in wetter areas. Savanna spreads over Cerra do, Brazil in the lower latitudes. This particular biome falls in between a grassland and a forest region. There are actually two very different seasons in savanna; a very long dry season (winter), and a very wet season (summer).

Pampas

These are large treeless plains with large grasslands areas. It is also known as temperate grasslands. Countries like Argentina (provinces of Buenos Aires, La Pampa, Santa Fe and Córdoba), most of Uruguay and the southern most states of Brazilian cover this region. Small plants such as grasses flourish, and trees are rare. These are fertile South American lowlands where pastoral and farming is done.

Desert vegetation

Desert habitat area have adapted to its dry, hot extremes by using both physical and behavioral mechanisms. They often have few or no leaves. It found in arid areas of Atacama desert, Sertao arid region of N.E. Brazil and N.W. Mexico (Sonora and Baja deserts). Lichens, acacia, scrub and Cacti are vegetation covers mostly found here.

AUSTRALIA AND OCEANIA

Extent

Thousands of islands combine to form Oceania region mostly covering the Central and South Pacific Ocean. The region is dominated by world's biggest island and two other major landmasses, micro-continent of Zealandia (includes New Zealand) and the western half of the island of New Guinea, made up of the nation of Papua New Guinea. Oceania also includes three island regions: Melanesia, Micronesia, and Polynesia (including the U.S. state of Hawaii). It stretches from the Strait of Malacca to the coast of Americas. Tropic of Capricorn divides it into almost two halves.

- Australia is the world's **largest island** and **smallest continent**.
- It is the only nation that completely covers a continent.
- Its total area is nearly double that of India and Pakistan combined.
- It lies entirely in the Southern Hemisphere and is aptly named - *Austral* meaning south.
- It is located between the Indian and Pacific Oceans, stretches west to east from 114°E longitude to 154°E longitude and from 10°S to 40°S latitude.
- The Tropic of Capricorn cuts the continent almost into half.
- Asia is the continent nearest to Australia.
- The nearest point on the mainland of Asia is Singapore
- To the west of Australia, Indian Ocean, to the south, the icy shore of Antarctica to the south-east is New Zealand. To the north-west is the continent of Asia.

Physical Divisions

Australia is the most levelled and lowest of all the continents. There are no high mountains, deep valleys or large rivers. Mount Kosciusko 2,230 metres above sea level, is the highest peak. The coastline is very smooth with no inlets except in the south. So there are very few good harbours. As a smallest confinent Australia has no prominent physical division. yet efforts have been made to divide it roughly into four categories, such as:

Eastern Highland

This is a chain of hills and mountains which interrupts the levelled land form of Australia. These are also known as great Dividing Range.

The Great Dividing Range

- It is, also known as the Easter Highlands, is Australia's most substantial mountain range. The range stretches more than 3500 km from the northeastern tip of Queens land, running the entire length of the eastern coastline through New South Wales, then into Victoria and turning water, before finally fading into the central plain at the Grampians in western Victoria.
- The Great Dividing Range does not consist of a single mountain range. It consists of a complex of mountain ranges, plateau, upland areas and escarpments with an ancient and complex geological history.
- The crest of the range is defined by the watershed or boundary between the drainage basins of rivers which drain directly eastward into the Pacific Ocean, and those rivers which drain into the Murray-Darling River system towards the west. In the north, the rivers on the west side of the range drain towards the Gulf of Carpentaria.

The Western Plateau

This eroded plateau has undergone the process of erosion for a quite longer period. It is characterised by several 'sinkhole' a network of underground caves which filled with water. The Western plateau is also called as the home for serveral deserts and the climate is comparatively dry owing to the cold water current of the western Australia. The series of desert in this region are:

- The ranges were originally home to Australian **Aboriginal** tribes such as the **kulin**.

Desert

- **Gibson Desert** - a central Australian desert
- **Great Sandy Desert** - a northwestern Australian desert

- **Great Victoria Desert** - the sixth largest desert in the world by area, located in south-central Australia.
- **Simpson Desert** - a central Australian desert
- **Little Sandy Desert** - a western Australian desert
- **Strzelecki Desert** - a south-central Australian desert
- **Tanami Desert** - a northern Australian desert
- **Western Desert** - a desert located in western Australia, comprising the Gibson, Great Sandy, and Little Sandy deserts.
- **Rangipo Desert** - a barren light altitude desert on the North Island Volcanic Plateau in New Zealand.

The Central Lowland

The extensive patch of plain or low land has its existence between Eastern Highlands and Western Plateau. The patch is drained by two rivers such as Murray and Darling which also facilitate the land with irrigation facility for farming and other essential activities. The area is also known as the Great Artesian Basin as it is covered by a number of underground pressurized wells from which the water comes out automatically to the surface. Yet they are not suitable for drinking as they are salty by nature.

The Great Barrier Reef

- This is the largest coral reef in the world.
- It lies along the east coast of Queensland, Australia, in the Pacific Ocean.
- It is about 2,000 kilometres long, in some places it is as close as 16 kilometres to the coast while in other places it is 200 kilometres away.
- It is one of the natural wonders of the world.
- It is formed by the tiny coral **polyps**.

The Islands

The islands situated surrounding the younger most continent in size is collectively known as Oceania. Broadly it has been divided into three major island groups Melanesia, Micronesia and Polynesia.

Melanesia is otherwise known as Black Islands and congregated around north and east of Australia. Some of the major islands are East Timor, Fiji, New Caledonia, Papua New Guinea, Solomon Islands, and Vanuatu.

Micronesia which is also called as Little Islands is the agglomeration of islands such as Guam, Kiribati, Marshall Islands, Federated States of Micronesia, Nauru, Northern Mariana Islands, Palau and Wake Island

Polynesia otherwise known as Many Lands which expand from islands of Midway in the north to New Zealand in south and include the series of islands such as American Samoa Cook Islands, French Polynesia, Niue, Pitcairn , Tokelau, Tonga, Tuvalu, Wallis and Futuna Islands.

The islands of Ocenai have been formed due to differential activities of volcanoes. The low islands of Micronesia have been formed by building up coral reefs on the rim of volcanic island, hence giving it a shape of a Ring which is known as Atolls. The atolls further encircles the lagoons which are characterised by shallow pools of clear water at a very low altitude of just few feet above sea level.

Drainage System

- Australia has low average rainfall.
- Being a hot dry country the rate of evaporation is high. So there is very little water left to flow as river to the sea.
- As a result of this the total dustrian continent is mainly drained by two of the largest drainage barins Murray and Darlias and an inland lake in also found which is knwon as lake Eyre Basin. Which accounts an area for over 1 million square kilometre.
- River Murray starts from the Snowy Mountains of the Great Dividing Range.
- Its tributaries are the Darling, Murrumbidgee and Lachlan. Many dams have been built across these to provide for irrigation and power generation.
- River Swan near Perth is also utilized in the same way.

Climatic zones

There are generally four types of wind prevail over Australian continent through out the year which affect the climate of the little continent to a large extent.

Seasonal change in the Temperate Zones

The coastal hinterland of New South Wales, much of Victoria, Tasmania, the south-eastern corner of South Australia and the south-west of Western Australia are contributing the temperate zones where the seasonal changes are as follows

- **Summer:** December to February
- **Autumn:** March to May
- **Winter:** June to August
- **Spring:** September to November

The two similarly affected areas to that of temperate zones are:

- **The temperate grassland** that surrounds the arid and semi-arid desert areas in the centre and gradually percolates into the area north of Alice Springs in the Northern Territory.
- **Desserts** are the arid and semi arid areas of the centre of the continent which stretch across the vast amount of South Australia and Western Australia.

Seasonal change in the Tropical Zones

There are three climatic zones in the tropical areas of Australia:

- **Equatorial** – the tip of Cape York and Bathurst and Melville Islands north of Darwin.
- **Tropical** – across northern Australia including Cape York, the Top End of the Northern Territory, land south of the Gulf of Carpentaria, and the Kimberley region.
- **Sub-tropical** – the coastal and inland fringe from Cairns along the Queensland coast and hinterland to the northern areas of New South Wales and the coastal fringe north of Perth to Geraldton in Western Australia.

  These above mentioned areas experience two exactly opposite spell of season *i.e.* wet and dry seasons.

  The wet season is otherwise called as the monsoon season, which lasts about six months, between November and March. The temperature ranges between 30 and 50 degrees Celsius and comparatively it is hotter than the dry season because of the high humidity during the wet, which is caused by large amounts of water in the air. It is also marked by heavy rainfall which leads to frequent flooding.

  The dry season lasts about six months, usually between April and October. Temperatures are lower and the skies are generally clearer during the dry. The average temperature is around 20 degrees Celsius.

Natural Vegetation

Downs

- The temperate grassland of Australia known as **downs** is found in the Murray-Darling basins of South Eastern part.
- They are largely used for pastoral activity.
- Cultivation is profitably done in the down areas where Mitchel grasses grown.
- The Mitchel grasses grow even on the cracking clay soils, basaltic soils, and even on skeletal soils.
- Similarly Canterbury grassland is found in New Zealand.

The tropical Rain forest island regions

These are home to dense forests with coconut palms and mangroves growing nearer the shorelines. High temperatures throughout the year with very little rainfall.

The deciduous forest region

It has a wealth of plant life and includes tall and short trees, shrubs, small plants and mosses. Four distinct seasons with warm summers and cold, wet winters. The trees shed their leaves in autumn.

Savanna

Very high temperatures all year and rain during the summer season only.

The dry desert and desert scrub region

It is home to the eucalyptus as well as those plants that can survive the arid conditions like *cactii*. Warm to high temperatures with very little rainfall. Hot summers and cold winters with above average rainfall.

The varying climate of Australia is largely dependent its size. The temperature ranges below zero in the Snowy Mountains in southern Australia to extreme heat in the Kimberley region in the north-west of the continent. Different climatic zones are characterized by distinct climatic phenomena with prominent seasonal changes

Four prominent seasons such as Summer, Autumn, Winter, and Spring are experienced in the Temperate zone, Desert and the Grassland climatic zones but drastically it has changed to wet and dry seasons in the tropical north of the continent which includes the Equatorial, Tropical and sub-tropical zones.

EUROPE

Size

- Europe is the **second smallest** continent, the smallest being Australia.
- Its area, including the islands around the coast, is about 10 million square kilometers.
- It is roughly three times the size of India and smaller than China.

Location

- A large part lies in the temperate zone as it stretches from 35°N to 80°N latitude.
- Longitudinally, it stretches from 10°W to 60°E
- The Prime Meridian, passes through London.
- In the north, though it stretches into the Arctic Circle, the Warm Gulf Stream keeps the ports ice free.
- The broad continent shelf on its west provides good fishing grounds and there are sheltered harbours along the indented coastline.
- It has the longest coastline in proportion to size.

Boundaries

- To the east, it is separated from Asia by the Ural Mountain, Caspian Sea, Caucasus Mountain and Black Sea.
- To the south is the Mediterranean Sea. The Agean Sea and Adriatic Sea are two of its branches.
- To the west, is the Strait of Gibraltar separating Europe from Africa and joining the Mediterranean to the Atlantic Ocean. The Bay of Biscay, English Channel and North Sea are pars of the Atlantic Ocean.
- Baltic Sea with two branches - Gulf of Bothnia and Gulf of Finland is an inlet in the north. The Arctic Ocean to the north has a bay called the White Sea.
- The peninsula of Greece, known as the Balkan Peninsula and Italy extend into the Mediterranean Sea.
- In the south-west, is the Iberian Peninsula which is made up of Spain and Portugal.
- In the north-west, is the Scandinavian, Peninsula consisting of Norway and Sweden.

Physical Divisions

The physical features of Europe are divided into four contrasting regions:

Western Upland

It is also known as the Northern Highlands, delineate the western edge of Europe and define the physical landscape of Scandinavia (Norway, Sweden, and Denmark), Finland, Iceland, Scotland, Ireland, the Brittany region of France, Spain, and Portugal. These landforms are result of glaciations of hard rock in the ancient times. Distinct physical features such as marshlands, lakes, and fjords have been emerged with the recession of glaciers form the highland areas. The famous Norwegian Fjords which are Lyse fjord, the Geiranger fjord.

North European Plain

It is the extensive low land spread along the bank of various mighty rivers such as Rhine, Weser, Elbe, Oder and Vistula. These river valleys are favourable for growing seasonal crops. It covers all most half of the Europe. Bordered by Baltican White sea from north and Black and Azov from south the plain is gradually narrowed down towards west. the northern part of the land is characterized by diversified glacial landforms such as Pipet Marshland, Valdai hills of western Russia, glacial lakes etc.

Central Uplands or Plateau

These are the collection of distinctive landscape of summits, steep slopes, valleys and depression which stretches across the central Europe. It extends from Belgium in the East to France in the West and from Czech Republic and south Germany in south to Switzerland and Austria in North. Except some river valleys such as like Rhine, Rhone, Elbe, and Danube river valleys all other areas of this division is sparsely populated.

Alpine Mountain Systems

These are located in south-central Europe, immediately north of the Mediterranean Sea. They extend for almost 700 miles

in a crescent shape from the coastline of southern France (near Monaco) into Switzerland, then through northern Italy and into Austria, and down through Slovenia, Croatia, Bosnia and Herzegovina, Serbia and Montenegro - then ending in Albania on the rugged coastline of the Adriatic Sea.
The highest point is Mont Blanc at 15,771 ft. (4,807m).

Mountains

The Ural Mountains

- These mountains separate Asia from Europe in athe east
- From north to south, these are 2,200 km long and 80-120 km broad with many parallel valleys.
- Though their average height is 300 m yet their highest peak is about 1,638 m high.

The Scandinavian Mountains

- The Scandinavia consists of Norway, Sweden and Denmark.
- In fact Scandinavia exists or *fenno-Scandia* which continues into the east through Finland to *Kola Peninsula* in Russia.

The Old Mountain Blocks

- These are *Hercynian* and *Caledonian* mountain chains.
- In the west the *Meseta of Spain,* the *Central Plateau of France,* the Britanny Peninsula, the Rhine Upland, the Block Forest, Vosges, Bohemian Plateau and Rhodope Mt etc, are examples of these old mountains.

The Alpine Mountain Ranges

- The highest peak is (Mount Blanc 5,000 m).
- The mountain range runs in many branches.
- The main ones are the Alps, the Carpathians, the Balkans, the Caucasus etc.
- Another branch is the Apennines (Italy, the Atlas (Africa and the Sierra Nevada Spain).
- Still another branch is the Dinaric and the Pindus mountain (Yugoslavia and Greece) and enters through the Crete island into Asia.

The Pyrenees

- The Pyrenees are half as long and broad as the Alps and separate broadly France from Spain.
- The highest peak is Pice de Aneto (3,404 m).

Islands of Europe

As surrounded by number of seas from all sides, Europe is an island rich continent. British Isles is the largest and the most important group of islands consisting of England, Scotland and Ireland. Some of the major islands of these groups are:
England consists of Isle of Wight, Isle of Sheppey, Hayling Island, Foulness Island, Portsea Island,Canvey Island, Mersea **Island**, Walney Island, Wallasea Island, Lundy, Isles of Scilly. Ireland is famous for Achill Island, Aran Islands, Rathlin Island.
Scotland has two prominent groups of Islands.
The islands of main archipelago consists of Shetland, Orkney, Outer Hebrides, Inner Hebrides, Islands of the Clyde, Islands of the Forth, Outlying islands and
Larger islands are Lewis and Harris, Skye, Mainland, Shetland, Mull, Islay. Jura, Arram, South and North Uist and south Uist.

Deserts

- **Halendi** - a region of Iceland and Europe's largest desert.
- **Bedowska Desert** - a desert located in Lesser Poland Voivodeship, Poland.
- **Deliblatska Peseara** - a desert located in Voivodina and Serbia.
- **Oltenian Sahara** - a desert spanning approximately 80000 hectares or 800 km^2 in the Romanian historical province of Oltenia.
- **Tabernad Desert** - a desert in Almeria, Spain.

Drainage Pattern

- The rivers of Europe are perennial being fed by melting snow or by the rain brought by the Westerlies.
- Many of them have their origin in the Alps.
- Rivers that flow into the Mediterranean Sea are Rhone (France) and Ebro (Spain).
- River Po of Italy flows into the Adriatic Sea.
- The Danube, Dnieper and Don flows into the Caspian Sea.
- Rivers that flow into the Atlantic Ocean are - Guadalquivir (Spain), Tagus and Douro (Portugal), Loire and Seine (France), The Rhine Weser and Elbe (Germany)
- Many rivers flow into the Baltic Sea.
- Thames, the chief river of England, flows into the English Channel.
- The Rhine and Danube are international rivers because they pass through many countries.
- The Rhine starts from the Alps in Switzerland and flow northwards through Germany and enters the sea through Holland. It passes through heavily industrialized regions and is used for transporting heavy goods. It is the busiest waterway of Europe. Rotterdam, the largest part of Europe, is on its delta.
- The Danube is also an international river. It rises from the Alps in Germany and flows through Australia, Hungary, Serbia and enters the Black Sea in Romania. It is not as important as the Rhine for international trade because the Black Sea in the interior.

Important Rivers of Europe

Rivers	Length in km	Draining into (Tributary of)
Volga	3,692	Caspian Sea
Danube	2,860	Black Sea
Ural	2,428	Caspian Sea
Dnieper	2,290	Black Sea
Pechora	1,809	Barents Sea
Don	1,950	Sea of Azov
Kama	1,805	Caspian Sea (Volga)
Nothern Dvina-Vychegda	1,774	White Sea
Oka	1,500	Caspian Sea (Volga)
Belaya	1,430	Caspian Sea (Kama)
Dniester	1,362	Black Sea
Rhine	1,236	North Sea

Elbe	1,091	North Sea
Donest	1,050	Black Sea (Don)
Vistula	1,047	Baltic Sea
Tagus	1,038	Atlantic Ocean
Daugara	1,020	Baltic Sea
Loire	1,013	Atlantic Ocean
Tisza	976	Black Sea (Danube)
Prut	953	Black Sea (Danube)
Sava	940	Black Sea (Danube)
Neman	937	Baltic Sea
Meuse	925	Noth Sea
Ebro	910	Mediterranean
Douro	897	Atlantic Ocean
Kuban	870	Sea of Azov
Mezen	857	Barents Sea
Oder	854	Baltic Sea
Rhone	813	Mediterranean
Seine	776	Atlantic Ocean

Gulfs and Bays

These are the parts of large water bodies which are adjacent to a massive land may it be continents or countries which are of economic importance for any human civilization, As Europe is surrounded by number of large water bodies such as Mediterranean Sea, Black Sea, North Sea etc. there are a lot of Gulfs, Bay and straits.

- **The Gulf of Finland** is situated in the eastern most arm of the Baltic Sea and extends between Finland (to the north) and Estonia (to the south) all the way to Saint Petersburg in Russia, where the river Neva drains into it. Other major cities around the gulf include Helsinki and Tallinn. The eastern parts of the Gulf of Finland belong to Russia, and some of Russia's most important oil harbours are located farthest in, near Saint Petersburg.
- **The Gulf of Bothnia** situated at the northern most part of Baltic Sea and bordered by Sweden at its western side and Finland at eastern side.
- **The Gulf of Riga** is a brackish water body which is considered as a sub-basin of the Baltic Sea. The areal extent of the Gulf of Riga is approximately 16,300 km². It is also called as the Bay of Riga which is a very shallow water sea with a maximum depth of 67metres.
- **The Gulf of Lions** extends from the easternmost spurs of Pyrenees and covers various lagoons, the Rhone River delta, limestone hills of Marseille. It's an embayment of the Mediterranean coast line of Languedoc-Roussillon and Provence in France,

Climate

- Europe has a mild climate with moderate rain through out the year.
- Some places are close to the sea and some are located in the centre of Eurasia.
- There are plains on the windward side and plateaus on the leeward side of mountains.
- The southern parts stretch to the south of the 40°N latitude and face desert winds blowing from the Sahara across the Mediterranean Sea.
- The northern parts lie within the Arctic Circle and are close to the North Pole.
- Temperature decreases from south to north because the south is closer to the Equator and has a lower latitude.
- The Mediterranean lands are warmer than the Arctic lands.

Gulf stream plays a major role in the climatic fluctuation over the Western Europe as it provides warming effects during winter. It is otherwise known as North Atlantic Drift which increases the temperature of coastal Europe.

On the other hand Siberian high brings colder and drier weather from the west.

The Danube region through the Balkan, Ukraine and southern part of Russia experience a continental climate.

Natural Vegetation

- Natural vegetation depends on the temperature and rainfall of that place.
- In Europe, the original vegetation has been cleared to make place for agriculture and development of industries and cities.
- Only in inhospitable places like the tundra and taiga we can see the natural vegetation.

Natural Vegetation are:

1. **Deciduous and Mixed Forest**
   - The trees of the Great European Plain are mostly deciduous.
   - They have hardwood and broad leaves which fall in autumn.
   - Elm oak beech and ash are some of the trees.
   - Some evergreen coniferous trees are found scattered. Hence they are called **mixed forests**.
   - The Black Forest of Germany and the Bavarian Hills are protected areas.
   - The Pyrenees and some highlands still have original forest cover.
2. **Taiga**
   - This is Russian name for evergreen coniferous forests.
   - Like North America, this belt stretches right across Eurasia.
   - The trees are evergreen, can withstand the intense cold and lack of water.
   - Pine, spruce, fir and larch are the chief types.
3. **Tundra**
   - In Lappland to the north of Norway, Sweden and Finland are the ice deserts.
   - Moses and lichens grow throughout the year and even under the ice in winter.
   - In summer, short grasses start growing.
4. **Steppes**
   - South of the East European mixed forests stretch vast grasslands called the *steppes*.
   - They are temperate grasslands similar to the prairies of North America.

5. **Maquis**
   - The vegetation around the Mediterranean Sea consists of drought resisting evergreens.
   - They do not need to shed their small leaves because the waxy coating holds back moisture in summer and the moist winter in the season of limited growth.
   - The trees are stunted and grow far apart.
   - This sparse woodland is called 'maquis' in Southern France.
   - The olive is the most typical tree of the region.
   - Cork oak, cypress, walnut; almond and cedar the only conifer, are some of the others.
   - Olives, citrus fruit and grapes are of great commercial value.
   - This is the 'fruit basket' of the western world.

ANTARCTICA

Location

- To the south of India, beyond the Indian Ocean lies the frozen continent of Antarctica.
- The name means *opposite the Arctic*.
- It is the southernmost continent and lies entirely within the Antarctic Circle spread around the South Pole.
- It separated from the rest of world by the icy waters of the Southern Ocean which comprises of the southern portions of the Indian, Atlantic and Pacific Oceans.
- Its area is over 14 million square kilometers.
- It is the fifth largest continent.
- It is larger than Europe and is twice the size of Australia.
- The continent is a high plateau which is frozen throughout the year.
- There is no coastal plain.
- There are mountain ranges, peaks, a rift valley and volcanoes.
- Two broad inlets, the Weddel Sea and the Ross Sea and the Trans-Antarctic Mountains which cross the entire continent divide the land into **West Antarctica** and **East Antarctica**.
- The former faces the Pacific Ocean. The Antarctic Peninsula points towards south America. It is the continuation of the Andes Mountain range.
- The latter, East Antarctica, faces the Atlantic and Indian Oceans, Mount Erebus, an active volcano, is actually of the Ross Sea.
- It is the only continent that is completely covered by permanent ice and snow hence it is known as the **white continent**.
- In some places its ice cap is 4,000 metres deep.
- The valleys between the mountain ranges are dry, windy, frozen and barren and strangely called **oases**.

Climate

- The climate of Antarctica is frozen cold because of its distance from the Equator and because of the great height of the plateau.
- In the winter months of May, June and July the sun never rises and the temperature at the South Pole falls to minus 90°C.
- In the summer months of December, January and February, the sun never sets and there continuous daylight. The summer temperature is about 0°C.
- Extremely cold and icy winds blow throughout the year.
- There is a marked difference between the summer and winter temperatures.
- There is also a vast difference between the temperatures of the continental interior.
- Most parts of the continent is dry with an average of 5 centimetres of rain annually.
- Antarctica is a cold desert.
- Mosses and lichens which cling to rocky slopes are found along the coast.
- There are scattered clumps of coarse grass and flowering plants in a few places where the climate is mild.

Aurora

- In winter, there is continuous night for 3 months in the polar regions. Curtains of brilliant coloured lights appear on these dark nights. They are caused by magnetic storms in the upper atmosphere. They are called **Aurora Australis** in the south and **Aurora Borealis** in the north.

Minerals

- Scientific studies have shown Antarctica to be rich in gold, platinum, nickel, copper and petroleum.
- But by the international Agreement this continent is to be used only by the scientists to study the climate of the Earth and the origin of its crust.
- About 70 per cent of the Earth's supply of fresh water can be extracted from the ice-caps of Antarctica.

Expeditions of Antarctica

- In 1912, a dramatic contest to reach the South Pole was held by two teams. The British team was led by Captain Robert F. Scott and the Norwegian team by Roald Amundsen.
- The five British men reached the pole only to find the Norwegian flag flying at the South Pole. They had been beaten by 34 days.
- **Indian expedition** to Antarctica had a 21 member team with Dr. S. Z.Quasim as its leader. It left from Goa on the 6th December, 1981, and landed on the frozen continent on 9th January 1982.
- They set up a scientific station called **Dakshin Gangotri** laid plans for a second base called **Maitri** and named a point **Mount Indira**.
- They left automatic weather recorders powered by solar batteries at the stations.
- South Pole is 2,250 kilometres away from Dakshin Gangotri.

Exercise -1

1. Which one of the following straits is nearest to the International Date Line?
   (a) Malacca Strait (b) Bering Strait
   (c) Strait of Florida (d) Strait of Gibraltar
2. Itaipu Dam built on the river Parana is one of the largest dams in the world. Which of the following two countries have this as a joint project?
   (a) Brazil and Peru (b) Paraguay and Ecuador
   (c) Brazil and Paraguay (d) Colombia and Paraguay
3. Other than India and China, which one of the following groups of countries border Myanmar?
   (a) Bangladesh, Thailand and Vietnam
   (b) Cambodia, Laos and Malaysia
   (c) Thailand, Vietnam and Malaysia
   (d) Thailand, Laos and Bangladesh
4. Which one of the following lakes forms an international boundary between Tanzania and Uganda?
   (a) Chained (b) Malawi
   (c) Victoria (d) Zambezi
5. Which one of the following countries of Africa finds a place in high human development category of UNDP?
   (a) South Africa (b) Kenya
   (c) Zimbabwe (d) Mauritius
6. The ports on either end of the Suez canal are
   (a) Cairo and Alexandria
   (b) Suez and Cairo
   (c) Cairo and Port Said
   (d) Port Said and Suez
7. Which one of the following town is located in the New England state of the USA?
   (a) Boston (b) Chicago
   (c) Milwauki (d) St. Paul
8. Most industrialized country in ASEAN is
   (a) Philippines (b) Thailand
   (c) Malaysia (d) Singapore
9. Which one of the following is the most industrialized country of Latin America?
   (a) Brazil (b) Chile
   (c) Colombia (d) Argentina
10. Which of the following is the lowest point of Africa?
    (a) Lake Assal (b) Lake Tangunjika
    (c) Lake Malawi (d) Lake Chad
11. Which is the shortest route from Moscow to San Francisco?
    (a) via Canada (b) over land
    (c) over the South Pole (d) over the North Pole
12. Which three continents have the largest areas of coniferous forest ?
    (a) Australia, Europe and South America
    (b) Asia, North America and Europe
    (c) North America, South America and Europe
    (d) Asia, Australia and South America
13. Which one the following port cities in Venezuela has been developed as an oil port?
    (a) Caracas (b) Maracaibo
    (c) Maracay (d) Carupano
14. In which part of the world would you find the Veld ?
    (a) Argentina (b) Australia
    (c) Central Europe (d) South Africa
15. The satellites of which one of the following countries have helped in the preparation of a detailed and complete map of Antarctica?
    (a) Canada (b) France
    (c) Russia (d) U.S.A
16. Which one of the following countries is the leading producer of Uranium?
    (a) United States of America
    (b) Canada
    (c) Germany
    (d) Zambia
17. Which one of the following countries has replaced Italy as the major importer of bauxite from India?
    (a) Canada (b) Greece
    (c) Ukraine (d) United Arab Emirates
18. Grand Banks is one of the important producers of
    (a) Nitrate (b) Iron ore
    (c) Marine fish (d) Bauxite
19. Plantation agriculture is most widespread in
    (a) Nile valley (b) Mississippi valley
    (c) California (d) Caribbean
20. The largest iron-producing region of USA is
    (a) North East Appalachian region
    (b) Alabama state
    (c) Western region
    (d) Lake Superior region
21. Which one of the following cities in USA is a steel manufacturing centre?
    (a) New York (b) Rochester
    (c) Chicago (d) Dallon
22. Port Stanely is the capital of the
    (a) West Indies
    (b) Falkland Island
    (c) Hawaii Island
    (d) Madagascar (Nayalgasey)
23. Which one of the following is the characteristic climate of the Tropical Savannah Region?
    (a) Rainfall throughout the year
    (b) Rainfall in winter only
    (c) An extremely short dry season
    (d) A definite dry and wet season
24. In the tropical zone of Africa the sequence of climates on both sides of the equator is
    (a) rainy tropical, monsoon tropical, semi-arid tropic, arcid tropic
    (b) rainy tropical, semi-arid tropic, arcid tropic, monsoon tropical
    (c) rainy tropical, semi-arid tropic, monsoon tropical, arid tropic
    (d) monsoon tropical, rainy tropical, semi-arid tropic, arid tropic

25. Which one of the following countries does not border Mediterranean Sea ?
(a) Malta (b) Libya
(c) Italy (d) Bulgaria

26. The wet forest of the Amazon basin are known as which one of the following ?
(a) Campos (b) Lianos
(c) Pampas (d) Selves

27. Which one of the following is a land-locked country?
(a) Angola (b) Mozambique
(c) Namibia (d) Zimbabwe

28. In which one of the following regions of the world, are the grasslands called Campos found ?
(a) Brazil (b) China
(c) Eurasia (d) North America

29. Savanna natural region is characterized by which one of the following?
(a) A distinct wet and dry season with annual range of temperature between 3°C – 8°C
(b) Broad-leaf evergreen forests and grasses
(c) Uniformly high temperature throughout the year
(d) No spatial variation in mean annual rainfall

30. Which forests lie in the Amazon Basin in South America?
(a) Montane forests
(b) Tropical rain forests
(c) Wet deciduous forests
(d) Subtropical mixed forests

31. Which one of the following is the busiest ocean route in the world?
(a) Mediterranean Suez Route
(b) South Atlantic Route
(c) North Atlantic Route
(d) Pacific Ocean Route

32. The sea of Okhotsk is enclosed by the Kurille Islands, Northern Japan and a long peninsula. What is the name of this peninsula?
(a) Kamachatka (b) Sakhalin
(c) Hokaido (d) Korea

33. Which of the following two gulfs are connected by Hormuz Strait?
(a) Persian Gulf—Gulf of Oman
(b) Persian Gulf—Gulf of Aden
(c) Gulf of Aden—Gulf of Oman
(d) Persian Gulf—Gulf of Aquaba

34. The Kiel canal connects
(a) Caribbean sea and Pacific Ocean
(b) Bering sea and Chukchi sea
(c) Red sea and Mediterranean sea
(d) Baltic sea and North sea

35. Which of the following is the highest mountain peak of the U.S.A.?
(a) Albert (b) Kilauea
(c) Mauna Lao (d) Mc kinley

36. The water fall 'Victoria' is associated with the river.
(a) Amazon (b) Missouri
(c) St. Lawrence (d) Zambezi

37. Which one of the following volcanoes is called the Light House of the Mediterranean?
(a) Etna (b) Vesuvius
(c) Kilimanjaro (d) Stromboli

38. Mount Fujiyama, the highest point in Japan is in
(a) Hokkaido (b) Kyushu
(c) Shikoku (d) Honshu

39. The correct sequence of languages in descending order in terms of their number of speakers in the world is
(a) Spanish, English, Chinese, Hindi
(b) English, Chinese, Hindi, Spanish
(c) Hindi, Chinese, Spanish, English
(d) Chinese, English, Hindi, Spanish

40. Which one of the following pairs is not correctly matched?
(a) Davis strait — Baffin Sea and Atlantic Ocean
(b) Dover strait — Arctic Sea and N. Atlantic Ocean
(c) Palk strait — Mannar Gulf and Bay of Bengal
(d) Sunda strait — Java Sea and Indian Ocean

41. The correct decreasing order of the population of the various continents is
(a) Asia, Europe, America, Africa, Australia.
(b) Asia, America, Europe, Africa, Australia.
(c) Asia, Eruope, Africa, America, Australia.
(d) Asia, America, Africa, Europe, Australia.

42. Which one of the following is not correctly matched?
(a) Duluth — Lake Superior
(b) Detroit — Lake Huron
(c) Chicago — Lake Michigan
(d) Ottawa — Lake Ontario

43. Which of the following pairs of straights and the countries they separate is wrongly matched?
(a) Gibraltar strait — Spain and Morocoo
(b) Bering strait — Sumatra and Malaysia
(c) Magellan strait — Chile and Tiera del fuego
(d) Bass strait — Australia and Tasmania

44. Currently half of the world's population lives in just six countries. Identify them from the following.
(a) India, China, Pakistan, Brazil, Bangladesh, Indonesia.
(b) India, China, Brazil, Pakistan, Bhutan, United State.
(c) China, India, United State, Indonesia, Brazil, Pakistan.
(d) China, India, Bangladesh, United State, Pakistan, Brazil.

45. Which of the following is not correctly matched?
(a) Indonesia — Jakarta
(b) Maldives — Male
(c) North Korea — Seoul
(d) Zimbabwe — Harare

46. Which one of the following 'City River' pairs is not correctly matched?
(a) Berlin — Rhine
(b) London — Thames
(c) New York — Hudson
(d) Vienna — Danube

47. Which one of the following pairs is correctly matched?

Geographical Feature		**Region**
(a) Abyssinian Plateau	:	Arabia
(b) Atlas Mountains	:	North-Western Africa
(c) Guiana Highlands	:	South-Western Africa
(d) Okavango Basin	:	Patagonia

48. "Climate is extreme, rainfall is scanty and the people used to be nomadic herders."
The above statement best describes which of the following regions?
(a) African Savannah
(b) Central Asian Steppe
(c) North American Prairie
(d) Siberian Tundra

49. Which of the following straits is not in Asia?
(a) Malacca Strait (b) Bass Strait
(c) Formosa Strait (d) Molucca Strait

50. Which of the following seas/gulfs are connected by the Suez Canal?
(a) The Mediterranean Sea and the Red Sea
(b) Gulf of Oman and the Red Sea
(c) The Mediterranean Sea and the Gulf of Oman
(d) Persian Gulf and the Arabian Sea

51. The broken hills famous for zinc and lead are located in
(a) Turkey (b) France
(c) Germany (d) Australia

52. Climate change resulting in the rise of temperature may benefit which of the countries/regions?
(a) South Africa
(b) East Indies islands comprising of Java, Sumatra and Borneo
(c) The Western coasts of South America
(d) Russia and Northern Europe

53. Which one among the following is not a landlocked country in Africa?
(a) Botswana (b) Zambia
(c) Lesotho (d) Nigeria

54. Savanna natural region is characterized by which one of the following?
(a) A distinct wet and dry season with annual range of temperature between 3°C – 8°C
(b) Broad-leaf evergreen forests and grasses
(c) Uniformly high temperature throughout the year
(d) No spatial variation in mean annual rainfall

55. Which forests lie in the Amazon Basin in South America?
(a) Montane forests
(b) Tropical rain forests
(c) Wet deciduous forests
(d) Subtropical mixed forests

56. The Victoria Falls in Africa is located on which river?
(a) Zaire (b) Orange
(c) Zambezi (d) Niger

57. Mount Merapi is located on which one of the islands?
(a) Java (b) Sumatra
(c) Borneo (d) Celebes

58. In which one of the following region are the Andes mountains located?
(a) East Europe (b) West Europe
(c) South Africa (d) South America

59. Temperature and rainfall of a meteorological station are given below:

	Temperature (0°C)	Rainfall (cm)
J	9.4	12.2
F	10.6	9.1
M	11.7	7.9
A	12.2	2.5
M	13.3	1.0
J	13.9	0.3
J	13.9	-
A	14.4	-
S	15.6	0.8
	15.0	2.5
N	13.3	6.1
D	10.6	11.7

Average temperature: 12.8°C
Average rainfall: 54.9 cm per annum
Identify the region having the above climatic patterns from amongst the following:
(a) Mediterranean region
(b) Monsoon region
(c) Steppe region
(d) N.W. European region

60. Claims to the historical Macedonian territory have been a bone of contention between which of the following countries?
(a) Portugal and Spain (b) Bulgaria and Greece
(c) Romania and Bulgaria (d) Portugal and Greece

61. Through which one of the following Straits, does a tunnel connect the United Kingdom and France?
(a) Davis Strait (b) Denmark Strait
(c) Strait of Dover (d) Strait of Gibraltar

62. The largest coral reef in the world is found near the coast of which one of the following countries?
(a) Australia (b) Cuba
(c) Ghana (d) Philippines

63. A class of animals known as Marsupials is a characteristic feature of
(a) Africa (b) Australia
(c) South America (d) South-east Asia

64. The Great Barrier Reef is broken in gaps due to
(a) outpouring of river water into the sea
(b) wave action
(c) oceanic currents
(d) tropical cyclones

65. Outside the Mediterranean region, where else is a Mediterranean climate found ?
(a) The Japanese and Chinese coasts
(b) The southern coast of Australia and parts of the western coast of North and South America
(c) The east coast of North America
(d) The North Atlantic coast of Africa

66. Which one of the following is the continent with the highest mean elevation in the world?
(a) Antarctia (b) North America
(c) Asia (d) South America

67. Which one of the following is the correct sequence of the given towns of Pakistan while moving from the North towards the South?
(a) Islamabad–Gujranwala–Peshawar–Multan
(b) Peshawar–Gujranwala–Multan–Islamabad
(c) Peshawar–Islamabad–Gujranwala–Multan
(d) Islamabad–Multan–Peshawar–Gujranwala

68. Which one of the following pairs is not correctly matched?
(a) Bahamas : Nassau
(b) Costa Rica : San Jose
(c) Nicaragua : Balmopan
(d) Dominican Republic: Santo Domingo

69. Which among the following has the world's largest reserves of Uranium?
(a) Australia (b) Canada
(c) Russian Federation (d) USA

70. Through which one of the following groups of countries does the Equator pass?
(a) Brazil, Zambia and Malaysia
(b) Colombia, Kenya and Indonesia
(c) Brazil, Sudan and Malaysia
(d) Venezuela, Ethiopia and Indonesia

71. Which one of the following cities is known as the Pittsburg of Japan?
(a) Kobe (b) Yuwaha
(c) Tokyo (d) Osaka

72. Intensive subsistence farming is prevalent in
(a) Canada (b) China
(c) USA (d) Ukraine

73. Baku is famous as
(a) Railway junction (b) Industrial city
(c) Fish port (d) Petroleum extracting centre

74. Ural industrial region is dominated by
(a) Textiles (b) Metal fabricating
(c) Electronics (d) Automobiles

75. The best inland waterways system is developed in
(a) Guinea coast (b) Central Europe
(c) Amazon basin (d) North America

76. Which one of the following is known as the Manchester of the East?
(a) Tokyo (b) Shanghai
(c) KualaLumpur (d) Osaka

77. Grozny is famous for the production of
(a) Petroleum (b) Uranium
(c) Gold (d) Thorium

78. Which country has the densest railway network in terms of per million people?
(a) China (b) USA
(c) India (d) Australia

79. The first three countries in order of iron-steel production in the world are
(a) USA, China, Germany
(b) Japan, USA, China
(c) Germany, China, USA
(d) Japan, Germany, China

80. Flanders industrial region is renowned for
(a) Iron & steel industry
(b) Car manufacturing
(c) Textile manufacturing
(d) Electronics

81. The third position in the manufacture of cars in the world is occupied by
(a) Japan (b) USA
(c) France (d) Germany

82. Largest producer of silver in the world is
(a) Mexico (b) USA
(c) Laos (d) South Africa

83. The main centres of ship building industry in Japan are
(a) Nagasaki and Yawata
(b) Yakohama and Wakohama
(c) Osaka and Kyoto
(d) Nagita and Issikari

84. The three leading coal producers of the world are:
(a) USA, Russia, Germany
(b) England, France, Australia
(c) France, Poland, Japan
(d) Germany, India, South Africa

85. The regions with highest and lowest densities are respectively
(a) Europe and Africa
(b) Asia and Oceania
(c) North America and Africa
(d) Europe and Oceania

86. Which of the following countries are the best examples of highly scientific development and management of pastoral farming?
(a) France and Spain
(b) Denmark and Holland
(c) Czechoslovakia and Poland
(d) Greenland and Norway

87. "From Aceh in the far north west to Torres Strait in the east 5000 miles, almost as far as from London to Baghadad. The archipelago has 14,000 islands, some mere equatorial rocks, others some of the largest in the world." This description best fits:
(a) West Indies (b) Japan
(c) Philippines (d) Indonesia

88. Which one of the following pairs is not correctly matched?

Well-known Place	Country
(a) Baikonour	Russia
(b) Kourou	French Guiana
(c) Borobudur	Indonesia
(d) Cannes	France

89. In which one of the following areas is monsoon climate found?
(a) Pacific Coast of Columbia
(b) South-Eastern United States
(c) Southern Part of South Africa
(d) Central California

90. Turkey is located between
(a) Black Sea and Caspian Sea
(b) Black Sea and Mediterranean Sea
(c) Gulf of Suez and Mediterranean Sea
(d) Gulf of Aqaba and Dead Sea

91. Which water body separates Australia from New Zealand?
(a) Cook Straits (b) Megallan
(c) Tasman Sea (d) Great Barrier Reef

92. The pacific Islands from new Guinea South East-wards to the Fiji Islands' group is called
(a) The Polynesia (b) The Mellanesia
(c) The Micronesia (d) The Autralasia

93. Which one among the following is not a Baltic nation?
(a) Lativia (b) Slovakia
(c) Lithuania (d) Estonia

94. Which one of the following mountain ranges separates Europe from Asia?
(a) Apenine (b) Black Forest
(c) Ural (d) Sulaiman

95. Which one of the following pairs is not correctly matched?
(a) Kuroshio : Warm ocean current
(b) Labrador : Warm ocean current
(c) Benguela : Cold ocean current
(d) Oyashio : Cold ocean current

96. Mr X has been invited to participate in a conference to be held at Buenos Aires. He has choosen the following shortest flight route
Mumbai to Frankfurt (non-stop)
Frankfurt to Sao Paulo (non-stop)
Sao Paulo to Buenos Aires (non-stop)
Which one of the following seas will likely to be flown over by Mr X ?
(a) Tasman Sea (b) Labrador Sea
(c) Beautfort Sea (d) Black Sea

97. Consider the following statements :
1. The Labrador current is a cold current in the North Atlantic Ocean.
2. The Falkland current is a warm current that flows along the Chile coast of South Pacific Ocean.
Which of the statements given above is/are correct ?
(a) Only 1 (b) Only 2
(c) Both 1 and 2 (d) Neither 1 nor 2

98. What is the name given to an almost circular coral reef inside which there is a lagoon ?
(a) Fringing reef (b) Barrier reef
(c) Atoll (d) Isthmus

99. In which one of the following region are the Andes mountains located?
(a) East Europe (b) West Europe
(c) South Africa (d) South America

100. The equatorial rain forest is also known as
(a) Savanna (b) Campos
(c) Selva (d) Lanose

101. In which one of the following regions of the world, are the grasslands called Campo found ?
(a) Brazil (b) China
(c) Eurasia (d) North America

102. Which one of the following pairs of islands is separated from each other by the 'Ten Degree Channel'? [CSAT 2014 - I]
(a) Andaman and Nicobar
(b) Nicobar and Sumatra
(c) Maldives and Lakshadweep
(d) Sumatra and Java

103. Turkey is located between [CSAT 2014 - I]
(a) Black Sea and Caspian Sea
(b) Black Sea and Mediterranean Sea
(c) Gulf of Suez and Mediterranean Sea
(d) Gulf of Aqaba and Dead Sea

104. Which one of the following countries of South-West Asia does not open out to the Mediterranean Sea? [CSAT 2015-I]
(a) Syria (b) Jordan
(c) Lebanon (d) lsrael

Exercise -2

Statement Based MCQ

1. What could be the main reason/reasons for the formation of African and Eurasian desert belt ?
   1. It is located in the sub-tropical high pressure cells.
   2. It is under the influence of warm ocean currents.

   Which of the statements given above is/are correct in this context ?
   (a) 1 only (b) 2 only
   (c) Both 1 and 2 (d) Neither 1 nor 2
2. Bermuda Triangle extends up to which of the following places?
   1. Southern Florida
   2. Puerto Rico
   3. Hawaii Islands

   Select the correct answer using the codes given below:
   (a) 1, 2 and 3 (b) 1 and 2
   (c) 2 and 3 (d) 1 and 3
3. Consider the following countries:
   1. Australia 2. Namibia
   3. Brazil 4. Chile

   Through which of the above does the Tropic of Capricorn pass?
   (a) 1 only (b) 2, 3 and 4
   (c) 1, 2 and 3 (d) 1, 2, 3 and 4
4. Consider the following statements :
   1. Tropical deciduous forests are found only in India, Central America and Brazil.
   2. Teak is the most important hardwood tree of tropical evergreen forests.

   Which of the statements given above is/are correct ?
   (a) 1 only (b) 2 only
   (c) Both 1 and 2 (d) Neither 1 nor 2
5. Consider the following statements :
   1. In Savanna climate, wet summers alternate with dry winters.
   2. In China type of climate, winters are very severe and summers are mild and dry.

   Which of the statements given above is/are correct ?
   (a) 1 only (b) 2 only
   (c) Both 1 and 2 (d) Neither 1 nor 2
6. Arrange the following continents in the ascending order of their areal size and select the correct answer from the codes given below:
   1. Antarctica 2. Australia
   3. Europe 4. South America
   (a) 1, 2, 3, 4 (b) 2, 4, 1, 3
   (c) 2, 3, 1, 4 (d) 1, 3, 4, 2
7. Japan is one of the leading industrial countries in the world because it has:
   1. developed hydel power
   2. large deposits of metallic mineral
   3. high technological capability
   4. insular location

   Of these statements:
   (a) 1, 2 and 4 are correct
   (b) 1, 2 and 3 are correct
   (c) 1 and 3 are correct
   (d) 2 and 4 are correct
8. Which of the following are temperate grasslands?
   Select the correct answer from the codes given below:
   1. Campos 2. Llanoes
   3. Downs 4. Pampas
   (a) 1 and 2 (b) 2 and 3
   (c) 3 and 4 (d) 1 and 4
9. Arrange the following islands of Japan in ascending order of their areal size and select the correct answer from the codes:
   1. Hokkaido 2. Honshu
   3. Shikoku 4. Kyushu
   (a) 4, 3, 2, 1 (b) 1, 2, 3, 4
   (c) 2, 4, 1, 3 (d) 3, 4, 1, 2
10. La Nina is suspected to have caused recent floods in Australia. How is La Nina different from El Nino ?
    1. La Nina is characterized by unusually cold ocean temperature in equatorial Indian Ocean whereas El Nino is characterized by unusually warm ocean temperature in the equatorial Pacific Ocean.
    2. El Nino has adverse effect on south-west monsoon of India, but La Nina has no effect on monsoon climate.

    Which of the statements given above is/are correct?
    (a) 1 only (b) 2 only
    (c) Both 1 and 2 (d) Neither 1 nor 2
11. Consider the following statements
    1. In Macedonia, ethnic Albanians are a minority.
    2. In Kosovo, Serbians are a majority.

    Which of these statements is/are correct?
    (a) 1 only (b) 2 only
    (c) Both 1 and 2 (d) Neither 1 nor 2
12. Which of the following items and their leading producers are correctly matched?
    1. Grapes - Italy 2. Oilseeds - India
    3. Millets - India 4. Coffee - Ethiopia

    Which of the above statement are correct ?
    (a) 1, 3 and 4 (b) 2, 3 and 4
    (c) 1, 2 and 3 (d) 1, 2, 3 and 4
13. A geographic region has the following distinct characteristics:
    1. Warm and dry climate
    2. Mild and wet winter
    3. Evergreen Oak trees

    The above features are distinct characteristics of which one of the following regions?
    (a) Mediterranean
    (b) Eastern China
    (c) Central Asia
    (d) Atlantic coast of North America
14. What is the correct sequence of occurrence of the following cities in South-East Asia as one proceeds from south to north?
    1. Bangkok 2. Hanoi
    3. Jakarta 4. Singapore

Select the correct answer using the code given below.
(a) 4-2-1-3 (b) 3-2-4-1
(c) 3-4-1-2 (d) 4-3-2-1

15. Consider the following statements with reference to doldrums:
1. Doldrums comprise the equatorial belt of low atmospheric pressure.
2. The trade winds converge at doldrums.
3. There is strong upward movement of air in doldrums.
4. Doldrums are characterized by turbulent weather.
Which of the statements given above are correct ?
(a) 1 and 2 only (b) 3 and 4 only
(c) 1, 2 and 3 only (d) 1, 2, 3 and 4

16. Consider the following pairs :

	Region		Country
1.	Chechnya	:	Russian Federation
2.	Darfur	:	Mali
3.	Swat Valley	:	Iraq

Which of the above pairs is/are correctly matched?
(a) 1 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

DIRECTIONS (Qs. 17 to 19) : The following questions consist of two statements, one labelled as the Assertion (A) and the other as 'Reason (R), You are to examine these two statements carefully and select the answers to these items using the codes given below:

17. **Assertion (A) :** The Steppe climate is most widespread in North America and Eurasia.
Reason (R) : The Steppe climate is characterized by wet summers as well as wet winters.
(a) Both A and R are individually true and R is the correct explanation of A.
(b) Both A and R are individually true but R is NOT the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

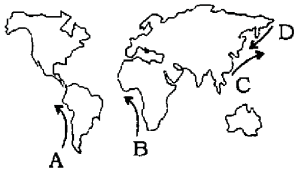
18. **Assertion (A):** Major natural regions of the world possess similar topography.
Reason (R): Climate is a major influencing factor in a natural region.
(a) Both A and R are individually true and R is the correct explanation of A
(b) Both A and R are individually true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false but R is true

19. **Statement I:** Temperatures of countries like United Kingdom, Norway, the Netherlands and Denmark are higher as compared to places located on similar latitudes during the winter.
Statement II: United Kingdom, Norway, the Netherlands and Denmark are located on the coast.
(a) Both the statements are individually true and Statement II is the correct explanation of Statement I.
(b) Both the statements 'are individually true but Statement II is not the correct explanation of Statement I.
(c) Statement I is true but Statement II is false.
(d) Statement I is false but Statement II is true.

20. Which among the following statements about the North Atlantic Drift is/are correct?
1. It keeps the west coast of Northern Europe ice free
2. It is responsible for the warm air mass which interacts with the cold air mass from the Polar region and causes rainfall in Western Europe
3. It meets the Labrador current near Vancouver Island and causes dense fog
Select the correct answer using the code given below
(a) 1, 2 and 3 (b) 1 and 2 only
(c) 2 only (d) 1 and 3 only

21. What is the correct sequence of occurrence of the following cities in South-East Asia as one proceeds from south to north? [CSAT 2014 - I]
1. Bangkok 2. Hanoi
3. Jakarta 4. Singapore
Select the correct answer using the code given below.
(a) 4-2-1-3 (b) 3-2-4-1
(c) 3-4-1-2 (d) 4-3-2-1

22. Match **List-I** with **List-II** and select the correct answer using the code given below the Lists :

List-I (Map showing ocean current)	List-II (Name of ocean current)
	1. Kuroshio
	2. Humboldt
	3. Benguela
	4. Oyashio

Codes :

	A	B	C	D		A	B	C	D
(a)	2	1	3	4	(b)	4	3	1	2
(c)	4	1	3	2	(d)	2	3	1	4

Matching Based MCQ

DIRECTIONS (Qs. 23 to 34) : Match List-I with List-II and select the correct answer using the codes given below the lists.

23.

	List-I (City)	List-II (Industry)
(A)	Osaka	(1) Shipbuilding
(B)	Hamburg	(2) Textiles
(C)	Detroit	(3) Iron & Steel
(D)	Pittsburg	(4) Automobiles

(a) A – 2 ; B – 1 ; C – 4 ; D – 3
(b) A – 1 ; B – 2 ; C – 3 ; D – 4
(c) A – 2 ; B – 3 ; C – 1 ; D – 4
(d) A – 4 ; B – 1 ; C – 2 ; D – 3

24.

	List-I	List-II
(A)	Iron & Steel	(1) Portsmouth
(B)	Automobile	(2) Dortmund
(C)	Shipbuilding	(3) Bangalore
(D)	Aircraft	(4) Detroit

(a) A – 1 ; B – 2 ; C – 3 ; D – 4
(b) A – 2 ; B – 1 ; C – 4 ; D – 3
(c) A – 4 ; B – 3 ; C – 2 ; D – 1
(d) A – 2 ; B – 4 ; C – 1 ; D – 3

25.

List-I (Crop)	List-II (Main Producing area)
(A) Coconut	(1) Kenya
(B) Banana	(2) Popua New Guinea
(C) Groundnut	(3) Ecuador
(D) Tea	(4) Senegal

26. Which of the following pairs are correctly matched?

(River)		(Countries)
1. Niger	—	Guinea
2. Orange	—	S. Africa
3. Karai	—	Egypt
4. Nile	—	Mali

Select the correct answer using the codes given below:
(a) 1 and 2 (b) 1 and 3
(c) 1, 3 and 4 (d) 2, 3 and 4

27. Match List-I and List-II and select the correct answer from the codes given below:

List-I (Type of winds)	List-II (Region)
A. Blizzard	1. Pairie Plains
B. Chinook	2. Siberian Plains
C. Bora	3. Greenland
D. Khamsin	4. Egypt

	A	B	C	D
(a)	3	1	4	2
(b)	1	2	3	4
(c)	2	1	3	4
(d)	4	3	1	2

28. Match List-I with List-II and select the correct answer using the code given below:

List-I (Current)	List-II (Feature)
A. Kuroshio current	1. Warm current in Atlantic Ocean
B. Peru current	2. Cold current in the Atlantic Ocean
C. Labrador current	3. Warm current in the Pacific Ocean
D. Florida current	4. Cold current in the Pacific Ocean

	A	B	C	D
(a)	3	4	2	1
(b)	3	2	4	1
(c)	1	4	2	3
(d)	1	2	4	3

29. Match **List-I** with **List-II** and select the correct answer from the codes given below.

List-I (Mountains peak)	List-II (Country)
A. Mt. Everest	1. India
B. K2	2. Nepal
C. Mt. McKinley	3. North America (USA)
D. Mt. Aconcagua	4. South America

Codes:

	A	B	C	D
(a)	2	1	3	4
(b)	1	2	3	4
(c)	4	3	2	1
(d)	3	4	1	2

30. Match **List-I** with **List-II** and select the correct answer from the codes given below:

List-I (Countries new name)	List-II (Countries old name)
A. Thailand	1. Nippon
B. Ghana	2. Gold Coast
C. Zambia	3. Siam
D. Japan	4. Northern Rhodesia

	A	B	C	D
(a)	3	2	4	1
(b)	1	2	3	4
(c)	2	3	1	4
(d)	4	3	2	1

31.

List-I (Geographic feature)	List-II (Country)
(A) Great Victoria Desert	(1) Australia
(B) Grand Canyon	(2) Canada
(C) Lake Winnipeg	(3) New Zealand
(D) Southern Alps	(4) USA

(a) A – 1 ; B – 2 ; C – 4 ; D – 3
(b) A – 1 ; B – 4 ; C – 2 ; D – 3
(c) A – 3 ; B – 2 ; C – 4 ; D – 1
(d) A – 3 ; B – 4 ; C – 2 ; D – 1

32.

List I (Sea)	List II (Country)
(A) Black Sea	(1) Bulgaria
(B) Red Sea	(2) China
(C) Yellow Sea	(3) Eritrea
(D) Caspian Sea	(4) Kazakhstan

(a) A – 1 ; B – 4 ; C – 2 ; D – 3
(b) A – 2 ; B – 3 ; C – 1 ; D – 4
(c) A – 1 ; B – 3 ; C – 2 ; D – 4
(d) A – 2 ; B – 4 ; C – 1 ; D – 3

33.

List-I (City)	List-II (River)
(A) Washington D.C.	(1) River Manzanares
(B) Berlin	(2) River Seine
(C) Paris	(3) River Spree
(D) Madrid	(4) River Potomac

(a) A – 2 ; B – 3 ; C – 4 ; D – 1
(b) A – 4 ; B – 1 ; C – 2 ; D – 3
(c) A – 2 ; B – 1 ; C – 4 ; D – 3
(d) A – 4 ; B – 3 ; C – 2 ; D – 1

34. Match the following

List I (Natural Vegetation of India)	List II (Annual Rainfall Received)
A. Tropical evergreen forests	1. 100-200 cm
B. Tropical deciduous forests	2. Above 200 cm
C. Tropical dryforests	3. Less than 50 cm
D. Arid forests	4. Above 300 cm
	5. 50-100 cm

Codes

	A	B	C	D
(a)	1	2	5	3
(b)	4	3	1	5
(c)	2	1	5	3
(d)	2	1	3	4

Hints and Explanations

EXERCISE-1

1. (b) Bering Strait is nearest to the International Date line, because the international Date line runs equidistant between the American continents, on its East and Asia, Australia, and Europe on its west.
2. (c) Itaipu Dam is built on River Parana is the largest dam in the world. This is a joint project of Brazil – Paraguay.
3. (d) Thailand, Laos and Bangladesh are countries bordering Myanmar.
4. (c) Lake Victoria acts as the international boundary between Tanzania and Uganda. It is the largest lake in Africa and second widest fresh water body in the world.
5. (d) 6. (d) 7. (a) 8. (c) 9. (a)
10. (a) 11. (d) 12. (b)
13. (b) Maracaibo is the oil-port of Venezuela.
14. (d)
15. (a) The satellite launched by Canada has helped in the preparation of a detailed and complete map of Antarctica.
16. (b) Canada is the largest producer of Uranium, accounting for about 22% of world output. Production of uranium in Canada is mainly from the Mc Arthur River mines in northern Saskatchewan province, which is the largest mine in the world.
17. (a) Canada is the largest importer of bauxite from India.
18. (c) 19. (c) 20. (d)
21. (c) 22. (b)
23. (d) The characteristic of the Tropical Savannah Region is a definite dry and wet season.
24. (a)
25. (d) Bulgaria does not border mediterranean sea, shares the boundary with Black-sea.
26. (d) 27. (d) 28. (a)
29. (c) Savanna subtropical grassland are prevailing in both hemisphere from 5° to 20° latitudes. The main countries of this area are South Africa, Sudan, Venezuela and Brazil. Hanoi is the Capital of Vietnam.
30. (b) The largest expanse of tropical rain forest is found in the Amajon basin of Brazil, extending from the Atlantic Coast of the foot hills of the Ande and from the Guiana Highlands in the north to the tropic of capricorn in the South.
31. (c)
32. (a) 33. (a)
34. (d) The Kiel canal connects Baltic sea and North sea. The Kiel Canal, known as the Kaiser-Wilhelm-Kanal until 1948, is a 98-kilometre long canal in the German state of Schleswig-Holstein. The canal links the North Sea at Brunsbüttel to the Baltic Sea at Kiel-Holtenau
35. (d) Mc kinley is the highest mountain peak of the USA. Mount Mc Kinley or Denali is the highest mountain peak in North America, with a summit elevation of 20,237 feet above sea level. At some 18,000 feet, the base to peak rise is considered the largest of any mountain situated entirely above sea level.
36. (d)
37. (d) Stromboli is called the light house of the Mediterranean. Stromboli is a small island in the Tyrrhenian Sea, off the north coast of Sicily, containing one of the three active volcanoes in Italy.
38. (d)
39. (d)
40. (b) Dover strait – English channel and North sea.The Strait of Dover or Dover Strait is the strait at the narrowest part of the English Channel, marking the boundary between the Channel and North Sea, separating Great Britain from continental Europe.
41. (c)
42. (b) Detroit is situated lake Erie. Detroit is the most populous city in the U.S. state of Michigan, and is the seat of Wayne County, the most populous county in the state and the largest city on the United States – Canada border.
43. (b) Bering strait divides Alaska and Russia.
44. (c) China – India – United State – Indonesia – Brazil – Pakistan
45. (c) North Korea – Pyong-Yong (It is the capital of North Korea.)
46. (a)
47. (b) Atlas mountain ranges are situated in the north western part of Africa. They extend almost 2000 km. They pass through Morocco, Algeria and Tunisia.
48. (b) The central Asian steppes run through Kazakhstan, Turkmenistan, Uzbekistan and Mongolia. The climate here is harsh with dust storms, little to no rainfall and temperature ranging from – 4 to 50 degree Celsius.
49. (b) Bass Strait is a sea strait which separates Tasmania from the Australian mainland.
50. (a) The Suez Canal is an artificial sea-level waterway in Egypt, It connects the Mediterranean Sea and the Red Sea.
51. (d) Broken Hills are located in New South Wales, Australia. It is a mining city.
52. (d) Climate change benefits Russia and Northern Europe as they are in colder region.
53. (d) Nigeria is not a landlocked country in Africa. Its coast in the south lies on the Gulf of Guinea in the Atlantic Ocean.
54. (c) Sovanna subtropical grassland are prevailing in both hemisphere from 5° to 20° latitudes. The main countries of this area are South Africa, Sudan, Venezuela and Brazil. Hanoi is the Capital of Vietnam.
55. (b) The largest expanse of tropical rain forest is found in the Amajon basin of Brazil, extending from the

Atlantic Coast of the foot hills of the Ande and from the Guiana Highlands in the north to the tropic of Capricorn in the South.

56. (c) Lake Victoria is the largest lake in Africa and is the source of River Nile, the longest river in the world.
57. (a)
58. (d) Andes mountains are located in the western part of South America, streth for about 7200 kilometers from Venezuela in the north to Tierra del Fuego in the south.
59. (c)
60. (b) Macedonian territory is disputed by Bulgaria and Greece.
61. (c) Strait of Dover connects United Kingdom and France. It is about 32 km in length.
62. (a) The largest coral reef is the Great Barrier Reef, located just off the north-eastern coast of Australia. The 1200 mile (1900 km) long reef is protected as a Marine Park.
63. (b) Marsupials are a group of mammals commonly have pouches or pocket of skin, where the mother nurses their young. These marsupians are found in Australia. The common example of marsupians are Kangaroo and Koala.
64. (a) 65. (b)
66. (a) The continent Antarctica is present at the highest mean elevation in the world. This is because it is covered by a huge layer of ice, about 7,100 feet (2,200 m) thick.
67. (c) While moving from the North to the South of Pakistan, the correct sequence of the town is Peshwar – Islamabad – Gujranwala – Multan.
68. (c) Managua is the capital of Nicaragua, not Balmopan.
69. (a) Australia has the world's largest uranium reserves. Approximately 24% of the planet's uranium is present in Australia.
70. (b) Colombia, Kenya & Indoneisa are countries through which the equator passes.
71. (b) 72. (b) 73. (d) 74. (b) 75. (b)
76. (d) 77. (a) 78. (d) 79. (b) 80. (c)
81. (d) 82. (a) 83. (a) 84. (a) 85. (d)
86. (b)
87. (d) Indonesia consists of 13,677 islands (nearly 14,000) and this country is 5000 miles from Torres strait.
88. (a) Baikonour is world's first and largest operational space launch facility. It is located in Kazakhstan, not in Russia.
89. (a) Monsoon type climate is found in Pacific Coast of Columbia.
90. (b) Turkey's smaller part is in Southeastern Europe and its larger part in Western Asia which is located between Black Sea and Mediterranean
91. (c) The Tasman Sea separates Australia from New Zealand.
92. (b) Mellanesia region consists of the four countries of Vanuatu, Solomon Islands, Fiji and Guinea. It is a sub-region of Oceania extending from the western end of the Pacific Ocean to the Arafura Sea, and eastward to Fiji. Besides these independent countries, Melanesia also includes New Caledonia, Maluku Islands and West Papua.
93. (b) Baltic Nations are those that have shorelines along the Baltic Sea. The group of countries presently referred Baltic States are Estonia, Latvia, and Lithuania. Slovakia is not a Baltic state.
94. (c) The Ural Mountain range forms the natural boundary between Europe and Asia. The Ural Mountains extend about 2,500 km from the Kara Sea to the Kazakh Steppe along the northern border of Kazakhstan. This range marks the northern part of the border between the continents of Europe and Asia.
95. (b) The Labrador Current is a cold current in the North Atlantic Ocean.
96. (d) Mr X will likely to be flown over Black Sea. Since Black Sea is bounded by Europe, Anatolia and Caucasus, it is ultimately connected to the Atlantic Ocean.
97. (a) The Falkand current is a cold current. It flows along the Argentina's coast in South Atlantic Ocean.
98. (c)
99. (d) Andes mountains are located in the western part of South America, streth for about 7200 kilometers from Venezuela in the north to Tierra del Fuego in the south.
100. (c) Dense equatorial forest, in the Amazon basin, characterized by tall broad-leaved evergreen trees, epiphytes, lianas, etc.
101. (a)
102. (a) The Ten Degree Channel is a channel that separates the Andaman Islands from the Nicobar Islands in the Bay of Bengal.
103. (b) Turkey's smaller part is in Southeastern Europe and its larger part in Western Asia which is located between Black Sea and Mediterranean
104. (b) Jordan does not open out to the Mediterranean Sea.

EXERCISE-2

1. (a) It is under the influence of cold ocean current. So given second statement is wrong.
2. (b) Bermuda Triangle is a strange and mysterious place in the southern Atlantic Ocean. It is roughly the shape of a triangle. The triangle extends upto south Florida, Pruto Rico and Bermuda Island.
3. (d) The Tropic of Capricorn pass over all the following countries.
4. (c) 5. (a)
6. (c) 2, 3, 1, 4 – Australia – Europe – Antarctica – South America.
7. (c)
8. (c) **Downs** – grassy plains called downs are located in New Zealand's South Island and southeast Australia. Pampas – South America's largest grassland, called pampas, which means plain, covers most east-central areas of Argentina.
9. (d) Shikoku – Kyushu – Hokkaido – Honshu
Honshu – Honshu has a total area of 88,017 square miles (227,962 sq km) and it is the world's seventh largest island.

Hokkaido – Hokkaido is the second largest island of Japan with a total area of 32,221 square miles (83,453 sq km).

Kyushu – It has a total area of 13,761 square miles (35,640 sq km).

Shikoku – Shikoku is the smallest of Japan's main islands with a total area of 7,260 square miles (18,800 sq km).

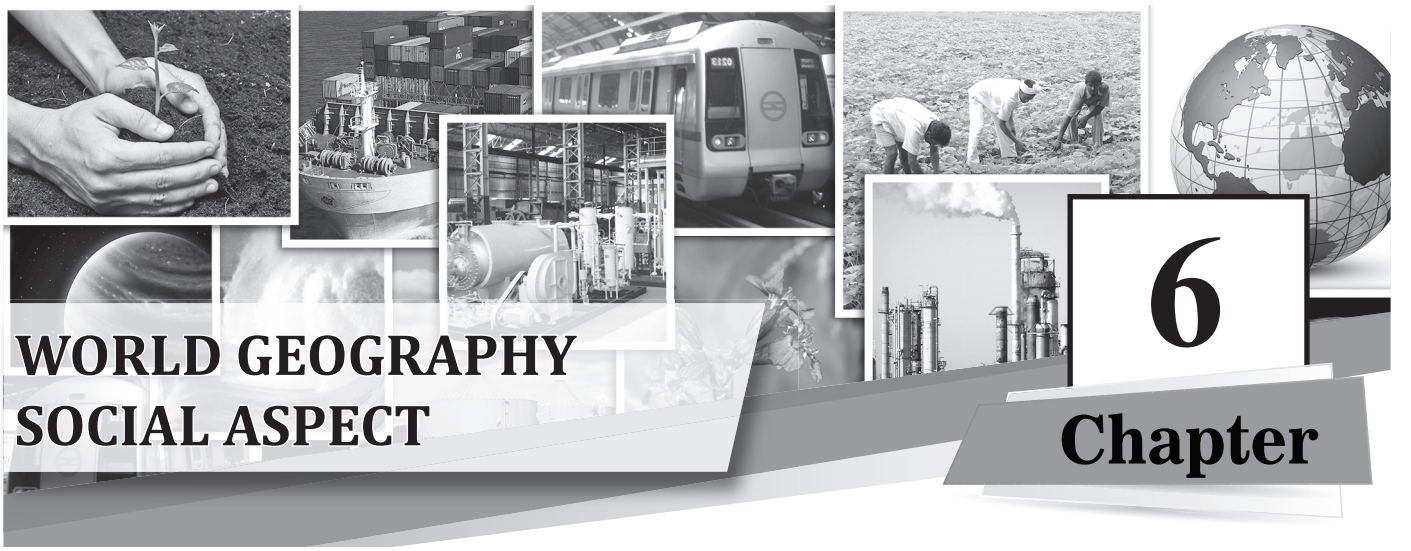
10. (d) La Nina is a coupled ocean-atmosphere phenomenon that is the counterpart of El Nino as part of the broader El Nino-Southern Oscillation climate pattern. During a period of La Nina, the sea surface temperature across the equatorial Eastern Central Pacific Ocean will be lower than normal by 3–5 °C. In the United States. A La Nina, on the other hand, is often beneficial for the monsoon, especially in the latter half.
11. (b) In Macedonia, ethinic Albanian population is 23%, which is a good number in Macedonia. But in Kosovo 92% Albanians present where Serbians are the minority.
12. (c)
13. (a) Mediterrian climate have mild, rainy winter and hot, dry summers and Evergreen, Oak trees.
14. (c) The correct sequence of occurrence of the following cities in South-East Asia as one proceeds from south to north is Jakarta-Singapore-Bangkok and Hanoi.
15. (d)
16. (a) The Chechen Republic is a federal subject (a republic) of Russia. Darfur is a region in western Sudan. Swat is a valley and an administrative district in Pakistan.
17. (c) The Steppes are areas of comparatively lower temperature and slightly more precipitation. Here annual average temperature is approximately 21°C. Temperate grasses are main vegetation of these regions. Norhern America's Prairies and the steppes of Eurasia are the major areas of thesee grassland.
18. (d) Major natural regions of the world have not same type of climates. The different climates make different topographies.
19. (a) Since United Kingdom, Norway, Netherland and Denmark are located on the coast, their temperature is higher than the places located on similar latitudes during the winter.
20. (b) The North Atlantic current or Drift or sea movement is a powerful warm ocean current that continues the gulf stream northeast, which stretches from Florida to north- western Europe. It moderates the chilled climate of western Europe.
21. (c) The correct sequence of occurrence of the following cities in South-East Asia as one proceeds from south to north is Jakarta-Singapore-Bangkok and Hanoi.
22. (d) HUMBOLDT - South Pacific Cool
    BENGUELA - South Atlantic Warm/Cool
    KUROSHIO - North Pacific Warm
    OYASHIO - North Pacific Cool
23. (d) 24. (d) 25. (a)
26. (a) The Niger river is the principal river of western Africa, extending about 4,180 km. Its drainage basin is 2,117,700 km^2 in area. Its source is in the Guinea Highlands in southeastern Guinea. The Orange river, Gariep river, Groote river or Senqu river is the longest river in South Africa. It rises in the Drakensberg mountains in Lesotho, flowing westwards through South Africa to the Atlantic Ocean.
27. (c) **Blizzard – Siberian Plains.** A blizzard is a severe snowstorm caused by strong sustained winds of at least 56 km/h (35 mph) and lasting for a prolonged period of time – typically three hours or more.

    Chinook – Prairie Plains. Chinook winds blows in the interior west of North America, where the Canadian Prairies and Great Plains meet various mountain ranges, although the original usage is in reference to wet, warm coastal winds in the Pacific Northwest of the United States of America.

    Bora – Green land. Cold and usually dry katabatic winds, like the Bora, result from the downslope gravity flow of cold, dense air. Katabatic flows slumping down from uplands or mountains may be funneled and strengthened by the landscape and are then known as mountain gap wind.

    Khamsin – Egypt. Khamsin can be triggered by depressions that move eastwards along the southern parts of the Mediterranean or along the North African coast from February to June. In Egypt, khamsin usually arrives in April but occasionally occurs between March to May, carrying great quantities of sand and dust from the deserts, with a speed up to 140 kilometres per hour, and a rise of temperatures as much as 20°C in two hours.
28. (a) A. Kuroshio current – warm Pacific current
    B. Peru current – cold current in Pacific ocean
    C. Labrador current – cold current in Atlantic ocean
    D. Florida current – Warm current in Atlantic ocean
29. (a) Mt. Everest – Nepal
    K2 – India
    Mt. McKinley – USA
    Mt. Aconcagua – South America

    All these are the names of highest mountain peaks located in the countries respectively.
30. (a) 1. Thailand – Siam
    2. Ghana – Gold Coast
    3. Zambia – Northern Rhodesia
    4. Japan – Nippon.
34. (c) A. Tropical evergreen forests- Above 200 cm
    B. Tropical deciduous forests - 100-200 cm
    C. Tropical Dry forest- 50-100 cm
    D. Arid forest- Less than 50 cm



6 Chapter

WORLD GEOGRAPHY SOCIAL ASPECT

As a part of *Human geography*, Cultural geography deals with the socio-cultural aspect of various human groups based upon their geographic location which includes their habitat, clothing, food, shelter, Skills, tools, language, religions, social organization and life style. Basing upon the above criteria each continent has some unique ethnic groups which are otherwise called as *Human Race,* who are confined to a particular region of that continent only.

Race

Race is biologically defined as a geographically isolated population of organisms that differs from other populations of the same species in certain heritable traits. As to clarify it further it is a categorization of humans based on their physical characteristics such as skin colour, stature, head form, face, hair, eye, nose, body type, blood group etc along with regional variations. Accordingly three major human races are identified which are distributed across the world. They are *Caucasoid, Mongoloid* and *Negroid* which further sub divided into geographically viable groups. In this chapter we are going to discuss continent wise racial groups and their distribution pattern.

Racial Groups and Their Distribution Pattern

Continents	Major Ethnic Group/Race	Distribution	Remarks
Asia	Arabian	Bahrain, State of Palestine, Lebanon, Comoros, Kuwait, Qatar, Syria, United Arab Emirates, Morocco, Egypt, Jordan, Iraq, Tunisia, Yemen, Djibouti, Sudan, Algeria, Somalia, Saudi Arabia, Oman, Libya, Mauritania	This is a major Pan ethnic Group which is primarily habited in Western Asia. The primary language spoken by Arabian group is *Arabic*. Besides 15 other languages are spoken among Arabians in different parts of the World
	Indian	Most part of Indian Sub continents (India, Pakistan and Bangladesh)	On the basis of ethno linguistic composition the group is highly diversified, still the majority of population is restricted within two major linguistic groups such as *Indo-Aryan and Dravidian*.
	Mongoloids	This group is primarily concentrated in Inner Mongolia Autonomous Region and gradually spreading towards Liaoning, Jilin, Heilongjiang, Xinjiang, Qinghai, Gansu, Ningxia, Hebei, Henan, Sichuan, Yunnan and Beijing	They speak mainly the dialect of *Atlantic Language* family. The major three of them are Inner *Mongolian, Barag-Buryat and Uirad*
Africa	Pygmies	Rwanda, Burundi, Uganda, the Democratic Republic of the Congo (DRC), the Republic of Congo (ROC), the Central African Republic, Cameroon, the Equatorial Guinea, Gabon, Angola, Botswana, Namibia, Madagascar, and Zambia are populated by these group	A short height tribal group who lives on hunting, gathering fruits, nuts and honey from dense jungles and they are primarily confined to rain forests only.
	Bushmen	They are the huge inhabitant of Kalahari desert. Other than this they spread along Botswana, Namibia, South Africa, Zambia, Zimbabwe and Angola, with loosely related groups in Tanzania.	They are basically yellow-skinned nomads whose primary food intake in plant products collected from jungles which accounts for 70% of their diet and for the rest 20%-30% they depend on hunting.

	Zulus	They are mainly concentrated in KwaZulu-Natal Province of South Africa. Some are also scattered throughout the other provinces. KwaZulu-Natal borders on Mozambique in the north, Eastern Cape in the south, the Indian Ocean in the east, and Lesotho in the west.	They are the descendants of *Nguni-speaking* people and best known African tribes who were exploited by Britishers during the late 1800s. The most spoken languages are Zulu and English.
	Massai	They are the semi nomadic tribes who originated from the lower Nile valley north of Lake Turkana (Northwest Kenya) and began migrating south around the 15^{th} century, and finally settled in Kenya around 17^{th} and 18^{th} Century	They commonly use Kenya and Tanzania, Swahili and English language for communication as well as education.
	Bantus	The Bantus are primarily found in Rwanda, Angola, Burundi, Zimbabwe, and South Africa, with some among other nations in the Southern part of Africa.	As these tribes are highly resourceful and adaptable their occupancy in the total continent is also the highest. They mainly speak bantu language which gave them their nomenclature. They live on agriculture and metal working which give opportunity to adopt colonization.
North America	Groups of Indigenous peoples	They mostly confined to Canada	The indigenous peoples of the Americas are the descendants of the pre-Columbian inhabitants of North and South America.
	Native Hawaiians	Most Native Hawaiians reside in State of Hawaii and the American Southwest	Native Hawaiians are the indigenous Polynesian people of the Hawaiian Islands or their descendants.
South America	Mestijo	Mainly concentrated in Latin America	They emerged due to extensive intermixing between Europeans and Native Americans early in the colonial period
	Mullatto	Brazil is home to Latin America's largest mulatto population. Other than Brazil they spread in Dominican Republic, Cuba, Panama, Costa Rica, Colombia, Puerto Rico, and Ecuador.	Mulattoes are people of mixture of European and African.
	Zambol	Zambos are the small minorities in the northwestern South American countries such as Colombia, Venezuela, Guyana and Ecuador.	This is a small yet noticeable group resulting from unions of Amerindian women to Afro-Ecuadorian men are not uncommon in major coastal cities of Ecuador.
Europe	Nordic	The Nordics are inhabited in the countries around North and Baltic Seas.	As a sub group of Caucasian race this group is a set of people having distinct physical characteristics such as concurrence of fair, colour, somewhat wavy hair, light eyes, reddish skin, tall stature and a dolichocephalic skull
	Mediterranean	They are mostly concentrated in Afghanistan, Baluchistan, and Hindustan, with perhaps a southward extension into Ceylon.	This is a relatively small, light boned, long skulled race, of brunet color becoming even swarthy in certain portions of its range and possibly emerged during Neolithic times
	Alpine	They acquire all central and eastern Europe, and extending through Asia Minor to the Hindu Kush and the Pamirs.	The Alpines have their special physical characteristic of round skull, medium height and sturdy build, both as to skeleton and muscles. The color of both hair and eyes was originally very dark and still tends strongly in that direction, but many light colored eyes especially gray, are now found in the Alpine populations of western Europe.
Australia	Aborigines and Torres Strait Islanders	They contribute only 3% of the total population though they are the original inhabitant of Australia and the rest 7% are contributed by races of Asiatic origin.	Upto 2010-2012 the average life expectancy of Aboriginal and Torres Strait Islander people was approximately ten years (10.6 years for men and 9.5 years for women) which is much below the race of Asiatic origin, the leading causes of death are being heart disease, diabetes, respiratory disease and cancer.

Population Density

Human being is dependent upon the resource provided by nature for living. Suitable climate, fertile land, favorable environment gives ample of opportunities to grow. Hence the geographical unit which provides all sorts of facilities to human for it growth has a high pressure of population rather than the unfavorable ones. In these areas the density of population is also high in comparison to that of the unfavorable climates.

Population Density refers to the capacity of a piece of land for supporting the population living on it. In other words it refers to the ratio between the numbers of people to the size of land which is generally measured in persons per sq. km.

Density of Population = Population / Area

Factors affecting Population Distribution

The population on the earth surface is very unevenly distributed as result of so many factors which broadly categorized into three sections.

Geographical Factors

- As nature and its resources provide living aids to human being, factors such as land, water, climate and soil play a major role in influencing the density of population of a particular locality. Smooth terrain, fertile land, suitable climate and proper provision of water for irrigation and other basic uses of human being supports comparatively a large of population that the unfavorable natural conditions:
- For example Indo-Gangetic plain provides favorable living environment than hilly terrain of North eastern part of India.

Economic Factors

- Sometimes the economic prosperity of a region attracts the population of the surrounding areas which leads to migration of population from rural to newly built urban area in search of earning livelihood. The urban agglomeration then gradually increases with further economic growth.
- On the other hand the areas with huge mineral deposits give rise to industrial development which again require skilled and semi- skilled labours to work for the industry hence result into growth of population.
- Canton and Shanghai of China, Tokyo of Japan, Seoul of South Korea, Mumbai and Delhi of India are the brightest example of such economic growth which attracts maximum population of the adjacent rural areas.

Socio-cultural Factors

- Besides geographical and economic factors, social aspects also play a vital role in the growth of population of a particular area. Sometimes regions with religious and cultural back ground help people find their way in the midst of such places.
- Social and cultural factors in India and China had strongly influence the increase in population as people sometimes attached to the belief of having large families. In the developed world, smaller families are the norm.

Trends in Population Growth

As per the recent statistics of United Nations population Find the world population has reached to 7 billion mark in 2011 which is quite alarming. The rate of growth has increased to seven times to that of early years of economic and social development. The growth was at its peak during 1750. The noticeable change occurred due to the massive change in three major social components of birth, death and migration. With technological advancement during the era of industrial development has helped in reducing the death rate and increasing the fertility rate, decrease in the infant mortality rate, increase in the life expectancy, decrease in the death rate and finally increasing urbanization and migration.

Crude Birth Rate is the number of live births per year per 1000 persons which is generally estimated mid-year.

It can be calculated as::

CBR = (Bi/P) × 1000 where Bi = the live births during the year

Crude Death Rate is number of death per 1000 population of a specific geographical location, Like CBR it is also estimated in mid year.

It can be calculated as:

CDR = (D/P) × 1000, where D = no. of death per year
P = Estimated mid- year population

Infant Mortality rate (IMR) is the number of deaths of infants under one year old per 1,000 live births. This rate is often used as an indicator of the level of health in a country.

The rate of population growth is the percentage of population change over a period of time and can be divided into:

Natural Growth refers to Birth - Death

Actual Growth refers to birth-death+ In migration–Out migration

Migration

- The third most important component of change in population is *Migration*. It's the movement of people from one place in the world to another for the purpose of taking up permanent or semi permanent residence, usually across a political boundary. The place people move from is known as ***Place of Origin*** and the place they move to is known as ***Place of Destination***.
- Basing upon the duration of stay the migration is of three types permanent, temporary and seasonal.
- There are two sets of factors which greatly influence migration,
  - **Push factor** are the reasons such as unemployment, poor living condition, political turmoil, unsuitable climate, natural disasters and socio-economic backwardness etc compels the dweller of a particular region to leave the place. This is somewhat less attractive. The resultant migration is called *Emigration*.
  - **Pull factors** seem like interesting as they attract the migrants with opportunities like better jobs, living condition, peace of mind and social stability and the resultant migration is known as *Immigration*.

Exercise -1

1. Currently half of the world's population lives in just six countries. Identify them from the following.
   (a) India, China, Pakistan, Brazil, Bangladesh, Indonesia.
   (b) India, China, Brazil, Pakistan, Bhutan, United State.
   (c) China, India, United State, Indonesia, Brazil, Pakistan.
   (d) China, India, Bangladesh, United State, Pakistan, Brazil.
2. The regions with highest and lowest densities are respectively
   (a) Europe and Africa
   (b) Asia and Oceania
   (c) North America and Africa
   (d) Europe and Oceania
3. In the Indian context the term 'De-notified tribes' refers to :
   (a) tribes which are aboriginals
   (b) nomadic tribes
   (c) tribes practising shifting cultivation
   (d) tribes which were earlier classified as criminal tribes
4. ".....They are people of yellow complexion, oblique eyes, high check bones, sparse hair and medium height." The reference here is to :
   (a) Nordic Aryans (b) Austrics
   (c) Negroids (d) Mongoloids
5. A person of mixed European and Indian blood in Latin America is called a :
   (a) Mulatto (b) Mestizo
   (c) Meiji (d) Mau Mau
6. The correct sequence of languages in descending order in terms of their number of speakers in the world is
   (a) Spanish, English, Chinese, Hindi
   (b) English, Chinese, Hindi, Spanish
   (c) Hindi, Chinese, Spanish, English
   (d) Chinese, English, Hindi, Spanish
7. The Semitic people belong to the?
   (a) Caucasoid race
   (b) Mangoloid race
   (c) Negroid race
   (d) Australoid race
8. The following Gulf countries have largest Indian communities
   (a) Saudi Arabia (b) Oman
   (c) Kuwait (d) Iraq
9. Which one of the following continents has the highest growth of population?
   (a) Africa (b) Asia
   (c) South America (d) North America
10. Economic density is ?
   (a) total number of people per unit of land
   (b) agricultural population per unit area of cultivated land
   (c) agricultural population per unit are of cultivated land
   (d) Ratio between the requirements of population and the resources made available to it.
11. Which of the following pairs are correctly matched?
   (a) Primary sex ratio: Sex at the time of conception
   (b) Secondary sex ratio: Sex at the time of enumeration
   (c) Tertiary sex ratio: Sex at the time of enumeration
   (d) Iambalanced sex ratio: Sex of workers
   Select the correct answer using the codes given below
   (a) 1, 2, 3 and 4 (b) 1, 3 and 4
   (c) 2 and 4 (d) 1, 2 and 3
12. Population explosion is associated with?
   (a) high birth rate low death rate
   (b) high birth rate and high death rate
   (c) low birth rate and high death rate
   (d) low birth rate and low death rate
13. Conundrums is the term of skin applied to?
   (a) Caucasoid Race (b) Negroid Race
   (c) Mongoloid (d) Australoid Race
14. In Which one the following countries, is Tamil a major language?
   (a) Myanmar (b) Indonesia
   (c) Mauritius (d) Singapore
15. Which of the following tribes, belongs to the Kalahari?
   (a) Hottentots (b) Zulus
   (c) Kirghis (d) Aborigines
16. Which of the following factors affects the birth rate?
   (a) Demographic structure
   (b) Polities
   (c) Religion
   (d) All of the above
17. Approximately one-half of the world population lives in?
   (a) East Asia and Europe
   (b) Europe and Estern-North America
   (c) South and South-East Asia
   (d) East and South Asia
18. The correct descending order of the following communities of world in terms of their population is
   (a) Sikhs, Christains, Budddhists, Jains
   (b) Sikhs, Christains, Jains, Buddhists
   (c) Christains, Sikhs, Jains, Buddhists
   (d) Christains, Sikhs, Buddhists, Jains
19. The country which leads in the production of rubber is
   (a) Australia (b) Indonesia
   (c) Malaysia (d) Thailand
20. Which one of the following is the correct descending order of the three most populous states of India (2011)?
   (a) Uttar Pradesh, Maharashtra, Bihar
   (b) Maharashtra, Bihar, West Bengal
   (c) Uttar Pradesh, Bihar, West Bengal
   (d) Uttar Pradesh, West Bengal, Bihar

Exercise -2

1. Consider the following statements
   1. Black Fellow: Australian aborigines.
   2. Yuit: Inhabitants of Siberia and St. Lawrence island of Alaska

   Which of the above statements is/are true?
   (a) Only 1 (b) Only 2
   (c) Both 1 and 2 (d) None of these
2. Consider the following statement According to the Malthusion model
   1. Population tends to increase arithmetically.
   2. Positive and preventive checks prevent excessive growth rate of population.
   3. The basis of preventive checks is moral restraint.
   4. Postponement of marriage is to be emplasized.

   Of these statements
   (a) 1 and 2 are correct
   (b) 1, 2 and 3 are correct
   (c) 2, 3 and 4 are correct
   (d) 1, 3 and 4 are correct
3. Which of the following is/are the stage(s) of demographic transition ?
   1. High death rate and birthrate, low growth rate.
   2. Rapid decline in death rate, continued low birthrate, very low growth rate.
   3. Rapid decline in birthrate, continued decline in death rate
   4. Low death rate and birthrate, low growth rate.

   Select the correct answer using the codes given below
   (a) Only 1 (b) 1, 2 and 3
   (c) 3 and 4 (d) 1 and 4
4. Match List-I with List-II. Select the correct answer from the codes given below:

List-I (Tribe)	**List-II (Region)**
A. Semang	1. Congo Basin
B. Kirghiz	2. Malaysia
C. Bushman	3. Central Asia
D. Pygmies	4. Kalahari desert

Codes:

	A	B	C	D
(a)	4	2	3	1
(b)	1	3	2	4
(c)	2	1	4	3
(d)	2	3	4	1

5. Match List-I with List-II and select the correct answer from the code given below:

List-I (Country)	**List-II (Capital)**
A. Brunei	1. Bander Seri Begawan
B. Indonesia	2. Phnom Penh
C. Laos	3. Vientiane
D. Combodia	4. Jakarta

Codes:

	A	B	C	D
(a)	1	4	3	2
(b)	2	4	1	3
(c)	4	1	3	2
(d)	3	1	4	2

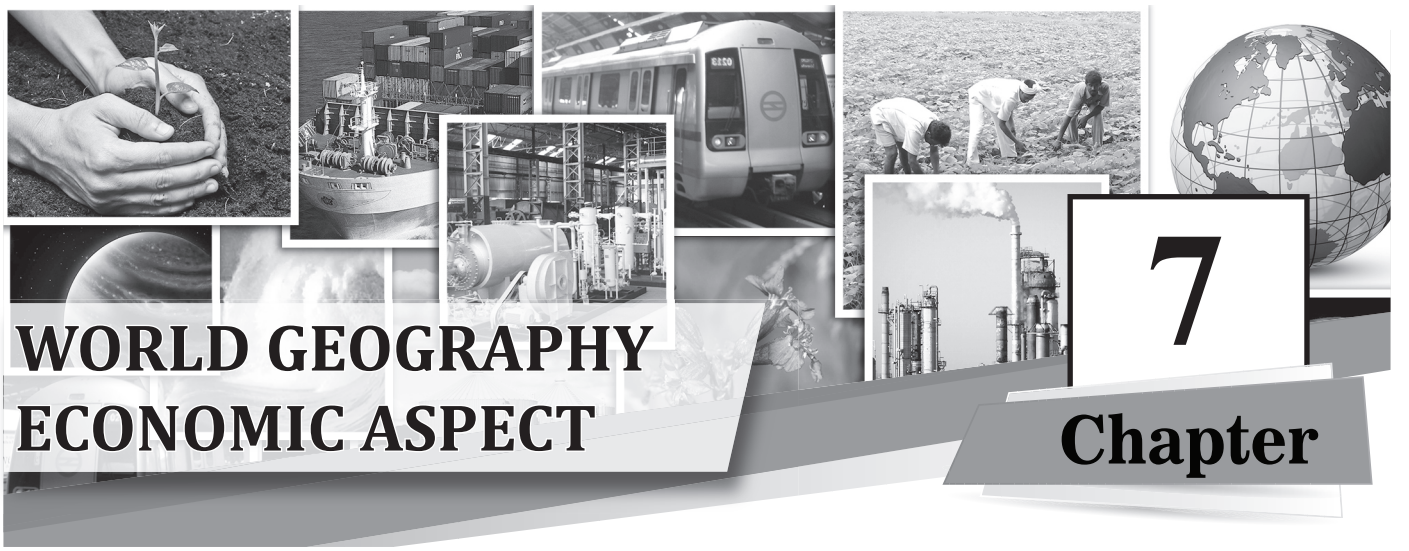
Hints and Explanations

EXERCISE-1

1. (c) China – India – United State – Indonesia – Brazil – Pakistan
2. (d)
3. (d) Denotified tribe in India refers to the tribes who where originally listed under the originally trible act of 1871. They are also known as Vimukta Jati.
4. (d) Mongloids are inhabitants of northern, eastern and south-east Asia.
   Their eyes has a characteristic fold of skin on the upper lid, hair is lank and straight and the height is medium. The group also includes the Chinese, Japanese, Burmese, Thais, Vietnamese and Malays.
5. (b) Mestizo is a type of person with mixed racial ancestry, especially of mixed European and Indian ancestry.
6. (d) 7. (c) 8. (d) 9. (d) 10. (d) 11. (c)
12. (a) 13. (b) 14. (b) 15. (a) 16. (d)
17. (d) 18. (d) 19. (c)
20. (a) Reference-Census 2011
    U.P., Maharashtra, Bihar

EXERCISE-2

1. (c) 2. (c)
3. (d) Demographic transition refers to the transition from high death rate and high birth rate to low death and birth rates, as a country develops from a pre-industrial to industrialised economic system.
4. (d) Semang – Malaysia
   Kirghiz – Central Asia
   Bushman – Kalahari desert
   Pygmies – Congo Basin
   All these names are of the tribal communities belonging to the countries respectively.
5. (a) Brunei – Bander seri begawan
   Indonesia – Jakarta
   Laos – Vientiane
   Combodia – Phnom Penh
   All these are names of south-Asian countries with the names of their capitals.



WORLD GEOGRAPHY ECONOMIC ASPECT

Chapter 7

Economic geography deals with the economic activities of human being basing upon the location, distribution and spatial organization as parts of Human Geography. Human activities meant for earning livelihood are known as *economic activities*. On the basis of resource and techniques used for performing these activities they are divided into *primary*, *secondary* and *tertiary activity*.

Primary activities are the direct interaction of human with environment that refers to the utilisation of earth's resources such as land, water, vegetation, building materials and minerals. Agriculture, pastoral farming, fishing, forestry, mining and quarrying etc. are categorized into primary economic activity.

Secondary Activities refers to the process of the value addition to natural resources by transforming the raw materials into essential finished product. Hence secondary activities are basically manufacturing, processing and construction industries.

Tertiary Activities involve the third level of human activities such as exchange of manufactured products i.e. trade and commerce.

With the advancement of new interventions these categorization has given rise to specialized services which can be termed as Quaternary and Quinary services.

PRIMARY ACTIVITIES

Agriculture

It is the process of producing food, feed and fiber through the cultivation of plants, and rearing livestock and is also known as farming. About 50% of the world's population is engaged in agriculture. In India as the land and climatic conditions are favorable for carrying out agricultural activities more than 2/3rd of the population is dependent on agriculture for their livelihood. The land utilized for agriculture is known as *arable land*.

The system of agriculture varies based on the method of farming, type of crop grown, cropping season etc., and they are as follows.

Subsistence Agriculture is the localized agricultural practice where the agricultural products are taken up by the producers or farmers only. It can be of two types:

Primitive Subsistence Agriculture is the age old practice of farming where people used to burn or slash large vegetative coverage and made them usable for agriculture. After a period of two to three years when the land started losing its fertility they shifted to some other area and usually repeat the same procedure. Hence it is also called as *Shifting Cultivation*. This process was adopted by the nomads or tribes of tropics, mainly in Africa, South and Central America and South East Asia. In different parts of the world it has been named differently such as *Jhuming* in North Eastern state of India, *Milpa* in Central America and Mexico, *Ladang* in Indonesia and Malaysia.

Intensive Subsistence Agriculture is generally monsoon driven agriculture and mainly practiced in Asia. It is further divided into two categories. They are:

- **Intensive subsistence agriculture dominated by wet paddy** where the dominant crop is rice. This is generally practiced in the areas of comparatively large population and the farm yard manure is used to maintain the fertility of the soil.
- **Intensive subsistence agriculture dominated by crops other than paddy** where the relief, climate and soil along with geographical location plays a major role in crop growth. Hence these factors are all together responsible for growing of crop other than paddy, such as wheat in western India. Wheat, shorgum , barley , soyabean in northern China, Manchuria, North Korea and North Japan.

Plantation Agriculture are the farming which are being practiced in comparatively large estates with the support of huge capital investment, advance managerial and technical aids, scientific methods of cultivation, cheap labour and well connected market. Some of the major crops of plantation agriculture are tea, coffee, cotton, oil palm, sugarcane, banana, and pineapple.

Plantation farming was introduced in European colonies situates over tropics. Later on the French introduced coffee and cocoa in Africa, British set up tea plantation in India and Srilanka, rubber in Malayasia and sugarcane and banana in West Indies, Spanish and Americans introduced coconut and sugarcane plantation in Philippines.

Extensive Commercial Grain Cultivation is practiced for wheat mainly followed by other crops such as corns, barley, oats, rye. The farming is fully mechanized as the farms are comparatively larger than the regular farms. This type of agriculture is profoundly done in the European Steppes, Canadian Prairies, and Argentinean Pompas, the Velds of South Africa and Australian Down and Canterbury Plains of New Zealand.

Mixed Farming is usually done for the farms of medium size. Wheat is again the primary crop followed by barley, oats, rye, maize, fodder and root crops. The crops are being grown in rotation and intercropping plays an important role in maintaining soil fertility. Both crop cultivation and animal husbandry have given equal importance. One of its important characteristics is its high capital expenditure on farm machinery and building and the other is the extensive use of chemical fertilizers. This kind of farming is done usually in the developed countries of the world such as North Western Europe, north eastern Africa, parts of Eurasia and the temperate latitude of southern continents.

Dairy Farming is the advanced level of farming in the categories of milch animals. These are also capital intensive farming mainly which facilitates animal shedding, storage of fodder, feeding and mulching machine, cattle breading health care and veterinary services etc. It is usually practiced near urban and industrial centers, as they provided fresh milk and dairy product. There is no off season for this type of farming. These are extensively performed in north Western Europe, Canada and South Eastern Australia, New Zealand and Tasmania

Mediterranean Agriculture is highly specialized type of agriculture generally practiced in the countries on the either side of the Mediterranean sea in Europe and in north Africa, from Tunisia to Atlantic Coast, South California, Central Chile, south western part of South Africa and Australia. This Lind rming generally emphasizes on the production of Citrus fruits.

Viticulture is otherwise known as the cultivation of Grapes especially in the Mediterranean region. These high quality grapes are used for the production of best quality wines with distinctive flavor and the inferior quality grapes are dried to produce raisins and currants. Olives and figs are also cultivated in these regions. These crops are grown normally in winters and therefore in great demand in European and North America market.

Market Gardening and Horticulture are the specialized crop production of high value where vegetables, fruits and flowers are exclusively grown for urban market. This can be grown in small farms which are well connected with urban centers. The essential factors of this practice are better irrigation facility, High Yield Variety of seeds, fertilizers, insecticides, greenhouses and artificial heating in cold regions. This kind of farming is famous in densely populated industrial district of north western Europe, north eastern United States and America and Mediterranean region. The world famous Tulip is being grown in Netherlands and flown to all major cities of Europe,

The kind of specialized farming being done in the area of vegetable farming is known as Truck Farming as it is named after the distance that a truck can cover over night for supplying vegetables.

Co-operative Farming is meant to pull in the resources of the society more efficiently and use them as the capital for crop growth without hampering the land or the farming practice. These movement were originated a centuries ago and has been implemented in European countries such as Denmark, Belgium, Sweden, Italy.

Mining

Mining is associated with the exploration of new land with enormous of mineral resources. The improvement of mining has begun with period of industrial revolution and since then its importance is continuously increases.

Factors affecting Mining

- The size, grade and mode of occurrence of the mineral
- Demand for the mineral, technologies available and used for extraction, capital to develop infrastructure and finally the labour and transportation cost.

Types of Mining

Depending upon the occurrence of mineral mining is of two types:

- **Surface Mining,** otherwise known as open cast mining which is comparatively easier and cheaper.
- **Under Ground mining** is being done with the help of vertical shaft which has to be sunk underground for the exploration. It is comparatively costlier and risky as at times the explorer may counter with fatal accidents due to poisonous gas, fire and floods.

Mining has lost its importance in developed countries due to high labour costs but in case of developing countries it is still a method of earning livelihood as 50% of the earnings come from mining only. Several countries of Africa and few countries of South America are still in the race.

SECONDARY ACTIVITIES

Manufacturing is the process of transforming natural resources to usable finished product as some of the raw material cannot be used in its crude form.

Classification of Industries

Manufacturing industries can be classified on the basis of their size, input or raw material, output/product and ownership,

1. Industries based on Size

- **Cottage or Household industries** are the smallest manufacturing units producing finished products using localized raw materials and simplest manufacturing tools. The finished products are being sold in the local market only.
- **Small scale industries** are the unit which provide finished product using local raw materials but sometimes these are

manufactured by simple power driven machinery with semi skilled labour. It provides employment opportunities to the local people, hence raising their local purchasing power. These industries are quite famous in countries like India, China, Indonesia and Brazil.

- **Large scale industries** involve large markets, raw material from various sources, specialized workers and hi-tech machinery for production as well as assemblage of various finished products. It has first introduced around 200 years ago in United Kingdom, north–eastern USA and Europe but it has spread to almost all over world.

2. Industries based on Input/Raw Material used

- **Agro based industry** is the industry which uses raw materials from field and farm and turns them into finished product such as sugar, pickle, fruit juice, beverages like tea and coffee, spices and oil, fats and textiles (cotton, jute, silk), rubber, etc.
- **Mineral based industries** use only minerals as their raw materials which further categorized into metal and non-metal minerals. The non- metal mineral industries are cement, pottery industry. But the metallic minerals are further divided into ferrous(which contain iron particle in it) and non ferrous (which does contain iron particle in the metal)
- **Chemical based industry** involves natural chemical minerals such as mineral- oil, petroleum, salt, sulphur, potash industry. At times raw materials are obtained from coal and wood. Some of the finished products are synthetic fiber, plastics, and Petroleum products like Vaseline etc.
- **Forest based industry** uses forest product as their raw materials such as log of woods bamboo, and grasses are used to produce finished product such as paper, wooden furniture etc.
- **Animal based industries** involve raw material extracted from animal either live or dead. Leather and wool are such type of industries.

3. Industries based on Output/Finished Product

- **Basic industries** are those industry whose finished product are being used as the raw material for other industries like iron and steel industries, cotton textile industries etc.
- **Consumer based industries** are the manufacturer of those goods which can be directly consumed by the consumer such as bread, biscuits, tea, soaps, paper, toiletries etc. These are also called non-basic goods.

4. Industries based on Ownership

- **Public Sector Industries** are owned and managed by Government only and also called As Public Sector Undertakings (PSU). In some countries like India both central and state government impose their authority on the industries sometimes individually or jointly.
- **Private Sector Industries** are entirely owned and governed by private companies and hence called as Private Sector Undertaking.
- **Joint Sector Industries** have shares and participation of both Private and Public sectors.

5. Industries based on weight

- **Heavy industries** involves heavy raw materials and its production is also heavy for example iron and steel industry
- **Light industries** use comparatively lighter material as input and the finished product is also light for example electrical industries.

Major industrial centres of the world

Country	Major Industrial Centers	Industries
Britain (Midland is the largest Industrial region centered at Birmingham)	Birmingham	Iron & Steel, Heavy Machinery
	Coventry	Automobile
	Burton-on-Trent	Brewing (largest brewery town of Britain)
	Stoke-on-Trent	Pottery (Pottery capital of Britain)
	New Castle	Shipbuilding
	Middlesbrough	Iron & Steel
	Bradford, Halifax, Leeds	Worsted textile
	Shefield (World's largest cutlery town)	Garments, Cutlery, Iron & Steel
	Manchester (Lancashire region)	Cotton textile
	Liverpool & Birkenhead	Shipbuilding, Heavy chemicals
	Along Manchester Canal	Iron & Steel, Shipbuilding
	Glosgow, Hamilton, Motherwell, Coatbridge	Shipbuilding & Linen industry
	Pot Glasgow	
	Belfast region (Main industrial region of Ireland)	
France	Lille	Textiles
	Dunkirus	Iron & Steel
	St. Etienne	Armaments & Bicycle
	Limoges	Pottery
	Lyone	Silk making
	Marseilles	Oil refineries
	Paris	Aircraft & Transport
	Champaque	Wine
	Lorrensar	Iron & Steel
Germany (Ruhr-Westphalia region, served by Rhine River, is the largest industrial region of Germany This industrial region is connected to North sea by Dortmund-Ems canal)	Frankfurt	Railway engineering
	Mainz	Leather, Brewing, Engineering
	Mannheim, Ludwigshafen	Chemical, electrical engineering, Iron & Steel.
	Hamburg	Shipbuilding
	Munich	Photographic equipment, Musical instrument
	Stuttgart	Automobile
	Aachen	Iron & Steel, Textile
	Leipzig	Optical instrument
	Jena Zeiss	Photographic equipment
	Dresden	Porcelain
	Karl Marx Stadt	Textiles
Belgium	Liege	Iron & Steel, Guns, pistols & other firearms
	Antwerp	Diamond cutting
	Ghent	Linen textiles
Luxemberg Netherland	Luxemberg city	Engineering
	Rotterdam	Shipbuilding and marine engineering
	Amsterdam	Diamond cutting
	Arnhem	Tin smelting
Sweden	Goteborg	Shipbuilding
	Stockhom	Shipbuilding

Switzerland	Zurich Basel Baden	Engineering and Textiles Engineering
Denmark	Kopenhagen	Dairy
Italy	Milan (main industrial region) Turin (Detroit of Italy)	Silk textile Motor Car
U.S.A. (Great Lake region) is the most important industrial region	Boston Pittsburg Akron Detroi Pontiac Flint Gary Chicago Toledo Birmingham Troy Buffalo San Fransisco (Silicon Valley)	Shipbuilding Iron and Steel (Iron & Steel capital of the world) World's largest synthetic rubber and tyre making centre Motor car and Aeroplane Cars and it's spare parts Iron and Steel Automobile Iron and Steel Garment Iron and Steel, Machine (It is also the largest flour milling centre of U.S.A.) Oil refining, Shipbuilding, Computer technology
Canada	Montreal Toronto Otawa Hamilton Birmingham) of Canada) Quebec	Shipbuilding and Aircraft Engineering and Automobile Paper Iron and Steel, Engineering Shipbuilding & Marine Engineering
Russia	Moscow and Gorky Magnitogost Leningrad (St. Petersberg)	Iron and Steel, Chemicals Iron and Steel, Oil refining Textile, Chemical, Paper
Ukraine	Krivoyrog	Iron & Steel and Heavy Machinery
Argentina	Bueons Aires	Shipbuilding
China	Shanghai Wuhan	Textile and Machinery Textile, Machinery, Shipbuilding, Iron and Steel
Japan	Nagoya (Detroit of Japan) Osaka (Manchester of Japan) Kyoto and Kobe Tokyo Nagasaki	Aircraft, Car, Machinery Shipbuilding, Textile, Iron & Steel Shipbuilding, Testtile, Iron & Steel Shipbuilding, Engineering, and Textile Shipbuilding, Iron and Steel, Machinery

TERTIARY ACTIVITIES

Tertiary Activities focuses both on production and exchange. Here production involves provision of services which are to be consumed. There is no such involvement of physical processing of raw material rather it's a service meant for exchanging the finished product. Services such as Trade and Transports belong to Tertiary economic activities.

1. Trade and commerce

Trading is essentially involves buying and selling of products intended for earning profit. The process is further divided into retail and wholesale.

2. Transport

It is a service which facilitates the process of trading of people, materials and manufactured products with ease. In other words it is the organized industry to satisfy man's need of mobility. On the basis of the modes of transport it can be of four types:

- **Land Transport** is the most preferred transportation system with reference to the movement of human being, animals and goods from one location to another. The two vital media which facilitate land transport across the world are Roads and Railways.

Road Transport

- Germany was the first country to develop nation wide highway network.
- Usa has the largest highway network in world followed by India.
- Highway 401 in Ontario (Canada) is the busiest highway and is the widest in world.
- The Karakoram highway in Pakistan to China is the highest international highway in world.
- China was the world's largest network of express ways network which extends over 1,23,000 km. USA ranks second in terms of expressways (7,7017).
- **Transport Canadian Highway** links Victoria with St. John City (7,821 km).
- Alaskan Highway joins the city of Anchorage in Alaska to Edmonlan in Canada. Covering a distance of 2,237 km.
- Pan American Highway is the largest international highway linking USA, Central America and South America. It covers a distance (30,000 km)
- Stuart Highway is the longest highway in Australia starting from Berdum in north Australia it reaches upto Melbourne situated in South Australia.

Road transport is as the most important communication medium as it facilitates door to door services for transporting goods and hence becoming the backbone of world's economic and social infrastructure.

Rail Transport

The history of railway were dated back in 650 BC and it was started with the introduction of wagan ways which were said to be further developed and widely used in 1550 AD in Germany with the invention of steam engine the railway grew many folds over the years. The first steam locomotive was built in 1804 in united kingdom. The first ever mechanised rail transport was introduced by England and ever since railways have remained as an important means of land transport.

- United State (2,50,000 km), China (1,21,000 km), Russia (90,000 km) and India (65,808) rank from first to fourth respectively in world scenario of largest railway network.
- India ranks first in carrying passenger per year by rail. Japan and Germany rank second and third in carrying rail passengers respectively.
- Steam engine was invented by Thomas Newcomen and was improved by James Watt.
- The first full-scale working railway steam locomotive was built in the United Kingdom in 1804 by Richard Trevithick.

- In 1811, John Blenkinsop designed first successful and practical railway locomotives.
- Dieselization was the replacement of steam locomotive with the diesel locomotive. This began in 1930s.
- Electrification of rail was started by Robert Davidson in 1838 in the form of electrical railway car.
- The *Trans-Australian Railway* includes the largest straight stretch of saithack in the world : 301 miles without any curve.
- *Qinghai-Tibet Railway* in China is the world's highest train journey, reaching the height of 5,072m above sea level at the Tanggula Pass.
- World's longest railway tunnel is the Seikan Tunnel, connecting Japan's northern Hokkaida island with Honshu. It is 33.46 miles long.
- The Napier to Gisborne Railway line is unique, as it crosses the main runway of Yesborne Airport.
- Venice Simplon orient express in the train against which all other luxury trains are measured.
- The *Trans-Siberian Railway* is the longest rail line in world. It connects St. Petersburg to Vladivostok via Moscow. Since 1916 its branches stretches into Mongolia, China and North Korea. It runs 9,332 kilometers (5,798.6 miles) and takes full week to cover this distance.

Trans-continental Railways connecting are part of a continent to its other part.

Major Trans-Continental Railways of World

- **Canadian Pacific Rail Route :** It runs from Halifax to Vancouver
- **Candian National Rail Route :** It joins St. John City to Vancouver.
- **Trans-Siberian Rail Route :** It connects St. Petersburg to Vlalivoslok.
- **Trans-caucasus Rail Route :** It starts from Batum, cross Tergana and reaches Krusk.
- **North Trans Continental Rail Route :** It originates at Seattle (USA) New York.
- **Mid Trans Continental Rail Route :** It joins san Francisco to New York.
- **Southern Trans Continental Rail Routes :** It runs from Los Angeles to New York and then reaches New Orleans.
- **Oriental Express Rail Route :** Connects Paris to Kustuntunia (Turkey)
- **Cape-Cairo Rail Route :** It is the longest rail route of Africa running from Cape Town in Southern part of continent and reaches Ciro near the coast of Mediterranean sea situated in the northern part of continent.
- **Trans-Andean Rail Route :** Starting from Valparais (Chile) reaches other end of the continent running west to east to Buenos Aires (Argentina).
- **Trans-Australian Continental Rail Route :** It connects west end of Australia to east end starting from Perth and reaches Sydney.

Transe-Asiatic Railways Line : This is a proposed project of united Nations Economic and Social Commission for Asia and Pacific. It will connect 28 countries including China, Thailand Bangladesh, India, Pakistan, Iran and Turkey.

Water Transport

Water transport is considered to be one of the oldest form of transport. It is cheapest mode of transport. The cost of production alongwith the cost of operation is also low incase of water transport. There are evidences which shows that boats were used in the form dugout canoe (a boat made from a hallowed tree trunk) in ancient period. It is considered that Egyptians probably were the first to use sail boat. The Mesopotamian and Indus valley civilization excavation have shown the presences of habour and ports.

Water transportation includes canals, lakes, rivers, seas and oceans. It is mainly divided into two categories:

Sea Routes

Oceans provide smooth traversable highway in all direction with low maintenance cost. Major sea routes are:

The North Atlantic Sea Route

It is linking two major industrially developed regions of the world such as North-Eastern USA and North-Western Europe.

The Mediterranean-Indian Ocean Sea Route

It is considered to be the most important sea route as at serves more countries and people than this route are port said, Aden, Mumbai, Colombo, and Singapore. The distance covered by this route has drastically reduced with the construction of suex canal.

The cape of Good Hope Sea Route

It connects west European and West African countries with Brazil, Argentina and Urguay in South America.

The North Pacific Sea Route

It is connecting Western European, North American with Australian countries is used for reaching Hongkong, Philippines and Indonesia. Honolulu is the most important sea port of this route.

Inland Water Transport

River, Canals, Lakes and Coastal area the important components of inland water transport as they facilitate transportation of goods and services with in the country. Boats qand steam are the important means of transport. The significant waterways of the world are:

The Rhine Waterway

River Rhine flows through Germany and Netherland. It is navigable for 700 km. It serves industrial areas of Switzerland, Germany, France, Belgium and the Netherlands.

The Dawube Waterway

River Danube serves Eastern Europe as it rises from Black forest and flows eastward through many countries. The nevigation is possible only upto Taurna Sevenin, this river transport facilitates the export of wheat, maize, timber and machinery.

The Volga Waterways

Volga is one of important water ways of Russia which provides a navigable water route of 11,200 km and it drains into caspian sea.

The Great Lake - St. Lawrence Seaways

Together with canal and welland canal, the great lake of North America Superior, Huron Erie and Ontario forms the Great lakes - St. Lawrence Seaways. Major ports of this routes are, Duluth and Buffalo.

Air Transport

It is the fastest way of transport but at the same time it is the costliest among the all medium of communication, still it is preferred by passenger for travelling across countries or sending cargoes across countries. The growth of Air Transport has reduced the travel time across the world to a great extent. But keeping in view the manufacturing of aircrafts and its associated elaborated infrastructure like hangars, landing, fuelling and maintaining these facilities, the air transport is considered to be the costliest among all transportation system.

Inter-continental Air routes

- These are the distinct air routes of Northern Hemisphere. Denser network of these Air routes are available in Eastern U.S.A, Western Europe and Southeast Asia.
- U.S.A. only accounts for 60% of the total network.
- The major nodal points or airport of this intercontinental air route are New York, London, Paris, Frankfurt, Rome, Moscow, Karachi, New Delhi, Mumbai, Bangkok, Singapore, Tokyo, San Francisco, Los Angeles and Chicago.
- Africa, Asiatic part of Russia and South America are deprived of any such services.
- There are few air services which are available only between 100 and 350 latitude in the southern hemisphere.

Pipeline Transport

- It is the excellent mode of transporting gaseous of liquid matters from one place to another.
- Cooking gas or L.P.G, oil and natural gas are the items that can be transported extensively through pipelines in many parts of the world.
- In some countries like New Zealand milk is supplied from farm to factories with the help of pipelines.
- In U.S.A, oil is one of the major products which is transported through pipeline from producing areas to consuming areas. Some of the other countries transporting oil through pipelines are Europe, Russia, West Asia and India.
- Big Inch is one of the famous pipelines which connect the oil wells of the gulf of Mexico to the North-eastern States.

Exercise -1

1. The national economy of New Zealand is based on
   (a) Export oriented agriculture
   (b) Heavy industries
   (c) Tourist industry
   (d) Electronic industry
2. Which one of the following pairs is not correctly matched?
   (a) Bahamas : Nassau
   (b) Costa Rica : San Jose
   (c) Nicaragua : Balmopan
   (d) Dominican Republic: Santo Domingo
3. Which among the following has the world's largest reserves of Uranium?
   (a) Australia (b) Canada
   (c) Russian Federation (d) USA
4. Which one of the following cities is known as the Pittsburg of Japan?
   (a) Kobe (b) Yuwaha
   (c) Tokyo (d) Osaka
5. Intensive subsistence farming is prevalent in
   (a) Canada (b) China
   (c) USA (d) Ukraine
6. Baku is famous as
   (a) Railway junction
   (b) Industrial city
   (c) Fish port
   (d) Petroleum extracting centre
7. Ural industrial region is dominated by
   (a) Textiles (b) Metal fabricating
   (c) Electronics (d) Automobiles
8. The best inland waterways system is developed in
   (a) Guinea coast (b) Central Europe
   (c) Amazon basin (d) North America
9. Which one of the following is known as the Manchester of the East?
   (a) Tokyo (b) Shanghai
   (c) KualaLumpur (d) Osaka
10. Grozny is famous for the production of
    (a) Petroleum (b) Uranium
    (c) Gold (d) Thorium
11. Which country has the densest railway network in terms of per million people?
    (a) China (b) USA
    (c) India (d) Australia
12. The first three countries in order of iron-steel production in the world are
    (a) USA, China, Germany
    (b) Japan, USA, China
    (c) Germany, China, USA
    (d) Japan, Germany, China
13. Flanders industrial region is renowned for
    (a) Iron & steel industry
    (b) Car manufacturing
    (c) Textile manufacturing
    (d) Electronics
14. The third position in the manufacture of cars in the world is occupied by
    (a) Japan (b) USA
    (c) France (d) Germany
15. Largest producer of silver in the world is
    (a) Mexico (b) USA
    (c) Laos (d) South Africa
16. The main centres of ship building industry in Japan are
    (a) Nagasaki and Yawata
    (b) Yakohama and Wakohama
    (c) Osaka and Kyoto
    (d) Nagita and Issikari
17. The three leading coal producers of the world are:
    (a) USA, Russia, Germany
    (b) England, France, Australia
    (c) France, Poland, Japan
    (d) Germany, India, South Africa
18. Which of the following countries are the best examples of highly scientific development and management of pastoral farming?
    (a) France and Spain
    (b) Denmark and Holland
    (c) Czechoslovakia and Poland
    (d) Greenland and Norway
19. Which one of the following countries of Africa finds a place in high human development category of UNDP?
    (a) South Africa (b) Kenya
    (c) Zimbabwe (d) Mauritius
20. The ports on either end of the Suez canal are
    (a) Cairo and Alexandria (b) Suez and Cairo
    (c) Cairo and Port Said (d) Port Said and Suez
21. Most industrialized country in ASEAN is
    (a) Philippines (b) Thailand
    (c) Malaysia (d) Singapore
22. Which one of the following is the most industrialized country of Latin America?
    (a) Brazil (b) Chile
    (c) Colombia (d) Argentina
23. Which is the shortest route from Moscow to San Francisco?
    (a) via Canada (b) over land
    (c) over the South Pole (d) over the North Pole
24. Which one among the following covers the highest percentage of forest area in the world?
    (a) Temperate coniferous forests
    (b) Temperate deciduous forests
    (c) Tropical monsoon forests
    (d) Tropical rain forests
25. Which one of the following countries has replaced Italy as the major importer of bauxite from India?
    (a) Canada (b) Greece
    (c) Ukraine (d) United Arab Emirates
26. Grand Banks is one of the important producers of
    (a) Nitrate (b) Iron ore
    (c) Marine fish (d) Bauxite

27. Plantation agriculture is most widespread in
(a) Nile valley (b) Mississippi valley
(c) California (d) Caribbean

28. The largest iron-producing region of USA is
(a) North East Appalachian region
(b) Alabama state
(c) Western region
(d) Lake Superior region

29. Detroit is famous for?
(a) motor car industry (b) copper industry
(c) mining industry (d) fishing industry

30. Which one of the following cities in USA is a steel manufacturing centre?
(a) New York (b) Rochester
(c) Chicago (d) Dallon

31. The main exporter of copper in the world is
(a) Ghana (b) Morocco
(c) Zambia (d) Belgium

32. Starting from the best quality of iron ore, Which one of the following is the correct sequence of the iron ore based on the contents of pure iron?
(a) Magnetite__Hematite__Limonite__Siderite
(b) Hematite__Magnetite__Limonite__Siderite
(c) Magnetite__Hematite__Siderite__Limonite
(d) Hematite__Magnetite__Siderite__Limonite

33. Which among the following has the world's largest reserves of Uranium?
(a) Australia
(b) Canada
(c) Russian Federation
(d) USA

34. Which one the following port cities in Venezuela has been developed as an oil port?
(a) Caracas (b) Maracaibo
(c) Maracay (d) Carupano

Exercise -2

Statement Based MCQ

1. The main features of the commercial dairy farming are
1. It is capital intensive.
2. It is labour intensive.
3. It is highly productive.
4. It is highly commercial.
Select the correct answer from the codes given below:
Codes:
(a) 1 and 3 only (b) 2 and 3 only
(c) 1, 3 and 4 only (d) 1, 2, 3 and 4

2. Which of the following are not the examples of shifting cultivation?
Select the correct answer from the codes given below:
1. Ladang 2. Hacienda
3. Fazenda 4. Pondu
Codes:
(a) 1 and 2 (b) 1 and 3
(c) 2 and 4 (d) 3 and 4

3. Which of the following are fund resources?
1. Coal 2. Copper
3. Petroleum 4. Forest
Select the correct answer from the codes given below:
Codes:
(a) 1 and 2 (b) 1 and 3
(c) 1 and 4 (d) 3 and 4

4. Tank irrigation is practised mainly in Peninsular India because
1. undulating relief and hard rocks make it difficult to dig canals and wells
2. rivers are rainfed
3. of compact nature of population and agricultural field
Select the correct answer using the codes given below :
(a) 1 and 2 (b) 2 and 3
(c) 1 and 3 (d) All of these

5. Which of the following are responsible for the decrease of per capita holding of cultivated land in India ?
1. Low per capita income.
2. Rapid rate of increase of population
3. Practice of dividing land equally among the heirs.
4. Use of traditional techniques of ploughing.
Select the correct answer using the codes given below :
(a) 1 and 2 (b) 2 and 3
(c) 1 and 4 (d) 2, 3 and 4

6. Which of the following items and their leading producers are correctly matched?
1. Grapes - Italy 2. Oilseeds - India
3. Millets - India 4. Coffee - Ethiopia
Which of the above statement are correct ?
(a) 1, 3 and 4 (b) 2, 3 and 4
(c) 1, 2 and 3 (d) 1, 2, 3 and 4

7. A geographic region has the following distinct characteristics:
1. Warm and dry climate 2. Mild and wet winter
3. Evergreen Oak trees
The above features are distinct characteristics of which one of the following regions?
(a) Mediterranean
(b) Eastern China
(c) Central Asia
(d) Atlantic coast of North America

8. Japan is one of the leading industrial countries in the world because it has:
1. developed hydel power
2. large deposits of metallic mineral
3. high technological capability
4. insular location
Of these statements:
(a) 1, 2 and 4 are correct
(b) 1, 2 and 3 are correct
(c) 1 and 3 are correct
(d) 2 and 4 are correct

9. Consider the following statements and select the correct answer from the codes given below:
Assertion (A): The W.T.O. aims to promote free trade.
Reason (R): It does not manage the global economy impartially.
Codes:
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true, but R is not the correct explanation of A.
(c) A is true, but R is false.
(d) A is false, but R is true.

Matching Based MCQ

DIRECTIONS (Qs. 10-26) : Match List-I with List-II and select the correct answer from the codes given below:

10.

List-I (Towns)	List-II (Industry)
(A) Pittsburg	(1) Textile
(B) Shanghai	(2) Iron & Steel
(C) Nagoya	(3) Automobiles
(D) Moscow	(4) Shipbuilding

(a) A – 1 ; B – 2 ; C – 3 ; D – 4
(b) A – 2 ; B – 1 ; C – 4 ; D – 3
(c) A – 3 ; B – 4 ; C – 1 ; D – 2
(d) A – 4 ; B – 3 ; C – 2 ; D – 1

11.

List-I (City)	List-II (Industry)
(A) Osaka	(1) Shipbuilding
(B) Hamburg	(2) Textiles
(C) Detroit	(3) Iron & Steel
(D) Pittsburg	(4) Automobiles

(a) A – 2 ; B – 1 ; C – 4 ; D – 3
(b) A – 1 ; B – 2 ; C – 3 ; D – 4
(c) A – 2 ; B – 3 ; C – 1 ; D – 4
(d) A – 4 ; B – 1 ; C – 2 ; D – 3

12.

List-I	List-II
(A) Iron & Steel	(1) Portsmouth
(B) Automobile	(2) Dortmund
(C) Shipbuilding	(3) Bangalore
(D) Aircraft	(4) Detroit

(a) A – 1 ; B – 2 ; C – 3 ; D – 4
(b) A – 2 ; B – 1 ; C – 4 ; D – 3
(c) A – 4 ; B – 3 ; C – 2 ; D – 1
(d) A – 2 ; B – 4 ; C – 1 ; D – 3

13.

List-I (Crop)	List-II (Main Producing area)
(A) Coconut	(1) Kenya
(B) Banana	(2) Popua New Guinea
(C) Groundnut	(3) Ecuador
(D) Tea	(4) Senegal

14.

List-I (Oil refineries)	List-II (Country)
A. Abadan	1. Saudi Arabia
B. Haifa	2. Iran
C. Kirkuk	3. Israel
D. Ras Tanavra	4. Iraq

Codes:

	A	B	C	D
(a)	2	1	4	3
(b)	2	3	4	1
(c)	1	3	2	1
(d)	4	2	3	1

15.

List-I (Mineral)	List-II (Area of production)
A. Coal	1. Highveld
B. Gold	2. Karaganda Basin
C. Iron ore	3. Krivoi Rog
D. Petroleum	4. San Joaquin valley

Codes:

	A	B	C	D
(a)	2	3	1	4
(b)	2	1	3	4
(c)	4	1	2	3
(d)	1	2	3	4

16.

List-I (Mineral)	List-II (Occurrence)
A. Coal	1. Bisbee
B. Copper ore	2. Baku
C. Iron ore	3. Mesabi
D. Petroleum	4. Westphalia

Codes:

	A	B	C	D
(a)	4	2	3	1
(b)	4	1	3	2
(c)	3	1	2	4
(d)	1	4	3	2

17.

List-I (Country)	List-II (Coal fields)
A. China	1. Pennsylvania
B. Germany	2. Saar
C. Ukraine	3. Shensi
D. U.S.A.	4. Donetz Basin

Codes:

	A	B	C	D
(a)	4	2	1	3
(b)	3	2	4	1
(c)	3	1	4	2
(d)	4	3	2	1

18.

List-I (Mineral)	List-II (Leading producer)
A. Tin	1. Zambia
B. Thorium	2. India
C. Uranium	3. Malaysia
D. Copper	4. Canada

Codes:

	A	B	C	D
(a)	3	4	2	1
(b)	1	2	4	3
(c)	3	2	4	1
(d)	4	3	2	1

19.

List-I (Country)	List-II (Oil field)
A. Iran	1. Bargan
B. Iraq	2. Damam
C. Kuwait	3. Kirkuk
D. Saudi Arabia	4. Masjid Sulaiman

Codes:

	A	B	C	D
(a)	4	3	2	1
(b)	3	4	1	2
(c)	2	3	4	1
(d)	4	3	1	2

20.

List-I (Industrial region)	**List-II (Country)**
A. Kinki	1. France
B. Lorraine	2. U.S.A.
C. Midlands	3. Japan
D. New England	4. U.K.

Codes:

	A	B	C	D
(a)	3	2	1	4
(b)	3	1	4	2
(c)	1	2	4	3
(d)	4	1	3	2

21.

List-I (Industry)	**List-II (Centre)**
A. Iron and steel	1. Turin
B. Ship building	2. Taipei
C. Electronics	3. Montreal
D. Automobile	4. Pittsburgh

Codes:

	A	B	C	D
(a)	1	2	3	4
(b)	4	3	2	1
(c)	3	4	1	2
(d)	2	4	1	3

22.

List-I (Iron and steel centre)	**List-II (Country)**
A. Cleveland	1. Canada
B. Essen	2. Russia
C. Hamilton	3. U.S.A.
D. Tula	4. Germany

Codes:

	A	B	C	D
(a)	1	4	2	3
(b)	3	4	1	2
(c)	3	1	2	3
(d)	4	3	1	2

23.

List-I (City)	**List-II (Important Industry)**
A. Shanghai	1. Ship building
B. Chicago	2. Iron and steel
C. Shefield	3. Cotton textile
D. Yokohama	4. Engineering

Codes:

	A	B	C	D
(a)	3	2	1	4
(b)	1	3	4	2
(c)	4	3	2	1
(d)	3	2	4	1

24.

List-I (Crops)	**List-II (Largest producer)**
A. Wheat	1. Brazil
B. Cotton	2. China
C. Sugarcane	3. U.S.A.
D. Tea	4. India

Codes:

	A	B	C	D
(a)	1	2	3	4
(b)	2	3	1	4
(c)	2	4	3	1
(d)	4	1	2	3

25.

List-I	**List-II**
A. Largest producer of wheat in the world	1 U.S.A.
B. Largest producer of milk in the world	2. China
C. Largest producer of sugarcane in the world	3. India
D. Largest producer of maize in the world	4. Brazil

Codes:

	A	B	C	D
(a)	1	2	4	3
(b)	2	3	4	1
(c)	3	4	2	1
(d)	1	3	2	4

26.

List-I	**List-II**
A. Iron and steel	1. Atlanta
B. Ship building	2. Bradford
C. Automobile	3. Cleveland
D. Woollen textile	4. Yakohama

Codes:

	A	B	C	D
(a)	3	4	1	2
(b)	1	2	4	3
(c)	2	4	1	3
(d)	3	2	1	4

Hints and Explanations

EXERCISE-1

1. (a)
2. (c) Managua is the capital of Nicaragua, not Balmopan.
3. (a) Australia has the world's largest uranium reserves. Approximately 24% of the planet's uranium is present in Australia.
4. (b) 5. (b) 6. (d) 7. (b) 8. (b) 9. (d)
10. (a) 11. (d) 12. (b) 13. (c) 14. (d) 15. (a)
16. (a) 17. (a) 18. (b) 19. (d) 20. (d) 21. (c)
22. (a) 23. (d)
24. (a) Temperature coniferous forests covers the highest percentage of forest area in the world.
25. (a) Canada is the largest importer of bauxite from India.
26. (c) 27. (c) 28. (d) 29. (a)
30. (c) 31. (c) 32. (a)
33. (a) Australia has the world's largest uranium reserves. Approximately 24% of the planet's uranium is present in Australia now 31%.
34. (b) Maracaibo is an oil-port of Venezuela as it has oil rich basis.

EXERCISE-2

1. (d) The main features of the commercial dairy farming are capital intensive, labour intensive, highly productive and highly commercial.
2. (c) Hacienda and Pondu are not the examples of shifting cultivation. Shifting cultivation is known as ladang cultivation in south east Asia. Fazendas (meaning "farms") were plantations found throughout Brazil; during the colonial period (16th - 18th centuries), they were concentrated primarily in the northeastern region, where sugar was produced.
3. (b) Coal and petroleum are the fund resource minerals. Because they are of the highest value in the foreign world market due to demand and also for scarcity.
4. (a) The tank irrigation is practised mainly in the peninsular India due to the following reasons
   1. The undulating relief and hard rocks makes it difficult to dig canals and wells.
   2. There is little percolation of rain water due to hard rock structure and ground water is not available in large quantity.
   3. Most of the rivers of this region are seasonal and dry up in summer season. Therefore, they cannot supply water to canals throughout the year.
   4. The scattered nature of population and agricultural fields also favours tank irrigation.
5. (b) The factors responsible for the decrease of per capita holding of cultivated land in India are
   1. Rapid rate of increase of population.
   2. Practice of dividing land equally among the heirs.
6. (c)
7. (a) Mediterrian climate have mild, rainy winter and hot, dry summers and Evergreen, Oak trees.
8. (c)
9. (b) The WTO established in 1995. It aims to promote free trade, but it does not manage the global economy impartially. The organization deals with regulation of trade between participating countries; it provides a framework for negotiating and formalizing trade agreements, and a dispute resolution process aimed at enforcing participant's adherence to WTO agreements, which are signed by representatives of member governments and ratified by their parliaments.
10. (b) 11. (d) 12. (d) 13. (a)
14. (b) The oil refineries of Iran are located in Abadan. Abadan is a city in and the capital of Abadan County, Khuzestan province, Iran. It lies on Abadan Island, 53 kilometres from the Persian Gulf, near the Iraq-Iran border. The oil refinery of Israel is located in Haifa. Haifa is the largest city in northern Israel, and the third-largest city in the country, with a population of over 291,000. The oil refinery of Iraq is located in Kirkuk. Kirkuk is a city in Iraq and the capital of Kirkuk Governorate. It is located in the Iraqi governorate of Kirkuk, 236 kilometres north of the capital, Baghdad. The oil refinery of Saudi Arabia is located in Ras Tanura. Ras Tanura is a city in the eastern province of Saudi Arabia located on a peninsula extending into the Persian Gulf.
15. (b) Karaganda Basin is known for coal production. Karagandy, more commonly known by its Russian name Karaganda, is the capital of Karagandy province in Kazakhstan. Highveld is known for gold production. The Highveld is the portion of the South African inland plateau. Krivoi Rog is known for iron ore production. It is a city in central Ukraine. It is situated in Dnipropetrovsk Oblast, to the southwest of the Oblast's administrative centre. San Joaquin valley is known for petroleum exploration. The San Joaquin Valley is the area of the central valley of the U.S. state of California that lies south of the Sacramento – San Joaquin river delta in Stockton.
16. (b) Coal mining occurs in Westphalia. It is a region in Germany. Copper ore occurs in Bisbee. Bisbee is a city in Cochise County, Arizona, United States, 82 miles southeast of Tucson. Iron ore occurs in Mesabi. The Mesabi Iron Range is a vast deposit of iron ore and the largest of four major iron ranges in the region collectively known as the Iron Range of Minnesota. Discovered in 1866, it is the chief deposit of iron ore in the United States. Baku is famous for petroleum exploration. Baku is the capital and largest city of Azerbaijan, as well as the largest city on the Caspian Sea and of the Caucasus region.
17. (b) Shensi is the coal field of China. It is a province of the People's Republic of China, officially part of the northwest China region. Saar is known as

the coal mining in Germany. The Saarland is one of Germany's sixteen federal states. Its capital is at Saarbrücken. Donetz Basin is the coal field of Ukraine. It comprises the Donbas Foldbelt, which is the uplifted and compressionally deformed part of the Pripyat–Dniepr–Donets (PDD) Basin. Pennsylvania is known for coal mining in U.S.A. Pennsylvania, officially the Commonwealth of Pennsylvania, is a U.S. state that is located in the northeastern and mid-Atlantic regions of the United States, and the Great Lakes region.

18. (c) Malaysia is the leading producer of tin. India is the leading producer of thorium. Canada is the leading producer of uranium. Zambia is the leading producer of copper.

19. (d) Masjid-e-Suleiman is the oil field of Iran. Kirkuk is the oil field of Iraq. Bargan is the oil field of Kuwait. Deman is the oil field of Saudi Arabia.

20. (b) Kinki is the industrial region of Japan. The Kansai region or the Kinki region lies in the southern-central region of Japan's main island Honshu. Lorraine is the industrial region of France. Lorraine is one of the 27 regions of France. The administrative region has two cities of equal importance: Metz, the regional prefecture and Nancy. Midlands is the industrial region of U.K. The Midlands is an area comprising central England that broadly corresponds to the early medieval Kingdom of Mercia. It borders southern England, northern England, East Anglia and Wales. New England is the industrial region of U.S.A. New England is a region in the northeastern corner of the United States consisting of the six states of Maine, Massachusetts, New Hampshire, Vermont, Rhode Island, and Connecticut.

21. (b) Turin is the centre of automobile industry. Turin is a city and an important business and cultural centre in northern Italy, capital of the Piedmont region. Pittsburgh is the centre of iron and steel industry. Pittsburgh is the seat of Allegheny County and with a population of 306,211 is the second-largest city in the U.S. state of Pennsylvania. Montreal is the centre of ship-building. Montreal is a city in the Canadian province of Quebec. It is the largest city in the province. Taipai is the centre of electronics. Taipei, officially known as Taipei City, is the capital of Taiwan. Situated at the northern tip of Taiwan, Taipei is located on the Tamsui river.

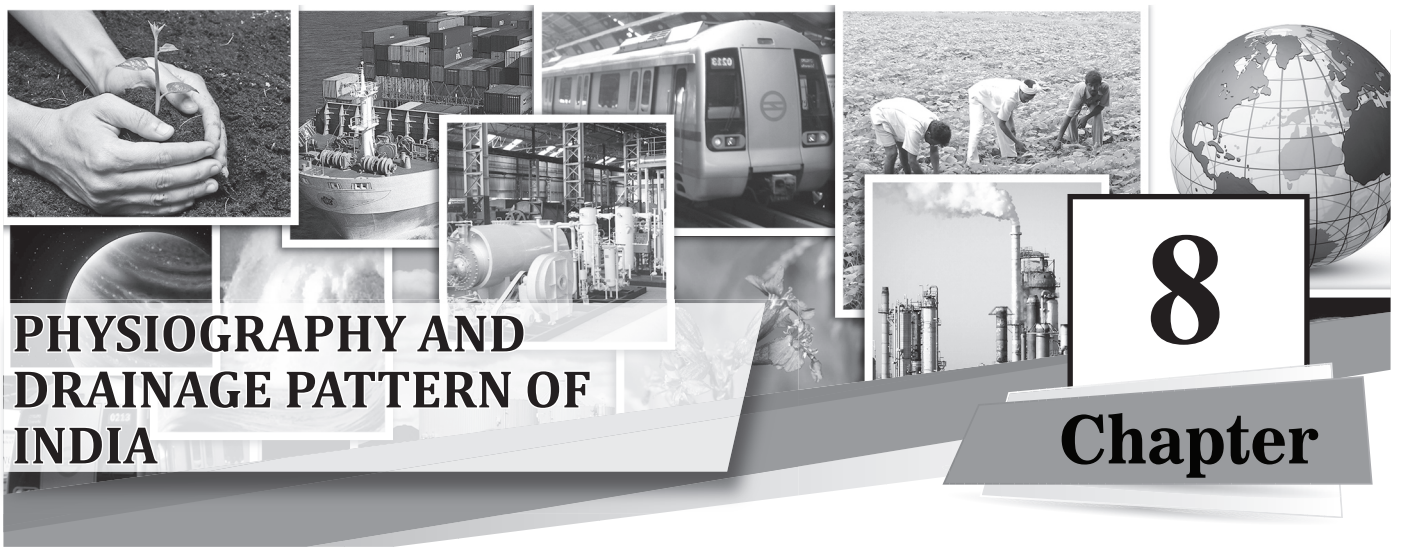
22. (b) Regarding to the Iron and steel centre, Cleveland is located in U.S.A. Essen is located in Germany. Hamilton is located in Canada. Tula is located in Russia.

23. (d) Cotton textile industry belongs to Shanghai. Iron and steel industry belongs to Chicago. Engineering industry belongs to Shefield. Ship building industry belongs to Tokohama.

24. (b) China is the largest producer of wheat. Roughly two-thirds of the total wheat production came from the north China plain and nearly another third from the central provinces. Winter wheat accounts for about 94% of China's total wheat output. U.S.A. is the largest producer of cotton. In its January report, USDA estimated a '13-14 US crop of 13.19 million bales. Upland production was estimated at 12.55 million bales and extra-long staple production at 636,000 bales. Brazil is the largest producer of sugarcane. Brazil's sugarcane industry association UNICA estimates Brazil's sugar cane production in 2012/13 at 531.4 million ton which is 8% up from the 493.2 million ton produced in 2011/12. India is the largest producer of tea. Tea Board of India shows that during January to August, tea production has risen by 6.2% to 705 million kg in 2013.

25. (b) Largest producer of wheat in the world is China. Largest producer of milk in the world is India. Largest producer of sugarcane in the world is Brazil. Largest producer of maize in the world is U.S.A.

26. (a) Iron and steel industry belongs to Cleveland. Ship building industry belongs to Yakohama. Automobile industry belongs to Atlanta. Woollen textile industry belongs to Bradford.

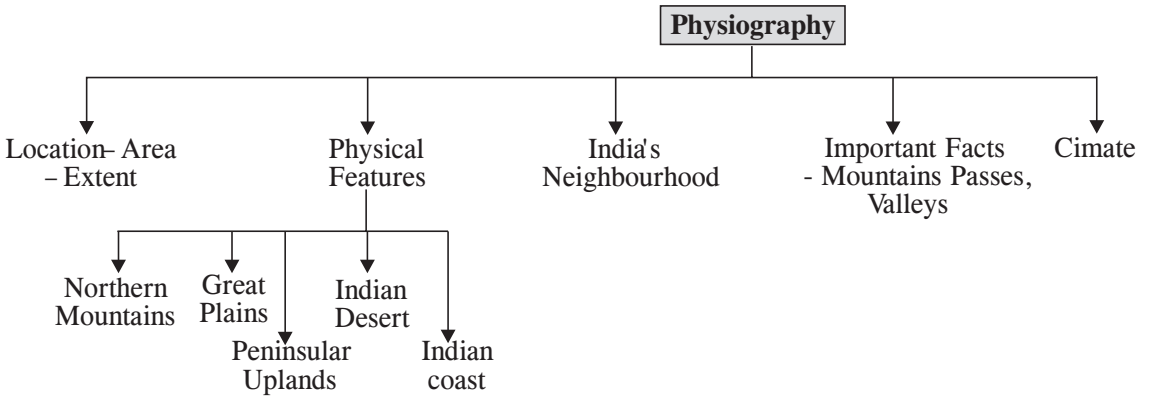


8 Chapter

PHYSIOGRAPHY AND DRAINAGE PATTERN OF INDIA

Introduction

'Physiography' of an area is the outcome of structure, process and the stage of development. The land of India is characterised by great diversity in its physical features. The North has a vast expanse of rugged topography consisting of series of mountain ranges with varied peaks, beautiful valleys and deep gorges. The South consists of stable table land with highly dissected plateaus and denuded rocks. In between these two lies the vast North Indian plain.



LOCATION - AREA - EXTENT

- India lies in the northern and eastern hemispheres of the globe between 8° 4′ N and 37°6′ N latitudes and 68°7′ E and 97°25′E longitudes.
- The southern most point extent upto 6°45′ N latitude to cover the last island of the Nicobar group of islands. The southern extreme is called **Pygmalion Point** or **Indira Point**.
- The **tropic of cancer** $\left(23\frac{1^\circ}{2}\text{N latitudes}\right)$ passes through the middle part of India and crosses the states of Gujarat, Rajasthan, Madhya Pradesh, Chhattisgarh, Jharkhand, West Bengal, Tripura and Mizoram.
- Its total length of land frontier of 15,200 kilometres passes through marshy lands, desert, level plains, rugged mountains, snow covered areas and thick forests.
- Besides land there is a maritime boundary of 6,100 kilometres along the main land mass which increases to 7,516 kilometres of the coastlines of Andaman-Nicobar and Lakshadweep Islands are added to it.

- India-Afghanistan and Pakistan-Afghanistan international boundary is called the **Durand Line**, determined as a "militarily strategic border between British India and Afghanistan".
- The India-China boundary (4,225 km) is a natural boundary running along the Himalayan ranges and is based on various treaties. Its eastern part (1,140 km) is called the **Mc Mahon Line**.
- The boundary with Pakistan and Bangladesh (the East Pakistan) was finalized at the time of partition in 1947 through the 'RedCliffe Award'.
- **The Tin Bigha Corridor** is a strip of land belonging to India is a part of West Bengal and lies adjacent to the Bangladesh border. In 1947, the border between India and Bangladesh was also demarcated by Sir Redcliffe.

- India is the only country which has given its name to an ocean, i.e. *Indian Ocean* encircled by 46 countries (27 littoral including Australia, 7 island states and 12 land locked countries).
- India commands a total geographical area of **32,87,263 sq. km** which is roughly 0.57% of the area of the earth and **2.4%** of the total area of the land hemisphere.
- India has roughly a quadrangular shape. It measures about 3,214 km from north to south and about 2,933 km from east to west, the difference between the two being just 281 km.
- Because of great longitudinal extent, the difference in local time between Eastern and Western extremes of the country is of two hours. In order to avoid the confusion with regard to the time at different places of the country, the local time along 82° 30' East longitudes is taken as the standard time of India, i.e. **India Standard Time** (IST).
- This meridian is known as the **Standard Meridian of India**. It passes through Mirzapur (UP). The Tropic of Cancer divides India almost into two equal halves. Thus, the Northern half of India is situated entirely in the Northern hemisphere and also belongs to the Eastern hemisphere because of its situation to the East of the Prime Meridian.
- After Russia, China, Canada, USA, Brazil and Australia, India is the **seventh largest country** of the world. Its area is almost equal to the area of Europe (excluding Russia), one-third of Canada, one fifth (1/5) of Russia, eight times of Japan and twelve times of United Kingdom.
- In population-size, India is the second giant country in the world after China.
- Its total population is more than the combined population of USA, Russia, Australia, Canada and Japan.
- The eastern boundaries of India are formed by a complex chain of the Himalayan offshoots consisting of the Mishmi, the Patkai, the Naga hills, the Barail range, the Mizo hills and finally the majestic Arakan Yoma Mountains range.
- The Arakan Yoma is submerged in the Bay of Bengal for sufficiently long stretch and emerges again in the form of Andaman and Nicobar Islands.
- The boundary line between India and Bangladesh crisscrosses the vast Ganga-Brahmaputra delta. This boundary runs is not even a small mount or hill which could be used for demarcating the boundary between the two countries.
- Jammu and Kashmir, Himachal Pradesh, Sikkim and Arunachal Pradesh are the states of India lying completely in the Himalayas, while the state of Uttarakhand lies partly in the Himalayas and partly in the northern plains.
- Madhya Pradesh, Chhattisgarh, Jharkhand, Maharashtra, Odisha, Andhra Pradesh, Karnataka, Kerala and Tamil Nadu, together make the great peninsular plateau.
- Gujarat, Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Odisha and West Bengal are states on the coast of India. Among our Union Territories, Daman and Pondicherry have sea boundaries.
- The Indian states on international boundaries (other country/ countries within brackets) are: Gujarat (Pakistan), Rajasthan (Pakistan), Punjab (Pakistan), Jammu and Kashmir (China and Pakistan), Himachal Pradesh (China), Bihar (Nepal), Uttarakhand (China and Nepal), Uttar Pradesh (Nepal), West Bengal (Bhutan, Nepal, and Bangladesh), Sikkim (China, Bhutan and Nepal), Arunachal Pradesh (Bhutan, China and Myanmar), Nagaland (Myanmar), Manipur (Myanmar), Mizoram (Bangladesh and Myanmar), Meghalaya (Bangladesh), Tripura (Bangladesh) and Assam (Bhutan, Bangladesh and Myanmar).
- The states of Haryana, Madhya Pradesh, Chhattishgarh and Jharkhand are the only *land-locked states which* are neither on the coast nor on an international border.

The States having Common Frontiers with Neighbouring Countries

Country	States
Pakistan	Jammu and Kashmir, Punjab, Rajasthan, Gujarat
Afghanistan	Jammu and Kashmir
China	Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim Arunachal Pradesh
Nepal	Uttarakhand, Uttar Pradesh, Bihar, West Bengal Sikkim
Bhutan	Sikkim, West Bengal, Assam, Arunachal Pradesh
Myanmar	Arunachal Pradesh, Nagaland, Manipur, Mizoram
Bangladesh	West Bengal, Meghalaya, Assam, Tripura, Mizoram

Four Ends of India

Easternmost point of India is known as Kibithu; situated on right bank of river Lohit separating India from China-Tibet region. It is a small village with the population at the altitude of 3,350 metre in Arunachal Pradesh. **Westernmost point** is situated in Kuch area of Gujarat called as Ghuar Mota. The region is famous for its harsh climate with 45°C in summer and 20°C in winter. During monsoon season this region looks like tortoise surrounded by seawater. **Northernmost** point of India has been in controversies ever since India's independence. The Siachen Glacier in the state of J&K is the northern boundary of India according to the official division of India during the time of Independences. The **Southernmost** point of the mainland of India is Kanyakumari District in the state of Tamil Nadu. Kanyakumari, formerly was known as Cape Comorin. It is the second largest and urbanized of Tamil Nadu. Indira Point is a village in the Nicobar district of Andaman and Nicobar Islands, India. It is located in the Great Nicobar tehsil. It is the location of the southernmost point of India's territory.

Area Wise Largest States

State	sq km
Rajasthan	342239
Madhya Pradesh	308245
Maharashtra	307713
Andhra Pradesh	160229
Uttar Pradesh	240928

Important Straits

Location	Channel
Indira point-Indonesia	Great Channel
Little Andaman and Nicobar	10° Channel
Minicoy-Lakshadweep	9° Channel
Maldives-Minicoy	8° Channel
India-Sri Lanka	Gulf of Mannar and Palk Strait

PHYSICAL FEATURES

Origin of Landforms

- The oldest landmass, the Indian Peninsula, was a part of the Gondwanaland. The Gondwanaland included India, Australia, Africa and South America as one single land mass. The convectional currents split the crust into a number of pieces, thus leading to the drifting of the Indo-Australian plate after being separated from the Gondwanaland, towards North. The Northward drift resulted in the collision of the Indian plate with the much larger Eurasian Plate.
- Due to this collision, the sedimentary deposit which were accumulated in the geosyncline (a long shallow depression between two large landmasses) known as the **Tethys** were folded to form the mountain system of Western Asia and Himalaya. The Himalayan upliftment out of the Tethys sea and subsidence of the Northern flank of the Peninsular plateau resulted in the formation of a large basin. In due course of time this depression, gradually got filled with deposition of sediments by the rivers flowing from the mountains in the North and the Peninsular plateau in the South.
- A flat land of extensive alluvial deposits led to the formation of the Northern plains of India. Geologically, the Peninsular plateau constitutes one of the ancient landmass on the Earth's surface. It was supposed to be one of the most stable land blocks. *The Himalayas and the Northern plains are the most recent landforms. From the view point of geology, Himalayan mountains form an unstable zone. The whole mountain system of Himalaya represents a very youthful topography* with conical peaks, V-shaped valleys and fast flowing rivers. *The Northern plains are formed of alluvial deposits. The Peninsular plateau is composed of igneous and metamorphic rocks with gently rising hills and wide valleys.*
- Out of the total area of the country, about 10.6% is occupied by mountains, 18.5% by hills, 27.7% by plateaus and 43.2% by the plains.
- India may be divided into five major physiographic regions, viz, (I) The Northern Mountains, (II) The Great Plains, (III) The Peninsular Uplands, and (IV) The Indian Coasts and Islands, & (V) The Indian Desert

I. The Northern Mountains

- The region extends all along the northern frontier of the country, for about 2500 km, with a varying width 240 to 320 km and a total area of about 5, 00,000 km^2.
- Himalayas represent the youngest and the highest folded mountains of the earth, rising to over 8000 m above sea level and consisting of three parallel ranges :
  (a) Himadri (Greater Himalayas),
  (b) Himachal (Lesser Himalayas), and
  (c) The Siwaliks (Outer Himalayas).
- The Himalayas are intersected by numerous valleys like Kashmir valley, the Karewas, the Doon valley, the Kangra and Kullu valley (Himachal Pradesh), Kathmandu valley (Nepal), Bhagirathi valley (near Gangotri) and Mandakini valley (near Kedarnath).

Principal Peaks of India

	Peak	*Height (Mtrs)*	*Location*
1.	Mt. Everest	8848	Nepal-Tibet
2.	Mt. K2 (Karakoram)	8611	India
3.	Kanchenjunga	8597	Nepal-India
4.	Dhaulagiri	8172	Nepal
5.	Nanga Parbat	8126	India
6.	Annapurna	8078	Nepal
7.	Gasherbrum	8068	India
8.	Nanda Devi	7817	India
9.	Mt. Kamet	7756	India
10.	Gurla Mandhata	7728	Tibet

Valleys and its locations

- Araku Valley : Andhra Pradesh
- Damodar Valley : Jharkhand and West Bengal
- Darma Valley : Uttarakhand
- Dzukou Valley : North-eastern part
- Johar Valley : Uttarakhand
- Markha Valley : Ladakh
- Nubra Valley : Ladakh
- Sangla Valley : Himachal pradesh
- Saur Valley : Uttarakhand
- Suru Valley : Ladakh
- Tons Valley : Uttarakhand
- Yumthang Valley : Sikkim

Divisions of the Himalayas

(a) The sub-Himalayas or Siwaliks :

- The range has a total length of about 2400 km from the Indus gorge to the Brahmaputra valley.
- It is known by various local names, i.e. the Jammu hills (Jammu & Kashmir), the Dundwa range (Uttarakhand), the Churia Muria hills (Nepal), the Daffla, Miri, Abor and Mishmi hil1s (Arunachal Pradesh).

(b) The Lesser Himalayas or Himachal:

- It is about 80 km wide with average height between 1300 to 5000 m.
- Important ranges include the Dhauladhar, Pirpanjal, Nag Tiba, Mahabharat range and Mussoorie range. The famous hill resorts like Shimla, Chail, Ranikhet, Chakrata, Mussoorie, Nainital, Almora and Darjeeling, etc. are situated over this range.
- Along the slopes are found a number of *small pastures* which are called *Merg in Kashmir* (viz. Gulmerg, Sonmerg, Tanmerg) and *Bugyal and Payar in* Uttarakhand.

Mountain Passes of India

Himalayan passes

- Banihal pass — between Doda and Anantnag (Jawahar Tunnel), J & K.
- Shipki La — River Sutluj enters India from Tibet, Himachal Pradesh.
- Bara Lachan La — between Kyelang and Leh, Himachal Pradesh.
- Rohtang pass — between Kullu and Kyelang, Himachal Pradesh.
- Bomdila pass — between Tezpur and Tawang, Arunachal Pradesh.

Himalayan passes between India and China

- Shipki La — Himachal Pradesh.
- Thaga La and Niti La — Uttarakhand .
- Lipu Lekh La — Tri-junction, India-Nepal-China, Uttarakhand.
- Jelep La — Between India and China (Gangtok-Lhasa Road) Sikkim.
- Nathu La — Between India and China (Entry to Chumbi Valley) Sikkim.

Trans Himalayan passes

- Karakoram pass and Aghil pass — Jammu & Kashmir.

Passes in Western Ghats

- *Palghat* — between Palakkad and Coimbatore.
- *Shenkota* — between Kollam and Madurai.
- *Thalghat* — between Mumbai and Pune.
- *Bhorghat* — between Mumbai and Nasik.

- The best known passes of the Pir Panjal range are the *Pir Panjal Pass* (3480 m), the *Bidil* (4270m), *Golabghar* (9812m) and *Banihal Pass* (235m). The Jammu-Sri Nagar highway uses the Banihal Pass.

(c) The Greater Himalayas or Himadri

- This zone rises abruptly like a wall north of the Lesser Himalayas. It is about 25 km wide with average height above 5000 m.
- The Himadri runs in an arc like shape in a length of 2500 km from *Nanga Parbat* (8126 m) in the west to *Namcha Barwa* (7756 m) in the east.
- This is the northernmost or the innermost of all the Himalayan ranges.
- With an average elevation of 6100 m above sea level this is the loftiest and the most continuous mountain range of the world.
- This mountain range boasts of the tallest peaks of the world, most of which remain under perpetual snow.
- They are, in descending order of altitude, *Mount Everest*, also called Sagarmatha or Chomo Langma (8848m), Lhotse 1 (8501m), Mount Akalu (8481m), Kanchenjunga South Peak (8474m), Kanchenjunga West Peak (8420m), Lhotsa Intermediate Peak (8410m), Cho Oyu (8153m), Nanga Parbat (8126m), Annapuma (8078m), Gosainthan or Shisha Pangma (8013m), Makalu South peak (8010 m).
- The Burzil pass and Zoji La in Kashmir, Bara Lapcha La and Shipki La in Himachal Pradesh, Thaga La, Niti Pass and Lipu Lekh Pass in Uttarakhand and Nathu La, Jelep La in Sikkim are worthy of mention.
- The Hindustan - Tibet road connecting Shimla with Gartok in Western Tibet passes through the Shipki La.
- Another important trade route connecting Kalimpong (near Darjeeling) with Lhasa in Tibet however passes through Jelep La (4386m).
- The Himadri runs in an arc like shape in a length of 2500 km from Nanga Parbat (8126 m) in the west to Namcha Barwa (7756 m) in the east.

(d) Trans Himalayas

- The Trans-Himalayan Zone with a width of 40 km in its eastern and western ends and a width of 222 km in its central part, it has important ranges such as the Zaskar Range and the Great Karakoram range. The Karakoram extends towards the south-east to form the Kailash Range (Tibet). The highest peak in the Karakoram range is K_2 (8,611 m). The longest glacier is Siachen in the Nubra Valley which is more than 72 km long.

Some important facts about peaks

- Highest Mt. Peak in India: *K_2 or Godwin Austin*
- Highest peak in Aravalli: Gurushikhar (in Mt. Abu)
- Highest peak in Satpura - Dhupgarh (Mahadeo Hills)
- Highest peak in E. Ghats - Mahendragiri (Orissa)
- Highest peak in W. Ghats - Anaimudi (Annamalai Hills - Kerala)
- Highest peak in Nilgiris - Doda Betta
- Hills in Southern Hill complex - Nilgiri, Annamalai, Cardamom & Palani
- Hills in Eastern Ghats: Shevaroy, Javadi, Palkonda, Nallamalai, Northern Circars
- Oblique ranges to Western Ghats in Maharashtra: Ajanta, Satmala, Harishchandra, Balaghat
- Satpura range from East to West: Amarkantak - Maikal- Mahadeo - Gawilgarh - Rajpipala
- Highest peak in Andaman and Nicobar is-lands- *Saddle Peak*
- The highest peak of Naga hills is Saramati peak.

(e) The Eastern Hills or the Purvanchal

- After crossing the Dihang gorge, the Himalayas take a sudden southward turn and form a series of comparatively low hills running in the shape of a crescent with its convex side pointing towards the west. These hills are collectively called the Purvanchal because they are located in the eastern part of India.
- The hill ranges running in north-south direction along the Burmese border and passing through Arunachal Pradesh (Tirap division), Nagaland, Manipur and Mizoram are collectively called *Purvanchal*. These are known by various local names, i.e. Patkai Bum (Arunachal Pradesh), Naga hills, Kohima hills, Manipur hills, Mizo hills, Tripura hills and Barail range.
- Extending from Arunachal Pradesh in the north to Mizoram in the south, they form India's boundary with Myanmar.
- In the north is the *Patkai Bum*, which forms the international boundary between Arunachal Pradesh and Myanmar.
- After running for some distance southwards, it merges into Naga Hills where Saramati (3826m) is the highest peak.
- South of Naga Hills are the Manipur hills, which are generally less than 2500 metres in elevation.
- The Barail range separates Naga Hills from Manipur Hills.
- South of the Manipur Hills are the Mizo Hills, which have an elevation of less than 1500 metres. The highest point is the Blue Mountain (2157m) in the South.

Longitudinal divisions of the Himalayas

Longitudinally, the Himalayas can be divided into following sections.

1. **The Punjab Himalayas**
   The 560 km long stretch of the Himalayas between the Indus and the Sutluj rivers is known as the Punjab Himalayas. A large portion of this sector lies in Jammu and Kashmir and Himachal Pradesh as a result of which it is also called the Kashmir and Himachal Himalaya. Karakoram, Ladakh, Pir Panjal, Zaskar and Dhaula Dhar are the main ranges of this section.
2. **Kumaon Himalayas**
   This section extends from Sutluj to Kali river valleys and is said to have 360 lakes, such as *Naini* Tal and *Bhim Tal*. The Pilgrimage centers (*Badrinath*, Gangotri) located in this section is of particular importance to the Hindus.
3. **Nepal Himalayas**
   This section extends from Kali to Tista and has the distinction of having some of the highest peaks in the world including Mt. Everest.
4. **Assam Himalayas**
   This section extends from Tista to Brahmaputra. The highest peak of this range is Namcha Barwa.

II. The Great Plains

- It is an aggravational plain formed by the alluvial deposits of the Indus, Ganga and the Brahmaputra and their tributaries. This is the largest alluvial tract of the world, extending for a length of 3200 km and width varies between 150 to 300 km.
- The plain stretches from west (from the banks of the Ravi and Sutluj) to east (the Ganga delta) to a lentgh of 2400 km.
- The plain merges into the Thar desert in the south-west. A low watershed of the Delhi ridge (278 m) along the right bank of the Yamuna river separates the Satluj plains (a part of the Indus plain) from the Ganga plains.

Divisions of the Great Plains

The Great Plains may be divided into a number of smaller units on the basis of the characteristics of the alluvium, surface gradient, drainage channels and regional traits.

Bhabar Plains

It lies all along the foot of the Siwaliks with remarkable continuity from the Indus to the Tista. It is generally 8 to 16 km wide belt consisting of gravel and unassorted sediments deposited by the Himalayan rivers in the foreland zone due to sudden break of slope. The porosity is so high that all streams disappear in the Bhabar tract leaving out only dry channels.

Terai Plains

South of the Bhabar lies a 15-30 km wide marshy tract called terai where streams reappear to the surface.

The Terai is more marked in the eastern part than in the west due to higher amount of rainfall.

It is a zone of excessive dampness, thick forests & rich wild life.

Bangar or Bhangar Plains

The Bhangar represents the uplands (alluvial terrace) formed by the deposition of the older alluvium and lie above the flood-limit of the plains. The main constituent of Bhangar is clay (locally known as kankar) which at places gives way to loam and sandyloam.

Khadar Plains

The younger alluvium of the flood plains of the numerous rivers is called the Khadar or Bet (in Punjab).

Its alluvium is light coloured and poor in calcareous matter consisting of deposits of sand, silt, mud and clay.

Delta Plains

Deltaic plain is an extension of the Khadar plain. It covers about 1.86 lakh sq km of area in the lower reaches of the Ganga river (West Bengal). It mainly consists of old mud, new mud and marsh. Upland area is locally known as *chars & marshy* land as '*bills*'. Large part of the coastal deltas is covered by thick impenetrable tidal forests called *Sunderbans*.

On the basis of regional characteristics, the Great Plains may be divided into following sub plains:

The Punjab-Haryana Plains

With a distance of 640 km from north-east to south-west and 300 km from west to east, these flat plains occupy 1.75 lakh sq km. They comprise the *Bist Doab* (between Sutlej and Beas rivers), the *Bari Doab* (between Beas and Ravi rivers), the *Chaj Doab* (between Chenab & Jhelum) & the *Sindh Sagar Doab* (between Jhelum - Chenab & Indus).

The Rajasthan Plains

These comprise the marusthali of Thar and the nearly Bagar areas and occupy an area of 1.75 lakh sq km. Sand dunes are longitudinal (in the west and south) and transverse (in the east). The Luni river flowing towards the south-west is the only river in the region. The Rajasthan desert is sloping towards two directions

(a) westwards to the Indus Valley in Pakistan, and
(b) southwards to the Rann of Kutch.

The Ganga Plains

Spreading across the states of Uttar Pradesh, West Bengal and Bihar for 3.57 lakh sq km,the plains comprise the raised bhangar areas and Khadar areas. The Ganga Plain is divided into the

(a) Ganga-Yamuna Doab,
(b) Rohilkhand Plain,
(c) Avadh Plain (covering the eastern half of Uttar Pradesh),
(d) Bihar Plain, and
(e) Bengal Plain.

The Ganga delta, which constitutes the Bengal basin, has part of it stretching along the sea and covered with tidal forests (the Sunderbans).

The Brahmaputra Plains

The low-level plains formed by deposits carried by mainly the Brahmaputra river but also the Diband, the Sesiri and the Luhit are bordered by high mountains. Moist soil conditions and thick forests form the northern extreme.

III. The Peninsular Uplands

Rising from the height of 150 m above the river plains up to an elevation of 600-900 m is the irregular triangle known as the *Peninsular Plateau*.

The Peninsular plateau is a tableland composed of the old crystalline, igneous and metamorphic rocks. It was formed due to the breaking and drifting of the Gondwanaland and thus, making it a part of the oldest landmass. This region of the country is surrounded on the three sides by water and thus, is a Peninsular plateau.

The plateau has broad and shallow valleys and rounded hills. Narmada river, which flows into a Rift valley, divided the region into two parts namely, the central highlands in its North and the Deccan plateau in its South.

- Its north-west limit is marked by Aravalli range and its northern extreme has the raised Bundelkhand. At its eastern and western ends are Eastern Ghats and Western Ghats respectively.
- The fault in which the Narmada river flows divides the region into two unequal parts; the smaller one in the north being known as the Central Highlands.
- It is slightly tilted towards north. The southern part has been tilted east with bold heights to the west. This area is popularly known as the Deccan Plateau comprising the Satpuras, Western and Eastern Ghats and a large number of plateaus.

On the basis of prominent relief features, the Peninsular plateau can be divided into three broad groups:

1. The Central Highlands

The Central Highlands are bounded to the West by the Aravali range. Satpura range demarcates its boundary in the South from Deccan plateau.

An Eastern extension of central high lands is formed by Rajmahal hills.

The general elevation of the central high lands ranges between 700-1000 m above the mean sea level. It slopes towards the North and North-Eastern directions.

The Aravalli Range

It runs North-East to South-West for 800 km from Delhi through Rajasthan to Palanpur in Gujarat. These are the relict mountains representing one of the world's oldest high lands formed as a result of folding process in Archean times. It has a lower elevation between Delhi and Ajmer, where it is characterised by a chain of discontinuous ranges. But it becomes a continuous range South of Ajmer where it rises to 900 m elevation.

The general height of this range varies between 400-1300 m. Gure Skikhar 1722 m) is the highest peak of the range, located in Ubu hills of Rajasthan. Barr, Piplighat, Dewari, Desuri are some of the passes associated with this range.

East Rajasthan Uplands

It is located East of the Aravali range in North-West India. The upland covers an area of 23,200 sq km and have a general elevation of 350 m. It constitutes the Northern part of Central Highlands.

Madhya Bharat Plateau

It is the Northern of the central highlands. It covers an area of about 22 thousand sq km.

Bundelkhand and Baghelkhand Uplands

It lies to the South of Yamuna river along border region of Uttar Pradesh and Madhya Pradesh. Bundelkhand covers five districts of Uttar Pradesh and four districts of Madhya Pradesh. Baghelkhand lies South-East of the Bundelkhand region and is largely made up of limestones and sandstones. They are represented by rounded Hummocky hills made of granite and sandstone. Streams like Betwa and Ken have carved out steep gorges, rocky banks and waterfalls in these uplands rendering them unfit for cultivation. The region is characterized by 'senile topography'

The Malwa Plateau Largely in Northern Madhya Pradesh, forms a triangular shape and is typical for having two systems of drainage. Rivers like Mahi and Narmada flow through it into the Arabian sea, while rivers like Chambal and Betwa flow through it to join Yamuna and ultimately fall into Bay of Bengal.

It is composed of lava flows and is covered with black soils. This plateau is marked in its North by the badlands or ravines formed by Chambal river by exercising gully erosion.

The Vindhya Ranges

It runs parallel to the Narmada Rift valley as an escarpment in an East-West direction from Jobat in Madhya pradesh to

Sasaram in Bihar for a distance of 1200 km. The general elevation of the ranges is 400-700 m. It consists of horizontal beds of sedimentary rocks.

This range acts as a watershed between North flowing rivers of the Ganga system and Peninsular rivers. It continues Eastwards as Bharner hills and Kaimur hills. Panna hills also lie in these ranges. The Great boundary fault separates the Aravallis from Vindhyan range.

The Chhotanagpur Plateau

It lies East of Baghelkhand in the State of Jharkhand covering some parts of Chhattisgarh and West Bengal. Its average elevation is 700 m above sea level. It is the storehouse of minerals and a large scale mining of iron, manganese, coal, uranium etc is done in this region. This plateau is drained by numerous rivers forming a radial drainage pattern. Damodar river valley is well-known for its coal deposits.

In the North-East of this region lies **Hazaribagh plateau**, while towards East are **Parasnath hills** and towards South-East is **Ranchi plateau. Rajmahal hills** form the North-Eastern edge of the Chhotanagpur plateau and are covered by black soil. The plateau is an example of Pat Land.

2. Deccan Plateau

Deccan plateau is bordered by the Western ghats in the West, Eastern ghats in the East and the Satpura, Maikal and Mahadeo hills in North. The Deccan Plateau is higher in the West and slopes gently eastwards. It is higher in South than its North.

The Satpura Ranges

It is a series of seven mountains that run in the East-West direction in between Narmada and Tapi rivers. It is an example of block mountain. Commencing from the Rajpipla hills in the West through the Mahadev hills to Maikal range, it stretches for about 900 km.

Dhupgarh (1325 m) on Mahadev hills near Pachmarhi in Madhya Pradesh is the highest peak of the ranges. Amarkantak is another important peak lying in the Maikal range at Madhya Pradesh-Chhattisgarh border and is the source of river Narmada.

Maharashtra Plateau is a basaltic sheet with a thickness of more than 2000 m. It has been formed by the consolidation of the lava. Maharashtra plateau covers the entire State of Maharashtra except Konkan coast and the Sahyadris.

Karnataka Plateau is situated at the south in Deccan plateau. It covers entire Karnatka except a small portion of North-East. It has the rocks of lava origin.

Telangana Plateau constitutes the North- Eastern part of Deccan plateau. It covers an area of 1.4 lakh sq km. It is located in the Western part of Andhra Pradesh.

The Western Ghats or Sahyadris form the Western edge of the Deccan plateau and lie parallel to the Western coast. They form a continuous water divide. They run continuously for 1600 km from Maharashtra to Kanyakumari and can be crossed through passes only.

Their average width varies from 50 km in the North to about 300 km in the South. It is composed of lava deposits up to 16° N latitude. Important peaks of the Western Ghats from North to South include - Kalsubai (1646m - highest peak of Maharashtra), Salher (1567 m), Mahabaleshwar (1424 m) in Maharashtra and Kudremukh (1892 m) as the highest peak in Karnataka. The Sivasamudran fall, Gokak fall and Mahatma Gandhi fall are important waterfalls in Western Ghats. Bhor Ghat, Thalghat and Palghat are the important passes facilitating movement between the Western coastal plains and rest of the country. Palghat gap separates Nilgiri hills in the South from Anaimalai hills. It is at the Nilgiris that Western Ghats and Eastern Ghats meet with each other. Anamudi (2695 m) in the Anaimalai hills is the highest peak of whole of Southern India. Another important peak is Dodabetta (2637m) of Nilgiri hills. Cardamom hills are the Southernmost hills and reach upto Kanyakumari and are famous for cultivation of Cardamom and spices.

The Eastern Ghats are discontinuous and irregular and dissected by rivers draining into the Bay of Bengal. These are a series of detached hills of heterogeneous composition which are called by various local names. The Western ghats are higher than the Eastern ghats.

Their average elevation is 900-1600 m as against 600 m of the Eastern Ghats. The Eastern Ghats stretch from the South of Mahanadi valley to the Nilgiris in the South. The Eastern Ghats are comparatively broader and do not form a continuous water divide.

Aroya Konda (1690 m) at Andhra-Odisha border is the highest peak of Eastern Ghats. Other important peaks include Mahendragiri (1501 m) in Odisha, Gali Konda (1643 m) etc. It is a continuous range from south of Mahanadi to Godavari. South of it, it is highly dissected.

They continue South of Krishna river in the form of dissected hills from North to South in Andhra Pradesh and Tamil Nadu as Nallamala hills. Palkonda range, Velikonda range, Javadi hills and Shevaroy hills only to confluence with Western Ghats at Nilgiri hills. Khondalites are predominantly found in Eastern Ghats.

Difference between Eastern Ghats and Western Ghats

Western Ghats	Eastern Ghats
Form a continuous water divide.	Discontinuous and dissected by rivers.
Can be crossed through passes	Series of detached hills
Higher than Eastern Ghats	Lower than Western Ghats
Face Arabian sea and run along the western plateau	Face Bay of Bengal and run along the Eastern Plateau
Comparatively narrow	Comparatively broader
Highest Peak-Anaimudi	Highest Peak-Mahendragiri

3. The North-Eastern Plateau

It is an extension of the main Peninsular plateau. It is believed that due to the force exerted by the North-Eastward movement of the Indian plateau at the time of the Himalayan origion, a huge fault was created between the Rajmahal hills and the Meghalaya plateau. Later this depression got filled up bv the deposition activity of the numerous rivers. Today, the Meghalaya and Karbi Anglong plateau stand detached - from the main Peninsular Block. The Meghalaya plateau is further sub- divided into three parts:–

(i) The Garo hills
(ii) The Khasi hills
(iii) The Jaintia hills

These hills are named after the tribal groups inhabiting this region. An extension of this is also seen in Karbi- Anglong hills of Assam. Similar to the Chhotanagpur plateau, the Meghalaya plateau is also rich in mineral resources like coal, iron ore, Sillimanite, limestone and uranium. This area receives maximum rainfall from the South West monsoon. As a result the Meghalaya plateau, especially Cherrapunji, displays a bare rocky surface devoid of any permanent vegetation cover. Highest peak of Meghalaya plateau is Nokrek, which is located in Garo hills.

Wandakaraya Region:– Its Abujhmar hills provide one of the richest iron-ore deposits at bailadilla range.

IV. The Indian Coasts and Islands

The Coastal Plains

The 4,500 km long coastline of India has the Arabian Sea on its west, the Bay of Bengal on its east and the Indian Ocean on its south. It runs from the *Rann of Kutch* in the west to the delta of the Ganga - Brahmaputra in the east. The coastal plain in India has been divided into the following two types:–

Western Coastal Plains

The Western coastal plains are an example of submerged coastal plain. The Western Coastal Plains include plains along Kutch and Kathiawar regions of Gujarat to Konkan plains of Maharashtra-Goa, Karnataka plains and the Southern Malabar plains along Kerala coast.

It is believed that the city of Dwarka which was once a part of the Indian main land situated along the West coast is submerged under water. Because of submergence it is a narrow belt and provides natural conditions for the development of ports and harbours. It consists of three sections:–

(i) **The Konkan Plains** extend from Daman to Goa for a distance of around 500 km with a width varying between 50-80 km. It consists of features of marine erosion as it is a shore line of submergence with a number islands dotting the coast. Mumbai was also islands until some connecting land was recovered from sea. These plains have fertile stretch of land and some sea water inlets called creeks are also there in between.

(ii) **Karnataka or Kannada Coastal Plains** stretch from Goa to Mangalore for about 225 km. These are narrow fertile plains. Sharavathi river forms Jog falls (271 m) in this region, which is the highest waterfall of India.

(iii) **The Malabar Coastal Plains** between Mangalore and Kanyakumari are 500 km long. They are much wider in extent and at places 96 km wide. These are low lying plains with extensive presence of lagoons, back waters, spits etc. The back water locally known as Kayals are the shallow lagoons or the inlets of the sea into the region. The largest among these is the Vembanad lake. Several lagoons have joined to form inland water ways. Every year the famous Nehru Trophy Vallamkali (boat race) is held in Punnamada Kayal in Kerala.

Eastern Coastal Plains

As compared to the Western coastal plain the Eastern coastal plain is broader and is an example of an emergent coast. There are well developed deltas here, formed by the rivers flowing Eastward into the Bay of Bengal. Because of its emergent nature, it has less number of ports and harbours. The plains are divided into two parts:–

(i) **Northern Circars:** Rivers such as the Mahanadi, the Godavari, the Krishna and the Cauveri have formed extensive deltas on this coast. It comprises the coastal areas of Odisha. Mahanadi forms delta with a thick layer of fine alluvium. Lake Chilka is important here. In South of it, it comprises Andhra coastline upto Krishna delta.

(ii) **Coromandel Coast:** South of Northern circars coromandel coast lies extending Southwards along Tamil Nadu coast. It covers an area of 23 thousand sq km. These plains constitute a fertile stretch of the cultivation of a range of crop.

The Islands

There are two main groups of islands in the Indian ocean far away from the coast. India has a number of islands (247) both in the Bay of Bengal (204 islands) and the Arabian sea (43 islands). One of them is the Lakshadweep Islands in the Arabian sea and the other is the Andaman and Nicobar islands in the Bay of Bengal.

Lakshadweep Islands

These islands group lies close to the Malabar coast of Kerala. This group of 25 islands is composed of small coral islands. The islands North of 11° N latitude are known as **Amindivi islands** and those South of it are Cannanore islands. They cover small area of 32 sq km.

Most of the islands have low elevation and do not rise more than 5 m above sea level. Shallow lagoons can be seen on their Western sides while sea slope is steeper towards their Eastern coasts. Kavaratti island is the administrative headquarters of Lakshadweep. The Pitli island, which is uninhabited, has a bird sanctuary.

Andaman and Nicobar Islands

Andaman and Nicobar archipelago has been formed by the extension of the tertiary mountain chains of **Arakan Yoma**. These islands lie close to equator and experience equatorial climate and have thick forest cover. Some of the islands are fringed with coral reefs. The entire group of islands is divided into two broad categories: the Andamans in the North and the Nicobars in the South.

The great Andaman group of islands in the North is separated by the Ten Degree Channel from the Nicobar group in the South.

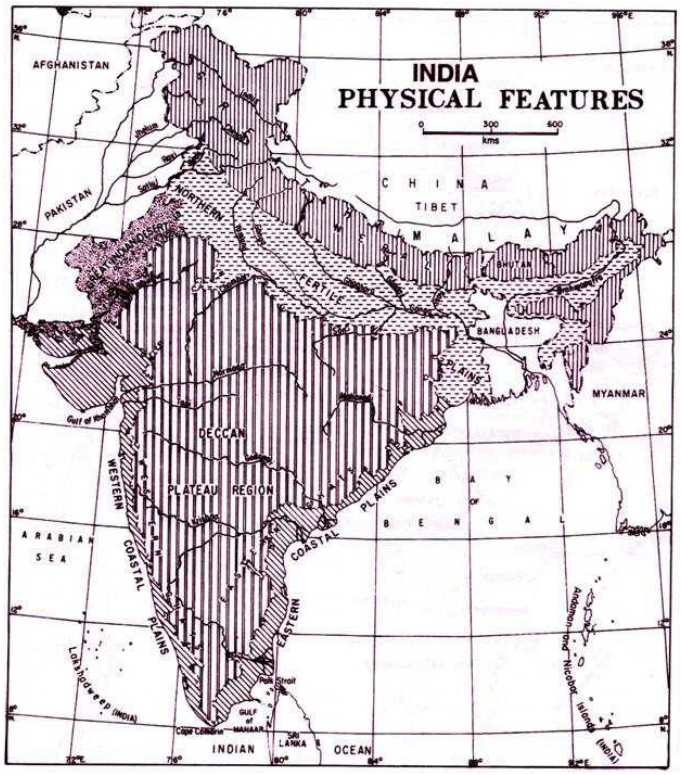
The Andaman islands are sub-divided into four major island groups: North Andaman. Middle Andaman, South Andaman and Little Andaman. Biggest island in Andaman Group is Middle Andaman (1536 sq km) and smallest is Ross island (0.8 km). The capital Port Blair is located on Eastern coast of South Andaman. Barren island and Narcondam island located North of Port Blair are volcanic islands.

Biggest island in Nicobar Group is Great Nicobar (1045 sq km) and smallest is Pilo Milow Island (1.35 sq km). Andaman and Nicobar islands has 4 National Parks and 40 small ports.

The Indian Desert

The Great Indian Desert also called **Thar desert** lies to the North-West of the Aravali hills. It spreads over four states namely- Punjab. Haryana. Rajasthan, and Gujarat. It is a land of undulating topography dotted with longitudinal dunes and branches. It has arid climate due to very low rainfall (below 150 cm) received by this region.

This region is also called as **Marusthali**. The underlying rock structure of desert is an extention of the peninsular plateau but its surface features have been covered by physical weathering and wind action due to extreme arid condition in this region. The Great Indian Desert can be divided into two parts: the Northern part is sloping towards Sindh and the Southern towards the Rann of Kutch. Most of the rivers in this region are ephemeral. Luni is one of the most important rivers of this region.



Mountain Passes in Peninsular India

Bhor Ghat	Bhor ghat in Western ghat joins Mumbai with Pune.
Goran Ghat	In Aravalli hills, joins city of Udaipur with Sirohi in Rajasthan
Haldighati	In Aravalli hills and connects Rajsamand with Pali district in Rajasthan.
Palghat	In Western ghat, joins Coimbatore with Kochi and Kozhikode. It joins Tamil Nadu with Kerala. The river Gayatri flows through it.
Thalghat	Located in Sahyadri range, joins Nashik with Mumbai. The NH-3 and the Bhopal-Indore railway line pass through it.

States with the Longest Coastline	
State/UT	**Length of Coastline (Km)**
1. Andaman & Nicobar Islands	1,962
2. Gujarat	1,215
3. Andhra Pradesh	974
4. Tamil Nadu	907
5. Maharashtra	653

Climate

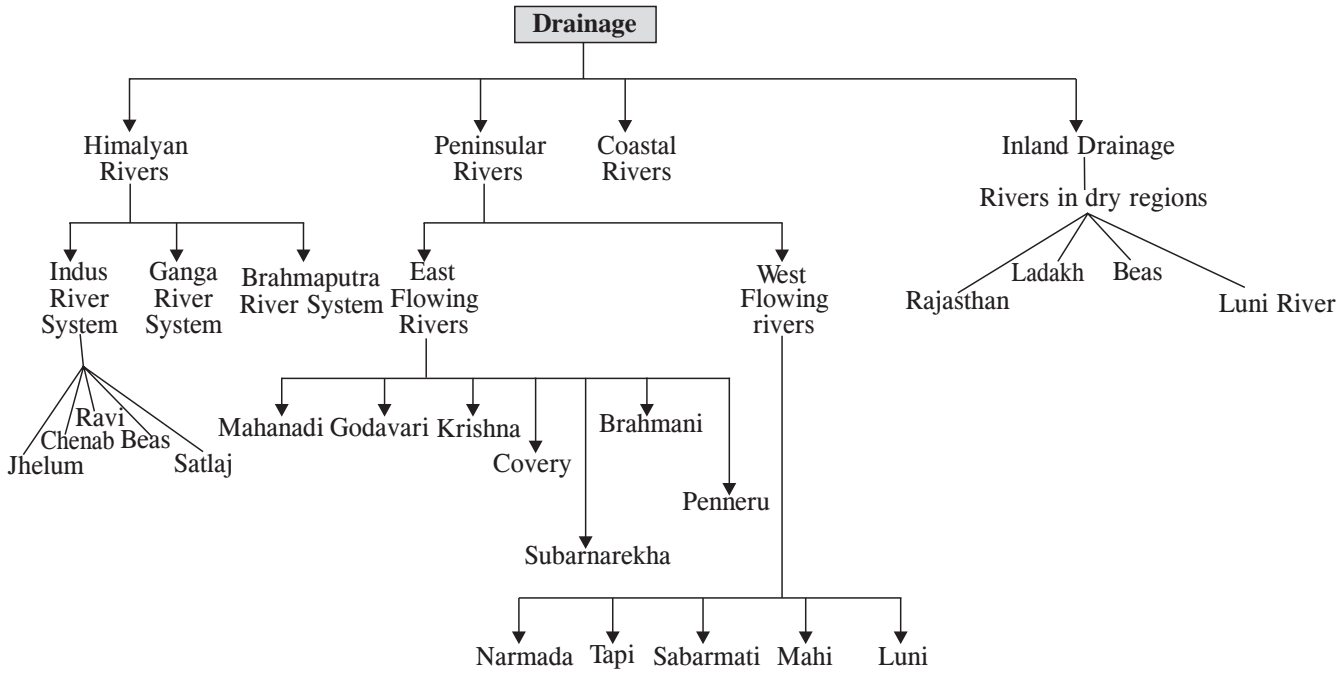
Although India is basically a tropical country, it experiences wide variation in climatic condition depending upon the altitude, latitude, distance from sea and relief. The variability can be observed in number of factors such as:

Western Rajasthan experiences a high temperature during June where as the areas close to Kashmir are relatively experiencing a much lower temperature. The coastal lands are comparatively having a moderate climate due to the nearness of sea.

The amount of rainfall also varies throughout the country. The rainfall in India is primarily governed by Monsoon wind which which generally hits the south west coast of India generally in June and known as onset of Monsoon. The wind then starts circulating via the Bay of Bengal covering the entire eastern, north eastern and parts of central India. The highest rainfall is experienced in Mawsynram in Meghalaya i.e. 1221 cm of annual rainfall every year. On the other hand in the month of October and November the monsoon trough of Low pressure starts receding from Northern Plain results into rain in Southern India. About 50% to 60% of rainfall in Tamil Nadu is caused due to Retreat of Monsoon form North East.

Rain fall Distribution in India

Amount of Rain fall	Heavy Rainfall (> 200cm)	Moderately Heavy Rainfall (100-200 cm)	Less Rainfall (50-100 cm)	Scanty Rainfall <50cms
States	West coasts, on the western Ghats, Sub-Himalayan areas in North East and Meghalaya Hills. Assam, West Bengal, Southern slopes of eastern Himalayas.	Southern Parts of Gujarat, East Tamil Nadu, North-eastern Peninsular, Western Ghats, eastern Maharashtra, Madhya Pradesh, Orrisa, the middle Ganga valley.	Upper Ganga valley, eastern Rajasthan, Punjab, Southern Plateau of Karnataka, Andhra Pradessh and Tamil Nadu.	Northern part of Kashmir, Western Rajasthan, Punjab and Deccan Plateau



DRAINAGE

The flow of water through well-defined channels is known as Drainage and the network of such channels is called a drainage system. A river drains the water collected from a specific area, is called its catchment Area. An area drained by a river and its tribuaries is called a Drainae Basin. The boundary line separating one drainage basin from the other is known as watershed.

India is drained by numerous rivers falling either into the Bay of Bengal or the Arabian Sea. The Ganga, Brahmaputra, Mahanadi, Godavari, Krishna and Cauvery are the major river systems draining into the Bay of Bengal, whereas the major river systems draining into the Arabian Sea are the Indus, Sabarmati, Narmada, Tapti and rivers of the west coast farther south. Indian rivers may be classified into four types depending upon the nature of the river, geographical location, source and drainage area covered: Himalayan, peninsular, coastal and rivers of inland drainage basin.

Himalayan Rivers

- These rivers are *perennial* as they are generally snow-fed and have reasonable flow throughout the year. During the monsoon the Himalayas receive very heavy rainfall and the rivers discharge the maximum quantity of water causing frequent flood. Brahamputra, Ganga, Jamuna, Ghagra, Gandak, Kosi are the main rivers.
- Some rivers are older than the mountain themselves. Their gorges are the evidence of it. So, they are also examples of antecedent rivers.

The Major river systems of the Himalayas Drainage

Indus River System

- Indus along with its tributaries forms one of the largest drainage systems of the world.
- Also known as Sindhu.
- Indus originates from the northern slope of Kailash range (Tibet) enters India and continues to flow in the north-west direction between the Ladakh and the Zaskar ranges.
- The **Shyok** and **Gilgit** are its important right bank tributaries and the **Zaskar** is left bank tributary.
- Indus river ends its mountainous journey at Attock and is joined by the Kabul river from Afghanistan.
- Just above Mithankot, it receives accumulated waters of five rivers (Panj-nad) Jhelum, Chenab, Ravi, Beas and Sutluj.
- Finally, it empties itself in the Arabian Sea near Karachi, making a big delta.
- It has length of 2900 km from its source to the Arabian sea.
- It is known as Singi Khamban Tibet.

Jhelum

- It rises from a spring at Verinag (in Kashir).
- **Lidar**, **Sind** and **Pohru** are the tributaries of Jhelum in Kashmir.
- At Muzaffarabad, the river takes a sharp hairpin swing southward and the **Kishaganga** joins at on its right bank.
- Thereafter, it forms the India-Pakistan boundary for 170 km and emerges at the Potwar Plateau near Mirpur. It has total length of 724 km.
- It joins the Chenab at Trimmu.

Chenab

- It is the largest tributary of the Indus.

- It originates near the Bara Lacha Pass in the Lahul-Spiti part of the Zaskar Range. The united stream (Chandra and Bhaga) called the *Chandrabhaga* flows in the north-west direction through Himachal Pradesh and enters Jammu & Kashmir as Chenab river.
- It enters the plain area near Akhnur in J&K.
- It cuts a deep gorge near Kishtwar.
- It receives waters of Jhelum and Ravi rivers.

Ravi

- It originates from Kullu hills near the Rohtang Pass in Himachal Pradesh.
- It cuts a deep gorge in the Dhaula Dhar range after crossing Chamba.
- It enters Punjab Plains near Madhopur and later enters Pakistan 26 km below Amritsar.
- It debouches into the Chenab a little above Rangpur in Pakistani Punjab.

Beas

- It also originates near Rohtang Pass, close to the source of the Ravi.
- It crosses the Dhaula Dhar range through a deep gorge from Lorji to Talwara.
- It debouches on the plain near Pong and meets the Satluj river at Harike.
- It lies entirely within the Indian territory.

Sutluj

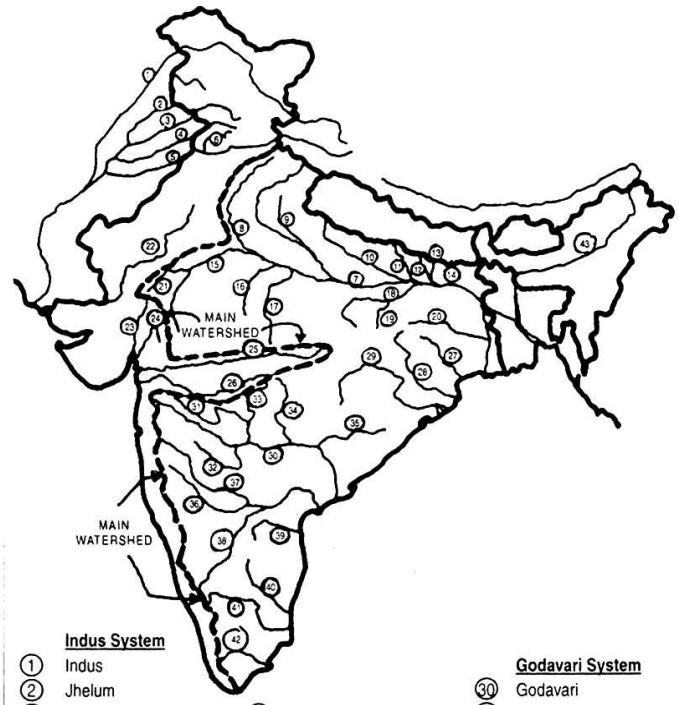
- It rises from the Mansarovar - Rakas Lake near Darma Pass in western Tibet, where it is also known as Langcher Khambab.
- In Nari Khorsan province of Tibet, it has created an extraordinary canyon.
- It is joined by the Spiti river at Namgia near the Shipki La.
- Before entering the Punjab Plain, it cuts a gorge in Naina Devi Dhar (Bhakra Dam has been constructed here).
- It enters the plain at Rupnagar (Ropar).
- It is joined by the Beas at Harike.
- From near Ferozepur to Fazilka, it forms the boundary between India and Pakistan for nearly 120km.
- It joins the Indus a few kilometers above Mithankot.

The Ganga River System

- It is the Largest in India.
- The total area of the Ganga basin in India is 861,404 sq km which accounts for 26.3% of the geographical area of the country.
- The Ganga basin covers over 12,500 sq km in northern India.

This basin is shared by:–

State	(%) share
Uttarakhand & UP	34.2
MP & Chhattisgarh	23.1
Bihar & Jharkhand	16.7
Rajasthan	13.0
West Bengal	8.3



Indus System
1. Indus
2. Jhelum
3. Chenab
4. Ravi
5. Satluj
6. Beas

Ganga System
7. Ganga
8. Yamuna
9. Ramganga
10. Ghaghra
11. Gandak
12. Burhi Gandak
13. Baghmati
14. Kosi
15. Chambal
16. Kali Sindh
17. Betwa
18. Son
19. Rihand
20. Damodar
21. Banas
22. Luni
23. Sabarmati
24. Mahi
25. Narmada
26. Tapti
27. Subarnarekha
28. South Koel/Brahmani
29. Mahanadi

Godavari System
30. Godavari
31. Penganga
32. Manjara
33. Wardha
34. Waiganga
35. Indravati

Krishna System
36. Krishna
37. Bhima
38. Tungabhadra
39. North Pennar
40. South Pennar
41. Cauvery
42. Waigai
43. Brahmaputra

Ganga

- It originates as *Bhagirathi* from the Gangotri glacier.
- *Alaknanda* joins it at *Devaprayag*. Pindar river joins it at Karan Prayag and *Mandakini* or Kali Ganga at Rudra Prayag.
- The combined waters of the Bhagirathi and the Alaknanda flow in the name of the Ganga, below *Devprayag*.
- It debouches on plain from hills in Haridwar.
- It is joined by Yamuna in Allahabad.
- Beyond *Farakka*, it is known as *Padma* in Bangladesh.
- It bifurcates itself into Bhagirathi-Hooghly in West Bengal and Padma-Meghna in Bangladesh.
- The delta formed by the Ganga-Brahmaputra is the largest delta of the world covering an area of 58,752 sq km.
- Sundarbans is a part of the world's largest delta.
- The total length, 2525 km, is distributed among states:
  (i) Uttar Pradesh – 1140, (ii) W. Bengal – 520 km, (iii) Bihar – 445 km, (iv) Uttrakhand – 310 km.

The Ganga Drainage System			
Name of the river	**Source**	**Length (in km)**	**Area drained (sq km)**
Ganga	Gangotri Glacier at 7,010 m	2,525	861,404

Yamuna	Yamnotri Glacier at 6,330	1,376	366,223
Chambal	Near Mhow (Indore-M.P)	1,050	139,468
Ramganga	Garhwal district at 3,110 m	596	32,493
Ghaghra	Near Gurla Mandhota peak	1,080	127,950
Gandak	South of Manasarovar	425 in India	46,300 (7,620 in India)
Kosi	Tibet-Nepal border at 7,620 Sikkim Nepal- Tibet Himalaya	730 in India	86,900 (21,500 in India)

Difference between Delta and Estuary

Delta	Estuary
1. The triangular deposits made by rivers at their mouth form Delta.	1. The sharp edged mouth of rivers, devoid of any deposits is known as estuary.
2. Deltas are founded in the regions of 100 tides and coastal plains	2. Regions of high tides and rift valleys witness estuaries.
3. Deltas are fertile lands	3. Estuary does not have festive lands.
4. Ganga, Brahmaputra, Krishna, Kaveri and Mahanadi rivers form Delta	4. Narmada and Tapi rivers form estuaries.

Yamuna

- It is the largest and the most important tributary of the Ganga.
- It originates from the Yamunotri glacier on the Bandarpunch Peak in Garhwal in Uttarakhand.
- It enters the plains near *Tajewala*.
- **Tons**, a tributary of it, joins it below Kalsi. At this site, the water carried by the Tons is twice the water carried by the Yamuna.
- It takes a southerly course upto Mathura and south easterly in its onward journey upto Allahabad where it unites with the Ganga.

Chambal

- It rises near Mhow in the highlands of Janapao Hills in MP.
- It enters a gorge at Chaurasigarh.
- It joins Yamuna in Etawah district of Uttar Pradesh.
- Banas joins it near Sawai Madhopur.
- ***Betwa***, rising in Bhopal, joins the Yamuna near *Hamirpur*. Dhasan is an important tributary of Betwa

Son

- It is a large south bank tributary of the Ganga.
- The Son river springs from the Amarkantak Plateau.
- It joins the Ganga near Danapur in Patna district.
- Its catchment area is 71,259 sq km.
- Almost all the tributaries join it on its right bank.
- Tributaries are Johilla, Rihand, Kanhar and North Koel.

Damodar

- It rises in the hills of the Chotanagpur plateau and flows through a rift valley.
- It is also called '**Sorrow of Bengal**'
- It joins the Hugli 48 km below Kolkata.
- The total length of the river is 541 km.
- Its catchment area is 25,820 sq km.

Ramganga

- It rises in the Garhwal district of Uttaranchal.
- It enters the Ganga plain near Kalagarh.
- Its basin covers 32,493 sq km.

Ghaghra

- It originates near the Gurla Mandhota peak, south of Manasarovar in Tibet.
- It is known as the karnali in Western Nepal.
- It joins Ganga a few kilometres downstream of Chapra in Bihar.
- The total catchment area of the river is 127,950 sq km out of which 45% is in India.

Kali

- It rises in high glaciers of snow covered region of trans-Himalayas.
- It forms the boundary between Nepal and Kumaon.
- It is known as the Sarda or Chauka after it reaches the plains near Tanakpur.

Gandak

- It originates near the Tibet-Nepal border.
- Kali Gandak, Mayangadi, Bari and Trishuli are the major tributaries of it.
- Its drainage area is 46,300 sq km out of which 7620 sq km is in India.

Burhi Gandak

- Originating from the western slopes of Sumesar hills near the India-Nepal border, it joins the Ganga opposite Monghyr town.
- Its length is 610 km and drainage area is 12,200 sqkm.

Kosi

- The Kosi river consists of seven streams, namely, Sut Kosi, Tamba Kosi, Talkha, Doodh Kosi, Botia Kosi, Arun and Tamber and is popularly known as Saptkaushiki.
- Seven rivers mingle with each other to form three streams named the Tumar, Arun and Sun Kosi.
- Then all three streams unite at *Triveni* north of the Mahabharat Range to form the Kosi.

The Brahmaputra River System

- The Brahmaputra rises in the great **chemayungdung** glacier in the **Kailas** range of the Himalayas.
- It flows eastward from its source region.
- Mariam La separates the source of the Brahmaputra from the Manasarovar lake.

- With a total length of 2900 km, it is one of the longest rivers of the world & passes through Tibet, India and Bangladesh.
- It is known as Tsangpo(means purifier) in Tibet and Yarlung Zangbo Jiangin in Chinese language.
- It is one of the most remarkable navigable waterways of the world where boats sail at an altitude of about 3000 metre above sea level.
- It emerges as a dynamic river after carving out a deep gorge near Namcha Barwa.
- It emerges from the foothills under the name of Siong or Dihang.
- It enters India west of Sadiya town in Arunachal Pradesh where it receives the Dibang and the Lohit. From here after ward, it is known as the *Brahmaputra*.
- It has a braided channel along most of its length in Assam.
- It is among the four largest rivers of the world in terms of volume of discharge at the mouth.
- The look is like a delta in reverse where Dibang and Lohit rivers meet the Brahmaputra river.
- **Tista**, a tributary of the Brahmaputra, was a tributary of the Ganga prior to the devastating floods of 1787.
- **Majuli** is the river island of the river Brahmaputra (area-1250 sq km). **Majuli island** is Largest riverine island of world.
- National waterways - 2 is on the Brahmaputra river from Sadiya to Dhubri.

The Peninsular River System

Three main directions of flow:

- Mahanadi, Godavari, Krishna, Cauvery and several smaller rivers draining towards south-east towards into the Bay of Bengal.
- The Narmada and the Tapi flowing towards west as well as several small rivers originating from the Western Ghats flow westwards into the Arabian Sea.
- Tributaries of Ganga and Yamuna such as Chambal, Betwa, Ken, Son and Damodar flow in the north-easterly direction.

The East Flowing Rivers

Mahanadi

- It has its source in Dandakaranya near Sihawa in Raipur district of Chhattisgarh.
- Its upper course lies in the saucer-shaped basin called the 'Chhattisgarh Plains'
- **Hirakud dam** is built on this river.

Godavari

- It is the largest river system of the Peninsular India.
- It is held in reverence as '**Vridha Ganga**' or '**Dakshina Ganga**'
- It has a catchment area of 312,812 sq km which covers about 10% of the area of India.
- It flows in Maharashtra, Andhra Pradesh, Madhya Pradesh, Chhattisgarh, Orissa and Karntaka.
- The source of the river is in the Trimbak Plateau of North Sahyadri near Nasik in Maharashtra and discharges its water into the Bay of Bengal.
- Manjra is the only important right bank tributary which joins the Godavari near Kondalwadi.
- Below Rajahmundry, the river Godavari divides itself into two main streams - the Gautami Godavari on the east and the Vashishta Godavari on the west - and forms a large delta before it pours into the Bay of Bengal.

Krishna

- It is the second largest east flowing river of Peninsula in India.
- It rises in Western Ghats near **Mahabaleshwar**.
- It debouches into the Bay of Bengal, forming a big delta in arcuate shape.
- The Koyna, Tungbhadra and Bhima are its major tributaries.
- *Koyna Dam* is made on the Koyana river, a tributary of the Krishna river.

Cauvery

- It is designated as "the Ganga of the South" or 'Dakshina Ganga'.
- Its source lies at Taal Cauvery on the Brahmagiri range of hills in the Western Ghats.
- Its upper catchment area receives rainfall during summer by the south-west monsoon and the lower catchment area receives rainfall during winter season by the retreating northeast Monsoon.
- It is one of the best regulated rivers and 90 to 95% of its irrigation and power potential already stands harnessed.
- *Sivasamudram waterfalls* is on this river.
- The river divides itself into two distinct channels at Srirangam, the northern channel is called Kollidam and the southern one retains the name Cauvery.
- Cauvery river also forms a big delta in a quadrilateral shape.

Subarnarekha

- It originates from the Ranchi plateau in Jharkhand.
- It forms the boundary between West Bengal and Orissa in its lower course.
- Its total length is 395 km.

Brahmani

- It comes into existence by the confluence of the Koel and the Sankh rivers near Rourkela in Odisha.
- It has a total length of 800 km.
- Its main tributaries are Kura, Sankhad and Tikra.

Penneru

- It springs from the Nandi Durg peak in Karnataka.
- The total length is 597 km.
- The principal tributaries are the Jayamangli, the Kunderu, the Chitravari, the Papagani and the Cheyyeru.

The West Flowing Rivers

Narmada

- It is the largest of all the west flowing rivers of the Peninsula.
- It rises from the Amarkantak plateau in Shahdol district of Madhya Pradesh.
- It flows through a rift valley between the Vindhyan Range on the north and the Satpura range on the south.
- The Dhuandhar (Clouds of Mist) falls is formed by the Narmada river in Jabalpur.
- It makes an estuary studded with several islands. Aliabet is the largest island.
- The **Sardar Sarovar *Project*** has been constructed on this river.

Tapi (or Tapti)

- It is the second largest west flowing river of the Indian peninsula.
- It is also known as 'the twin' or of the Narmada.
- It originates from Multai in Betul district of Madhya Pradesh.

Sabarmati

- This 320 km long river is the name given to the combined streams-the Sabar and the Hathmati.
- It rises from the hills of Mewar in the Aravalli Range. Its tributaries are Hatmati, Sedhi, Wakul, Meshwa, Vatrak etc.

Mahi

- It rises in the Vindhyan range and debouches into the Gulf of Khambhat.
- Its length is 533 km.
- It drains an area of 34,862 sq km.
- The main tributaries are Som, Anas and Panam.
- Mahi river cuts tropic of cancer twice.

Luni (or the Salt River)

- Its water is brackish below Balotra.
- Its source lies to the west of Ajmer (Rajasthan) in the Aravallis.
- The river is known as the Sagarmati in its upper course and from Govindgarh, where Sarsuti joins it, becomes Luni. Finally, it is lost in the Rann of Kachchh.

Inland Drainage

Some rivers of India do not reach upto the sea and constitute inland drainage. These rivers are mostly present in the drier regions of the country like Western Rajasthan, Ladakh and Aksai Chin etc. **Ghaggar river is the most important example of inland drainage**. it is a seasonal stream rising from the lower slopes of Himalayas and is said to flow on the dried bed of ancient river Saraswati. It forms boundary between Punjab and Haryana for much of its length and gets subsumed in Rajasthan desert. Another such river is Luni, which is the largest river of Rajasthan. It originates near Pushkar and flows South-West of Aravalis till it reaches Rann of Kutch.

Famous Cities and River Banks

City	River	City	River	City	River
Allahabad	At the confluence of the Ganga and Yamuna (Sangam)	Ferozpur	Satluj	Mathura	Yamuna
		Guwahati	Brahmaputra	Nasik	Godavari
		Hardwar	Ganga	Patna	Ganga
Agra	Yamuna	Hyderabad	Musi	Panjim	Mandavi
Ayodhya	Saryu	Jabalpur	Narmada	Srinagar	Jhelum
Ahmedabad	Sabarmati	Jamshedpur	Swarnarekha	Surat	Tapti
Badrinath	Alaknanda	Jaunpur	Gomti	Sambalpur	Mahanadi
Bareilly	Ram Ganga	Kanpur	Ganga	Serirangapatam	Cauvery
Cuttack	Mahandadi	Kota	Chambal	Tiruchurapalli	Cauvery
Curnool	Tungabhadra	Kolkata	Hooghly	Ujjain	Kshipra
Delhi	Yamuna	Lucknow	Gomti	Vijayawada	Krishna
Dibrugarh	Brahmaputra	Ludhiana	Sutlej	Varanasi	Ganga

Annual yield of water

River	Contribution (%)
Brahmaputra	33.8
Ganga	25.2
Godavari	6.4
Indus	4.3
Mahanadi	3.6
Krishna	3.4
Narmada	2.9

List of the Projects, State, Location and their Purpose

S. No.	Name of the Project	Location	State	Purpose
1	Nagarjuna Sagar multi-purpose Project	River Krishna	Andhra Pradesh	Irrigation, Hydroelectricity
2	Pochampad Project	River Godavari	Andhra Pradesh	Irrigation
3	Lower Sileru Project	River Sileru (Godavari)	Andhra Pradesh	Hydroelectricity
4	Kakrapar Project	River Tapi	Gujarat	Irrigation
5	Kothagudem Project	Singareni Coalfields	Andhra Pradesh	Thermal power
6	Kosi Project	River Kosi	Bihar	Flood Control, Irrigation, Hydroelectricity
7	Gandak Project	River Gandak	Uttar Pradesh. Bihar	Irrigation, Hydroetectricity
8	Dhuvaran Power Station	Kheda District	Gujarat	Thermal Power
9	Sabarigiri (Pamba Kakki) Project	River Pamba-Kakki	Kerala	Hydroelectricity
10	Idukki Project	Rivers Periyar, Cheruthoni, Idukki	Kerala	Hydroelectricity
11	Chambal Project	River Chambal	Rajasthan, Madhya Pradesh	Irrigation, Hydroelectricity
12	Tawa Project	River Tawa (Narmada)	Madhya Pradesh	Irrigation
13	Korba Project	Near Korba Coalfields	Chhattisgarh	Thermal Power
14	Satpura Power Station	Patharkada Coalfields	Madhya Pradesh	Thermal Power
15	Koyna Project	River Koyna	Maharashtra	Hydroelectricity
16	Nagpur Power Station	Koradi, near Nagpur city	Maharashtra	Thermal Power
17	Tungabhadra Multi-purpose Project	River Tungabhadra	Karnataka, Andhra Pradesh	Irrigation, Hydroelectricity
18	Upper Krishna Project	River Krishna	Karnataka	Irrigation
19	Sharavathi Project	River Sharavathi, Near Jog Falls	Karnataka	Hydroelectricity
20	Hirakund multi-purpose Project	River Mahanadi	Odisha	Irrigation, Hydroelectricity
21	Mahanadi Delta Project	River Mahanadi	Odisha	Irrigation
22	Bhakra Nangal Multi-purpose Project	River Sutlej	Himachal Pradesh, Punjab. Haryana	Irrigation, Hydroelectricity
23	Rajasthan Canal Project	River Sutlej in Punjab	Rajasthan, Headworks in Punjab	Irrigation
24	Kundah Project	River Kundah	Tamil Nadu	Hydroelectricity
25	Ramganga Multipurpose Project	Chuisot Stream near Kalagarh	Uttarakhand	Irrigation, Hydroelectricity
26	Matatila Multipurpose Project	River Betwa	Uttar Pradesh. Madhya Pradesh	Irrigation, Hydroelectricity
27	Rihand Scheme	River Rihand	Uttar Pradesh	Hydroelectricity
28	Damodar Valley Project	River Damodar	Jharkhand, Shared with West Bengal	Flood Control, Irrigation
29	Ukai Project	River Tapi	Gujarat	Irrigation
30	Mahi Project	River Mahi	Gujarat	Irrigation
31	Ghataprabha Project	River Ghataprabha	Andhra Pradesh and Karnataka	Irrigation
32	Bhima Project	River Bhima	Maharashtra	Irrigation
33	Sardar Sarovar Project	River Narmada	Gujarat and Madhya Pradesh	Irrigation and Hydroelectricity
34	Bansagar Project	River Son	Madhya Pradesh, Chhattisgarh	Irrigation
35	Dul Hasti Project	River Chenab	Jammu and Kashmir	Hydroelectricity

36	Salal Project	River Chenab	Jammu and Kashmir	Hydroelectricity
37	Their Dam Project	River Ravi	Punjab	Irrigation, Hydroelectricity
38	Malaprabha Project	River Malaprabha	Karnataka	Irrigation
39	Jayakwadi Project	River Godavari	Maharashtra	Irrigation
40	Beas Project	River Beas	Punjab and Haryana	Hydroelectricity
41	Sharda Sahayak	River Ghaghra	Uttar Pradesh	Irrigation
42	Mayurakshi Project	River Mayurkhsi	West Bengal	Irrigation, Hydroelectricity
43	Rana Pratap Sagar project	River Chambal	Rajasthan	Hydroelectricity
44	Mettur Project	River Cauvery	Tamil Nadu	Hydroelectricity
45	Pallivasal Project	River Munnar Abuja	Kerala	Hydroelectricity
46	Papanasam Project	River Thamirabarani	Tamil Nadu	Hydroelectricity
47	Loktak Project	Lake Loktak	Manipur	Hydroelectricity
48	Tehri Project	River Bhagirathi (Ganga)	Uttarakhand	Hydroelectricity
49	Farakka Project	Ganga	West Bengal	Irrigation
50	Daman Ganga	River Daman Ganga	Gujarat	Irrigation and River Link
51	Gima Project	River Gima (Tributary of Tapi)	Maharashtra	Irrigation and River Link
52	Pamba Project	River Pamba	Kerala	River Conservation and Irrigation
53	Tapovan-Vishnugarh	River Alaknanda	Uttarakhand	Hydroelectricity
54	Omkareshwar	River Narmada	Madhya Pradesh	Hydropower and Irrigation

Rivers and Disputing States

River	Disputing States
Krishna	Maharashtra, Andhra Pradesh, Karnataka
Godavari	Maharashtra, Andhra Pradesh, Madhya Pradesh, Odisha, Karnataka
Cauvery	Kerala, Karnataka, Tamil Nadu, Puducherry
Narmada	Rajasthan, Madhya Pradesh, Gujarat, Maharashtra
Mahadayi/mandovi	Goa and Karnataka
Vansadhara	Andhra Pradesh and Odisha
Ravi and Beas	Punjab and Haryana
Mullaperiyar	Kerala and Tamil Nadu

Important Falls in India

Water Fall	Height in Meters	River	Location
Kunchikal falls	455	Varahi	Karnataka
Langshiang falls	337	Kynshi	Meghalaya
Nohkalikai falls	335	—	Meghalaya
Nohshgithiang	315	—	Meghalaya
Dudhzagar falls	310	Mandovi	Goa
Kynoem falls	305	—	Meghalaya
Meenmutty falls	300	Karimpuzha	Kerala
Thalaiyar falls	297	Majjalar	Tamil Nadu
Barkana falls	259	Sita	Karnataka
Barchipani falls	399	Budhabalanga	Orissa

Lakes of India			
Wular Lake	Jammu & Kashmir	Bhim Tal	Uttarakhand
Lonar	Maharashtra	Sambhar	Rajasthan
Kolleru	Andhra Pradesh	Sukhna	Chandigarh
Loktak	Manipur	Parashuram Kund	Arunachal Pradesh
Dal Lake	Jammu & Kashmir	Pongong Tso	Jammu & Kashmir
Naini Tal	Uttarakhand	Tso Morari	Jammu & Kashmir
Salt Lake	Kolkata	Nakki Lake	Rajasthan
Chilka	Odisha	Pushkar Lake	Rajasthan
Pulicut	Andhra Pradesh	Udaipur Lake	Rajasthan
Vembanad Kayal	Kerala	Upper & Lower Lake	Bhopal, MP
Ashtamudi	Kerala	Nizam Sagar	Hyderabad

Main Rivers and their Tributaries

Rivers	Left Bank Tributaries	Right Bank Tributaries
Indus	Zaskar, Panjnad, Nubra	Shyok, Gilgit, Kabul
Mahanadi	Ib, Mand, Hasdo, Sheonath	Ong, Jonk, Tel
Godavari	Penganga, Wardha, Wainganga, indravati and Sabari	Manjira
Krishna	Bhima, Doni, Musi, Muneru	Malprabha, Ghatprabha, Tungabhadra
Cauvery	Herangi, Hemavati, Lokpavani, Srimsha and Arkavati	Laksmantirtha, Kabani, Suvarnavati, Bhavani and Amaravati
Narmada	Burhner, Banjar, Sher, Shakkar, Towa and Kundi	Hiran, Barna, Kolar
Tapi	Sipra, Kapra, Khursi, Mona, Girna, Bori, Amaravati	Purna, Betul, Patki, Suki, More, Arunavati, Gomai
Ganga	Gomati, Ghanghara, Gandak, Burhi Gandak and Kosi	Yamuna, Son, Punpun
Yamuna	Tons	Chambal, Sind, Betwa, ken

Difference between the Himalayan & the Peninsular River

S. No.	Aspects	Himalayan River	Peninsular River
1	Place of Origin	Himalayan Mountain covered with glaciers	Peninsular Plateau & Central highland
2	Nature	Perennial	Seasonal
3	Type of Drainage	Antecedent & consequent leading to dendritic pattern in plains	Super imposed, rejuvenated resulting in trellis, radial & rectangular patterns
4	Basins	Very large basins	Relatively smaller basin
5	Depth & Valleys	Rivers form deep vallays & gorges in their source areas	River valleys are often shallow
6	Flow of water	Cause much erosion & have great flow of water	Create much less erosion & also have weaken flow of water.
7	Irrigation	Irrigate the northern plains	Irrigate the Deccan Plateau.
8	Stage	Young & active	Old rivers with graded profile.

Longest Rivers Flowing in India

River	Length (km)	River	Length (km)
Ganga	2510	Krishna	1400
Godavari	1465	Yamuna	1376
Sutlej	1440	Narmada	1289

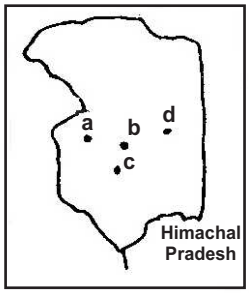
Exercise -1

1. With reference to, the river Luni, which one of the following statements is correct?
   (a) It flows into Gulf of Khambhat
   (b) It flows into Gulf of Kutch
   (c) It flows into Pakistan and merges with a tributary of Indus
   (d) It is lost in the marshy land of the Rann of Kutch
2. The Brahmaputra, Irrawady and Mekong rivers originate in Tibet and flow through narrow and parallel mountain ranges in their upper reaches. Of these rivers, Brahmaputra makes a "U" turn in its course to flow into India. This "U" turn is due to
   (a) Uplift of folded Himalayan series
   (b) Syntaxial bending of geologically young Himalayas
   (c) Geo-tectonic disturbance in the tertiary folded mountain chains
   (d) Both (a) and (b)
3. The tributary of Indus which does not flow through Pakistan is
   (a) Ravi (b) Beas
   (c) Sutlej (d) Chenab
4. Which one of the following sections of Himalaya is the longest?
   (a) Punjab Himalaya (b) Kumaon Himalaya
   (c) Assam Himalaya (d) Nepal Himalaya
5. Which one of the following physiographic units has been created by both exogenic and endogenic forces?
   (a) The Peninsular plateau
   (b) The Thar desert
   (c) The Indo-Gangetic Plain
   (d) The Himalayas
6. Which of the following is the main difference between the Western and Eastern Ghats?
   (a) Height
   (b) Continuity
   (c) Proximity to the coast
   (d) Vegetation
7. Which of the following is not true with regard to the coastal plains of India?
   (a) The west coast has a narrow alluvial margin interspersed by hilly terrain
   (b) The eastern coast has a wide plain with well developed deltas of the major rivers
   (c) The west coast has little indentation except towards the south
   (d) The west and east coasts have the same alluvial features
8. Most of the rivers flowing west-ward from the Western Ghats do not form deltas because
   (a) of the high gradient
   (b) they are too slow
   (c) they are not perennial
   (d) there is no vegetation
9. One of the states through which the Tropic of Cancer passes is
   (a) Jammu and Kashmir (b) Himachal Pradesh
   (c) Bihar (d) Jharkhand
10. The rocks in the Himalayan system are mainly
   (a) sedimentary (b) igneous
   (c) plutonic (d) dyke
11. The highest peak in Indian territory is K_2. In which range is it located ?
   (a) Central Himalayas (b) Trans-Himalayas
   (c) Karakoram Range (d) Kumaun Himalayas
12. The territorial waters of India extend up to
   (a) 12 nautical miles (b) 6 nautical miles
   (c) 15 nautical miles (d) 10 nautical miles
13. Where is the Maikal range situated ?
   (a) Rajasthan (b) Jammu and Kashmir
   (c) Chhattisgarh (d) Tamil Nadu
14. Which of the following rivers flows through a rift valley?
   (a) Ganga (b) Narmada
   (c) Brahmaputra (d) Krishna
15. What is the most important characteristic of the islands (Indian) located in the Arabian Sea?
   (a) They are all very small in size
   (b) They are all of coral origin
   (c) They have a very dry climate
   (d) They are extended parts of the mainland
16. Which area in India has an internal type of drainage ?
   (a) Central Himalayas
   (b) Tamil Nadu
   (c) Chhota Nagpur plateau
   (d) Western Rajasthan
17. Which one is not an important characteristic of the Himalayan rivers ?
   (a) They have a great capacity for erosion
   (b) They have a perennial flow
   (c) They do not form gorges
   (d) Many of them have their sources in the inner Himalayas
18. Most rivers flowing west from the Western Ghats do not form deltas because of
   (a) lack of eroded material
   (b) the high gradient
   (c) lack of vegetation-free area
   (d) low velocity
19. The Thar Desert is believed to be expanding. The most suitable way to check it would be by
   (a) afforestation
   (b) artificial rain
   (c) canal irrigation
   (d) using the area for cattle-rearing
20. Rivers that pass through Himachal Pradesh are :
   (a) Beas and Chenab only
   (b) Beas and Ravi only
   (c) Chenab, Ravi and Sutlej only
   (d) Beas, Chenab, Ravi, Satlej and Yamuna

21. Which one of the following is not a lagoon?
(a) Ashtamudi lake (b) Chilka lake
(c) Periyar lake (d) Pulicat lake

22. Which of the following industrial towns is located on the Chhotanagpur plateau.
(a) Bhilai (b) Ranchi
(c) Asansol (d) Durgapur

23. In the rough outline map of a part of Jammu and Kashmir shown in the figure, palces marked a, b, c, d represent respectively :



(a) Anantnag, Baramula, Srinagar and Kargil
(b) Baramula, Srinagar, Kargil and Anantnag
(c) Baramula, Srinagar, Anantnag and Kargil
(d) Srinagar, Baramula, Kargil and Anantnag

24. Out of the four southern States: Andhra Pradesh, Karnataka, Kerala and Tamil Nadu, which shares boundaries with the maximum number of Indian States?
(a) Andhra Pradesh only
(b) Karnataka only
(c) Each of Andhra Pradesh and Karnataka
(d) Each of Tamil Nadu and Kerala

25. Which one of the following is the largest canal ?
(a) Sharda Canal (b) Lower Ganga Canal
(c) Upper Ganga Canal (d) Yamuna Canal (West)

26. The 'Chilka lake region' lies in between the deltas of:
(a) Ganga and Mahanadi
(b) Godavari and Krishna
(c) Mahanadi and Godavari
(d) Krishna and Cauvery

27. Which one of the following Indian States does not border Bangladesh?
(a) Assam (b) Manipur
(c) Mizoram (d) Tripura

28. Which one of the following pairs is not correctly matched?

	River		**Tributary**
(a)	Yamuna	:	Betwa
(b)	Ganga	:	Sone
(c)	Mahanadi	:	Wardha
(d)	Godavari	:	Manjra

29. From north to south, which one of the following is the correct sequence of the given hills?
(a) Kaimur Hills — Mahadeo Hills — Satmala Hills
(b) Mahadeo Hills — Kaimur Hills — Satmala Hills
(c) Kaimur Hills — Satmala Hills — Mahadeo Hills
(d) Mahadeo Hills — Satmala Hills — Kaimur Hills

30. Which one of the following pairs is not correctly matched ?

(a)	Indus	:	Shyok
(b)	Ganga	:	Gandak
(c)	Godavari	:	Musi
(d)	Krishna	:	Tungabhadra

31. Where is the Nanda Devi peak located ?
(a) Himachal Pradesh (b) Uttarakhand
(c) Sikkim (d) Nepal

32. The river Sone is a tributary of which one of the following rivers ?
(a) Ganga (b) Yamuna
(c) Narmada (d) Mahanadi

33. Which one of the following is the correct sequence of passes when one travels along the Himalayas from Kashmir to Sikkim?
(a) Zozila-Nathula-Shipkila
(b) Nathula-Shipkila-Zozila
(c) Nathula-Zozila-Shipkila
(d) Zozila-Shipkila-Nathula

34. From West to East, which one of the following is the correct sequence of Hills?
(a) Mahadeo Hills—Maikala Hills—Garhjat Hills
(b) Mahadeo Hills—Garhjat Hills—Maikala Hills
(c) Maikala Hills—Mahadeo Hills—Garhjat Hills
(d) Maikala Hills—Garhjat Hills—Mahadeo Hills

35. The Tropic of Cancer passes through which one of the following?
(a) Assam (b) Manipur
(c) Mizoram (d) Nagaland

36. Port Blair-the capital of Andaman and Nicobar Islands, is located in which one of the following islands?
(a) North Andaman (b) Little Andaman
(c) Middle Andaman (d) South Andaman

37. The Tibetan river 'Tsangpo' enters India through the state of:
(a) Arunachal Pradesh (b) Assam
(c) Manipur (d) Nagaland

38. Which one of the following does not characterise the Himalayas?
(a) Various parallel ranges of the Himalayas form a convex arc
(b) There exist syntaxial bends at both the terminals of the Himalayas
(c) Indus, Sutlej and Brahmaputra rivers are examples of antecedent drainage
(d) The Himalayas are wider in the east than in the west

39. Which among the following statements provides the best evidence that a river is flowing through a rift valley?
(a) The Chambal valley is marked by bad land topography
(b) River Tapi does not have Delta but Estuary only
(c) River Mahanadi flows through a gorge at Satkosia
(d) River Colorado has the Grand Canyon along its valley

40. The Narmada river in the Peninsular plateau flows westward with a remarkably straight channel. It is because the
(a) slope gradient in this part controls the river channel pattern
(b) river carries a huge amount of water which has created a straight channel course
(c) river forms the boundary between the Central Highlands and the Deccan Plateau
(d) river flows through the trough of a rift valley inclined westward

41. The reservoir GB Pant Sagar is located on which river?
(a) Betwa (b) Ghaghara
(c) Kosi (d) Rihand

42. River Luni originates near Pushkar and drains into which one of the following?
(a) Rann of Kachchh (b) Arbian Sea
(c) Gulf of Cambay (d) Lake Sambhar

43. Which one of the following states has built the famous Gandhi Sagar across the Chambal River?
(a) Rajasthan (b) Maharashtra
(c) Uttar Pradesh (d) Madhya Pradesh

44. What is 'Operation Kolleru' that was recently in the news?
(a) A massive river linkage project
(b) A project to improve a wetland
(c) A project to supply drinking water to a mega city
(d) A rural drinking water supply scheme of a southern state

45. In the Cauvery River water dispute, which one of the following groups of states are concerned?
(a) Kerala and Karnataka only
(b) Karnataka, Andhra Pradesh and Maharashtra
(c) Kerala, Karnataka, Tamil Nadu and Union Terrtory of Puducherry
(d) Kerala, Goa, Karnataka and Tamil Nadu

46. Which waterway separates India from Sri Lanka?
(a) 8° Channel
(b) Palk Strait
(c) 10° Channel
(d) Andaman Sea

47. Which one of the following peaks is the highest?
(a) Nanda Devi (b) Kanchenjunga
(c) Godwin Austin (d) Nanga Parbat

48. With which one of the following countries, India shares maximum length of the border?
(a) Bangladesh (b) Pakistan
(c) China (d) Nepal

49. Which of the following tributaries of the Ganga System flows Northwards?
(a) Kosi (b) Ghaghara
(c) Gandak (d) Sone

50. The city of Nasik is situated on the bank of which one of the following rivers?
(a) Krishna (b) Mandovi
(c) Godavari (d) Tapti

51. Rihand Valley Project is located in which one of the following states?
(a) Odisha (b) Gujarat
(c) Himachal Pradesh (d) Uttar Pradesh

52. Which of the following Indian stats does not have a common International border with Bangladesh?
(a) Manipur (b) West Bengal
(c) Tripura (d) Asom

53. 28.38° N and 77.12° E are the respective latitude and longitude of which one of the following places?
(a) Jaipur (b) Delhi
(c) Lucknow (d) Allahabad

54. Which one of the following rivers flows into the Arabian Sea?
(a) Indravati (b) Godavari
(c) Cauvery (d) Narmada

55. Madhya Pradesh shares its border with how many States?
(a) 3 (b) 4
(c) 5 (d) 6

56. Match the following

List I (Multi purpose River Projects)	**List II** (Hydel Power Station)
A. Rihand	1. Hirakund
B. Gandak	2. Balmikinagar
C. Chambal	3. Pipri
D. Mahanadi	4. Kota

Codes :

	A	B	C	D
(a)	3	4	2	1
(b)	1	2	4	3
(c)	3	2	4	1
(d)	1	4	2	3

57. Which one of the following is the oldest mountain range in India?
(a) Himalayas (b) Aravalli
(c) Satpura (d) Nilgiri

58. Which one of the following longitudes determines the Indian standard time?
(a) 85.5° E (b) 86.5° E
(c) 84.5° E (d) 82.5° E

59. The hill range that separates the State of Manipur from the State of Nagaland is known as
(a) Arakan hills (b) Patkai hills
(c) Barail hills (d) Manipur hills

60. The channel separating the Andaman Island from the Nicobar Islands is known as
(a) Coco channel (b) 10° channel
(c) Duncan passage (d) somboraro channel

61. Which is the correct arrangement of the following rivers from North to South?
(a) Godavari, Penner, Cauveri, Periyar
(b) Penner, Godavari, Periyar, Cauveri
(c) Godavari, Cauveri, Penner, Periyar
(d) Cauveri, Godavari, Periyar, Penner

62. Which one of the following places is not located on the bank of river Ganga?
(a) Uttarkashi (b) Kanpur
(c) Fatehpur (d) Bhagalpur

63. Which among the following states of India have common borders with Pakistan?
(a) Jammu and Kashmir, Himachal Pradesh, Punjab and Rajasthan
(b) Punjab, Jammu and Kashmir, Rajasthan and Gujarat
(c) Jammu and Kashmir, Punjab, Haryana and Rajasthan
(d) Punjab, Himachal Pradesh, Gujarat and Rajasthan

64. Which of the following three rivers of the peninsula India have the Amarkantak region as their source?
(a) Narmada, Krishna Godavari
(b) Son, Mahanadi, Narmada
(c) Godavari, Krishna, Cauvery
(d) Chambal. Betwa, Luni

65. Which one among the following rivers does not flow into the Bay of Bengal?
(a) Mahanadi (b) Cauveri
(c) Tapti (d) Godavari

66. The country that shares longest border with India is
(a) China (b) Bangladesh
(c) Nepal (d) Pakistan

67. Amarkantak plateau in the Maikal hills marks the origin of the river
(a) Gandak (b) Chambal
(c) Narmada (d) Ghaggar

68. Which one among the following states does not form part of the Narmada basin ?
(a) Madhya Pradesh (b) Gujrat
(c) Rajasthan (d) Maharashtra

69. Match the following

List I (Hydroelectric power station)	List II (Location in map)
A. Nagarjuna Sagar B. Mettur C. Hirakund D. Sileru	

Codes :

	A	B	C	D
(a)	3	4	1	2
(b)	3	1	4	2
(c)	2	1	4	3
(d)	2	4	1	3

70. Which one among the following is nearest to the Tropic of Cancer ?
(a) Patna (b) Ranchi
(c) Rourkela (d) Varanasi

71. In which one of the following states is Zojila pass located?
(a) Arunachal Pradesh (b) Jammu and Kashmir
(c) Himachal Pradesh (d) Sikkim

72. Which one of the following pairs is not correctly matched?
(a) Indus : Shyok
(b) Ganga : Gandak
(c) Godavari : Musi
(d) Krishna : Tungabhadra

73. Where is the Nanda Devi peak located ?
(a) Himachal Pradesh (b) Uttarakhand
(c) Sikkim (d) Nepal

74. The river Sone is a tributary of which one of the following rivers ?
(a) Ganga (b) Yamuna
(c) Narmada (d) Mahanadi

75. Which one of the following is the correct sequence of passes when one travels along the Himalayas from Kashmir to Sikkim?
(a) Zozila-Nathula-Shipkila
(b) Nathula-Shipkila-Zozila
(c) Nathula-Zozila-Shipkila
(d) Zozila-Shipkila-Nathula

76. Which one among the following peaks is the highest?
(a) Dhaula Giri (b) Namcha Barwa
(c) Nanda Devi (d) Nanga Parvat

77. From West to East, which one of the following is the correct sequence of Hills?
(a) Mahadeo Hills—Maikala Hills—Garhjat Hills
(b) Mahadeo Hills—Garhjat Hills—Maikala Hills
(c) Maikala Hills—Mahadeo Hills—Garhjat Hills
(d) Maikala Hills—Garhjat Hills—Mahadeo Hills

78. The Tropic of Cancer passes through which one of the following?
(a) Assam (b) Manipur
(c) Mizoram (d) Nagaland

79. Mahatma Gandhi Hydroelectric project is on which river ?
(a) Godavari (b) Sharavati
(c) Cauvery (d) Krishna

80. Indian Standard Time refers to the local time of which one of the following places in India?
(a) Allahabad (b) Bhopal
(c) Delhi (d) Lucknow

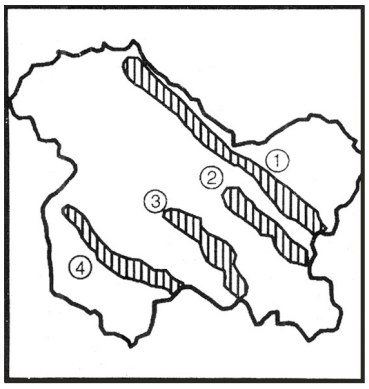
81. Which one of the following rivers flow between Vindhyan and Satpura ranges?
(a) Narmada (b) Son
(c) Mahe (d) Netravati

82. Amravati, Bhavani, Hemavati and Kabini are tributaries of which one of the following rivers?
(a) Mahanadi (b) Godavari
(c) Kaveri (d) Krishna

83. The Tropic of Cancer does not pass through
(a) Orissa (b) Tripura
(c) Chhattisgarh (d) Rajasthan

84. Which one of the following mountain ranges is spread over only one state in India?
(a) Aravalli (b) Satpura
(c) Ajanta (d) Sahyadri

85. Examine the map of Jammu and Kashmir given below:
The mountains ranges marked 1, 2, 3 and 4 are respectively:



(a) Ladakh, Zanskar, Karakoram and Pir Panjal
(b) Karakoram, Ladakh, Zanskar and Pir Panjal
(c) Karakoram, Zanskar, Pir Panjal and Ladakh
(d) Ladakh, Pir Panjal, Karakoram and Zanskar

86. Which one of the following east flowing rivers of India has rift valley due to down warping?
(a) Damodar (b) Mahanadi
(c) Sone (d) Yamuna

87. If it is 10.00 am. I.S.T., then what would be the local time at Shillong on 92° E longitude?
(a) 9.38 a.m. (b) 10.38 a.m.
(c) 10.22 a.m. (d) 9.22 a.m.

88. The correct sequence of the eastward flowing rivers of the peninsular India from north to south is :
(a) Subarnarekha, Mahanadi, Godavari, Krishna, Pennar, Cauvery and Vagai
(b) Subarnarekha, Mahanadi, Krishna, Godavari, Cauvery and Vagai
(c) Mahanadi, Subarnarekha, Godavari, Krishna, Cauvery, Pennar and Vagai
(d) Mahanadi, Subarnarekha, Krishna, Godavari, Cauvery, Vagai and Pennar

89. Among the following cities, which one is nearest to the Tropic of Cancer?
(a) Delhi (b) Kolkata
(c) Jodhpur (d) Nagpur

90. Gandhi Sagar Dam is a part of which one of the following?
(a) Chambal Project
(b) Kosi Project
(c) Damodar Valley Project
(d) Bhakra Nangal Project

91. Where are Shevaroy hills located?
(a) Andhra Pradesh (b) Karnataka
(c) Kerala (d) Tamil Nadu

92. Out of the four southern States: Andhra Pradesh, Karnataka, Kerala and Tamil Nadu, which shares boundaries with the maximum number of Indian States?
(a) Andhra Pradesh only
(b) Karnataka only
(c) Each of Andhra Pradesh and Karnataka
(d) Each of Tamil Nadu and Kerala

93. Which of the following hills are found where the Eastern Ghats and the Western Ghats meet?
(a) Anamalai Hills (b) Cardamom Hills
(c) Nilgiri Hills (d) Shevaroy Hills

94. Which one of the following statements is not true?
(a) Ghaggar's water is utilised in the Indira Gandhi canal
(b) Narmada rises from Amarkantak region
(c) Nizam Sagar is situated on the Manjra river
(d) Penganga is a tributary of the Godavari

95. Which one of the following statements is not correct?
(a) The Western Ghats are relatively lower in their northern region.
(b) The Anai Mudi is the highest peak in the Western Ghats.
(c) Tapi river lies to the south of Satpura.
(d) The Narmada and Tapti river valleys are said to be old rift valleys.

Exercise -2

Statement Based MCQ

1. If there were no Himalayan ranges, what would have been the most likely geographical impact on India?
   1. Much of the country would experience the cold waves from Siberia.
   2. Indo-gangetic plain would be devoid of such extensive alluvial soils.
   3. The pattern of monsoon would be different from what it is at present.

   Which of the statements given above is/are correct?
   (a) 1 only (b) 1 and 3
   (c) 2 and 3 (d) 1, 2 and 3
2. Consider the following statements:
   1. The Brahmaputra plain extends in Assam for about 640 Kms from Dhubri to Sadiya.
   2. The Peninsular plateau is made up of highly denuded rocks.

   Which of the above statements is/are not correct?
   (a) 1 only (b) 2 only
   (c) Both 1 and 2 (d) Neither 1 nor 2
3. Consider the following statements with regard to Himalaya.
   1. Mt Everest, Kanchenjunga fall in the inner Himalaya.
   2. The inner Himalaya has an average altitude of 6000 metres.
   3. Kothri Dun and Patli Dun are longitudinal valley.

   Which of the above statements is/are correct?
   (a) 1, 2 and 3 (b) 1 and 2
   (c) 1 and 3 (d) 3 only
4. Consider the following statements about Telengana
   1. It is a situated to the south-east of the Deccan lava plateau.
   2. It is high plateau highly denuded and dissected.
   3. Monadrocks are also found in the plateau.
   4. Its northern parts have scanty vegetation.

   Choose the incorrect statements:
   (a) 1, 2 and 4 (b) 2 and 3
   (c) 1 and 4 (d) 2 only
5. Which of the following are true with respect to the Indian Peninsular Plateau?
   1. The southern plateau block is formed mainly of granites and gneiss.
   2. The Deccan lava plateau is an elevated tableland consisting of horizontally arranged lavasheets.
   3. The Malwa plateau dominates the Vindhyan scarps forming the northern flank of the plateau.
   4. The troughs of the Narmada and the Tapti are interposed between the Vindhyan and the Satpura ranges

   (a) 1, 2 and 3 (b) 1 and 2
   (c) 1, 2, 3 and 4 (d) 1, 3 and 4
6. Which of the following is true with regard to the characteristics of the Himalayan rivers ?
   1. Many of them have their sources in the inner Himalays.
   2. They have a perennial flow.
   3. They have a great capacity for erosion.
   4. They do not form gorges.

   (a) 1 and 2 (b) 1, 2 and 3
   (c) 3 and 4 (d) 2 and 4
7. When you travel in Himalayas, you will see the following
   1. Deep gorges
   2. U-turn river courses
   3. Parallel mountain ranges
   4. Steep gradients causing land-sliding

   Which of the above can be said to be the evidences for Himalayas being young fold mountains?
   (a) 1 and 2 (b) 1, 2 and 4
   (c) 3 and 4 (d) 1, 2, 3 and 4
8. Consider the following statements:
   1. A valley glacier consists of not only ice but rocks also.
   2. The largest valley glaciers in India are in the Karakoram range.
   3. Mountain glaciers can dig new valleys.

   Which of the statements given above is/are correct?
   (a) 1 only (b) 1 and 2
   (c) 2 and 3 (d) 1, 2 and 3
9. Consider the following statements:
   1. Ranjit Sagar Dam is on the river Beas.
   2. Hirakund Dam is on the river Damodar.
   3. The reservoir Gandhi Sagar is on the river Chambal.

   Which of the statements given above is/are correct?
   (a) 1 and 2 (b) 3 only
   (c) 2 and 3 (d) 1 and 3
10. Consider the following statements :
    1. Alamatti dam is on the Cauvery river.
    2. Mettur dam in on the Krishna river.
    3. Gandhi Sagar Reservoir is on the Chambal river.

    Which of the statements given above is/are correct?
    (a) 1 and 2 (b) 2 only
    (c) 1 and 3 (d) 3 only
11. Identify from the following states of India through which the Tropic of Cancer passes and arrange them from East to West.
    1. Gujarat 2. West Bengal
    3. Uttar Pradesh 4. Jharkhand
    5. Madhya Pradesh 6. Bihar
    7. Chhattisgarh

    Select the correct answer using the codes given below.
    (a) 2-5-7-4-1 (b) 2-4-7-5-1
    (c) 3-2-6-7-5 (d) 3-7-4-6-2

12. Which of the following statements is/are true?
(I) Longitudes of Jabalpur's location is between those of Indore and Bhopal.
(II) Latitude of Aurangabad's location is between those of Vadodara and Pune
(III) Bangalore is situated more south ward than Chennai.
(a) I and III (b) only II
(c) II and III (d) I, II and III

13. Tank irrigation is practised mainly in Peninsular India because
1. undulating relief and hard rocks make it difficult to dig canals and wells
2. rivers are rainfed
3. of compact nature of population and agricultural fields
Select the correct answer using the codes given below
Codes
(a) 1 and 2 (b) 2 and 3
(c) 1 and 3 (d) All of these

14. Which of the following statements about Nathu la Pass are correct?
1. It links Sikkim with Tibet.
2. It was the main artery of the ancient Silk Route.
3. It was reopened in the year 2006.
Select the correct answer using the codes given below
(a) 1, 2 and 3 (b) 1 and 2
(c) 2 and 3 (d) 1 and 3

15. Which of the following is/are West flowing river(s) of India?
1. Mahanadi 2. Krishna
3. Narmada 4. Cauvery
Select the correct answer using the codes given below
(a) 1, 2 and 4 (b) 2 and 3
(c) Only 3 (d) 1 and 3

16. Arrange the following features formed by rivers in its course starting from upstream:
1. Meanders 2. Falls
3. Delta 4. Oxbow Lake
Select the correct answer using the code given below:
(a) 2 – 1 – 3 – 4 (b) 2 – 1 – 4 – 3
(c) 1 – 2 – 3 – 4 (d) 1 – 4 – 2 – 3

17. Arrange the following tributaries of river Indus from North to South :
1. Chenab 2. Jhelum
3. Ravi 4. Sutlej
Select the correct answer using the code given below :
(a) 4-3-1-2 (b) 2-3-1-4
(c) 1-2-3-4 (d) 2-1-3-4

18. Consider the following statements:
1. Ranjit Sagar Dam is on the river Beas.
2. Hirakund Dam is on the river Damodar.
3. The reservoir Gandhi Sagar is on the river Chambal.
Which of the statements given above is/are correct?
(a) 1 and 2 (b) 2 only
(c) 2 and 3 (d) 1 and 3

19. Which one of the following pairs is correctly matched?

Rivers	Major Tributaries
(a) Godavari:	Pairi, Hasdo, Tel
(b) Maha:	Puma, Penganga, Wain ganga
(c) Krishna:	Manjra, Dudhana, Indravati
(d) Cauvery:	Kabani, Hemavati, Amaravati

20. Consider the following statements :
1. Alamatti dam is on the Cauvery river.
2. Mettur dam in on the Krishna river.
3. Gandhi Sagar Reservoir is on the Chambal river.
Which of the statements given above is/are correct?
(a) 1 and 2 only (b) 2 only
(c) 1 and 3 only (d) 3 only

21. Consider the following rivers:
1. Betwa
2. Kosi
3. Gandak
Which of the above join(s) Yamuna river?
(a) 1 only (b) 1 and 2
(c) 1 and 3 (d) 2 and 3

22. Identify from the following states of India through which the Tropic of Cancer passes and arrange them from East to West.
1. Gujarat 2. West Bengal
3. Uttar Pradesh 4. Jharkhand
5. Madhya Pradesh 6. Bihar
7. Chhattisgarh
Select the correct answer using the codes given below.
(a) 2-5-7-4-1 (b) 2-4-7-5-1
(c) 3-2-6-7-5 (d) 3-7-4-6-2

23. Consider the following statements:
1. Longitude of Jabalpur's location is between those of Indore and Bhopal.
2. Latitude of Aurangabad's location is between those of Vadodara and Pune.
3. Bangalore is situated more southward than Chennai
Which of these statements is/are correct?
(a) 1 and 3 (b) Only 2
(c) 2 and 3 (d) 1, 2 and 3

24. Consider the following pairs:

Tributary River	Main River
1. Chambal	Narmada
2. Sone	Yamuna
3. Manas	Brahmaputra

Which of the pairs given above is/are correctly matched?
(a) 1, 2 and 3 (b) l and 2 only
(c) 2 and 3 only (d) 3 only

25. The Narmada river flows to the west, while most other large peninsular rivers flow to the east. Why?
1. It occupies a linear rift valley.
2. It flows between the Vindhyas and the Satpuras.
3. The land slopes to the west from Central India.
Select the correct answer using the codes given below.
(a) 1 only (b) 2 and 3
(c) 1 and 3 (d) None

Matching Based MCQ

DIRECTIONS (Qs. 26 to 37) : Match List-I with List-II and select the correct answer using the codes given below the lists.

26.

	List-I	List-II
(A)	Mahanadi	(1) Manjra
(B)	Godavari	(2) Orisan
(C)	Narmada	(3) Aner
(D)	Tapi	(4) Ib

(a) A – 4 ; B – 1 ; C – 3 ; D – 2
(b) A – 2 ; B – 1 ; C – 4 ; D – 3
(c) A – 4 ; B – 1 ; C – 2 ; D – 3
(d) A – 2 ; B – 1 ; C – 3 ; D – 4

27.

	List-I	List-II
(A)	Krishna	(1) Chambal
(B)	Brahmaputra	(2) Indravati
(C)	Godavari	(3) Tisha
(D)	Yamuna	(4) Bhima

(a) A – 4 ; B – 3 ; C – 2 ; D – 1
(b) A – 3 ; B – 4 ; C – 1 ; D – 2
(c) A – 4 ; B – 3 ; C – 1 ; D – 2
(d) A – 3 ; B – 4 ; C – 2 ; D – 1

28. Which one of the following pairs is not correctly matched?

River	City
A. Gomati	Lucknow
B. Sarya	Ayodhya
C. Alakananda	Badrinath
D. Narmada	Satna

29. Match the following

List I River	List II Tributary
A. Brahamaputra	1. Musi
B. Krishna	2. Tawa
C. Narmada	3. Bhavani
D. Cauveri	4. Dikhow

Codes :

	A	B	C	D
(a)	4	2	1	3
(b)	4	1	2	3
(c)	3	2	1	4
(d)	3	1	2	4

30. Match the following

List I (Pass)	List II (State)
A. Zoji La Pass	1. Sikkim
B. Bara Lacha Pass	2. Uttarakhand
C. Jelep La Pass	3. Himachal Preadesh
D. Niti Pass	4. Jammu and Kashmir

Codes :

	A	B	C	D
(a)	4	1	3	2
(b)	2	3	1	4
(c)	4	3	1	2
(d)	2	1	3	4

31. Match the following.

List I	List II
(River)	(Source)
A. Ganga	1. Amarkantak
B. Sone	2. Gaumukh
C. Godavari	3. Mahabaleshwar
D. Krishna	4. Trimbakeshwer

Codes :

	A	B	C	D
(a)	1	2	4	5
(b)	2	1	3	4
(c)	4	3	1	2
(d)	2	1	4	3

32. Match the following

List I	List II
(River)	(Tributary)
A. Ganga	1. Chambal and Ken
B. Indus	2. Wainganga and Indravati
C. Yamuna	3. Chenab and Sutlej
D.Godavari	4. Gomti and Kosi

Codes :

	A	B	C	D
(a)	4	1	3	2
(b)	4	3	1	2
(c)	2	1	3	4
(d)	2	3	1	4

33. Match list I with List II and select the correct answer using the codes given below the lists:

	List I (Peak)		List II (State)
A.	Dodabetta	1.	Maharashtra
B.	Guru Shikhar	2.	Madhaya Pradesh
C.	Kalsubai	3.	Tamil Nadu
D.	Dhupgarh	4.	Rajasthan

Codes:

	A	B	C	D
(a)	3	1	4	2
(b)	2	1	4	3
(c)	3	4	1	2
(d)	2	4	1	3

34. Match List I with List II and select the correct answer using the codes given below the lists:

	List I (Himalayan Peaks)		List II (States)
A.	Nanga Parbat	1.	Jammu & Kashmir
B.	Nanda Devi	2.	Sikkam
C.	Kanchanjunga	3.	Uttarakhand

Codes :

	A	B	C
(a)	1	2	3
(b)	1	3	2
(c)	2	3	1
(d)	3	1	2

35. Match List-I (Valley) with List-II (State) and select the correct answer using the codes given below the lists:

List-I (Valley)	List-II (State)
A. Markha Valley	1. Sikkim
B. Dzukou Valley	2. Himachal Pradesh
C. Sangla Valley	3. Jammu & Kashmir
D. Yumthang Valley	4. Nagaland

Codes :

(a) A-2; B-4; C-3; D-1
(b) A-3; B-1; C-2; D-4
(c) A-2; B-1; C-3; D-4
(d) A-3; B-4; C-2; D-1

36. Match List I with List II and select the correct answer using the code given below the Lists :

List I (Himalayan Peak)	List II (State)
A. K2	1. Uttarakhand
B. Nanda Devi	2. Jammu & Kashmir
C. Tara Pahar	3. Sikkim
D. Kanchenjunga	4. Himachal Pradesh

Code:

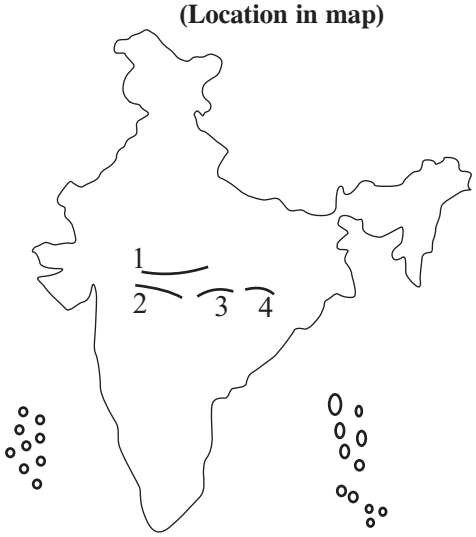
	A	B	C	D
(a)	2	4	1	3
(b)	2	1	4	3
(c)	3	1	4	2
(d)	3	4	1	2

37. Match List I with List II and select the correct answer using the code given below the Lists :

List I
(Hill range of Central India)

A. Satpura
B. Mahadeo
C. Vindhya
D. Maikala

List II
(Location in map)



Code :

	A	B	C	D
(a)	4	3	1	2
(b)	4	1	3	2
(c)	2	1	3	4
(d)	2	3	1	4

Hints and Explanations

EXERCISE-1

1. (d) Luni river originates from Aravalli range and flows in south west direction through the hills and finally ends up in the marshy land of Rann of Kutch.
2. (b) Brahamputra originates near Mt. Kailash and is known to take a U turn near Mount Namcha Barwa. This U turn is also known as Great Bend. The U Turn is because of the 180° bend of the Himalayan structural trends.

3. (b) 4. (d) 5. (c) 6. (b) 7. (d)
8. (a) 9. (d) 10. (a) 11. (c) 12. (a)
13. (c) 14. (b) 15. (b) 16. (d) 17. (c)
18. (b) 19. (a)

20. (d) Rivers like Beas, Chenab, Ravi, Sutlej and Yamuna passes through Himachal Pradesh.
21. (a) Chilka, Periyar and Pulicate lake are lagoons. They are formed due to separation of sea water by deposition and clay, but Ashtamudi lake is not a lagoon.

22. (b) 23. (c)

24. (c) Both Andhra Pradesh and Karnataka shares boundaries with maximum number of Indian states.

25. (d) 26. (c) 27. (b)

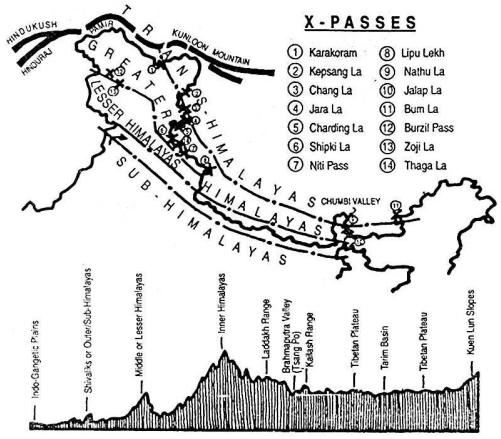
28. (c) Wardha river is a tributary of River Godavari.
29. (a)
30. (c) Musi is the tributary of Krishna, Panganga, Wanganga, Wardha, Indiravati, Pravada etc. are the tributaries of Godavari.
31. (b) Nanda Devi Peak (7817 m) is situated in Uttarakhand.
32. (a) Ramganga, Gomit, Ghaghra, Gundak, Kosi, Son, Mahananda are the tributaries of Ganga.
33. (d)
34. (a) From West to East the sequence of Hills : Nanda Devi Hills — Maikala Hills — Grahjat hills
35. (c) Tropic of cancer passes through Mizoram.
36. (d) Port Blair is the largest town and a municipal council in Andaman district in the Andaman Islands and the capital of the Andaman and Nicobar Islands, a Union Territory of India. It lies on the east coast of South Andaman Island and is the main entry point to the islands.

37. (a) 38. (d)

39. (d) The Colorado river is the primary river of the American Southwest. The original name of this river is Rio Colorado or Red River by the Spanish.
40. (d) The Narmada river (Rewa) is the fifth largest river in the Indian subcontinent. It is third largest river which is completely flows in India after Ganga and Godavari.
41. (d) Govind Ballabh Pant Sagar is on the Rihand River which is the tributary of the Son River.
42. (a) The Luni is a river of western Rajasthan state. It originates in the Pushkar valley of the Aravalli Range near Ajmer and ends in Rann of Kutch in Gujarat.
43. (d) The Gandhi Sagar Dam is one of the four major dams built on India's Chambal River. The dam is located in the Mandsaur district of Madhya Pradesh.
44. (b) With a view to restoring the past glory for Kolleru lake, government had taken up 'Operation Kolleru' on the Krishna and West Godavari district borders. Kolleru Lake is one of the largest freshwater lakes in India located in state of Andhra Pradesh
45. (c) Cauvery river dispute is among Kerala, Karnataka, Tamil Nadu and Puducherry.
46. (b) The Palk Strait is situated between the Tamil Nadu and the Mannar district of the Northern Province of Sri Lanka. It connects the Bay of Bengal in the northeast with the Palk Bay and thence with the Gulf of Mannar in the southwest.
47. (c) Godwin Austen (K^2) is the highest peak in the given options. It is the world's second tallest peak. It is located in the Karakoram range of the Himalaya in Northern Kashmir. Its height is 8611m.
48. (a) Bangladesh shares longest border with India. Both countries share a 4,096-kilometer) long international border.
49. (d) The Son flows north-northwest through Madhya Pradesh.
50. (c) Nasik is located on the banks of the Godavari.
51. (d) The Rihand Dam was constructed across the Rihand River near Pipri in Sonbhadra district of Mirzapur division in 1962 for hydropower generation.
52. (a)
53. (b) The Latitude & Longitude for New Delhi are 28.38° N and 77.12°.
54. (d) Narmada flows into the Gulf of Khambhat (Arabian Sea).
55. (c)
56. (c)
    1. Rihand - Pipri
    2. Gandak- Balmikinagar
    3. Chambal- Kota
    4. Mahanadi- Hirakund
57. (b) The Aravalli range are the oldest fold mountains in India.
58. (d) Indian Standard Time is calculated on the basis of 82.5° E longitude in Shankargarh Fort Mirzapur (Allahabad).
59. (c)
60. (b) The Ten Degree Channel is a channel that separates the South Andaman and Car Nicobar in the Bay of Bengal.
61. (a) Correct sequence is Godavari- Penner- Cauveri- Periyar

The Godavari is the second longest river in India after the river Ganga. It originates from Western Ghats of central India near Nasik in Maharashtra. The Penner originates from Nandi Hills in Chikballapur District of Karnataka. This river flows from north as well as east corners across Andhra Pradesh. The Cauvery originates from Western Ghats in Karnataka and flows generally south and east through Karnataka and Tamil Nadu. The Periyar originates from Western Ghats range near the border with Tamil Nadu and flows in Kerala.

62. (c) Uttarkashi is located on a confluence of two rivers varuna and
63. (b) Punjab, Jammu and Kashmir, Rajasthan and Gujarat have common borders with Pakistan.
64. (b) Son, Mahanadi and Narmada rivers originate from Amarkantak region.
65. (c) Tapti does not flow in to the Bay of Bengal. The river rises in the eastern Satpura Range of southern Madhya Pradesh and flows into the Gulf of Cambay of the Arabian Sea.
66. (b) Bangladesh shares longest border with India. India and Bangladesh share a 4,096 kilometres long international border. It is the fifth-longest land border in the world.
67. (c) The origin of the river is a tiny reservoir named as Narmada Kund which is situated on the Amarkantak Hill in Anuppur District of East Madhya Pradesh. Amarkantak region is a unique natural heritage area and is the meeting point of the Vindhyas and the Satpuras, with the Maikal Hills being the fulcrum.
68. (c) The Narmada River travels a distance of 1,312 km before it falls into Gulf of Cambay in the Arabian Sea near Bharuch in Gujarat. The first 1,079 km of its run is in Madhya Pradesh. In the next length of 35 km, the river forms the boundary between the States of Madhya Pradesh and Maharashtra. Again, in the next length of 39 km, it forms the boundarybetween Maharashtra and Gujarat.
69. (b)
70. (b) Tropic of Cancer comes across Jharkhand and Ranchi is nearest of it.
71. (b) Zojila Pass is situated in Jasker range in Jammu and Kashmir state. It passes through Srinagar-Leh National Highway.
72. (c) Musi Rives is a tributary of the krishna River in the Deccan ptaleau flowing through telangana stata in India.
73. (c)
74. (b) Nanda Devi Peak (7817 m) is situated in Uttarakhand.
75. (a) Ramganga, Gomati, Ghaghra, Gundak, Kosi, Son, Mahananda are the tributaries of Ganga.
76. (d) The correct sequence of passes given in the question is shown in the following diagram.



77. (a) Dhaulagiri is some of highest peak in great Himalaya range. Its height is approximately 8172 m. Height of Nanda devi is 7816 m.
78. (a) From West to East The sequence of Hills : Nanda Devi Hills — Maikala Hills — Grahjat hills
79. (b)
80. (a) The standard time in India is the local time of a place at 82.5° E longitude near Mirzapur. This meridian also divides India approximately into half.
81. (a)
82. (c) The Kaveri rises from the Brahmagiri hills in the Coorg district at 1,341 m above sea level and drain the Maysore plateau before flowing into the plain.
83. (a) The tropic of cancer passes through tripura, Chhattisgarh and Rajasthan states in India.
84. (c) Ajanta mountain range a short range, which spreads within Maharashtra.
    - Aravali ranges covers Rajasthan, Haryana and Delhi
    - Satpura ranges are found in Gujrat and Madhya Pradesh.
    - Sahyadris ranges starts from Gujrat, Maharastra border and crossing Goa, Karnataka. It reaches Kerala tip upto Cape Comrin.
    - Ajanta is found in the Aurangabad district of Maharastra.
85. (b) According to the physiography map of India the mountains ranges found in Jammu and Kashmir is Karakoram which is marked as '1' in figure. Ladakh range which is marked as '2', Zanskar range which is marked as '3', and Pir Panjal which is marked as '4'.
86. (a) Damodar is a east flowing river with rift valley due to down warping. Down warp denotes a segment of the earth's crust that is broadly bent downward.
87. (b)
88. (a) The correct sequence of eastward flowing river of the peninsular India from north to south is Subarnarekha, Mahanadi, Godavari, Krishna, Pennar, Cauvery and Vagai.
89. (b) The Tropic of Cancer located at 23.5° north. Location of Kolkata is 22°33' N. So, Kolkata is nearer to Tropic of Cancer. Delhi is 28.38°N.

90. (a) Gandhi Sagar Dam is situated on the river Chambal in 1960, near Bhanpura of Madhya Pradesh.
91. (d) Shevaroy hill is situated near Salem of Tamil Nadu. This hill range covers an area of fifty square kilometers.
92. (c) Both Andhra Pradesh and Karnataka shares boundaries with maximum number of Indian states.
93. (c) Nilgiri hills are at the junction of the eastern and western ghats of the Sahayadri hills. The heights of the hills range varies between 2,280 and 2,290 metres.
94. (a) Indira Gandhi Canal originated from Harike barrage at Sultanpur on Sutlej but Ghaggar is a tributary of river Saraswati, which ends in the Thar desert.
95. (a) Western Ghats are relationship higher in the Southern region.

EXERCISE-2

1. (d) All the statements given in the question are correct.
2. (d) 3. (a) 4. (d) 5. (c) 6. (b)
7. (d) All are correct.
8. (d)
9. (d) Hirakund Dam is situated on the river Mahanadi.
10. (d) Gandhi Sagar Reservoir on Chambal river, jointly executed by Madhya Pradesh and Rajasthan.
11. (b)
12. (c)
13. (a) The tank irrigation is practised mainly in peninsular India due to the following reasons:
    1. The undulating relief and hard rocks make it difficult to dig canals and wells.
    2. There is little percolation of rain water due to hard rock structure and ground water is not available in large quantity.
    3. Most of the rivers of this region are seasonal and dry up in summer season. Therefore, they cannot supply water to canals throughout the year.
    4. There are several streams which become torrential during rainy season. The only way to make best use of this water is to impound it by constructing bunds and building tanks. Otherwise this water would go waste to the sea.
    5. The scattered nature of population and agricultural fields also favour tank irrigation.
14. (a) Nathu La is a mountain pass in the Himalayas. It connects the Indian state of Sikkim with China's Tibet Autonomous Region. Nathu La is located on the 563 km Old Silk Route, an offshoot of the historic Silk Road. It was sealed by India after the 1962 Sino-Indian War and was re-opened in 2006 following numerous bilateral trade agreements.
15. (c) West flowing rivers:
    Narmada River(1057 km)- Rises in Amarkantak Plateau and flows into gulf of khambat.
    Tapti(724 km) - Rises from Betul district in Maharashtra. Luni and Payaswani are also west flowing rivers.
16. (b) Falls are possible only when a river is losing height suddenly. Next comes meanders. When a river reaches flatter land,flow is slowed down and meanders are formed through erosion of the river banks and deposition on the inside of bends.
    Oxbow lake is formed when a wide meander is cut off from the main river, creating a free-standing body of water.
    Delta is formed at the mouth of a river, where the river flows into an ocean, sea, estuary, lake, or reservoir.
17. (d) The Indus River originates near the Mansarovar Lake in the Tibetan plateau, on the northern slopes of the Kailash Mountain Range. Given below are the main tributaries of the Indus River from north to south:
    - Jhelum
    - Chenab
    - Ravi
    - Sutlej
18. (b) Hirakund Dam is situated on the river Mahanandi.
19. (d) Godavari is the largest in the peninsular region. It has formed an extensive delta in Andhra Pradesh. It rises near Nasik in Maharashtra.
    Cauvery is known as the Ganga of the South. It rises in the Coorg district of Karnataka.
    Krishna rises in the Western Ghat near Mahabaleshwar and flows through Andhra Pradesh.
20. (d) Gandhi Sagar Reservoir on Chambal river, jointly executed by Madhya Pradesh and Rajasthan.
21. (a) 22. (b)
23. (c) The longitude of Jabalpur's location is to the east of Bhopal, Bangalore is north of Channai.
24. (d) Tributaries of Brahmaputra in India are the Manas, Pagladiya, Puthimari, Dhanisri, Jia Bhariti and Subansiri.
    Manas is a tributary of Brahmaputra Chambal is the chief tributary of Yammuna and sone is a tributary of Ganga.
25. (a) 26. (c) 27. (a)
28. (d) The source of the Narmada is Amarkantak in the Anuppur District (eastern Madhya Pradesh).
29. (b)
    1. Brahamaputra- Dikhow
    2. Krishna- Musi
    3. Narmada- Tawa
    4. Cauveri- Bhavani

30. (c)
    1. Zoji La Pass- Jammu and Kashmir
    2. Bara Lacha Pass- Himachal Pradesh
    3. Jalep La Pass- Sikkim
    4. Niti pass- Uttarakhand.

31. (d) 1. Ganga - Gaumukh
    2. Son- Amarkantak
    3. Godavari- Trimbakeshwar
    4. Krishna- Mahabaleshwar

32. (b)

River	Tributary
Ganga	Gomti and Kosi
Indus	Chenab and Sutlej
Yamuna	Chambal and Ken
Godavari	Wainganga and Indravati

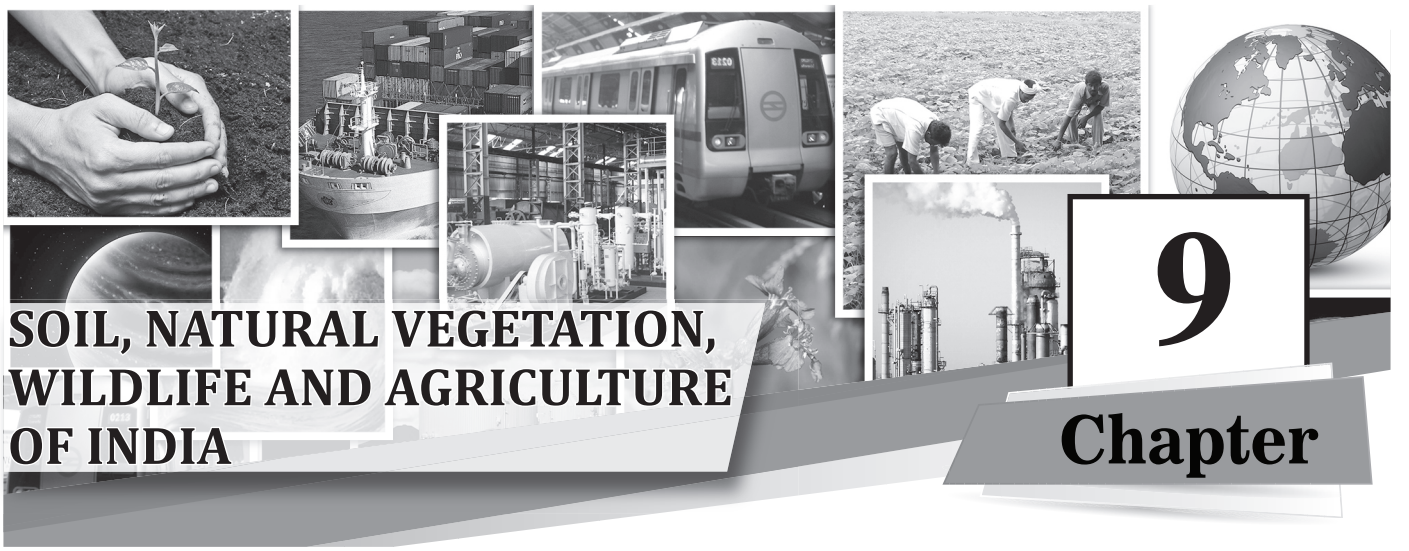
33. (c) Dodabetta (Tamil Nadu), Guru Shikhar (Rajasthan), Kalsubai (Maharashtra) and Dhupgarh (Madhya Pradesh).

34. (b) Nanga parbat (8126 m)-Jammu & Kashmir, Nanda Devi (7817 m) – Uttrakhand and Kanchenjunga (8598 m) Sikkim.

35. (d)

36. (b) K2-Jammu and Kashmir, Nanda Devi-Uttarakhand, Tara Pahar-Himachal Pradesh, Kanchenjunga-Sikkim.

37. (a)

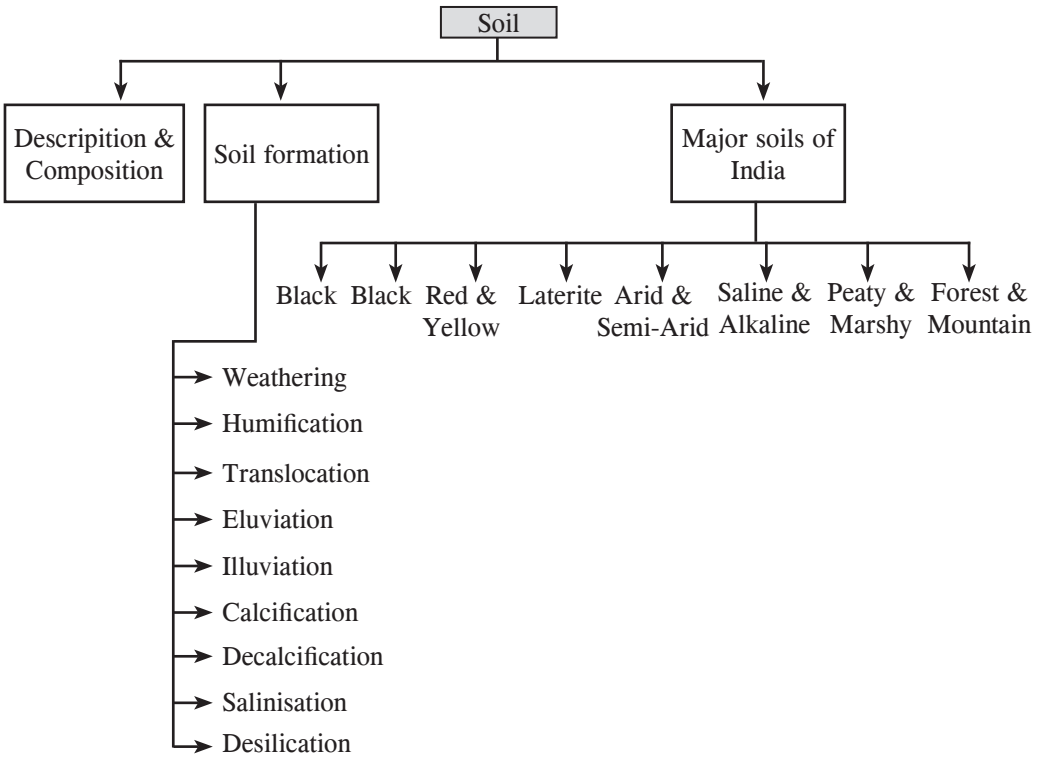


9 Chapter

SOIL, NATURAL VEGETATION, WILDLIFE AND AGRICULTURE OF INDIA

Introduction

Soil is the mixture of rock debris and organic materials which develop on the earth's surface. Soil forms different layers of particles of different sizes. A vertical section that shows different layers of soil is called a Soil Profile. Each layer is called a Horizon.



Basic Facts

- Soil formation process is called **pedogenesis** and the scientific study of soils is known as **pedology**.
- Under the soil layer are gravels of parent rock and concretions formed by the accumulation of leached materials collectively known as **sub-soil**.
- There are two classes of minerals abundant in soils. **Primary minerals** and **Secondary minerals**.
- **Primary minerals** are mostly silicate minerals-compounds of silicon and oxygen, with varying proportions of aluminium, calcium, sodium, iron and magnesium. But they play no important role in sustaining plant or animal life.
- **Secondary minerals** - clay minerals, mineral oxides, etc. are essential for soil development and for soil fertility.
- The nature of the clay minerals in a soil determines its base status. If the clay minerals can hold abundant base ions, the soil is of high base status and generally will be highly fertile, and vice versa.

Soil Forming Processes – The transformation of rocks into soil is called soil formation.
The fundamental & specific process of soil formation are as follows –

1. **Weathering** - the process that results in the break down and chemical changes of the parent rocks in situ.
2. **Humification** - It is the process of transformation of raw organic matter into humus. It helps in formation of surface layer.
3. **Translocation** - It refers to the material movement within the solid body. Two process of translocation are eluviation and illuviation.
4. **Eluviation** - the downward transport of fine particles, particularly the clays and colloids, from the uppermost part of the soil.
5. **Illuviation** - the accumulation of materials that are brought downward, in the underlying zone.
6. **Calcification** – occurs in dry regions where due to lack of excessive moisture, the soil accumulates considerable amount of soluble materials of calcium carbonate and magnesium in some part of soil profile.
7. **Decalcification -** the leaching of calcium carbonate from the entire soil. It general1y happens in moist climates.
8. **Salinisation or alkalisation** takes place in the case of extreme evaporation where soluble salts or sodium salts accumulate on the soil surface as a result of the capil1ary action of water from a water table.
9. **Desilication** - In this process, silica, together with many bases, is removed from a soil profile by intense weathering and leaching. It leads to development of ferralsol soils. Desilicified soils are known as **ferralsols**.

Major Soil Groups of India

(i) Alluvial Soil

- It covers about 15 lakh sq km (45.6%) of the total land area of the country.
- It contributes largest share of our agricultural wealth.
- It is yet immature and has weak profiles.
- It is rich in potash, phosphoric acid, lime and organic matter but deficient in nitrogen and humus contents. It is one of the most fertile in the world.
- It is found in river plains and also along with the coastal regions of India. Its extent is from Punjab in west to west Bengal & Assam in the east.
- It is divided mainly into younger **Khadar** and older **Bhangar** soils.
- Khadar soils are found in the low areas of valley bottom which are flooded almost every year.
- The Bhangar is found on the higher areas of the flood plains. **A few metres below the surface of the bhangar are beds of lime nodules known as *Kankar*.**
- Along the Shiwalik foothills, there are alluvial fans having coarse, often pebbly soils. This zone is called **Bhabar**.
- To the south of the bhabar is a long narrow strip of swampy lowland with silty soils known as **Terai**. The terai soils are rich in nitrogen and organic matter but are deficient in phosphate.

Difference between Khadar and Bhangar

	Khadar	Bhangar
(i)	khadar is the newer and younger deposits of the flood plains	Bhangar is the older alluvium. It forms the largest part of the Northern plains
(ii)	This type of alluvial soil found in the lower levels in the plains near the rivers.	Bhangar found in higher up in the plains at river terraces away from rivers
(iii)	It is loamy and porous soil.	It is clayey and non-porous soil
(iv)	It is more fertile than Bhangar as new layers are deposited year after year during monsoonal floods	It is less fertile than khadar as it is not renewed.
(v)	It is pale brown, sandy clays & loams, more dry & leached less calcareous & carbonaceous	It is generally dark coloured & of a more clayey composition.

(ii) Black soils

- They are also known as '**Regur**' and '**Black cotton**' soils.
- They are spread over 5.46 Lakh sq km (16.6%) of the total geographical area of the country.
- The black colour of these soils has been attributed to the presence of a small proportion of titaniferous magnetite or even to iron and black constituents of the parent rock.
- The black soil is very retentive of moisture. It swells greatly and become sticky when wet in rainy season, and shrink when dried in dry season and develop wide cracks. Thus, there occurs a kind of 'self ploughing'.
- They contain lime, iron, magnesium, alumina and potash but lack phosphorous, nitrogen, organic matter and humus.
- Generally, the black soils of uplands are of low fertility but they are darker, deeper and richer in the valleys.

(iii) Red and Yellow Soils

- Most of the red soils have come into existence due to weathering of ancient crystalline and metamorphic rocks.
- The soil develops a reddish colour due to a wide diffusion of iron in crystalline and metamorphic rocks. It looks yellow when it occurs in a hydrated form.
- It covers about 3.5 lakh sq km (l0.6%) of the total geographical area of the country.
- The red soils are poor in lime, magnesia, phosphates nitrogen and humus, but are fairly rich in potash.
- They are lying on the periphery of the peninsular plateau.
- They are not retentive of moisture.

(iv) Laterite soils

- Derives from Latin word 'Laterite' meaning 'brick'.
- The laterite soils are formed in the areas of high temperature and high rainfall with alternate wet and dry periods.
- These are the result of intense leaching. With rain, lime and silica are leached away and soils rich in iron oxide and aluminium compound are left behind.
- They are poor in organic matter, nitrogen, phosphate and calcium, while iron oxide & potash are in excess

- They cover an area of 2.48 lakh sq km.
- The laterite soils on the higher areas are generally more acidic than those in the low-lying areas.
- They are widely use in formation of bricks for construction of house.

(v) Arid and semi-arid soils

- They cover an area of 1.42lakh sq km(4.32%) of the total area of India.
- The desert soils consist of sand (90 to 95%) and clay (5 to 10%).
- Nitrogen is insufficient and the phosphate content is normal.
- Lower horizons of the soil are occupied by 'Kankar' layers because of the increasing calcium content downwards.
- These soils are poor and contain little humus and organic matter.

(vi) Saline and Alkaline soils

- They are known by different names such as reh, kallar, usar, thur, rakar, karl & chopan.
- Saline soils contain a larger proportion of sodium, potassium and magnesium and thus, they are infertile.
- They occur in arid and semi-arid regions and in waterlogged and swampy areas.
- They lack nitrogen and calcium.

(vii) Peaty and Marshy soils

- They are found in the areas of heavy rainfall and high humidity.
- They are rich in humus and organic content, but deficient potosh and phosphate.
- Organic matter may go even up to 40-50%.
- They are normally heavy and black in colour & highly acidic.

(viii) Forest and Mountain soils

- These soils occupy about 2.85 lakh sq km (8.67%) of the total land area of the country.
- Such soils are mainly found on the hills slopes covered by forests.
- These soils are heterogenous in nature and their character changes with parent rocks, ground-configuration and climate.
- The forest soils are very rich in humus but are deficient in potash, phosphorus and lime.
- The forest soils are loamy and silty on valley sides and coarse-grained in the upper slopes.

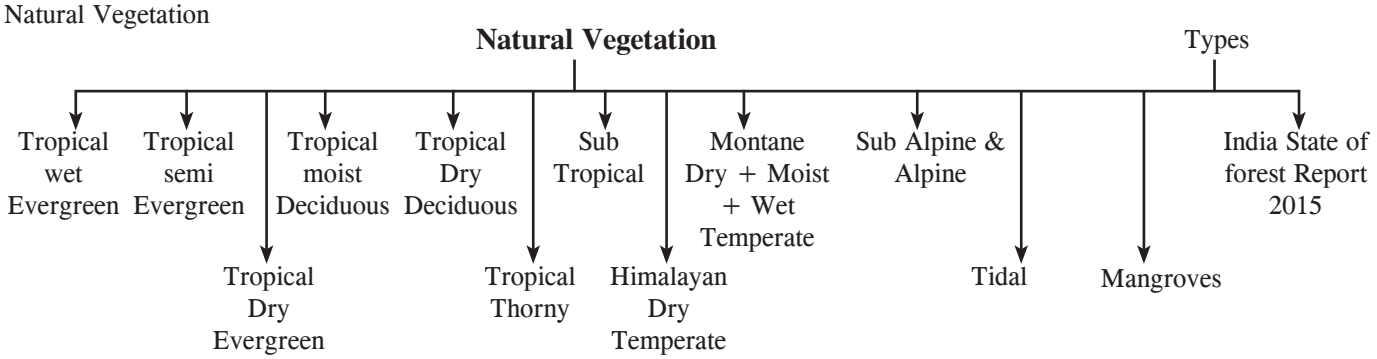
Soils of India: Types, Depth, pH Range and Regional Distribution

Type	pH range	Distribution	Predominant Crops
Alluvial Soil	6.5-8.4	Ganga and Brahmaputra river valleys; deltas of Godavari and Krishna; Plains of Uttar Pradesh, Uttarakhand, Punjab, Haryana, West Bengal and Bihar; Coastal strip of peninsular India	Rice, wheat, sugarcane, oilseeds, Jute, maize, vegetables & fruits.
Desert Soil	7.6-8.4	Rajasthan, northern Gujarat and southern Punjab	Wheat, grams, melon, bajra (with irrigation), barley, cotton, maize, pulses.
Black Soil	6.5-8.4	Maharashtra and Malwa plateaus, Kathiawar peninsula, Telengana and Rayalasema region of Andhra and northern part of Karnataka, some parts of Tamil Nadu.	Cotton, millets, tobacco, sugarcane (Millets include jowar, bajra and ragi), castor, sunflower.
Red & yellow Soil	Below 5.5-7.5	Scattered in peninsular India, Eastern parts of Deccan plateau, southern states of Kerala, Tamil Nadu and Karnataka, and Chhota Nagpur plateau (Jharkhand), Semi-arid tract of Rajasthan.	Millets, wheat, tobacco, rice, cotton, sugarcane, pulses, groundnut, potatoes, fruits, Oilseeds.
Laterite Soil	Below 5.5	Assam hills, Tamil Nadu, Madhya Pradesh, Kerala, Karnataka, and Eastern Ghat region of Orissa.	Coffee, rubber, cashewnut, tapioca
Mountain Soil (It includes peat, forest and hill soils)	5.0-6.5	Coniferous forest belt of Jammu and Kashmir, Himachal Pradesh, Uttarakhand and Sikkim.	Fruits, tea, coffee, wheat, maize, barley.
Saline Soils		Western Gujarat, deltas of Eastern Coast & in Sunderban areas of West Bengal	
Peaty & Marshy Soils		Northern part of Bihar, Southern part of Uttaranchal & the coastal areas of West Bengal, Orissa & Tamil Nadu	

Rainfall

- The average annual rainfall of India is about 118 cm. There are large spatial and temporal variations.
- Of the country's total rainfall, about 75 per cent is received in the monsoon months from June to September, 13 per cent comes in the post-monsoon season, 10 per cent in the pre-monsoon season and the remaining 2 per cent in the winter season.
- In January and February, north-west India gets rainfall from the western disturbances.
- Coromandel coast receives rainfall by the north-east monsoons in the winter season.
- The highest record, is 103.6 cm in 24 hours at Cherrapunji in Meghalaya.

Natural Vegetation



Natural Vegetation refers to a plant community that has been left undisturbed over a long time, so as to allow its individual species to adjust themselves to climate & soil conditions as fully as possible.

- The geographical factors which influence natural vegetation include climate, soil and topography.
- Areas receiving 200 cm or more rainfall per annum have **evergreen rain forests**.
- **Monsoon deciduous** forests dominate in areas which receive rainfall between 100 and 200 cm.
- In areas having 50 to 100 cm rainfall, there are drier deciduous or **tropical savanna** grading into open thorny scrub.
- The areas with less than 50 cm rainfall have only dry thorny scrub and low open bush merging into **semi-desert**.
- As the temperature falls with altitude in the Himalayan region, the vegetal cover changes from tropical to sub-tropical, temperate and finally alpine.
- The forests are very unevenly distributed. They are more scarce in Gangetic area.

India State of Forest Report 2015

The word forest is derived from Latin 'fores' meaning outside, the reference being to a fence & it must have included all uncultivated & unhabited land.

- Total forest and tree cover is 79.42 million hectare, which is 24.16% of the total geographical area.
- India's forest and tree cover has increased by 5, 081 sq km. While the total forest cover of the country has increased by 3, 775 sq km, the tree cover has gone up by 1, 306 sq km.
- Open Forest area has increased by 4, 744 sq km, which is 9.14% of the geographical area.
- Very Dense Forest area has increased by 2, 404 sq kms, which is 2.61% of the geographical area.
- About 40% forest cover is in 9 big patches of 10, 000 sq km and more.
- Increase in total forest cover also includes an increase in Mangrove cover.
- Maximum increase in forest cover has been observed in – Tamil Nadu (2, 501 sq km), followed by Kerala (1, 317 sq km) and Jammu & Kashmir (450 sq km).
- Madhya Pradesh has the largest forest cover of 77, 462 sq km in the country, followed by Arunachal Pradesh, with a forest cover of 67, 248 sq km & Chhattisgarh with 55, 586 sq km.
- Mizoram (88.93 %) has the highest forest cover in percentage terms, followed by Lakshadweep with 84.56 %.
- 7 States/UTs – Mizoram, Lakshadweep, Andaman & Nicobar Island, Arunachal Pradesh, Nagaland, Meghalaya and Manipur – have more than 75% forest cover.
- 8 states – Tripura, Goa, Sikkim, Kerala, Uttarakhand, Dadra & Nagar Haveli, Chhattisgarh and Assam – have forest cover between 33% to 75%.
- Total carbon stock in country's forest is 7, 044 million tones, an increase of 103 million tonnes.

India's Natural Vegetation

No.	Vegetation type	Distribution	Characteristic vegetation
1.	Tropical Wet Evergreen Vegetation	In areas where the annual rainfall is over 250 cm and the average annual humidity exceeds 77 per cent (North-East states, western portions of the Western Ghats and Andaman and Nicobar).	Lofty, very dense, multilayered forest with mesosphytic evergreens, e.g., bamboos, ebony, rose-wood, champa, toon, jamun, mesa, white cedar, mahogony.
2.	Tropical Semi-Evergreen Vegetation	Found in regions where the annual rainfall is between 200-250 cm and the humidity approaches 75% (Upper Assam, lower eastern Himalayas, Orissa, the Andaman and Nicobar islands & Western Coast).	Evergreen trees mixed with deciduous ones, less dense but more gregarious e.g., aini, semul, gutel, kadam, irul, thorny bamboo, rosewood, Kusum, hollock bonsum, white cedar, Indian chestnut, champa, mango, bamboos etc.
3.	Tropical Dry Evergreen Vegetation	In areas where the mean rainfall is about 100 cm, mostly from north-east monsoon, the mean annual humidity is 75%, and the mean annual temperature is 28°C (Tamil Nadu coast).	Short statured trees, with complete canopy, coriaceous leaved trees of short boles, no canopy layer differentiation. e.g., khirmi, jamun, kokko, toddy palm, tarrina, ritha, neem etc.

4.	Tropical Moist Deciduous Vegetation (Also known as monsoon forest)	In areas having moderate rainfall of 100-200 cm, a mean annual temperature of about 27°C, and an average relative humidity of 60 to 75% (Western Ghats, Odisha, eastern coastal plains, and Himalayan foothills).	Trees which shed their leaves during spring & early summer season, very useful forests because they yield valuable timber & several other forest products, heavily buttressed trees, shrubby undergrowth with patches of bamboos, climbers & canes. e.g. sal, teak, sandalwood, siris, palas, mahua, sisam, amla etc.
5.	Tropical Dry Deciduous Vegetation	In areas where rainfall is less than 150 cm and dry period is relatively long (eastern Rajasthan, Kathiawar, rain shadow area of the Deccan plateau, Central India).	Trees which grow relativity shorter then the tropical moist deciduous trees closed & uneven canopy. Examples include teak, sal, bijasal, palas, khair, tendu, rosewood, anjar etc.
6.	Tropical Thorny Vegetation	Mostly prevalent in areas having very low rainfall, i.e., 50 cm to 75 cm, the annual mean temperature between 25°C and 30°C, and the annual humidity less than 50% (Kutchh, Saurashtra, Punjab, Haryana, Rajasthan, Upper Ganga plains and the Deccan plateau).	Open stunted forest breaking down into xerophytic bush, e.g., babul, accasia, senegal, ber, khair, ak, neem, Cactii etc.
7.	Sub-Tropical Vegetation	Found at 1,000-2000 m altitude in eastern and western Himalayas, and drier areas of Kashmir.	Luxurious forests of evergreen species. Eg. – Oak, chestnut, ash, birch, pine, sal, chir pine, oak, wild olives.
8.	Himalayan Dry Temperate Vegetation	In the inner dry ranges of the Himalayas where precipitation is below 10 cm. (Ladakh Lahul, Chamba, Kinnaur, Garhwal, Sikkim).	Predominantly coniferous forests with xerophytic shrubs, e.g., chilgoza, deodar, oak, maple, ash, celtis, etc.
9.	Himalayan or Montane/ Mountain Moist Temperate Vegetation	In the temperate eastern and western Himalayas, between 1,500 m and 3,300 m (Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and Darjeeling).	Broad leaved evergreens mixed with dominant coniferous species, generally 30 to 50 m high, open forest with shrubby undergrowth. e.g., deodar, spruce, maple, ash, pine, fir, beach, etc.
10.	Himalayan or Montane/ Mountain Wet Temperate Vegetation	Found between 1,800 m and 3,000 m of altitude (eastern Himalayas, Nilgiris, the Annamalai, Palni hills of South India, Sikkim, Nagaland, hills of West Bengal, Assam, Arunachal Pradesh) where average rainfall is between 150 cm and 300 cm. & humidity is over 80%.	Evergreen forests, short-boleds branchy trees, dense and rounded leaves. Examples include oak, magnolia, chilauni, birch, plum, deodar, laurel and maple.
11.	Sub-Alpine and Alpine Vegetation	Above 2,900 m of altitude in the eastern Himalayas and above 3,500 m of altitude in the western Himalayas and extends up to the snowline.	Dwarf shrubs which degenerate into a low evergreen scrubs and into xerophytic vegetation; examples include fir, juniper, pine birch and *Rhododendron*, *spruce*.
12.	Littoral or Tidal or Delta or Swamp Vegetation	In and around the tidal creeks and along the deltas of the rivers Ganga, Mahanadi, Krishna and Godavari.	Evergreen trees having profuse growth and stiltlike roots, e.g., sundari in the great Sunderban delta, *Rhizophora*, nipa fruiticans (a type of palm), palms, keora, amur etc.

Mangroves

- Mangroves are very specialized forest ecosystem of tropical and subtropical region of the world bordering sheltered sea-coasts.

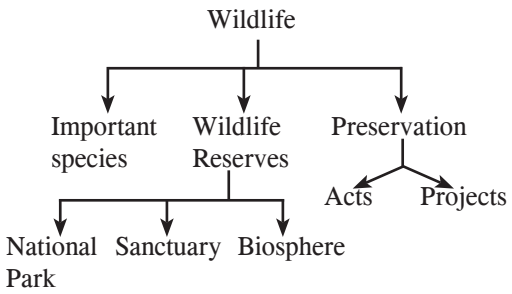
Mangroves of India	
State	**Mangrove**
East coast	
West Bengal	Sunderbans
Orissa	Mahanadi, Bhitarkanika
Andhra Pradesh	Godavari, Krishna
Tamil Nadu	Pichavaram, Muthupet, Point Calimere
West coast	
Gujarat	Gulf of Kutch, Gulf of Khambat
Goa	Goa
Karnataka	Coondapur
Maharashtra	Achra/Ratnagiri
Kerala	Vembanad
Other mangroves	
Andaman & Nicobar Islands	Andaman islands & Nicobar islands

- They occur all along the Indian coastline in the sheltered estuaries, tidal creeks, backwaters, salt marshes and mudflats, covering a total area of 0.67 m ha.
- Mangroves are dominated by salt tolerant halophytic plants of diverse structure, and are invaluable marine nurseries for a large variety of fish and other marine fauna.

- Mangroves have a dense network of aerial roots which help to aerate the root system and anchor the tree.
- In world's total mangrove vegetation, India's share stands at 3%.

State/UT	Forest cover as Percentage of geographical area (%)
Andhra Pradesh	16.86
Arunachal Pradesh	80.50
Assam	35.28
Bihar	37.27
Chhattisgarh	41.18
Delhi	11.88
Goa	59.94
Gujarat	7.46
Haryana	3.64
Himachal Pradesh	26.37
Jammu & Kashmir	10.14
Jharkhand	28.82
Karnatka	18.87
Kerala	44.52
Madhya Pradesh	25.21
Lakshadeep	84.96
Puduchery	10.43
State/UT	**Forest Cover as Percentage of Geographical Area (%)**
Maharashtra	16.46
Manipur	76.54
Meghalya	77.02
Mizoram	90.68
Nagaland	80.33
Orissa	31.41
Punjab	3.50
Rajasthan	4.70
Sikkim	47.34
Tamil Nadu	18.16
Tripura	76.04
Uttar Pradesh	5.95
West Bengal	14.64
Andman & Nicobar	81.51
Chandigarh	14.72
Dadra & Nagar Haveli	42.97
Daman & Diu	5.49
Uttrakhand	45.80

WILDLIFE



- Wildlife comprises animals, birds, and insects living in forests.
- With large regional variations in physiography, climate and edaphic types. Indian forests offer a wide range of habitat types, which is responsible for a large variety of wild life in India.
- **Elephant is the largest Indian mammal,** which only a few centuries ago, was found in large numbers in vast forest tracts of India.
- **The one-horned rhinoceros, India's second largest mammal** was once found throughout the Indo-Gangetic Plain as far west as Rajasthan. The number of this mammal has drastically decreased and now there are less than 1,500 rhinoceros in India, confined to the restricted locations in Assam and West Bengal.
- Rhinoceros are protected in Kaziranga and Manas sanctuaries of Assam and the Jaldapara sanctuary of West Bengal.
- The wild buffalo is found in Assam and in Bastar district of Chhattisgarh.
- The gaur or the Indian bison is one of the largest existing bovine and is found in the forests of Central India.
- There are about 3,000 tigers in India mainly found in the forests of eastern Himalayan foothills and in parts of the peninsular India.
- The number of Cheetahs had fallen to less than two hundred until successful breeding programme in the Gir sanctuary in Gujarat resulted in some recovery.
- The arboreal clouded leopard is found in northern Assam while the Black Panther is widely distributed predator.
- Brown, Black and Sloth Bear are found at high altitudes in the northwestern and central Himalayas.
- Yak, the ox of snows is largely found in Ladakh and is tamed to be used as a draught animal.
- Stag or barasingha is found in Assam and Madhya Pradesh.
- The Munjac or barking deer are found extensively in the lower wooded slopes of the Himalayas and in the forests of southern India.
- The kastura or the musk deer, much sought after for its musk pod, live in the birch woods in the higher forests of the Himalayas.
- India's first National Park is Jim Corbett Park in Uttarakhand, established in 1936

- Thamin is a pretty deer found in Manipur.
- India is extremely rich in bird life. There are about 2,000 species of birds in India.
- Although most of the bird has their origin in India, a number of them have their source in other areas. Some birds such as ducks, cranes, swallows, ant flycatchers migrate from central Asia to the wetlands of Bharatpur every winter. Recently, some migratory birds have been seen near Mathura.

National Park: A reserved area meant for preserving its natural vegetation, wildlife and natural beauty.

Sanctuary: A reserved area meant for preservation and development of endangered species.

Biosphere: Multipurpose protected areas to preserve genetic diversity in representative ecosystems.

As of July 2015, there were 105 National Parks.
Number of wildlife Sanctuaries – 531
Number of Biosphere Reserves – 18.

Preservation of Wildlife

- The fast dwindling forest cover in India has adversely affected wildlife in the country.
- The number of several species has been drastically reduced, some are endangered species, and the others are on the verge of extinction while some of them have already disappeared.
- **Indian Board for Wildlife was constituted in 1952.** The main purpose of the board was to advise the Government on the means of conservation and protection of wildlife, construction of national parks, sanctuaries and zoological gardens as well as promoting public awareness regarding conservation of wildlife.
- The Wildlife (protection) Act, 1972 is a comprehensive law which gives firm status to the national parks and sanctuaries and other

Distinction between National Park, Sanctuary and Biosphere Reserve

National Park	*Sanctuary*	*Biosphere Reserve*
• Habitat for particular wild animal species	• Generally species-oriented such as citrus, pitcher plant. etc.	• Ecosystem-oriented i.e. All forms of life
• The general size range is 0.04 to 3162 sq km.	• The general size range is 0.61 to 7818 sq km.	• The general size range is over 5670 sq km
• Boundaries fixed by legislation	• Boundaries are not sacrosanct	• Boundaries fixed by legislation
• Except the buffer zone, no biotic interference	• Limited biotic interference	• Except the buffer zone, no biotic interference
• Tourism permissible	• Tourism permissible	• Tourism normally not permissible
• Research and Scientific management lacking	• Research and Scientific management lacking	• Managed attention
• So far no gene pool and conservation	• So far no gene pool and conservation given	

- Endangered species of plants and animals have been brought under the purview of this act. **Project Tiger**, one of the premier conservation efforts in the country was **launched in April, 1972**. It is a centrally financed scheme under which 40 tiger reserves have been set up.
- As a result of the tiger project the tiger population is now well over 3000. A tiger crisis cell has also been formed in the Ministry of Environment and Forest.
- The National Wildlife Action Plan adopted in 1983 provides the framework and programme for conservation of wildlife.
- A Central Zoo Authority has been set up for the proper management of zoological parks in the country. It coordinates the activities of over 200 zoos and also supervises the exchange of animals.

Endangered Species Projects

Project Tiger: The sort of India has taken a pioneering initiative for consuming tiger by launching the 'Project Tiger' is 1973. India is home to 70% of tigers in the world. **In 2014, there were 2,226 tigers. Statewise, Karnataka has the highest number of tigers (406) followed by 340 in Uttarakhand, 308 in Madhya Pradesh, 229 in Tamil Nadu.** The project tiger aims to foster as exclusives tiger agenda in the core area of tiger reserves, which an inclusive people oriented agenda in the buffer. The largest tiger reserve is the Nagarjunsagar-Srisailam tiger reserve of Andhra Pradesh which covers the area of 3538 km^2.

Project Elephant: Project elephant, a centrally sponsored scheme was launched in February 1992 to provide surgical and technical support to major elephant bearing states in the country for protection of elephants, their habitats and corridor. The project is being implemented in 13 states/UT's viz. Andhra Pradesh, Arunchal Pradesh, Assam, Jharkhand, Karanataka, Kerala Meghlaya, Nagaland, Orissa, Tamilnadu, Utttranchal, Uttar Pradesh and West Bengal. There are 28 notified elephant reserve in India covering approximately 60,000 89 km area.

Project Snow Leopard: This project was lunched to safe guard and conserve India's unique natural habitats of high altitude wildlife population and their habitats by promoting conservation through participatory policies and actions. This project was drifted by Ministry of Environment and Forests,

Govt of India. It was launched in January. There are nearly 750 snow leopards in the country.

Memorandum of Understanding (MOU) or Siberian Crane: This memorandum came into effect 1st July, 1993 and was amended is January, 1999. This memorandum was focuses on conserving the siberian crane as one of these rarest crane species. India had signed the MOU on 13th Dec. 1998. Siberian crane are migratory visitors to India in winter season.

MOU for Marine Twotle: Major threats to marine turtle include unexceptionable exploitation, distinction of resting and feeding habitats and incidental morality is fishing operations. The objectives of this memorandum are conservation and management of Marine turtles and their habitats. India had signed this memorandom on 20 february, 2007.

MOU for Dugong: The dugong is a seagrass dependent marine's mammal of tropical and subtropical coastal water. The dugong are vulnarable to human related influences due to their life history. Dugong is commonly known as sea cow. In India, these are found is Indian waters. From Gujarat to Andaman and Nicobar islands India had signed mou for Dugong on 28 May, 2008.

Major Wildlife Reserves

Jammu and Kashmir

National Parks

Dachigam
Hemis
Kishtwar

Sanctuaries

Baltal
Changthang
Gulmarg
Hirpora
Hokarsar
Kanji
Karakoram
Lachipora
Limber
Nandini
Overa
Overa-Aru
Ramnagar
Surinsar-Mansar
Tongri

Himachal Pradesh

National Parks

Great Himalayan
Pin Valley

Sanctuaries

Bandli
Chail
Churdhar
Daranghati
Darlaghat
Gamgul Siahbehi
Gobind Sagar and Naina Devi
Kais
Kalatop & Khajjiar
Kanawar
Khokhan
Kugti
Lippa Asrang
Majathal
Manali
Naina Devi
Nargu
Pong Dam Sanctuary
Raksham Chitkul
Renuka
Rupi Bhabha
Sechu Tuan Nala
Shikari Devi
Shilli
Simbalbara
Talra
Tirthan
Tundah

Punjab

Sanctuaries

Abohar
Harike Lake
Bir Gurdialpura
Bir Bunnerheri
Bir Motibagh

Haryana

Sultanpur

Sanctuaries

Bir Shikargarh
Chautala

Delhi

Indira Priyadarshini

Chandigarh

Sukhna

Rajasthan

National Parks

Desert
Keoladeo
Ranthambore
Sariska

Sanctuaries

Bandh Bartha
Bassi
Bhensrodgarh
Darah
Jaisamand
Jamwa Ramgarh
Jawahar Sagar
Keladevi
Kumbhalgarh
Mount Abu
Nahargarh
National Chambal
National Garhial
Phulwari
Ramgarh Bundi
Sawai Mansingh
Shergarh
Sita Mata
Sunda Mata
Todgarh Raoli
TalChapper
Van Vihar

Uttar Pradesh

Dudwa

Sanctuaries

Chandra Prabha
Chilla
Hastinapur
Kaimur
Kateraniaghat
Kishanpur
Maahavir Swamy
National Chambal
Nawabganj
Ranipur
Samaspur
Sohagabarwa

Uttaranchal

National Parks

Corbett
Gangotri
Govind
Nanda Devi
Rajaji
Valley of flowers

Sanctuaries

Askot
Binsar
Govind Pashu
Kedarnath
Sonanadi

Madhya Pradesh

National Parks

Bandhavgarh
Dinosaur Fossils

Sanctuaries

Ghati
Kanha
Madhav
Panna
Pench
Sanjay
Satpura
Van Vihar

Sanctuaries

Achanakmar
Badankhoh
Bagdara
Barnawapara
Bhairamgarh
Bori
Gandhi Sagar
Ghatigaon
Gomardah
Karera
Ken Gharial
Kuno-Palpur
Kheoni
Narsingarh
National Chambal
Noradehi
Pachmarhi
Palpur
Pamed Wild Buffalo
Panpatha
Pench
Fensatallite
Ratapani
Sailana Florican
Sanjay (Dubrj)
Sardarpur Florican
Samarsot
Singhori (Sindhari)
Sitanadi
Sone Gharial
Tamor Pingla
Udanti Wild Buffalo

Chhattisgarh

Indravati
Kanger Ghati

Orissa

National Parks

Bhitar Kanika
Simlipal

Sanctuaries

Badrama
Baisipalli
Balukhand Konark
Bhitarkanika
Chandaka Dampara
Chilka Lake (Nalaban)
Debrigarh
Hadgarh
Karlapat
Khalasuni
Kotgarh
Kuldiha
Lakhari Valley
Satkosia Gorge
Simlipal
Sunabeda
Ushakothi

Bihar

Valmiki

Sanctuaries

Bhimbandh
Chandra Prabha
Kabar
Kaimur
Nakti Dam
Rajgir
Valmikinagar
Udaipur

Jharkhand

Dalma
Gautam Buddha
Hazaribagh
Koderma
Lawalong
Mahuadanr
Palamau
Parasnath
Topchanchi

Maharashtra

National Parks

Gugamal
Nawegaon
Sanjay Gandhi
Tadoba

Sanctuaries

Andhari
Aner Dam
Bhimashankar
Bor
Chandoli
Chaprala
Dhakna Kolkaz
Gandhari
Gautala Autramghat
Great Indian Bustard
Jaikwadi
Kalsubai Harishchandra
Katepurna
Koyna
Malvan Marine
Melghat
Nagzira
Nandur Madmeshwar
Painganga
Phansad
Radhangiri
Sagareshwar
Tansa
Wainganga
Yawal

Gujarat

Vansda
Gir
Marine (Gulf of Kutch)
Velavadar/Blackbuck

Sanctuaries

Balaram-Ambaji
Barda
Dhumkhal
Gir
Jambughoda
Jessore
Khijadiya
Kutch Desert
Marine (Gulf of Kutch)
NalSarovar
Narayan (Chenkars)
Sarovar
Paniya
Purna
Rampara
Ratanmahal
Shoolpaneshwar
Wild Ass

Goa, Daman and Diu

Bhagwan Mahavir

Sanctuaries

Bhagwan Mahavir
Cotigao

West Bengal

National Parks

Neora Valley
Singalila
Sundarban

Sanctuaries

Buxa
Bibnutibhushan
Betuadahary
Ballavpur
Chapramari
Gorumara
Halliday Island
Jaldapara
Jorpokhri
Lothian Island
Mahananda
Narendrapur
Pamadhan
Ramnabagan
Raiganj
Sajnakhali
Senchal

Sikkim

National Parks

Khangchendzonga

Sanctuaries
Fambong Lho
Kyongasia Alpine
Maenam
Shingba Rhododendron

Manipur
Keibul Lamjao
Siroi

Sanctuary
Yagoupokpi Lokchao

Meghalaya
Balphakram
Nokrek

Sanctuary
Bhagmara
Nongkhyllem
Siju

Arunachal Pradesh
Mouling
Namdapha

Sanctuaries
D'Ering Memorial
Dibang Valley
Eagle nest
Itanagar
Kamlang
Kane
Mehao
Pakhui
Sessa Orchid

Mizoram
Murlen
Phawngpui

Sanctuaries
Dampa
Khawnglung
Ngengpui

Nagaland
Nitangki
Pulebatze
Fakim

Tripura
Charilam
Sepahijala
Rishna
Bison
Clouded Leopard

Assam
Kaziranga
Nambiar
Dibru-Saikhowa

Sanctuaries
Dipor Beel
Garampani
Laokhowa
Manas
Nameri
Orang
Pabha
Pobitara
Sonai Rupai

Andhra Pradesh

National Parks
Shri Venkataswara

Sanctuaries
Coringa
Eturnagaram
Gundlabrahmeswaram
Koundinya
Kawai
Kinnerasani
Kolleru
Krishna
Lanjamadugu
Manjira
Nagarjunasagar-Srisailam
Neelapattu
Pakhal
Papikonda
Pocharam
Pranahita
Pulicat
Rollapadu
Srilanka Malleswara
Siwaram

Karnataka

National Parks
Anshi
Bandipur
Bannerghatta
Kudremukh
Nagarhole

Sanctuaries
Arabithittu
Bhadra
Rangaswamy- Temple
Biligiri
Bramhagiri
Cauvery
Dandeli
Ghataprabha
Melkote Temple
Mukambika
Nugu
Pushpagiri
Ranganthittu
Ranebennur
Sharavathi Valley
Shettihally
Someswara
Talakaveri

Kerala
Eravikulam
Periyar
Silent Valley

Sanctuaries
Aralam
Chimony
Chinnar
Idukki
Neyyar
Parambikulam
Peechi Vazhani
Peppara
Periyar
Shendurney
Thattekkad Bird
Wynad

Tamil Nadu
Guindy
Indira Gandhi
or Anamalai

Sanctuaries
Kalakad
Karikili
Mudumalai
Mukurthi
Mundanthurai
Point Cali mere
Pulicat
Srivilliputhur
Vedantangal
Vettangudi

The Andaman Islands

National Parks
Campbell Bay
Galathea
Wandur
Mount Harriet Island
Saddle Peak

Sanctuaries
Barren Island
Battimalve Island
Benett Island
Bluff Island
Bondoville Island
Buchaan Island
Cinque Island
Crocodile (Lohabrrack)
Defence Island
East (Inglis) Island
East Island
Flat Island
Interview Island
James Island
Kyd Island
Landfall Island
Narcondum Island
North Reef Island
Paget Island
Pitman Island
Point Island
Ranger Island

Fleef Island	Sir Hugh Rose Island	Swamp Island	Tillonchang Island
Roper Island	South Brother Island	Table (Delgarno) Island	West Island
Ross Island	South Reef Island	Table (Excelsior) Island	
Sandy Island	South Sentinel Island	Talabaicha Island	
Shearme Island	Spike Island	Temple Island	

Biosphere Reserves of India

S. No.	Name	Type	Key Funna	Area (In Km^2)
1.	Nilgiri Biosphere Δ Reserve, Tamilnadu, Kerala Karnataka	Western Ghat	Nilgiri Tahr, Lion talked macaque	5520
2.	Nanda Devi, Utrakhand Δ	Western Himalyas Coast	—	5860
3.	Gulf of Mannar, Tamilnadu Δ	East Himalayas	Dugong	10500
4.	Nokrek, Meghalya Δ	Gangatic Delta	Red Panda	820
5.	Sunderbans, West Bengal Δ	East Himalayas	Royal Bengal Tiger	9630
6.	Manas, Assam	Deccan Peniusula	Red Panda	2837
7.	Simlipal, Odissa Δ	Eastern Himalayas Semi-Arid	Royal Bengal Tiger, Ganv, Wild elephant	4374
8.	Dihang - dibang, Arunachal Pradesh	Maikals Hills	—	5112
9.	Panchmarhi Biosphere Δ	Desert	Flying squirrel	4981.72
10.	Amerkantak, Madhya Padesh Chhatisgarh Δ	Western Himalayas	Giant Squirrel	3835
11.	Rann of Kutch, Gujarat		Indian wild ass	12454
12.	Pin valley national park (Cold Desert), Himachal Pradesh	East Himalayas Western Glats	Show Leopased	7770
13.	Khangchendzonga, Sikkim		Red Panda	2620
14.	Agasthyamalai Biosphere resurve, Kerala, Tamilnadu	Islands	Nilgiri Tahr Elephants	1828
15.	Nicobar Biosphere Reserve, A & Nicobar, Islands Δ	East Himalayas Eastern Ghats	Saltwater Crocodile	885
16.	Dibru-Saikhowa, Assam	Catchment area of Ken River	Golden Langur	765
17.	Seshachalam Hills, Andhra Pradesh			
18.	Panna, Madhya Pradesh		Tiger, Chital, Chinkara, Sembhar and Sloth bear	543

Δ Biosphere Reserves listed in UNESCO World Network of Biosphere Reserves.

Specialities of National Park and Sanctuary

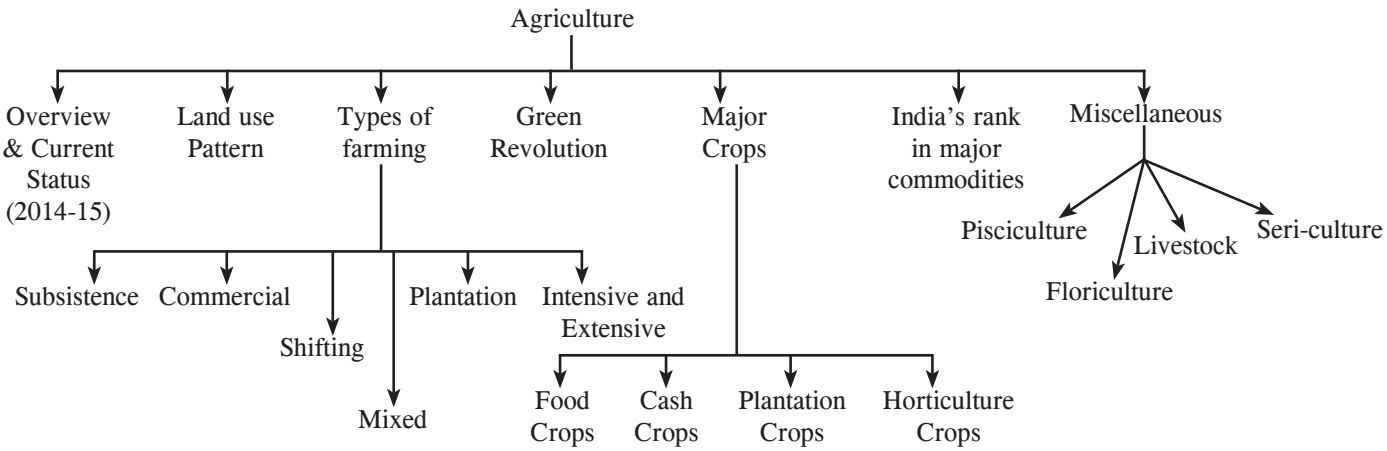
- Gir National Park in Gujarat is the only existent habitat for the nearly extinct Asiatic Lions in India.
- The Kaziranga Sanctuary in Assam is a major habitat of the endangered Rhinoceros.
- Periyar in Kerala is famous for the the wild Elephants
- Dachigam National Park is natural habitat of Kashmiri Stag.
- Nandankanan national park in Orissa serves as the natural habitat of white tigers.
- The Padmaja Naidu Himalayan Zoological Park in Darjeeling (West Bengal) has undertaken Project Red Panda with a view to conserving this species.
- The entire Little Rann of Kutch in Gujarat is known as the “Indian Wild Ass Sanctuary”.
- Bhitarkanika in Orissa is a hot-spot of biodiversity. It’s home to largest population of giant salt water crocodile in India.
- Gahirmatha, the only marine wildlife sanctuary of Orissa, is the most suitable natural place for Olive Ridley sea turtles’ for mating and nesting.
- The National Chambal Sanctuary is famous for the rare gangetic dolphin and also for magar (crocodile) and gharial (alligator).
- Ranganathittu Bird Sanctuary in Karnataka is a favourite abode for birds

National Parks by the largest area			Wildlife Sanctuaries by the largest area		
National Parks	**State**	**Area (sq km)**	**Wildlife Sanctuary**	**State**	**Area (sq km)**
1. Hemis	Jammu & Kashmir	4,100.00	1. Great Indian Bustard	Maharashtra	8,496.44
2. Desert	Rajasthan	3,162.00	2. Kachchh Desert	Gujarat	7,506.22
3. Namdapha	Arunachal Pradesh	1,807.82	3. Karakoram	Jammu & Kashmir	5,000.00
4. Khangchendzonga	Sikkim	1,784.00	4. Wild Ass	Gujarat	4,953.71
5. Gangotri	Uttarakhand	1,552.00	5. Dibang	Arunachal Pradesh	4,149.00

Western Ghats

The Western Ghats (or Sahyadri) is a mountain range that runs parallel to the western coast of the Indian peninsula. It is a UNESCO World Heritage Site and is one of the 8 "hottest hotspots" of biological diversity in the world. The Western Ghats stretches into 6 states – Tamil Nadu, Kerala, Karnataka, Gujarat, Goa & Maharashtra. It hosts a large list of exceptional endemic species, the International Union for Conservation (IUCN) lists 5,000 vascular plant species, 228 freshwater fish species, 179 amphibians, 157 reptiles, 508 birds & 139 mammal species, some of the very rare species include the Great Indian Hornbill, Lion-Tailed Macaque, Travancore Turtles & Nilgiri Martens.
In recent times 2 panels have been set up, under Madhav Gadgil & Kasturirangan, for protection of the Western Ghats.

Agriculture



Agriculture includes raising of Crops from the land, animal husbandry, agroforestry & pisciculture. India is an agriculturally important country. Two-thirds of its population is engaged in agricultural activities. Agriculture is a primary activity, which produces most of the food that we consume and raw material for various industries.

Overview of Agricultural Sector: Highlights

(Source: - Economic Survey 2014-15)

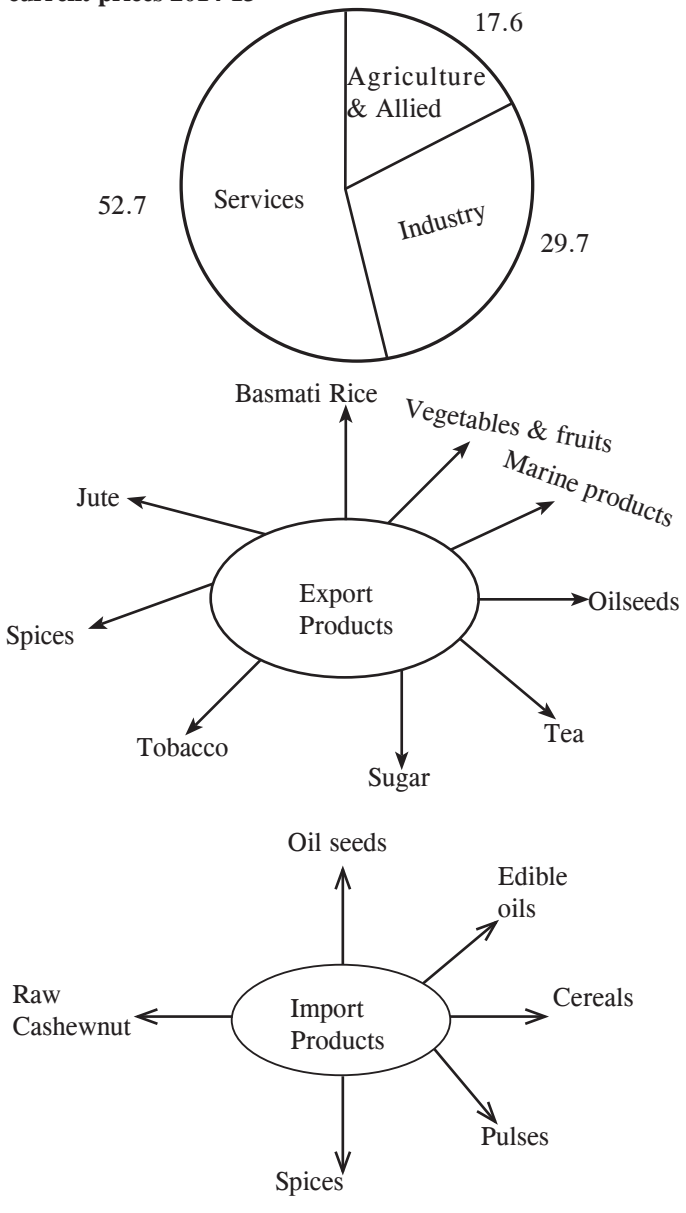
- Share of agriculture in total GDP is 18%.
- Target of 4% for agriculture & allied sectors in the 12th plan.
- Growth registered in 2014-15 is 1.1%.
- During 2014-15, banks have disbursed ₹. 8,40,643 crore (provisional) credit to the agriculture sector, against a target of ₹. 8,00,000 crore.
- India's agricultural exports were valued at US $ 47 billion in 2013.
- India ranks first in milk production, accounting for 17% of world production.
- The National livestock Mission has been launched in 2014-15 with an approved outlay of ₹. 2,800 crore during the 12th plan.
- The revamped National Food Security Mission (NFSM) is being implemented from 2014-15, in 619 districts of 28 states. In addition to rice, wheat & Pulses, crops like coarse cereals & commercial crops (sugarcane, cotton, & jute) have been included since 2014-15.
- With effect from 2014-15, the mission for Integrated Development of Horticulture has been operationalized by bringing all ongoing schemes on Horticulture under a single umbrella.
- The following initiatives announced in Budget 2014-15 have brought the issue of sustainability & climate adoptation to the forefront:
  (i) The Pradhan Mantri Krishi Sinchayee Yojana.
  (ii) 'Neeranchal' a new programme to give additional impetus to watershed development in the country.
  (iii) The National Adaptation Fund for climate change, with an initial sum of ₹. 100 crore.

(iv) A scheme to provide a "Soil Health Card" to every farmer.

- 4th Advanced Production Estimates of major crops during 2014-15 (released by the Departments of Agriculture & Cooperation) is as under: –

(A.)	Foodgrains	–	252.68 MT
	• Rice	–	104.80 MT
	• Wheat	–	88.94 MT
	• Coarse Cereals	–	41.75 MT
	• Maize	–	23.67 MT
	• Pulses	–	17.20 MT
	• Tur	–	2.78 MT
	• Gram	–	7.17 MT
(B.)	Oilseeds	–	26.68 MT
	• Soyabean	–	10.53 MT
	• Groundnut	–	6.56 MT
	• Rapeseed & Mustard	–	6.31 MT
(C.)	Cotton	–	35.48 million bales
(D.)	Sugarcane	–	359.33 MT

Diagram – Sectoral Share (%) in GVA at factor cost at current prices 2014-15



Land use Pattern

- Cropped area in the year under consideration is called Net Sown Area.
- The net sown area occupies the highest category (above 55% of the reporting area) in Punjab, Haryana, West Bengal, Maharashtra, Uttar Pradesh, Bihar and Kerala.
- Medium category (30-55%) in Karnataka, Gujarat, Tamil Nadu, Rajasthan, Madhya Pradesh, Andhra Pradesh, Chhattisgarh, Orissa, Goa and Assam.
- Low category (below 30%) in Himachal Pradesh, Jammu and Kashmir, Meghalaya, Nagaland, Manipur, Jharkhand, Uttarakhand, Mizoram and Arunachal Pradesh.

Area sown more than once: This area is used to grow more than one crop in a year. This accounts for 34.3% of the net sown area and 16.6% of the total reporting area of the country. This type of area comprises land with rich fertile soil and regulars water supply.

Forests: It is the area which the govt. has identified & demarcated for forest growth.

Land not available for cultivation : This class consists of two types of land (i) Land put to non-agricultural uses (ii) barren and unculturable waste.

Permanent pastures and other grazing land: It amounts to about 3.45% (i.e. 11.8 mha) of the total reporting area. The area presently under pastures is not sufficient keeping in view the large population of livestock in the country.

Land under miscellaneous tree crops and groves: It includes all cultivable land which is not included under net area sown, but is put to some agricultural use.

Culturable Wasteland: It includes all lands available for cultivation, but not cultivated for one reason or the other.

Types of Farming

India is a vast country and had various climatic patters and geographical condition, so these are different types of farming.

1. **Subsistence Farming:** In this type of farming farmer produce for his own consumption. These is no surplus left for sale. This involves cultivation of food crops like rice, wheat, pulses etc.
2. **Commercial Farming:** In this farming, food crops produced specifically for sale in the market by using improved variety of seeds and machinery. Normally it is characterised by large farms and only one crop is grown. Advance machinery, chemical fertilizers, hybrid seeds and pesticides are used.

   Cotton, sugarcane, tobacco, oil seeds, chillies etc. are commercial crops.
3. **Shifting Cultivation:** Shifting cultivation means the migratory subsistence farming. Under this system, a plot of land is cultivated for few years and when the crop yield declines the plot of land is changed. Dry paddy, buck wheat, maize, small millets, tobacco & sugarcane are the main crops grown under this type of agriculture. It is known by different names in different parts of the country. It is "Jhumming" in –north eastern states;

'podu' in Andhra Pradesh, 'Bewar' in M.P., 'Kumari' in Western Ghats.

4. **Mixed Farming:** Mixed farming is raising of crops and rearing of cattle, poultry, bee keeping, seri culture etc. on he same cattle or poultry do not need extra expenditure as they thrive on the farm wasters. Livestocks animals provide substitute income when crops are not ready. This type of farming is done in densely populated areas.
5. **Plantation Farming:** Predominance of a single crop (only for sale) farming in tropical regions is called planation farming. Important crops grown under this type of farming are cotton, tea, rubber, spices, coconuts etc. This farming outlay. Latest knowledge and modern methods of agriculture are used in this farming.
6. **Intensive Agriculture:** System of cultivation using large amount of labour and capital with application of fertilizers and insecticides is called intensive agriculture. Use of high efficiency machinery for planting, cultivating and harvesting as well as latest irrigation equipment.
7. **Extensive Agriculture:** System of crop cultivation using small amounts of labour and capital in relation to area of land being farmed. The crop yield in extensive agriculture depends primarily on the natural fertility of the soil, terrain climate and the availability of water.

Main crops season in India

Season	Ground is Prepared	Harvest	Major crops of the season
Kharif	In April, May and the seeds are sown in June on arrival of rain.	Beginning of November	Rice, maize, Jowar, bajara, cotton, jute, groundnut, pulses etc.
Rabi	By end of October or beginning of November.	April to June	Wheat, barley, peas, gram, oilseeds, tobacco etc.
Zaid	It is summer season crops sown at beginning of the season in February and March	April and May	Urad, moong, melons, cucumber

Wheat is cultivated with high yielding varieties of seeds like Lerma, Rajo, Sonora 63 and 64 (Mexican varieties), Sona 227, Kalyan Sona, Sonalika, Chhoti Lerma, Sharbati Sonora, Shera, Heera, Safed Lerma, UP 302, Saran, Champaran and C-1-7 etc.

Green Revolution

The term "Green Revolution" is applied to the period from 1967 to 1978. The green revolution started by Dr. Norman Borlaug in Mexico. Between 1947 and 1967, efforts at achieving food self sufficiency were not entirely successful. Population was growing at a much faster rate than good production. This called for drastic action to increase yield. The action came in the form of the green revolution. The term green revolution is a general one that is applied to successful agricultural experiments in many countries. But it was most successful in India.

There were three basic elements in India regarding Green revolution

- Continued expansion of farming areas.
- Double cropping of existing farm and
- Using new and scientific treated seeds with improved genetics.

12 Components of the Green Revolution

High yield varieties (seeds), irrigation, use of fertilizers, use of insecticide and pesticide, command area development, consolidation of holding, land reform, supply of agricultural credit, rural electrification, rural roads and marketing, farm mechanisation, agricultural universities.

Impacts of Green Revolution

Impacts of Green Revolution are as follows

Positive Impact Increase in agricultural production, reduction of the import of foodgrains, capitalistic farming, industrial growth and rural employment.

Negative Impact Inter-crop imbalance, increase in regional imbalance, unemployment due to mechanisation. Increase in inter-regional migration, ecological problems and social conflict between large and small farmers.

Various Revolutions in Agriculture

Revolutions	Area
Green Revolution	Agriculture (Food Production)
Yellow Revolution	Oil seeds production (Edible oil)
White Revolution	Milk
Blue Revolution	Fish
Pink Revolution	Shrimp, food processing
Brown Revolution	Coffee/Cocoa
Red Revolution	Meat/Tomato
Golden Revolution	Fruits/Apple/Honey/Horticulture
Grey Revolution	Fertilizers
Silver Revolution	Eggs/Poultry
Golden Fibre	Jute
Silver Fibre	Cotton

MAJOR CROPS

Indian crops can be divided into following categories:

- **Food crops :** Rice, wheat, maize, millets-jowar, bajra etc.
- **Cash crops :** Cotton, jute, sugarcane, tobacco, groundnut etc.
- **Plantation crops :** Tea, Coffee, spices, coconut, rubber etc.
- **Horticulture crops :** Apple, mango, banana, citrus etc.

Crops	Temp. (0°C)	Rainfall (cm)	Soil	Distribution
Cash Crops				
Cotton (Gossypium)	21-30	50-75	Black soil	Gujarat, M.P., Kernataka, Maharashta, Punjab
Jute (Corchorus Capsularis)	24-35	125-200	Sandy or clayed loams, deep rich	West Bengal Odisha Bihar Assam Meghalaya
Sugarcane (saccnarum officinarum)	20-26	75-150	Loamy soil	Uttar Pradesh Maharashtra, Tamil nadu, Karnataka
Tobacco (Nicotiana)	15-38	50-100	Friable sandy soil	Uttar Pradesh, Andhra Pradesh, Gujarat, Karnataka
Food Crops				
Rice (oryza sativa)	24-27	150	Clayed and loamy soil	West Bengal, Karnataka, Andhara Pradesh, Assam Odisha, Uttar Punjab, Pradesh Telangana, Chhattisgarh
Wheat (triticum)	10-15	75	Light, sandy, clayed loamy soil	Uttar Pradesh Punjab, Haryana, Rajasthan
Jowar (Sorghum)	27-32	30-65	Black clayed loamy soil	Maharashtra, Karnataka, Madhya Pradesh, Andhra Pradesh
Bajra (Penisetu Typhoidum)	25-35	40-50	Loamy soil	Rajasthan, Uttar Pradesh, Haryana, Maharashtra, Gujarat
Plantation Crops				
Tea (Camellia Thea)	24-30	150-250	Loamy forest soil	Kerala, Tamil Nadu, West Bengal, Assam
Coffee (coffea)	16-28	150-250	Friable forest loamy soils	Karnataka, Kerala, Tamil Nadu
Rubber (Hevea Brasiliensis)	25-35	300	Loamy soils	Kerala, Karnataka, Tamil Nadu

Spices (plantation crop)

- India is the second largest producer of pepper.
- India is the largest producer of ginger, cardamom and arecanut.
- India is the third largest producer of coconut next to Philippines and Indonesia.
- Kerala leads in the production of pepper, cardamom, ginger, arecanut and coconut among Indian states.
- Andhra Pradesh is the largest producer of chillies and turmeric.
- India is the largest producer, processor, consumer and exporter of cashew nut in the world.

India's Ranks in Major Commodity		
Rice	–	2
Wheat	–	2
Millets	–	1
Tea	–	2
Sugarcane	–	2
Jute	–	1
Silk	–	2
Banana	–	1
Mangoes	–	1
Apple	–	3
Cotton	–	2
Buffalo Milk	–	1
Pulses	–	1

Fisheries/pisciculture

- Fish catch in India is of two types - marine fisheries and inland fisheries.
- India is the third largest producer of fish and second largest producer of inland fishing in the world.
- It accounts for about one per cent of the total agricultural production in India.
- About 75% of marine fish landings are on the west coast and only 25% in the east coast.
- Important fish caught along the coast are shark, sardine, herring, Mumbai duck, fly fish ribbon fish and Mackerrel.
- West Bengal is the largest producer of fish in India and is the largest producer of inland fish (31 %) also.
- Kerala has about 85% of India's total processing facilities and processes the largest amount of fish in the country.
- India exports about 8% of the total fish production. Sri Lanka alone purchases 80% of our fish and fish products.
- Sasson Dock in Mumbai is a major fishing harbour.
- There are six major fishing harbours and 38 minor fishing harbours. The major harbours are –Cochin, Chennai, Vishakhapatnam, Roy Chowk, Paradip and Sasson dock.
- The Central Institute of Fisheries, Nautical and Engineering Training is at Kochi.
- The Central Institute of Coastal Engineering for Fisheries is in the Bengaluru.

Livestock and Dairy Farming

Livestock includes domestic animals such as cattle, buffaloes, sheep, goats, horses, ponies, donkeys, camels, pigs etc. India's animal wealth is both large and varied. India has about 20% of the world's livestock population.

Dairy Farming includes a class of agricultural enterprise for long-term production of milk which is processed for eventual sale of a dairy product. India is endowed with largest livestock population in the would. It accounts for about 57.3% of the world's buffalo population and 14.7% of the cattle population.

Different Breeds of Animals

Milch Breeds of Cattle Gir, Sindhi, Red Sindhi, Sahiwal, Tharparkar and Deoni

Draught Breeds of Cattle Nagori, Bauchaur, Malvi Hallikar, Ponwar, Siri, Bargur.

Dual Purposse Breeds of Cattle Tharparkar, Haryana, Mewati, Kankrej, Rath, Nimari, Dangi, Ongole.

Goats Breeds Angora, Pashmina, Barabari, Marwari, Mehsana Beetal, Kathiawari and Zalwadi.

Buffaloes Breeds Murrah, Jafarabadi, Shruti, Mehsana, Nagpuri, Nili Ravi, Bhadawari.

Horses and Ponies Breeds Marwari, Kathiawari, Manipuri, Bhutani, Spiti and Chummarti.

Sericulture

Sericulture refers to the rearing of the silk worms for the raw silk production. Silk is a protein produced form the salivary gland of silk worms.

- Important features of Indian sericulture are as follows.
- It is a agro-based labour intensive, export oriented and cottage industry.
- Silk is exported to more than 80 countries like USA, UK, Italy, UAE, Saudi Arabia etc.
- India enjoys the unique distinction of being the only country in the world to produce all the four varieties of silk such as Mulberry, Tasar, Eri and Muga.
- Muga is the monopoly of India. India ranks second in the world after China in Silk production.

Horticulture

Horticulture is a comprehensive term and includes fruits vegetables, spices, floriculture and coconut. Some of the most important crops grown in India as a part of the horticulture sector are: mango, cashewnut, apple, banana, orange, grape, peach, pear, apricot, strawberry and vegetables. Some important information regarding these fruits is given in the table.

Fruits Crops and their Favourable Climate, Distribution and Relevant Information

Fruit Crops	Favorable Climate	Distribution	Relevant Information
Apple	Temperate fruit crop- It requires average temperature from 21 °C to 4 C during the active growing season, 100-125 cm rainfall well distributed throughout the growing season. These conditions are found on the hill slopes at altitudes arranging from 1500-2700 m above sea level.	Kullu and Shimla in Himachal Pradesh, Kashmir valley and hilly areas of Uttarakhand.	Loamy soil, rich in organic matter, free from water logging are suitable for apple cultivation.
Banana	Primarily a tropical and sub-tropical crop requiring average temperature of 20°C to 30°C throughout the growing period and rainfall fairly above 150 cm.	Tamil Nadu and Maharashtra are the two main producers	India is the largest producer of banana in the world.
Mango	It is native of monsoon land and is grown in areas with temperature 20°C to 30°C and rainfall 75 cm to 250 cm.	Uttar Pradesh. Bihar, Andhra Pradesh, West Bengal, Odisha, Kerala, Tamil Nadu are the major producers.	India is the largest producer of mango and contributes 54% of the world production of mango.
Grapes	It requires long summer, short winter and moderately fertile well drained soil.	The major producing States are Uttarakhand, Himachal Pradesh. Jammu and Kashmir.	In Northern India, the plant gives only one crop during summer, but in South India, the plant grows throughout the year, one in March, April and the other in August and September.
Strawberry	It requires above 16°C temperature during its growing season and lots of water because its fields are sub-merges under 10 cm of fresh and slowly moving water for atleast three months.	The main producers are the hilly areas of Jammu and Kashmir, Himachal Pradesh, Uttarakhand.	Water retaining fertile soil is most suitable.

Floriculture

Government of India has identified floriculture as a sunrise industry and accorded it 100% export oriented status. Owing to steady increase in demand of flower, floriculture has become one of the important commercial trades in agriculture. Floriculture products mainly consist of cut flowers, pot plants, cut foilage, seeds bulbs, tubers, rooted cuttings and dried flowers or leaves. Maharashtra, Karnataka, Andhra Pradesh, Haryana, Tamil Nadu, Rajasthan, West Bengal have emerged as major floriculture centers.

Exercise -1

1. A geographic area with an altitude of 400 metres has following characteristics.

Month	J	F	M	A	M	J	J	A	S	O	N	D
Average maximum temp °C	31	31	31	31	30	30	29	28	29	29	30	31
Average minimum temp °C	21	21	21	21	21	21	20	20	20	20	20	20
Rainfall (mm)	51	85	188	158	139	121	134	168	185	221	198	86

If this geographic area were to have a natural forest, which one of the following would it most likely be?
(a) Moist temperate coniferous forest
(b) Montane subtropical forest
(c) Temperate forest
(d) Tropical rain forest

2. The lower Gangetic plain is characterised by humid climate with high temperature throughout the year. Which one among the following pairs of crops is most suitable for this region ? (a) Paddy and Cotton
(b) Wheat and Jute
(c) Paddy and Jute (d) Wheat and Cotton

3. Salinization occurs when the irrigation water accumulated in the soil evaporates, leaving behind salts and minerals. What are the effects of salinization on the irrigated land ?
(a) It greatly increases the crop production
(b) It makes some soils impermeable
(c) It raises the water table
(d) It fills the air spaces in the soil with water

4. Which one of the following statements is correct?
(a) Red soil lie on the periphery of the Peninsular plateau
(b) The laterite soils are more acidic on the low-lying areas than on the higher areas
(c) Alluvial soils are poor in potash and phosphorus
(d) Black soils are rich in phosphorous, nitrogen and organic matter

5. What do you understand by the word regur ?
(a) Black soil found in the Deccan
(b) Grey-brown soil found in Russia
(c) Red colour sticky soil found in the Amazon area
(d) Black soil found in northern Argentina

6. Which of the following is not a tropical type of soil ?
(a) Red soil (b) Desert soil
(c) Black soil (d) Brown soil

7. The retreating monsoon withdraws from the
(a) west coast to the east
(b) north to the south
(c) north-east India to the west coast
(d) north-west India to Bengal

8. Orographic rainfall occurs along the
(a) Eastern Ghats (b) Himalayas
(c) Aravallis (d) Jaintia hills

9. Black soil requires least tilling because
(a) it is fertile
(b) it develops cracks on drying
(c) it is a lava origin
(d) it has plenty of iron and aluminium compounds

10. Why is it that India has one of the lowest agricultural yields in the world ?
(a) Summers are very hot
(b) Lack of fertile soil
(c) Farmers being poor and illiterate do not use modern farming techniques
(d) Occurrence of frost at night

11. The state with the largest area under waste land is
(a) Gujarat (b) Madhya Pradesh
(c) Jammu and Kashmir (d) Rajasthan

12. Which of the following would be most suited for an area which has only two months of scanty rainfall in a year ?
(a) Sugarcane (b) Tea
(c) Cotton (d) Pulses

13. Sucrose content is sugarcane decreases :
(a) if high rainfall occurs during the period of growth of the plant
(b) if frost occurs during the period of ripening
(c) if there is fluctuation in temperature during the period of growth of the plant
(d) if there is high temperature during the time of ripening

14. Doon valley is able to grow rice because
(a) it has warm summers and snow-melt waters for irrigation.
(b) people in the valley are rice eaters
(c) other crops cannot be grown
(d) there is a huge export demand

15. India has the highest productive potential of fisheries in
(a) inland water bodies
(b) shallow continental shelf
(c) deep sea areas
(d) brackish water lagoons

16. During winter, the northern half of India is warmer than areas at similar latitudes outside the country by 3° to 8°C. This is due to
(a) India experiencing a tropical monsoon climate.
(b) the warm currents
(c) the Tropic of Cancer passing through the middle of the country
(d) the presence of the Himalayas with their east and west extent

17. The extreme of temperature between summer and winter is quite low in southern part of Peninsular India mainly because
(a) the sun's rays are almost vertical throughout the year
(b) adjoining oceans moderate the temperature
(c) sky is generally cloudy
(d) strong winds blow throughout the year

18. The irregularity in the amount of rain in different parts of the north Indian plains, during different years, is mainly due to the
(a) irregular intensity of low pressure in the northwestern part of India
(b) difference in frequency of cyclones
(c) variations in the location of the axis of the low pressure trough
(d) the amount of moisture carried by the winds not being the same every year

19. How do the 'western disturbances' affect the crops in north India?
(a) They cause heavy damage to the standing crops
(b) They bring in locusts which destroy the crops
(c) They are beneficial to the crops by causing winter rain
(d) They help in keeping the plants warm to some extent in winter

20. Most of the precipitation in India is _____ in nature.
(a) cyclonic (b) convectional
(c) orographic (d) frontal

21. Which soil requires the least tilling ?
(a) Red (b) Black
(c) Laterite (d) Alluvial

22. What kind of soil predominates in the Sunderbans area ?
(a) Red (b) Laterite
(c) Black (d) Alluvial

23. Which one of the following does not belong to biosphere reserves set-up so far?
(a) Great Nicobar (b) Sunderbans
(c) Nanda Devi (d) Gulf of Kachchh

24. Which one of the following regions of India is now regarded as an 'ecological hot spot'?
(a) Western Himalayas (b) Eastern Himalayas
(c) Western Ghats (d) Eastern Ghats

25. Out of all the Biosphere Reserves in India, four have been recognized on the World Network by UNESCO. Which one of the following is not one of them?
(a) Gulf of Mannar (b) Kanchenjunga
(c) Nanda Devi (d) Sunderbans

26. Which of the following forest species is not characteristics of Deciduous forests?
(a) Teak (b) Sal
(c) Sandalwood (d) Deodar

27. In India, in which one of the following areas are the tropical evergreen forests found ?
(a) The Western Ghats (b) The Eastern Ghats
(c) The Western Himalaya (d) The Central Himalaya

28. On the basis of the process of their formation, which of the following soils is formed differently from the other three?
(a) Khadar (b) Bangar
(c) Bhabar (d) Regur

29. Which one among the following is the best reason for the marked increase in the agricultural production in India in the past decades?
(a) Increases in the area under cultivation
(b) Conversion of barren land into agricultural land
(c) Use of improved agricultural methods and technologies
(d) Priority status given by the successive governments to agricultural sector over the industry sector

30. Which one among the following is not a reason for practising tank irrigation in Peninsular India?
(a) The undulating relief and hard rocks
(b) Little percolation of rain water due to impervious rock structure
(c) Most of the rivers of Peninsular India are perennial
(d) There are many streams which become torrential during rainy season

31. Contour bunding is a method of soil conservation used in
(a) desert margins, liable to strong wind action
(b) low flat plains, close to stream courses, liable to flooding
(c) scrublands, liable to spread of weed growth
(d) None of the above

32. In India, cluster bean (Guar) is traditionally used as a vegetable or animal feed, but recently the cultivation of this has assumed significance. Which one of the following statements is correct in this context?
(a) The oil extracted from seeds is used in the manufacture of biodegradable plastics
(b) The gum made from its seeds is used in the extraction of shale gas
(c) The leaf extract of this plant has the properties of antihistamines
(d) It is a source of high quality biodiesel

33. Among the following forest types in India, which one occupies the largest area?
(a) Tropical wet evergreen forest
(b) Tropical moist deciduous forest
(c) Sub-tropical dry evergreen forest
(d) Montane wet temperate forest

34. The National Forestry Action Plan aims to bring 33% of land area in India under tree cover by which year?
(a) 2008 (b) 2012
(c) 2016 (d) 2020

35. What is mixed farming?
(a) Growing of several crops in a planned way
(b) Growing rabi as well as kharif crops
(c) Growing several crops and also rearing animals
(d) Growing of fruits as well as vegetables

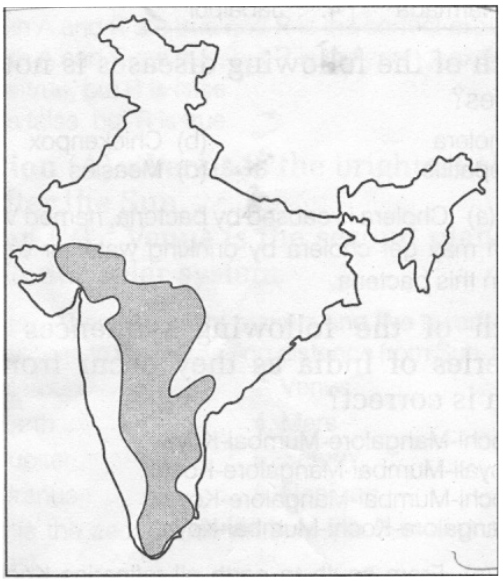
36. Which one of the following states has the largest forest area to its total land area?
(a) Mizoram (b) Arunachal Pradesh
(c) Sikkim (d) Jammu and Kashmir

37. In which one of the following states is Ranganathittu Bird Sanctuary located?
(a) Tamil Nadu (b) Kerala
(c) Karnataka (d) Andhra Pradesh

38. In which one of the following places is the Forest Survey of India (FSI), a national organisation engaged in forest cover mapping, forest inventory and training in the field of remote sensing and GIS, located?
(a) Dehradun (b) Itanagar
(c) Ahmedabad (d) Aizawl

39. Which one of the following states is the largest producer of black pepper in India?
(a) Tamil Nadu (b) Kerala
(c) Karnataka (d) Andhra Pradesh

40. The shaded area in the map given below is the major producer of which one of the following?



(a) Cotton (b) Groundnut
(c) Wheat (d) Mustard

41. Which one of the following is categorised as millet?
(a) Wheat (b) Rice
(c) Sorghum (a) Maize

42. Leaching is the maximum in the soil type of
(a) Laterite (b) Red
(c) Regur (d) Desert

43. Sal trees are the typical species of
(a) Tropical rain forest (b) Tropical monsoon forest
(c) Taiga forest (d) Tundra forest

44. Which one of the following is the correct sequence of the given tiger reserves of India from North to South?
(a) Dudwa-Kanha-Indravati-Bandipur
(b) Kanha-Bandipur-Dudwa-Indravati
(c) Indravati-Kanha-Dudwa-Bandipur
(d) Dudwa-Kanha-Bandipur-Indravati

45. In wildlife conservation which one among the following best defines an 'endemic species'?
(a) When the critical number of a species declines in a forest due to parasitic attack
(b) A species which is cosmopolitan and can be commonly found in biosphere
(c) An endangered species which is found in a few restricted areas on the Earth
(d) A species confined to a particular region and not found anywhere else

46. Red soil colour is caused by
(a) aluminium compounds (b) mercury compounds
(c) iron compound (d) clay

47. Which one of the following is the example of subsistence farming?
(a) Shifting cultivation
(b) Commercial farming
(c) Extensive and intensive farming
(d) Organic farming

48. In India, in which one of the following areas are the tropical evergreen forests found ?
(a) The Western Ghats (b) The Eastern Ghats
(c) The Western Himalaya (d) The Central Himalaya

49. In which of the following Hills is tea cultivated?
(a) Maikala Hills (b) Nallamalai Hills
(c) Nilgiri Hills (d) Shivalik Hills

50. Which one of the following types of forest covers the maximum area in India?
(a) Tropical rain forest
(b) Tropical moist deciduous forest
(c) Tropical dry deciduous forest
(d) Tropical dry evergreen forest

51. The minimum land area recommended for forest cover to maintain proper ecological balance in India is :
(a) 25% (b) 33%
(c) 43% (d) 53%

52. The first marine sanctuary in India, within its bounds coral reefs, mollusca, dolphins, tortoises and various kinds of sea birds, has been established in:
(a) Sundarbans (b) Chilka Lake
(c) Gulf of Kutch (d) Lakshadweep

53. Amongst the following Indian States which one has the minimum total forest cover?
(a) Sikkim (b) Goa
(c) Haryana (d) Kerala

54. Which one of the following is not a Biosphere reserve?
(a) Agasthyamali (b) Nallamalai
(c) Nilgiri (d) Panchmarhi

55. Which one of the following is also known as Top Slip?
(a) Ismlipal National Park
(b) Periyar Wildlife Sanctuary
(c) Manjira Wildlife Sanctuary
(d) Indira Gandhi Wildlife Sanctuary and National Park

56. Which one of the following is located in the Bastar region?
(a) Bandhavgarh National Park
(b) Dandeli Sanctuary
(c) Rajaji National Park
(d) Indravati National Park

57. Which one of the following is not essentially a species of the Himalayan vegetation?
(a) Juniper (b) Mahogany
(c) Islver fir (d) Spruce

58. Which one among the following has the maximum number of National Parks?
(a) Andaman and Nicobar Islands
(b) Arunachal Pradesh
(c) Assam
(d) Meghalaya

59. When you travel in certain parts of India, you will notice red soil. What is the main reason for this colour?
(a) Abundance of magnesium
(b) Accumulated humus
(c) Presence of ferric oxides
(d) Abundance of phosphates

60. Contour bunding is a method of soil conservation used in
(a) desert margins, liable to strong wind action
(b) low flat plains, close to stream courses, liable to flooding
(c) scrublands, liable to spread of weed growth
(d) None of the above

61. Which one of the following sets of conditions is necessary for a good crop of wheat?
(a) Moderate temperature and moderate rainfall
(b) High temperature and heavy rainfall
(c) High temperature and moderate rainfall
(d) Low temperature and low rainfall

62. Which one of the following agricultural practices is eco-friendly?
(a) Organic farming
(b) Shifting cultivation
(c) Cultivation of high yielding varieties
(d) Growing plants in glass-houses

63. The Genetic Engineering Approval Committee, whose permission is required for cultivation of any genetically modified crop such as Bt Cotton in India, is under the Union Ministry of :
(a) Agriculture
(b) Environment and Forests
(c) Commerce and Industry
(d) Rural-Development

64. An objective of the National Food Security Mission is to increase the production of certain crops through area expansion and productivity enhancement in a sustainable manner in the identified districts of the country. What are those crops?
(a) Rice and wheat only
(b) Rice, wheat and pulses only
(c) Rice, wheat, pulses and oil seeds only
(d) Rice, wheat, pulses, oil seeds and vegetables

65. Given below are the names of four energy crops. Which one of them can be cultivated for ethanol ?
(a) Jatropha (b) Maize
(c) Pongamia (d) Sunflower

66. Which of the following is the chief characteristic of 'mixed farming'?
(a) Cultivation of both cash crops and food crops
(b) Cultivation of two or more crops in the same field
(c) Rearing of animals and cultivation of crops together
(d) None of the above

67. Which one of the following regions of India has a combination of mangrove forest, evergreen forest and deciduous forest? [CSAT 2015-I]
(a) North Coastal Andhra Pradesh
(b) South-West Bengal
(c) Southern Saurashtra
(d) Andaman and Nicobar Islands

68. Which one of the following best describes the main objective of 'Seed Village Concept'? [CSAT 2015-I]
(a) Encouraging the farmers to use their own farm seeds and discouraging them to buy the seeds from others
(b) Involving the farmers for training in quality seed production and thereby to make available quality seeds to others at appropriate time and affordable cost
(c) Earmarking some villages exclusively for the production of certified seeds
(d) Identifying the entrepreneurs in village and providing them technology and finance to set up seed companies

69. The agricultural production in different parts of India is very much affected by varying intensities of floods and droughts. Which one of the following measures would not be sustainable in this respect?
(a) Provision for extensive irrigation facilities
(b) Change in the crop calendar
(c) Avoidance of flood and drought prone areas for agriculture
(d) Emphasis on selection of crops best suited to flood and drought conditions

70. Kanha National Park belongs to which one among the following biogeographical areas in the world?
(a) Tropical Sub-humid Forests
(b) Tropical Humid Forests
(c) Tropical Dry Forests
(d) Tropical Moist Forests
(d) Middle and South Andaman

71. What is the sequential order of vegetation types observed while moving from Assam Valley to Rajasthan Plains?
(a) Tropical Wet Evergreen
Tropical Moist Deciduous
Tropical Dry Deciduous
Tropical Thorn Forest
(b) Tropical Thorn Forest
Tropical Dry Deciduous
Tropical Moist Deciduous
Tropical Wet Evergreen
(c) Tropical Moist Deciduous
Tropical Wet Evergreen
Tropical Dry Deciduous
Tropical Thorn Forest
(d) Tropical Dry Deciduous
Tropical Thorn Forest
Tropical Moist Deciduous
Tropical Wet Evergreen

72. Which one of the following is the correct sequence in the decreasing order of production (in million tones) of the given foodgrains in India?
    (a) Wheat - Rice - Pulses - Coarse Cereals
    (b) Rice - Wheat - Pulses - Coarse Cereals
    (c) Wheat - Rice - Coarse Cereals - Pulses
    (d) Rice - Wheat - Coarse Cereals - Pulses

73. In India, cluster bean (Guar) is traditionally used as a vegetable or animal feed, but recently the cultivation of this has assumed significance. Which one of the following statements is correct in this context? [CSAT 2014 - I]
    (a) The oil extracted from seeds is used in the manufacture of biodegradable plastics
    (b) The gum made from its seeds is used in the extraction of shale gas
    (c) The leaf extract of this plant has the properties of antihistamines
    (d) It is a source of high quality biodiesel

74. In India, markets in agricultural products are regulated under the [CSAT 2015 - I]
    (a) Essential Commodities Act, 1955
    (b) Agricultural Produce Market Committee Act enacted by States
    (c) Agricultural Produce (Grading and Marking) Act, 1937
    (d) Food Products Order, 1956 and Meat and Food Products Order, 1973

75. The terms 'Agreement on Agriculture', 'Agreement on the Application of Sanitary and Phytosanitary Measures' and 'Peace Clause' appear in the news frequently in the context of the affairs of the [CSAT 2015 - I]
    (a) Food and Agriculture Organization
    (b) United Nations Framework Conference on Climate Change
    (c) World Trade Organisation
    (d) United Nations Environment Programme

Exercise -2

Statement Based MCQ

1. Consider the following statements :
   1. Biodiversity hotspots are located only in tropical regions.
   2. India has four biodiversity hotspots i.e., Eastern Himalayas, Western Himalayas, Western Ghats and Andaman and Nicobar Islands.

   Which of the statements given above is/are correct ?
   (a) 1 (b) 2 only
   (c) Both 1 and 2 (d) Neither I nor 2
2. With reference to soil conservation, consider the following practices:
   1. Crop rotation 2. Sand fences
   3. Terracing 4. Wind breaks

   Which of the above are considered appropriate methods for soil conservation in India?
   (a) 1, 2 and 3 (b) 2 and 4
   (c) 1, 3 and 4 (d) 1, 2, 3 and 4
3. Consider the following statements:
   1. Silent Valley National Park in the Nallamalai range.
   2. Pathrakkadavu Hydroelectric project is proposed to be built near the Silent Valley National Park.
   3. The Kunthi river originates in Silent Valley's rainforests.

   Which of the statements given above is/are correct?
   (a) 1 and 3 (b) 2 only
   (c) 2 and 3 (d) 1, 2 and 3
4. A state in India has the following characteristics :
   1. Its northern part is arid and semi-arid.
   2. Its central part produces cotton.
   3. Cultivation of cash crops is predominant over food crops.

   Which one of the following states has all of the above characteristics ?
   (a) Andhra Pradesh (b) Gujarat
   (c) Karnataka (d) Tamil Nadu
5. Consider the following crops of India
   1. Cowpea 2. Green gram
   3. Pigeon pea

   Which of the above is/are used as pulse, fodder and green manure?
   (a) 1 and 2 (b) 2 only
   (c) 1 and 3 (d) 1, 2 and 3
6. Consider the following statements
   1. India is the only country in the world producing all the five known commercial varieties of silk.
   2. India is the largest producer of sugar in the world.

   Which of the statements given above less is/are correct?
   (a) 1 only (b) 2 only
   (c) Both 1 and 2 (d) Neither 1 nor 2
7. Though coffee and tea both are cultivated on hill slopes, there is some difference between them regarding their cultivation. In this context, consider the following statements:
   1. Coffee plant requires a hot and humid climate of tropical areas whereas tea can be cultivated in both tropical and subtropical areas.
   2. Coffee is propagated by seeds but tea is propagated by stem cuttings only.

   Which of the statements given above is/ are correct?
   (a) 1 only (b) 2 only
   (c) Both 1 and 2 (d) Neither 1 nor 2
8. The active agents of soil forming process are
   1. Climate 2. Parent material
   3. Biota 4. Topography
   5. Time

   Select the correct answer from the codes given below:
   (a) 1 and 2 (b) 1 and 3
   (c) 4 and 5 (d) 3, 4 and 5
9. Which of the following factors have caused water logging in the black lava soil of Deccan
   1. Introduction of irrigation
   2. Sugarcane cultivation
   3. High-rainfall

   Select the correct answer
   (a) 1, 2 and 3 (b) 1 and 2
   (c) 1 only (d) 1 and 3
10. Which of the following are the rivers at the delta mouths of which mangroves occur in abundance?
    1. Narmada 2. Subarnarekha
    3. Krishna 4. Ganga

    Select the correct answer:
    (a) 1 and 3 (b) 3 and 4
    (c) 2 and 4 (d) 1, 3 and 4
11. Consider the following statements:
    Andhra Pradesh is one of the leading producers of rice because
    1. It has fertile alluvial soil in the coastal plain.
    2. It receives about 125 cm of rainfall per annum in the coastal tract.
    3. It has a lot of tank irrigation in the coastal plain.

    Of these statements:
    (a) 1, 2 and 3 (b) 1 and 2
    (c) 2 and 3 (d) 1 and 3
12. Consider the following statements about Indian forestry:
    1. About 40 per cent of the Indian forests are in the inaccessible mountainous regions which impode the speedy transfer of felled trees.
    2. Although according to India's forest policy, a high proportion of the land area shall be covered by forest except in some states, the percentage of forest cover is precariously low.
    3. Exploitation of forests is less time consuming and less costly, as almost in every forest a single type of tree dominates.
    4. The annual productivity of the forests is 3.5 cubic metres per hectare.

    Of these statements
    (a) 1 and 2 (b) 1, 2 and 3
    (c) 3 and 4 (d) 1, 2, 3 and 4

13. What are the major causes of droughts in India?
    1. Most of the rainfall occurs within a few months.
    2. The absence of forests results in rapid run-off and thus droughts.
    3. Rainfall is highly variable.
    4. The amount of rainfall is inadequate.
    (a) 1, 3 and 4 (b) 2, 3 and 4
    (c) 1, 2 and 3 (d) 1, 2 and 4
14. Consider the following programmes:
    1. Afforestation and development of wastelands.
    2. Reforestation and replantation in existing forests.
    3. Encouraging the wood substitutes and supplying other types of fuel.
    4. Promotion of wide use of insecticides and pesticides to restrict the loss of forest area from degradation caused by pests and insects.
    The National Forest Policy of 1988 includes:
    (a) 1, 2, 3 and 4 (b) 2 and 4
    (c) 1, 3 and 4 (d) 1, 2 and 3
15. Consider the following statements regarding environment issues of India:
    1. Gulf of Mannar is one of the biosphere reserves.
    2. The Ganga Action Plan, phase II has been merged with the National River Conservation Plan.
    3. The National Museum of Natural History at New Delhi imparts non-formal education in environment and conservation.
    4. Environmental Information System (ENVIS) acts as a decentralized information network for environment information.
    Which of these statements are correct?
    (a) 1, 2 and 4 (b) 1, 2, 3 and 4
    (c) 2 and 3 (d) 1, 3 and 4
16. Consider the following statements:
    The black cotton soil of India
    1. is mainly distributed over the river valleys of the lava region of the Deccan.
    2. has a great capacity of retaining moisture
    3. is extremely fertile at surface
    4. occupies about 10 per cent of the total area of the country of these statements
    (a) 1, 2 and 3 (b) 1, 3 and 4
    (c) 1 and 2 (d) 3 and 4
17. Consider the following statements :
    1. The equatorial forests are evergreen.
    2. The Mediterranean region has deciduous forests of broad leaved trees.
    3. Taiga forests are found in Kashmir.
    Which of the statements given above are correct ?
    (a) 1 and 2 (b) 2 and 3
    (c) 1 and 3 (d) 1, 2 and 3
18. Tamil Nadu is a leading producer of mill-made cotton yarn in the country. What could be the reason?
    1. Black cotton soil is the predominant type of soil in the State.
    2. Rich pool of skilled labour is available.
    Which of the above is/are the correct reasons?
    (a) 1 only (b) 2 only
    (c) Both 1 and 2 (d) Neither 1 nor 2
19. Which of the following is/are unique characteristic/ characteristics of equatorial forests?
    1. Presence of tall, closely set trees with crowns forming a continuous canopy
    2. Coexistence of a large number of species
    3. Presence of numerous varieties of epiphytes
    Select the correct answer using the codes given below.
    (a) 1 only (b) 2 and 3 only
    (c) 1 and 3 only (d) 1, 2 and 3
20. Consider the following pairs:

National Park	**River flowing through the Park**
1. Corbett National Park:	Ganga
2. Kaziranga National Park:	Manas
3. Silent Valley: National Park :	Kaveri

    Which of the above pairs is/are correctly matched?
    (a) 1 and 2 (b) 3 only
    (c) 1 and 3 (d) None of these
21. The Narmada river flows to the west, while most other large peninsular rivers flow to the east. Why?
    1. It occupies a linear rift valley.
    2. It flows between the Vindhyas and the Satpuras.
    3. The land slopes to the west from Central India.
    Select the correct answer using the codes given below.
    (a) 1 only (b) 2 and 3
    (c) 1 and 3 (d) None
22. Which of the following statements regarding laterite soils of India are correct?
    1. They are generally red in colour.
    2. They are rich in nitrogen and potash.
    3. They are well-developed in Rajasthan and UP.
    4. Tapioca and cashew nuts grow well on these soils.
    Select the correct answer using the codes given below.
    (a) 1, 2 and 3 (b) 2, 3 and 4
    (c) 1 and 4 (d) 2 and 3 only
23. If you travel through the Himalayas, you are likely to see which of the following plants naturally growing there?
    1. Oak
    2. Rhododendron
    3. Sandalwood
    Select the correct answer using the code given below.
    (a) 1 and 2 only (b) 3 only
    (c) 1 and 3 only (d) 1, 2 and 3
24. Consider the following crops:
    1. Cotton 2. Groundnut
    3. Rice 4. Wheat
    Which of these are Kharif crops?
    (a) 1 and 4 (b) 2 and 3 only
    (c) 1, 2 and 3 (d) 2, 3 and 4
25. With reference to Neem tree, consider the following statements :
    1. Neem oil can be used as a pesticide to control the proliferation of some species of insects and mites.
    2. Neem seeds are used in the manufacture of biofuels and hospital detergents.
    3. Neem oil has applications in pharmaceutical industry.
    Which of the statements given above is/are correct?
    (a) 1 and 2 only (b) 3 only
    (c) 1 and 3 only (d) 1, 2 and 3

26. Consider the following statements :
    1. Maize can be used for the production of starch.
    2. Oil extracted from maize can be a feedstock for biodiesel.
    3. Alcoholic beverages can be produced by using maize.

    Which of the statements given above is/are correct?
    (a) 1 only (b) 1 and 2 only
    (c) 2 and 3 only (d) 1, 2 and 3
27. What are the significances of a practical approach to sugarcane production known as 'Sustainable Sugarcane Initiative'?
    1. Seed cost is very low in this compared to the conventional method of cultivation.
    2. Drip irrigation can be practiced very effectively in this.
    3. There is no application of chemical/inorganic fertilizers at all in this.
    4. The scope for intercropping is more in this compared to the conventional method of cultivation.

    Select the correct answer using the code given below.
    (a) 1 and 3 only (b) 1, 2 and 4 only
    (c) 2, 3 and 4 only (d) 1, 2, 3 and 4
28. What are the benefits of implementing the 'Integrated Watershed Development Programme'?
    1. Prevention of soil runoff
    2. Linking the country's perennial rivers with seasonal rivers
    3. Rainwater harvesting and recharge of groundwater table
    4. Regeneration of natural vegetation

    Select the correct answer using the code given below.
    (a) 1 and 2 only (b) 2, 3 and 4 only
    (c) 1, 3 and 4 only (d) 1, 2, 3 and 4

Matching Based MCQ

29. Consider the following statements
    1. National parks are a special category of protected areas of land and sea coasts where people are an integral part of the system.
    2. Sanctuaries are concerned with conservation of particular species.
    3. Biosphere reserves are connected with the habitat of a particular wild animal.

    Which of the statements given above is/are correct?
    (a) 1,2 and 3 (b) Only 2
    (c) 1 and 2 (d) 1 and 3
30. Which one of the following statements on biosphere reserves is not correct?
    (a) In 1973, UNESCO launched a worldwide programme on man and biosphere
    (b) Biosphere reserves promote research on ecological conservation
    (c) Nanda Devi Biosphere Reserve is located in Madhya pradesh
    (d) Biosphere reserves are multipurpose protected areas to preserve the genetic diversity in ecosystems
31. Consider the following statements about black soil of India
    1. Black soil becomes sticky when it is wet.
    2. Black soil contains adequate nitrogen as well as phosphorus required for the growth of plants.

    Which of the statements given above is/are correct?
    (a) Only 1 (b) Only 2
    (c) Both 1 and 2 (d) Neither 1 nor 2
32. Which of the following statements regarding red soils of India is/are correct?
    1. The colour of the soil is red due to ferric oxide content.
    2. Red soils are rich in lime, humous and potash.
    3. They are porous and have friable structure.

    Select the correct answer using the code given below
    (a) Only 1 (b) 1 and 3
    (c) 2 and 3 (d) 1, 2 and 3
33. Which of the following statements regarding jhum cultivation in India are correct ?
    1. It is largely practised in North-Eastern Indian states.
    2. It is referred to as 'slash and burn' technique.
    3. In it, the fertility of soil is exhausted in a few years.

    Select the correct answer using the code given below :
    (a) 1 and 2 only (b) 2 and 3 only
    (c) 1 and 3 only (d) 1, 2 and 3
34. Which of the following statements relating to Indian agriculture is/are correct ?
    1. India has the World's largest cropped area.
    2. Cropping pattern is dominated by cereal crop.
    3. The average size of an Indian farm holding is too small for several agricultural operations.

    Select the correct answer using the code given below :
    (a) 1 only (b) 1 and 2 only
    (c) 2 and 3 only (d) 1, 2 and 3
35. Consider the following statements:
    1. The forest cover in India constitutes around 20% of its geographical area. Out of the total forest cover, dense forest constitutes around 40%.
    2. The National Forestry Action Programme aims at bringing one third of the area of India under tree forest cover.

    Which of the statements given above is/are correct?
    (a) 1 only (b) 2 only
    (c) both 1 and 2 (d) Neither 1 nor 2
36. Consider the following statements:
    1. The boundaries of a National Park are defined by legislation.
    2. A Biosphere Reserve is declared to conserve a few specific species of flora and fauna.
    3. In a Wildlife Sanctuary, limited biotic interference is permitted.

    Which of the statements given above is/are correct?
    (a) 1 only (b) 2 and 3 only
    (c) 1 and 3 only (d) 1, 2 and 3
37. Following are the characteristics of an area in India:
    1. Hot and humid climate
    2. Annual rainfall 200 cm
    3. Hill slopes up to an altitude of 1100 metres
    4. Annual range of temperature 15°C to 30°C.

Which one among the following crops are you most likely to find in the area described above?
(a) Mustard (b) Cotton
(c) Pepper (d) Virginia tobacco

38. Which of the following statements regarding laterite soils of India are correct?
1. They are generally red in colour.
2. They are rich in nitrogen and potash.
3. They are well-developed in Rajasthan and UP.
4. Tapioca and cashew nuts grow well on these soils.
Select the correct answer using the codes given below.
(a) 1, 2 and 3 (b) 2, 3 and 4
(c) 1 and 4 (d) 2 and 3 only

39. The following are the major oilseeds produced in India:
1. Sesamum 2. Mustard
3. Groundnut 4. Soyabean
Which one of the following is the correct sequence of the descending order of the quantity of their production?
(a) 1, 2, 3, 4 (b) 3, 2, 4, 1
(c) 2, 4, 3, 1 (d) 3, 4, 2, 1

40. Consider the following high yielding varieties of crops in India:
1. Arjun 2. Jaya
3. Padma 4. Sonalika
Which of these are of wheat?
(a) 1 and 2 (b) 2 and 3
(c) 1 and 4 (d) 3 and 4

41. Consider the following statements:
1. India is the original home of the cotton plant
2. India is the first country in the world to develop hybrid cotton variety leading to increased production
Which of these statements is/are correct?
(a) Only 1 (b) Only 2
(c) Both 1 and 2 (d) Neither 1 nor 2

42. Consider the following statements:
1. India ranks first in the world in fruit production
2. India ranks second in the world in export of tobacco
Which of these statements is/are correct?
(a) Only 1 (b) Only 2
(c) Both 1 and 2 (d) Neither I nor 2

43. Consider the following crops:
1. Cotton 2. Groundnut
3. Maize 4. Mustard
Which of the above are kharif crops?
(a) 1 and 2 (b) 1, 2 and 3
(c) 3 and 4 (d) 1, 2 , 3 and 4

44. Consider the following statements:
1. India is the only country in the world producing all the five known commercial varieties of silk.
2. India is the largest producer of sugar in the world.
Which of the statements given above less is/are correct?
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

45. Due to their extensive rice cultivation, some regions may be contributing to global warming. To what possible reason/reasons is this is attributable?
1. The anaerobic conditions associated with rice cultivation cause the emission of methane.
2. When nitrogen based fertilizers are used, nitrous oxide is emitted from the cultivated soil.
Which of the statements given above is/are correct?
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

46. Consider the following crops of India :
1. Cowpea 2. Green gram
3. Pigeon pea
Which of the above is/are used as pulse, fodder and green manure?
(a) 1 and 2 only (b) 2 only
(c) 1 and 3 only (d) 1, 2 and 3

47. Consider the following crops of India :
1. Groundnut
2. Sesamum
3. Pearl millet
Which of the above is/are predominantly rained crop/ crops?
(a) 1 and 2 only (b) 2 and 3 only
(c) 3 only (d) 1, 2 and 3

48. Consider the following crops:
1. Cotton 2. Groundnut
3. Rice 4. Wheat
Which of these are Kharif crops?
(a) 1 and 4 (b) 2 and 3 only
(c) 1, 2 and 3 (d) 2, 3 and 4

49. With reference to Neem tree, consider the following statements : [CSAT 2014-I]
1. Neem oil can be used as a pesticide to control the proliferation of some species of insects and mites.
2. Neem seeds are used in the manufacture of biofuels and hospital detergents.
3. Neem oil has applications in pharmaceutical industry.
Which of the statements given above is/are correct?
(a) 1 and 2 only (b) 3 only
(c) 1 and 3 only (d) 1, 2 and 3

50. Consider the following pairs : [CSAT 2014-I]

	Region		**Well-known for the production of**
1.	Kinnaur	:	Areca nut
2.	Mewat	:	Mango
3.	Coromandel	:	Soya bean

Which of the above pairs is/ are correctly matched?
(a) 1 and 2 only (b) 3 only
(c) 1, 2 and 3 (d) None

51. Consider the following statements : [CSAT 2014 - I]
1. Maize can be used for the production of starch.
2. Oil extracted from maize can be a feedstock for biodiesel.
3. Alcoholic beverages can be produced by using maize.
Which of the statements given above is/are correct?
(a) 1 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 2 and 3

52. What are the significances of a practical approach to sugarcane production known as 'Sustainable Sugarcane Initiative'? [CSAT 2014-I]
1. Seed cost is very low in this compared to the conventional method of cultivation.
2. Drip irrigation can be practiced very effectively in this.

3. There is no application of chemical/inorganic fertilizers at all in this.
4. The scope for intercropping is more in this compared to the conventional method of cultivation.

Select the correct answer using the code given below.
(a) 1 and 3 only (b) 1, 2 and 4 only
(c) 2, 3 and 4 only (d) 1, 2, 3 and 4

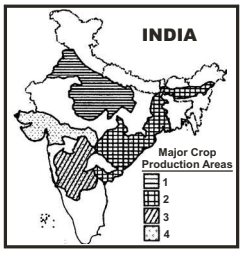
53. What can be the impact of excessive / inappropriate use of nitrogenous fertilizers in agriculture? [CSAT 2015 - I]
1. Proliferation of nitrogen-fixing microorganisms in soil can occur.
2. Increase in the acidity of soil can take place.
3. Leaching of nitrate to the ground-water can occur.

Select the correct answer using the code given below.
(a) 1 and 3 only (b) 2 only
(c) 2 and 3 only (d) 1, 2 and 3

54. Consider the following States [CSAT 2015-I]
1. Arunachal Pradesh
2. Himachal Pradesh
3. Mizoram

In which of the above States do 'Tropical Wet Evergreen Forests' occur?
(a) 1 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

55. In the map the given four areas are differently shaded, three of which indicate cereal crops production areas and one indicates non-cereal crop production area.
As per the index given, the non-cereal crop production area is :



(a) 1 (b) 2
(c) 3 (d) 4

56. Consider the following pairs :

Region		Well-known for the production of
1. Kinnaur	:	Areca nut
2. Mewat	:	Mango
3. Coromandel	:	Soya bean

Which of the above pairs is/ are correctly matched?
(a) 1 and 2 only (b) 3 only
(c) 1, 2 and 3 (d) None

57. Consider the following pairs :

Programme/Project		Ministry
1. Drought-Prone Area Programme	:	Ministry of Agriculture
2. Desert Development Programme	:	Ministry of Environment and Forests
3. National Watershed Development Project for Rainfed Areas	:	Ministry of Rural Development

Which of the above pairs is/ are correctly matched?
(a) 1 and 2 only (b) 3 only
(c) 1, 2 and 3 (d) None

58. Match the following

List I (Natural Vegetation of India)	List II (Annual Rainfall Received)
A. Tropical evergreen forests	1. 100-200 cm
B. Tropical deciduous forests	2. Above 200 cm
C. Tropical dry forests	3. Less than 50 cm
D. Arid forests	4. Above 300 cm
	5. 50-100 cm

Codes:

	A	B	C	D		A	B	C	D
(a)	1	2	5	3	(b)	4	3	1	5
(c)	2	1	5	3	(d)	2	1	3	4

59. Match the following

List I (Biosphere Reserve)		List II (Places)	
A.	Manas	1.	Meghalaya
B.	Pachmarhi	2.	Asom
C.	Nokrek	3.	Madhya Pradesh
D.	Achanakmar Amarkantak	4.	Chhattisgarh

Codes :

	A	B	C	D		A	B	C	D
(a)	4	3	1	2	(b)	2	1	3	4
(c)	4	1	3	2	(d)	2	3	1	4

60. Match the following

List I (Tiger Reserve)	List II (State)
A. Indravati	1. Karnatka
B. Periyar	2. Odisha
C. Simlipal	3. Kerala
D. Bandipur	4. Chhattisgarh

Codes :

	A	B	C	D		A	B	C	D
(a)	1	2	3	4	(b)	1	3	2	4
(c)	4	3	2	1	(d)	4	2	3	1

61. Arrange the following tiger reserves of India from North to South :
1. Indravati 2. Dudhwa
3. Bandipur 4. Similipal

Select the correct answer using the code given below :
(a) 3 – 4 – 1 – 2 (b) 4 – 2 – 3 – 1
(c) 2 – 4 – 1 – 3 (d) 2 – 1 – 4 – 3

62. Match List-I and List-II and select the correct answer using the codes given below :

List-I (Product)		List-II (Major Producer)
A.	Tea	1. Andhra Pradesh
B.	Jute	2. Kerala
C.	Rubber	3. Orissa
D.	Tobacco	4. Tamil Nadu

Codes :

	A	B	C	D
(a)	2	3	4	1
(b)	4	1	2	3
(c)	2	1	4	3
(d)	4	3	2	1

63. Match List-I with List-II and select the correct answer using the code given below the Lists :

	List-I		**List-II**
	(Type of vegetation)		**(State)**
A.	Mangrove	1	Madhya Pradesh
B.	Scrub	2	Karnataka
C.	Teak	3	Rajasthan
D.	Coniferous	4	Arunachal Pradesh

Code:

	A	B	C	D
(a)	4	1	3	2
(b)	2	1	3	4
(c)	4	3	1	2
(d)	2	3	1	4

64. Which one of the following pairs is correctly matched?
(a) Teak : Jammu and Kashmir
(b) Deodar : Madhya Pradesh
(c) Sandalwood : Kerala
(d) Sundari : West Bengal

65. Match List-I (Mangrove) with List-II (State) and select the correct answer using the codes given below the lists:

List-I (Mangrove)	List-II (State)
A. Achra Ratnagiri	1. Karnataka
B. Coondapur	2. Kerala
C. Pichavaram	3. Andhra Pradesh
D. Vembanad	4. Maharashtra
	5. Tamil Nadu

Codes:
(a) A-2; B-1; C-5; D-4 (b) A-4; B-5; C-3; D-2
(c) A-2; B-5; C-3; D-4 (d) A-4; B-1; C-5; D-2

66. Match List I (National Park/Sanctuary) with List II (State) and select the correct answer using the codes given below:

List-I	**List-II**
A Kanger Ghati National Park	1. Chhattisgarh
B. Nagerhole National Park	2. Haryana
C. Kugti Wildlife Sanctuary	3. Himachal Pradesh
D. Sultanpur Bird Sanctuary	4. Karnataka

Codes :
(a) A-3; B-2; C-1; D-4
(b) A-1; B-4; C-3; D-2
(c) A-3; B-4; C-1; D-2
(d) A-1; B-2; C-3; D-4

67. Match List-I (Biosphere Reserve) with List-II (States) and select the correct answer using the codes given below:

List-I	**List-II**
A. Similipal	1. Sikkim
B. Dehong Deband	2. Uttaranchal
C. Nokrek	3. Arunachal Pradesh
D. Kanchenjunga	4. Orissa
	5. Meghalaya

Codes:
(a) A-1; B-3; C-5; D-4
(b) A-4; B-5; C -2; D-1
(c) A-1; B-5; C-2; D-4
(d) A-4; B-3; C-5; D-1

68. Match List-I with List-II and select the correct answer using the codes given below the lists:

List-I (National Park /Wildlife Sanctuary)	**List-II (State)**
A. Bondla Wildlife Sanctuary	1. Orissa
B. Kangerghat National Park	2. Assam
C. Orang Sanctuary	3. Chhattisgarh
D. Ushkothi Wildlife Sanctuary	4. Goa
	5. Tripura

Codes :
(a) A-2; B-1; C-5; D-3 (b) A-4; B-3; C-2; D-1
(c) A-2; B-3; C-5; D-1 (d) A-4; B-1; C-2; D-3

69. Match List-I (National Park/Wildlife Sanctuary) with List-I) (Nearby Town) and select the correct answer using the codes given below the lists:

List-I (National Park/ Wildlife Sanctuary)	**List-II (Nearby Town)**
A. Chandra Prabha	1. Jaipur
B. Karera	2. Jhansi
C. Jaisamand	3. Agra
D. Nahargarh	4. Varanasi
	5. Udaipur

Codes :
(a) A-4; B-4; C-1; D-1 (b) A-5; B-2; C-3; D-1
(c) A-4; B-2; C-5; D-1 (d) A-5; B-1; C-3; D-2

70. Which of the following pairs of states and their important crops are correctly matched?
1. Kerala–Tapioca 2. Maharashtra–Cotton
3. West Bengal–Jute 4. Gujarat–Groundnut
(a) 1, 2 and 3 (b) 1, 2 and 4
(c) 1, 3 and 4 (d) 2, 3 and 4

71. Match List-I with List-II and select the correct answer:

List-I (Crops)	**List-II (Geographical conditions)**
A. Barley	1. Hot and dry climate with poor soil
B. Rice	2. Cool climate with poorer soil
C. Millets	3. Warm and moist climate with high attitude
D. Tea	4. Hot and moist climate with rich soil

Codes:
(a) A – 2; B – 4; C – 1; D – 3
(b) A – 3; B – 4; C – 1; D – 2
(c) A – 2; B – 1; C – 4; D – 3
(d) A – 3; B – 2; C – 4; D –1

72. Consider the map given below:

The place marked A, B, C and D in the map are respectively known for the cultivation of :
(a) groundnut, ragi, tobacco and sugarcane
(b) groundnut, sugarcane, ragi and tobacco
(c) ragi, sugarcane, groundnut and tobacco
(d) ragi, groundnut, sugarcane and tobacco

73. Match List-I with List-II and select the correct answer using the codes given below the lists:

List-I (Agricultural products)	List-II (Foremost producer)
A. Cotton	1. Madhya Pradesh
B. Gram	2. Gujarat
C. Black pepper	3. West Bengal
D. Pineapple	4. Kerala

Codes:
(a) A-2; B-1; C- 4; D-3 (b) A-2; B-1; C- 3; D-4
(c) A-1; B-2; C- 4; D-3 (d) A-1; B-2; C- 3; D-4

74. Match List I with List II and select the correct answer using the codes given below the lists:

List-I	List-II
A. Cotton	1. Rainfall 1000–1500 mm; Temperature 40°–60°C
B. Flax	2. Rainfall 1500–2000 mm; Temperature 25°–35°C
C. Sugar beet	3. Rainfall 600–800 mm; Temperature 5°–18° C
D. Jute	4. Rainfall 500–1000 mm; Temperature 18°–22°C
	5. Rainfall 500–600 mm; Temperature 18°–22°C

Codes:
(a) A-1; B-3; C-4; D-2 (b) A-2; B-3; C-5; D-4
(c) A-4; B-5; C-2; D-1 (d) A-4; B-3; C-5; D-2

75. Consider the following pairs:

National Park	River flowing through the Park
1. Corbett National Park	: Ganga
2. Kaziranga National Park	: Manas
3. Silent Valley: National Park	: Kaveri

Which of the above pairs is/are correctly matched?
(a) 1 and 2 (b) 3 only
(c) 1 and 3 (d) None of these

76. Consider the following pairs : [CSAT 2015 - I]

Programme/Project		Ministry
1 . Drought-Prone Area Programme	:	Ministry of Agriculture
2. Desert Development Environment and Forests	:	Ministry of Programme
3. National Watershed Development Project for Rainfed Areas	:	Ministry of Rural Development

Which of the above pairs is/ are correctly matched?
(a) 1 and 2 only (b) 3 only
(c) 1, 2 and 3 (d) None

77. Consider the following pairs :

Wetlands		Confluence of rivers
1. Harike Wetlands	:	Confluence of Beas and Satluj/Sutlej
2. Keoladeo Ghana National Park	:	Confluence of Banas and Chambal
3. Kolleru Lake	:	Confluence of Musi and Krishna

Which of the above pairs is/ are correctly matched?
(a) 1 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

78. Consider the following pairs :

Hills		Region
1. Cardamom Hills	:	Coromandel Coast
2. Kaimur Hills	:	Konkan Coast
3. Mahadeo Hills	:	Central India
4. Mikir Hills	:	North-East India

Which of the above pairs are correctly matched?
(a) 1 and 2 (b) 2 and 3
(c) 3 and 4 (d) 2 and 4

Hints and Explanations

EXERCISE-1

1. (d) Tropical rain forest temperature gets higher than 34°C and drops below 20°C and average rain fall 50–260 inches yearly.
2. (c) The low and deltaic plains of the Ganges and Brahamputra rivers that is characterised by swamps and Sundarbans. So, the people out there grow Paddy and Jute.
3. (b) Unless the salts and minerals are washed down into the groundwater, the sodium and other ions are absorbed by the colloidal clay particles. It leads to the deflocculating of the particles and the soil becomes structure less and impermeable to water.
4. (a) 5. (a) 6. (d) 7. (d) 8. (c)
9. (b) When it rains, the water carries the soil into cracks and thus to the lower layers; it has the same effect as tilling.
10. (c) 11. (c) 12. (d) 13. (a) 14. (a)
15. (c) 16. (d) 17. (a) 18. (a) 19. (c)
20. (c)
21. (b) Black soil becomes sticky when wet and develops cracks on drying. When it rains, top soil is carried into the cracks with the rain water. Thus, the soil of the upper layers is continuously taken to lower horizons, with the same effect as tilling.
22. (d)
23. (d) Great Nicobar, Sundarbans, Nanda Devi are biosphere reservoir declared by Govt. of India, but Gulf of Kachchh is not a biosphere reservoir, it is dry sandy plain.
24. (c) Western Ghat is known as ecological hot spots in India by the Wild Life Act of 1972 of Indian Constitution.
25. (b) 26. (d) 27. (a)
28. (d) First three soils are formed by the silt brought up by the river.
29. (c) The Deccan Traps are a large igneous province, one of the largest volcanic features on Earth. It is located on the Deccan Plateau of west-central India.
30. (c)
31. (b) Contour Bunding is one of the simple method of soil and water conservation. This technique is used at places where the land is sloppy. Due to slope, soil and nutrients erode fast which makes agriculture on this land very uneconomical. To adopt this technique the agriculture fields contours are marked and then the bunds are taken along the contours.
32. (b) Guar gum is used in hydraulic fracturing technology during shale gas extraction.
33. (b) The Eastern Highlands moist deciduous forests is a tropical moist broadleaf forest of east-central India. It covers an area of 341,100 square kilometers extending across portions of Andhra Pradesh, Chhattisgarh, Jharkhand,Madhya Pradesh, Maharashtra, Orissa, and Telangana states.
34. (b) The National Forestry Action Plan aims to bring 33% of land area in India under tree cover by 2012.
35. (c) Mixed farming is an agrarian system that mixes arable farming with the raising of livestock. When on a farm along-with crop production, some other agriculture based practice like poultry, dairy farming or bee keeping etc. is adopted then this is known as mixed farming.
36. (a) According to 2011 Forest Survey of India. Mizoram has third highest total forest cover with 1,594,000 hectares and highest percentage area (90.68%) covered by forests, among the states of India.
37. (c) Ranganathittu Bird Sanctuary is located in Karnataka.
38. (a) Forest Survey of India (FSI) is an organisation under the Ministry of Environment & Forests. Government of India conducts survey and assessment of forest resources in the country. The organization came into being in June, 1981. The headquarters of FSI are at Dehradun.
39. (b) Kerala is the largest producer of pepper in India. Kerala accounts for 97.4 per cent of the total area under the crop in the country.
40. (a) The shaded area in the map is major cotton producer states in India. Cotton producing states in India are Gujarat, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu etc.
41. (c) Sorghum is a genus of plants in the grass family. One species is grown for grain and many of which are used as fodder plants. Millets are a group of highly variable small-seeded grasses, widely grown around the world as cereal crops or grains for fodder and human food. Thus, Sorghum is categorized as millet.
42. (a) In agriculture, leaching refers to the loss of water-soluble plant nutrients from the soil, due to rain and irrigation. The rate of leaching increases with the amount of rainfall, high temperatures, and the removal of protective vegetation. In areas of extensive leaching, many plant nutrients are lost, leaving quartz and hydroxides of iron, manganese, and aluminium. This remainder forms a distinctive type of soil, called laterite.
43. (b) The trees in Monsoon Forests shed their leaves for about six to eight weeks in summer on account of a long dry spell. The rainfall suited for such forests is between 75 to 200 cm. Sal is of the dry deciduous variety of tropical monsoon forest.

44. (a) 1. Dudwa National park - Uttar Pradesh
2. Kanha National Park- Madhya Pradesh
3. Indravati National Park - Chattisgarh
4. Bandipur National Park- Karnataka

45. (d) An endemic species is one whose habitat is restricted to a particular area. The term could refer to an animal, a plant, a fungus, or even a microorganism. Some of the endemic species in India are Grey-headed Bulbul, Malabar Lark, Nilgiri Flycatcher and Grey Jungle fowl etc.

46. (c) Red soils develop in a warm, temperate, wet climate under deciduous forests and have thin organic and mineral layers overlying a yellowish-brown leached layer resting on red layer made of iron oxide(ferric oxide). Red soils generally form from iron-rich sediments. They are usually poor growing soils, low in nutrients and humus and difficult to cultivate.

47. (a) Subsistence Farming is a type of farming in which most of the produce (subsistence crop) is consumed by the farmer and his family, leaving little or nothing to be marketed.

48. (a)

49. (c) In India, tea growing areas are Darjeeling in West Bengal, the Nilgiri in the South Wynaad, Cochin and Malabar in Kerala.

50. (c) Tropical dry deciduous forests run from the Himalayan foot hills to Kanyakumari and comprise important trees like bijasal, teak, tendu, amaltas, khair, palas, rosewood and axlewood.

51. (b) For proper ecological balance 33% of forest land is recommended, but in India we have only 20.14% of forest coverage.

52. (c) Gulf of Kutch in 1980, 270 km from Obha to Sadiya.

53. (c) Haryana has 6.83% of area is forest cover area of the total land coverage, whereas Sikkim has 36%, 38.5% in Goa and 28.9% of Kerala has forest area of their total land mass.

54. (b) Nallamalai is not a biosphere reserve. It is hill of Eastern ghats which stretches over Kurnool, Mahabubnagar, Guntur and Kadapa districts of the state of Andhra Pradesh.

55. (d) Indira Gandhi Wildlife Sanctuary and National Park is known as top slip. It is a part of Western Ghats is located above 300 metres from the sea level on the Anamalai mountain ranges.

56. (b) Indravati National Park is located in the Bastar region. The park is situated at the distance of 97.4 km Bastar.

57. (b) Mahogany is a species of tree found throughout the Caribbean, central and south America but not in Himalayas.

58. (a) Andaman and Nicobar has 9 national parks; Assam has 6, Arunachal Pradesh and Maghalaya both have 2 each.

59. (c) Red soil in India is largely found in Deccan plateau. Red soil is less clayey and sandier in nature and has a rich content of iron and small amount of humus. Red soil is also known as yellow soil. The redness is the soil is due to Jerric oxide, is 2nd largest soil found in India from south of Bundelkhand to North of Raj mahal hill.

60. (d) Contour Bunding is one of the simple method of soil and water conservation. This technique is used at places where the land is sloppy. Due to slope, soil and nutrients erode fast which makes agriculture on this land very uneconomical. To adopt this technique the agriculture fields contours are marked and then the bunds are taken along the contours.

61. (a) Wheat is a temperate region crop thus require moderate temperature and rainfall both. Temperature should not exceed above 20°C and rainfall should be between 50-100 cm alongwith a first free growing season.

62. (a) Organic farming is a production system of crops which avoids the use of synthetic and chemical inputs like fertilizers, pesticides, growth regulators and livestock feed additives.

63. (a) The genetic engineering approval committee comes under Ministry of Enviroment, Forest and Climate change.

64. (b) National Food Security Mission launched by government of India to increase the food production of rice, wheat and pulses and commercial gaps like sugarcance jute. The target is to increase the production of rice by 10 million tones, wheat by 8 million tones and pulses, by 2 million tones by the end of Eleventh Plan.

65. (b)

66. (c) Mixed farming refer to rearing of animals and cultivation of crops together.

67. (d) Andaman and Nicobar Islands is rich in biodiversity. Different types of forests as Tropical Evergreen forests, Moist Deciduous forests, Mangrove forests, Littoral forests are found here.

68. (b) Seed village concept is to promote the quality seed production of foundation and certified seed classes. The area which is suitable for raising a particular crop will be selected, and raised with single variety of a kind. Suitable area for seed production will be identified by the Scientists. The foundation/ certified seeds or University labelled seeds will be supplied by the University through Krishi Vigyan Kendras (KVKs) and Research Stations at 50% subsidy cost to the identified farmers in the area. The farmers will use these quality seeds and take up their own seed production in a small area (1 acre) for their own use. The crops are Rice, Pulses and Oilseeds.

69. (c) Avoidance of flood and drought prone areas for agriculture would not be sustainable in this respect.
70. (c) Kanha National Park belongs to tropical moist dry deciduous forest. It is a tiger reserve of India and the largest national park of Madhya Pradesh.
71. (a) The sequential order of vegetation types observed while moving from Assam valley to Rajasthan is : Tropical wet evergreen ® Tropical moist deciduous Teropical dry deciduous ® Tropical thorn forest.
72. (d) Production of rice is 96.43 MT, wheat is 78.4 MT, pulses is 15.11 MT and coarse cereals are 40.73 MT in India. So, the correct sequence in decreasing order is Rice – Wheat – Coarse cereals – Pulses.
73. (b) Guar gum is used in hydraulic fracturing technology during shale gas extraction.
74. (b) Agricultural Produce Market Committee Acts of respective states are responsible for markets in agricultural products.
75. (c) 'Agreement on Agriculture', 'Agreement on the Application of Sanitary and Phytosanitary Measures' and 'Peace Clause' are related to World Trade Organisation.

EXERCISE-2

1. (d) Biodiversity hot spots are found in temperature regions only. Eastern Himalayas, Western Ghats and Andaman Islands are such hot spots.
2. (c)
3. (d) Silent Valley National Park is situated in Nilgiri Hills of Western Ghats. The park is bound by Attappadi reserved forest to the east and vested forest of Palaghat division and Nilamber division to the south-west respectively.
4. (b)
5. (d) All are used as pulse, folder and green manure.
6. (a) Five varieties of silkworms are reared in India for producing five varieties of silk. Mulberry silk, Muga silk, Tasar silk, Oak tasar silk and Eri silk. India is the 2nd largest producer of sugar in the world.
7. (a) Both tea and coffee can be propagated by seeds and stem cutting, so (b) is wrong.
8. (b) 9. (c) 10. (b) 11. (b) 12. (b)
13. (c)
14. (d) National Forest Policy 1988 describes the protection of forest and development of forest, it does not describe the use of insecticide and pesticide in forest areas.
15. (b) All the statements given in the options are correct.
16. (a)
17. (c) The Mediterranean region has deciduous forests of thick bark and thick leaves. Because it get high sun rays and much rainfall.
18. (b) The predominant soil in Tamil Nadu is red which supports cotton cultivation and a rich pool of skilled labour is available in Tamil Nadu.
19. (d) The canopy is the primary layer of the forest forming a roof over the two remaining layers. The densest of the biodiversity is found here along with a large variety of epiphytes.
20. (d) Through Corbett National Park Ramganga flows (not Ganga) which is a tributary of Ganges. Through Silent Valley National Park river Bhavani flows which is a tributary of Kaveri.
    Kaziranga and Manas are both national parks.
21. (a) The land slopes west ward from central India due to deposition of alluvial fan. The rift valley which is occupied by the Narmada is one of the reasons of Narmada flowing to the west. The rift is formed due to complex natural processes leading to either subsidence or upliftment of the earth's surface. The area is seismically active and has seen major upheavals. Such movements reshape the landscape. There is readjustment of slopes and rivers either start bringing more material or change course.
22. (c) Laterite soil is rusty red in colour due to iron oxide present in it. In the lateritic soil cashews and tapiocas can be grown.
23. (a) Oak and Rhododendron is found in Himalayan region while sandalwood is found in South India.
24. (c) Rice is the main kharif crop and groundnut and cotton are also the kharif crops.
25. (d) All 1,2 and 3 are true.
26. (d) All three statements are correct as Maize can be used for the production of starch.Oil extracted from maize can be a feedstock for biodiesel. Alcoholic beverages can be produced by using maize.
27. (b) NPK (fertilizers) can be applied at the rate of 112 kg, 25 kg and 48 kg per acre, respectively through inorganic or organic methods. Hence statement #3 is wrong, this eliminates (a), (c) and (d). therefore, answer (b) 1,2,4 only.
28. (c) Integrated Watershed Management Programme (IWMP) was launched during 2009-10. It aims at Prevention of soil runoff, Rainwater harvesting and recharge of groundwater table and Regeneration of natural vegetation.
29. (c) National Park an area of countryside, or occasionally sea or fresh water, protected by the state for the enjoyment of the general public or the preservation of wildlife.
    An animal sanctuary is a facility where animals are brought to live and be protected for the rest of their lives.
    A biosphere reserve is an area of land or water that is protected by law in order to support the conservation of ecosystems, as well as the sustainability of mankind's impact on the environme

30. (c) Nanda Devi Biosphere Reserve is located in Uttarakhand. It was inscribed a World Heritage Site by UNESCO in 1988.
31. (a) Black soils become sticky when it is wet. It is rich in iron, lime, calcium, Magnesium, carbonates, and alumina and poor in Phosphorous, Nitrogen and Organic matter. The soil is black in colour because it is volcanic in origin. It is created from igneous rocks, and is also called 'regur soil'.
32. (b) Red soils are very poor in lime, humous and potash.
33. (c) Jhum is a traditional form of shifting cultivation common in the North-East. Slash-and-burn is a mere land clearing method used by many people around the globe to open up forest land and use it for permanent agriculture. On the contrary, shifting cultivation is an integrated farming system involving forestry, agriculture and strong social organisation on the part of the communities. The village or group of villages practice jhum on one particular tract of land until the soil is depleted of nutrients and then move on to another allowing the former tract of land to regenerate.
34. (d) India has the world's largest cropped and irrigated area.The cropping pattern of foodgrains in India is dominated by cereal crop. The average size of an Indian farm holding isbelow 2 hectares which constitute almost 80% of all Indian farmers.
35. (b) Out of the total forest cover, dense forest constitute around 2.54%; very dense forest and 8.77% are moderately dense forest. National Forestry Action Programme aims a long term plan to achieve the target of 33% forest cover.
36. (c) The fix boundary of a National Park is described in the Wildlife Protection Act, 1972. The legislation states the actual area of the National Park which is notified by the state government. A biosphere reserve conserves an ecosystem and not just few specific species of plants and animals.
37. (c)
38. (c) Laterite soil is rusty red in colour due to iron oxide present in it. In the lateritic soil cashews and tapiocas can be grown.
39. (c)
40. (c) Arjun and Sonalika are hybrid variety of wheat produced by Indian Council of Agricultural Research.
41. (c) India is the original home of cotton plant, and India ranks number one in the world accounting for 20% of the total area planted under cotton. The cotton hybrid variety H–4 developed first and Raj–16, Dhanalaxmi, and Fateh are the variety which were developed in India.
42. (d) India ranked 2nd in the fruit production in the world and ranked 6th in production of tobacco.
43. (b) Cotton, Groundnut and Maize are kharif crop whereas Mustard is a rabi crop.
44. (a) Five varieties of silkworms are reared in India for producing five varieties of silk. Mulberry silk, Muga silk, Tasar silk, Oak tasar silk and Eri silk. India is the 2nd largest producer of sugar in the world.
45. (c)
46. (d) All are used as pulse, folder and green manure ?
47. (d) All of them are predominantly rain fed crops
48. (c) Rice is the main kharif crop and groundnut and cotton are also the kharif crops wheat is a raki.
49. (d) All 1,2 and 3 are true.
50. (d) Kinnaur (Himachal) is famous for apples. Areca nut mostly confined to Karnataka, Kerala and Assam.
Mewat in haryana is not famous for mango. UP is famous for mango.
Similarly, coromandel coast is not famous for soya beans.Top two producers of soya are Madhya Pradesh and Maharashtra which are outside coromandel coast.
Therefore, (d) is the correct option.
51. (d) All three statements are correct as Maize can be used for the production of starch.Oil extracted from maize can be a feedstock for biodiesel. Alcoholic beverages can be produced by using maize.
52. (b) NPK (fertilizers) can be applied at the rate of 112 kg, 25 kg and 48 kg per acre, respectively through inorganic or organic methods. Hence statement #3 is wrong, this eliminates (a), (c) and (d). therefore, answer (b) 1,2,4 only.
53. (c) Excessive/ inappropriate use of nitrogenous fertilizers increase the acidity of soil and Leaching of nitrate to the ground water.
54. (c) Tropical Wet Evergreen Forests are found in Assam, Arunachal Pradesh, Meghalaya, Nagaland, Tripura, West Bengal and Andaman and Nicobar Island and on the eastern and western slopes of the Western Ghats in such states as Tamil Nadu, Karnataka, Kerala and Maharashtra.
55. (d) Cotton grows there
56. (d) Kinnaur (Himachal) is famous for apples. Areca nut mostly confined to Karnataka, Kerala and Assam.
Mewat in haryana is not famous for mango. UP is famous for mango.
Similarly, coromandel coast is not famous for soya beans.Top two producers of soya are Madhya Pradesh and Maharashtra which are outside coromandel coast.
Therefore, (d) is the correct option.
57. (d) The draught prone area programme is by ministry of Rural development to minimise the adverse effects of drought on production of crops and livestock and productivity of land, water and human resources. The

desert development programme is also by ministry of Rural development to minimise the adverse effect of drought and control desertification. National Watershed Development Project for Rainfed Areas is by ministry of agriculture.

58. (c) A. Tropical evergreen forests- Above 200 cm
B. Tropical deciduous forests - 100-200 cm
C. Tropical Dry forest- 50-100 cm
D. Arid forest- Less than 50 cm

59. (d) 1. Manas- Asom
2. Pachmarhi - Madhya Pradesh
3. Nokrek - Meghalaya
4. Achanakmar-Amarkantak- Chhattisgarh,

60. (c)

Tiger Reserves	States
1. Indravati Tiger Reserve -	Chhattishgarh
2. Periyar Tiger Reserve -	Kerala,
3. Simlipal Tiger Reserve -	Odisha
4. Bandipur Tiger Reserve -	Karnataka

61. (c) The correct arrangement from north to south is as follows:
Dudhwa- Uttar Pradesh
Simlipal - Odisha
Indravati - Chattisgarh
Bandipur- Karnataka

62. (d) Chief Producer States
Tea — Assam, West Bengal, Tamil Nadu
Jute — West Bengal, Bihar, Assam, Orissa
Rubber — Kerala, Tamil Nadu, Karnataka
Tobacco — Andhra Praesh, Gujarat, Karnataka, Tamil Nadu

63. (c) Mangrove, Scrub, teak and coniferous are the various types of vegetations found in Karnataka, Rajasthan, Madhya Pradesh and Arunachal Pradesh respectively.

64. (d) Sundari tree is found in Sundarban area of West Bengal. Sundarban is a largest wetland area in the world. Sundarban got its name itself due to abundance of 'Sundari' tree in this area.

65. (d) Achra Ratnagiri Mangrove is in Maharashtra, Coondapur Mangrove is in Karnataka, Pichavaram Mangrove is in Tamil Nadu and Vembanad Mangrove is in Kerala.

66. (b) National Park/ Sanctuary
A. Kanger Ghati National Park - Chhattisgarh
B. Nagerhole National Park - Karnataka
C. Kugti Wildlife Sanctuary - Himachal Pradesh
D. Sultanpur Bird Sanctuary - Haryana

67. (d) Similipal biosphere reserve is in Orissa. Dehong Deband biosphere reserve is in Arunachal Pradesh, Nokrek biosphere reserve is in Meghalaya and Kanchenjunga biosphere reserve is situated in Sikkim.

68. (b) National Park/ Wildlife Sanctuary
Bondla Wildlife Sanctuary - Goa
Kangerghat National Park - Chhattisgarh
Orang Sanctuary - Assam
Ushkothi Wildlife Sanctuary - Orissa.

69. (c)

70. (d) Option 1 is not correct because, Tapioca is not an important crap of Kerala.

71. (a) Barley requires cool climate with poor soil quality. Barley can be grown in high latitude even beyond the Arctic circle. Whereas rice needs hot and moist climate with rich soil.
Millets are grown in hot and dry climate with poor soil, whereas tea needs warm and moist climate with high altitude.

72. (b) The place marked in the given map of India.
'A' refers to Gujarat where groundnut is a major crop.
'B' refers to western part of Maharashtra which is known for sugarcane.
'C' refers to southern part of Orissa and northern part of Andhra Pradesh, where 'Ragi' is cultivated abundantly.
'D' refers Andhra Pradesh and tobacco is cultivated in this area.

73. (a) Gujarat is the foremost producer of cotton. Gram is produced in Madhya Pradesh, Black pepper is produced in Kerala and Pineapple is produced highest in West Bengal.

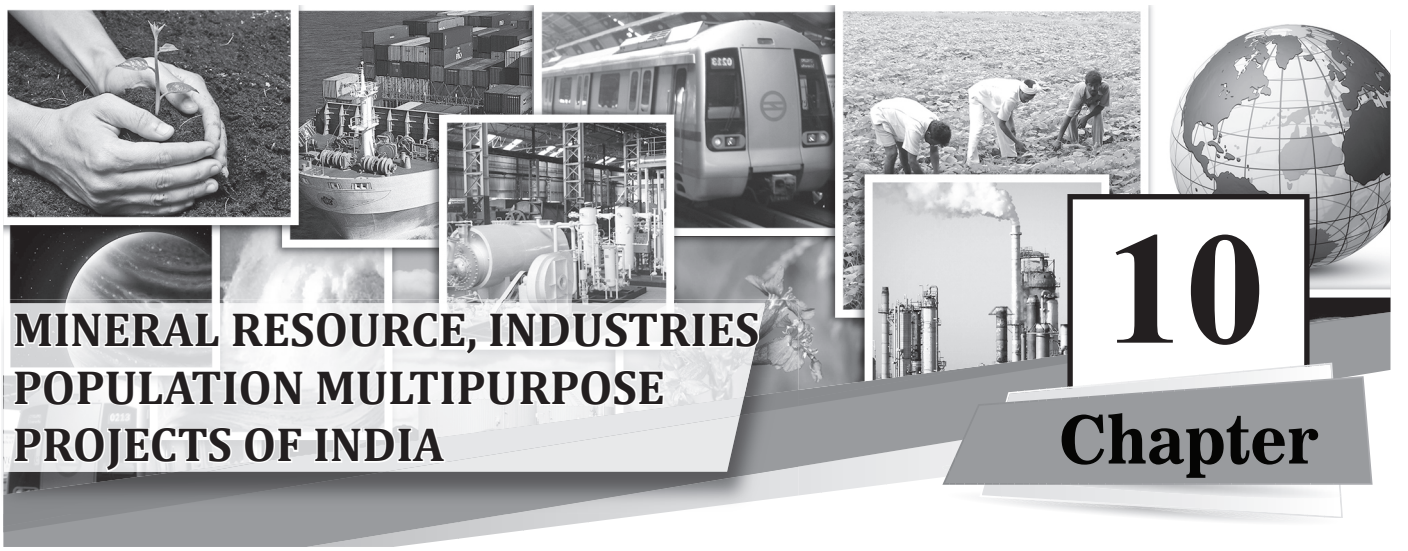
74. (b) A. Cotton cultivation needs 1500–2000 mm and the suitable temperature for cotton growth is 25° – 35°C.
B. Flax cultivation needs 600–800 mm and temperature varies from 5° – 18° C.
C. The suitable climatic condition for sugar beet requires 500–600 mm and temperature 18°–22° C.
D. Jute cultivation needs 500–1000 mm rainfall and temperature between 18°–22°C

75. (d) Through Corbett National Park Ramganga flows (not Ganga) which is a tributary of Ganges. Through Silent Valley National Park river Bhavani flows which is a tributary of Kaveri.
Kaziranga and Manas are both national parks.

76. (d) The draught prone area programme is by ministry of Rural development to minimise the adverse effects of drought on production of crops and livestock and productivity of land, water and human resources. The desert development programme is also by ministry of Rural development to minimise the adverse effect of drought and control desertification. National Watershed Development Project for Rainfed Areas is by ministry of agriculture.

77. (a) Harike Wetlands is at Confluence of Beas and Satluj/Sutlej. The Keoladeo National Park formerly known as the Bharatpur Bird Sanctuary in Bharatpur is at the confluence of two rivers, the Gambhir and Banganga. Kolleru Lake is one of the largest freshwater lakes in India located in state of Andhra Pradesh. Kolleru is located between Krishna and Godavari delta.

78. (c) The Cardamom Hills are southern hills of India and part of the southern Western Ghats located in southeast Kerala and southwest Tamil Nadu. They are not in coromandel coast. Kaimur Range is the eastern portion of the Vindhya Range extending from Madhya Pradesh to Bihar. They are not in konkan coast. The Mahadeo Hills are in Madhya Pradesh, state of central India.Mikir hills are in assam i.e. in North East India.



10 Chapter

MINERAL RESOURCE, INDUSTRIES POPULATION MULTIPURPOSE PROJECTS OF INDIA

MINERAL RESOURCE OF INDIA

Minerals are the natural resources which are used in many industries as raw materials. Iron ore, manganese, bauxite, copper, etc. are such minerals.

Minerals are of two types: **metallic** and **non-metallic**. Iron ore and copper are metallic minerals while limestone and dolomite are non-metallic minerals.

Metallic minerals are further sub-divided into ferrous and **non-ferrous minerals**. Those metallic minerals which have iron content belong to ferrous group. The metallic minerals belonging to non-ferrous group do not have iron content.

India is rich in iron, mica, manganese, bauxite; self sufficient in antimony, building materials, cement materials, clay, chromite, lime, dolomite, and gold, but deficient in copper, lead, mercury, zinc, tin, nickel, petroleum products, rock phosphate, sulphur, and tungsten.

Mineral resources like potassium are totally absent and have to be imported. Minerals like crude petroleum (which accounts for about 80 per cent of the total value of Indian imports) diamonds (uncut), sulphur, and rock phosphorus are imported.

The state with the highest mineral output is Jharkhand. India is rich in ferrrous metals but its reserves of non-ferrous metals are poor.

Mineral	Ore	Found in	Features
Iron	**Magnetite—**the best quality of iron ore and contains 72% pure iron. **Haematite**-contains 60 to 70% pure iron. **Limonite**-contains 40 to 60% pure iron. **Siderite**-contains many impurities and has just 40 to 50% pure iron.	Odisha (Sonai, Mayubhanj, Keonjhar), Jharkhand and Bihar (Singhbhum Hazaribagh, Palamau, Shahbad), Chhattisgarh and Madhya Pradesh (Raipur, Durg, Bastar, Raigarh, Bilaspur, Jabalpur, Balaghat), Andhra Pradesh (Krishna, Kurnool, Chittor, Cuddapha, Warangal, Guntur), Tamil Nadu (Salem, Tiruchirapalli), Karnataka (Ballary, Chitradurg, Chikmagalur), Maharashtra (Ratnagiri, Chanda), Goa	India has the world's largest reserves, approximately one-fourth of world's known reserves; Jharkhand has the largest reserves accounting for about 25% of the total reserves of iron ore in India.
Coal (Black Gold)	**Anthracite Coal—**the best quality of coal and contains 80 to 95% carbon. It is found only in Jammu and Kashmir in small quantity. **Bituminous coal—**The most widely used coal and contains 40 to 80% carbon. It is found in Jharkhand, Orissa, West Bengal, Chhattisgarh and Madhya Pradesh. **Lignite**– Also known as brown coal. It is a lower grade coal and contains about 40 to	Bihar-Jharkhand-Bengal belt (Raniganj, Jharia, Giridih, Bokaro, Karanpur), Madhya Pradesh and Chhattisgarh belt (Singrauli, Korba, Raigarh, Sonhat, Sohagpur. Umaria), Odisha (Desgarh, Talcher), Maharashtra (Chand), Andhra Pradesh (Singreni), Assam (Makum, Lakhimpur); in small quantities in Arunachal Pradesh, Meghalaya, Jammu and Kashmir, and Nagaland	"About one-fourth of India's coal reserves lie in the DamodarValley, across Bihar, Jharkhand, and West Bengal. India is the fourth largest coal producing country in the world according to 1992 coal production in the country."

	50% carbon. It is found in Palna of Rajasthan, Neyveli of Tamil Nadu, Lakhimpur of Assam and Karewa of Jammu and Kashmir. **Peat**–It is the first stage of transformation of wood into coal and contains less than 40% carbon.		
Manganese	India has the second largest manganese ore reserves in the world after Zimbabwe. India is the fifth largest producer in the world after Brazil, Gabon, South Africa and Australia.	Odisha (Keonjhar, Kalahandi, Mayurbhaj, Talcher) Madhya Pradesh (Balaghat, Seoni, Chhindwara, Jabalpur), Maharashtra (Nagpur, Bhandara, Ratnagiri), Gujarat (Panchmahal), Karnataka (Chitradurg, Tumkur, Shimoga, Chikmagalur, Belgaum, North Canara, Dharwar), Jharkhand (Singbhum), Andhra Pradesh (Visakhapatnam), Rajasthan (Udaipur, Bansawara)	Orissa is the leading producer of manganese in the country. India ranks third in world in manganese production.
Mica	The three major types of mica found in India are – Muscovite, Phlogopite and Biotite.	Bihar (Gaya Monghyr), Jharkhand (Hazaribagh), Rajasthan (Ajmer, Shahpur, Tonk, Bhilwara, Jaipur), Andhra Pradesh (Nellore)	India has largest deposits of mica in world India alone contributes about two-thirds of the world's production
Bauxite (aluminium ore)		Jharkhand (Palamu), Gujarat (Kaira), Madhya Pradesh (Katni, Jabalpur, Balaghat, Bilaspur, Bastar), Tamil Nadu (Salem), Karnataka (Chitradurg, Belgaum), Maharashtra (Kolhapur), Jammu and Kashmir (Kotli)	Third largest producer in the world.
Copper	India contributes to about 3.5 to 4% of the world's total production of copper.	Jharkhand (Singhbhum, Hazaribagh), Rajasthan (Khetri, Alwar, Bhilwara, Jhunjhunu, Sirohi), Andhra Pradesh (Guntur, Khamman, Agnigundala), Karnataka (Chitradurg, Hassan, Chikmagalur, Raichur), Madhya Pradesh (Balaghat), Gujarat (Banaskantha); some quantities also found in Sikkim, Punjab, Uttar Pradesh, and Tamil Nadu.	Very meager reserves; almost all copper comes from Singbhum and Hazaribagh in Jharkhand and Khetri in Rajasthan.
Crude oil	51.08 crore tones	Assam, Tripura, Manipur, West Bengal, Ganga Valley, Himachal Pradesh, Kutch of West Bengal coast, Orissa, Andhra Pradesh, Maharashtra, and Gujarat.	
Lignite	429 crore tones	Tamil Nadu (Neyveli fields) Some deposits also found in Gujarat, Punducherry, Rajasthan (Palana fields), Jammu and Kashmir (Riasi fields).	Maximum deposits of about 383 crore tones, are found in Tamil Nadu.
Gold	India's contribution to gold production across the world is less than one percent (0.75%).	Karnataka (Kolar gold fields, Hutti Mines), in small quantities in Andhra Pradesh (Ramgiri gold fields and Anantpur).	Karnataka was the leading producer of gold accounting for 99% of the total production. The remaining production came from Jharkhand.
Magnesite	23.91 crore tones	Tamil Nadu (Salem), Uttranchal (Almora, Chamoli, Pithoragarh), Karnataka (Mysore, Hassan)	

INDUSTRY

Agro-Based Industry

This group of industries depend on the raw material produced by agricultural sector. The products comprise mostly of the consumer goods.

Cotton Textiles Industry

Cotton accounts for 70% of the total fabric produced. The first successful cotton textile mill was set up at Mumbai by a Parsi entrepreneur.

Geographical distribution

Mumbai, Ahmedabad, Surat, Solapur, Pune, Nagpur (Maharashtra and Gujarat). Coimbatore, Madurai and Chennai (Tamil Nadu), Ludhiana (Punjab), Bengaluru (Karnataka), Kolkata (West Bengal), Kanpur (Uttar Pradesh).

Woolen Textile Industry

- The first woolen textiles mill was set up in 1876 at Kanpur, because Kanpur was the principal depot for the British Indian Army.
- The woolen textiles industry in India is partly a cottage industry and partly, a factory industry.

Georaphical spread

Kanpur (Uttar Pradesh), Dhariwal and Ludhiana (Punjab), Mumbai (Maharashtra), Bengaluru (Karnataka), Jamnagar (Gujarat), Srinagar (Jammu and Kashmir).

Jute Textiles Industry

- This jute mill was set up at Rishra near Calcutta in 1855.
- After independence, this sector made rapid progress as an export-oriented industry.

Geographical location

- Nearly 90% of the manufacturing capacity is located in a narrow belt about 100 km long and 3 km wide along river Hooghly.
- Recently slight dispersal of industries have been marked as the use of gunny bag has increased to many folds in sugar and cement industries. These industries are producing gunny bags using local fibres like mesta and Bimlipatlan as the raw material for production.
- West Bengal accounts for 84.1 per cent of the total jute manufactures of the country.
- Andhra Pradesh contributes another 10 percent of the production.
- India ranks number two in the export of jute goods in the world.

Sugar Industry

Indian sugar industry is the second largest agro-based industry in India.

Geographical distribution

Uttar Pradesh and Bihar alone account for 70% of the productive capacity and 75% of the total employment of 30 lakh.

- **Uttar Pradesh:** There are two belts one in western Uttar Pradesh and the other in eastern Uttar Pradesh. The western belt includes Meerut, Saharanpur, Muzaffarnagar, Bijnor and Moradabad, and the eastern belt includes Gorakhpur, Deoria, Basti and Gonda.
- **Bihar:** This is an extension of the eastern Uttar Pradesh belt, which includes Darbhanda, Saran, Champaran and Muzaffarpur.
- The reasons for concentration of sugar industry in Uttar Pradesh and Bihar are–
  - (i) fertile alluvial soil, rich in lime and potash;
  - (ii) level topography-suitable for irrigation;
  - (iii) abundant water for washing and processing;
  - (iv) sugar industry is relatively independent of coal and electricity, because bagasse is enough to run steam;
  - (v) densely populated market with excellent transport links;
  - (vi) availability of cheap labour;
  - (vii) cultivation is done in compact block, which ensures ready availability of fresh cane to factories.
- In Maharashtra, Nasik, Pune, Satara, Sangli, Kolhapur, Sholapur are the centres well integrated in the cooperative sector in terms of cultivation and sugar factories.
- In Punjab, Centres exist mainly in the eastern side, in Phagwara, Dhuri.
- In Karnataka, Munirabad, Shimoga and Mandya are the main centres.
- In Tamil Nadu, Nalikupuram, Pugulur, Coimbatore and Pandyarajpuram are famous for producing sugar.
- Andhra Pradesh. Nizamabad, Medak, west and east Godavari, Visakhapatnam and Chittoor produce sugar.
- In Odisha Bargarh and Rayagada in Odisha produce sugar.
- In Madhya Pradesh, Sehore is the sugar producing centre.

Differences in Sugar production in North India and Peninsular India.

1. Yields are higher in south India
2. The southern sugarcane, being of the tropical variety, has more sucrose content.
3. The crushing season is longer in the south, where it lasts from October to May-June. In the north, it lasts from November to February.

Silk Industry

- India is the only country producing all the five known commercial varieties of silk, viz. Mulberry, Tasar (Tropical), Oak Tasar, Eri and Muga.
- India is the second largest producer of raw silk, accounting for 20% of the world production, next to China.
- Karnataka is the foremost silk producing state in India, which accounts for 50% of Mulberry silk of the country.

- About 50% of India's silk cloth is also manufactured in Karnataka, followed by West Bengal (13% of country's total silk).

Metallurgical Industries

- These industries form the economic backbone of a developing country.

Iron and Steel Industry

- The first iron and steel unit on modern lines was established in 1830 at Porto Novo in Tamil Nadu.
- But the real beginning of modern iron and steel industry was made in 1907 when TISCO was set up at Sakchi, Jamshedpur.
- IISCO was set up in 1919 at Burnpur on the bank river Barakar.
- Mysore steel works at Bhadravati came into existence in 1923, produces alloy and pig iron.
- SAIL was established in 1973.
- India is eighth largest producer of steel in the world.
- The first on-shore steel plant in India was set up at Vishakhapatnam (Andhra Pradesh)
- India is the leading country in the production of sponge iron.
- Steel Authority of India Ltd (SAIL) has the highest sales followed by Tata Steel Ltd (2004-05).

Different Steel Plants and their location

TISCO (Jharkhand)

IISCO (West Bengal)

Visweswaraya Steel Plant (Karnataka)

Bhilai Steel Plant (Chhattisgarh)

Bokaro Steel Plant (Jharkhand)

Rourkela Steel Plant (Orissa)

Durgapur Steel Plant (West Bengal)

Aluminium Smelting Industry

- Aluminium is extracted from bauxite at Muri in Jharkhand.
- The reduction plant of alumina is located at Alupuram in Kerala and the fabrication plant at Belur manufactures aluminium sheets, rods, aluminium paste, electric conductors, domestic utensils etc.
- In order to achieve the economics of scale, a second smelter was set up at Hirakud.
- The Hindustan Aluminium Corporation Limited (HINDALCO) is located at Renukoot near Mirzapur in Uttar Pradesh and the Bharat Aluminium Company (BALCO) has set up two units at Korba and Ratnagiri, to utilize bauxite ores of Amarkantak in Madhya Pradesh and of Udaigiri Dhangarvadi region in Maharashtra, respectively.
- Integrated Aluminium plant of NALCO at Damanjodi near Jeypur in Koraput district of Orissa is the largest complex in India.
- NALCO, the lowest cost producer of aluminium in the world, at present ranked among the top 10 global companies and is the second to HINDALCO in India.
- Aluminium companies with the highest sales in descending order: HINDALCO, NALCO, INDAL, MALCO
- A huge public sector aluminium company, the National Aluminium Company (NALCO) was set up with assistance from a French company at Damanjodi near Jeypore (Koraput district in Odisha)

Engineering Industries

- These industries contribute about 10% of the total exports of the country.
- Heavy Engineering Corporation Ltd was set up at Ranchi (Jharkhand) in 1958.
- Drills for drilling holes in rocky areas are manufactured at Naroda (Ahmedabad).
- Kirloskar Brothers Ltd is the pioneer company in the manufacturing of machine tools.
- HMT is the largest manufacture of machine tools in the country.
- HMT's plants: Bengaluru, Pinjore, Kalamassery (Kerala), Hyderabad, Sri Nagar and Ajmer.
- Locomotives: Chittaranjan Locomotive Works, Diesel Locomotive Works (Varanasi), Tata Engineering and Locomotive Works (Jamshedpur) in 1964.
- BHEL, Bhopal has been developed to manufacture electric locomotive for the Indian railways.
- Wheel and Axle Plant was set up at Bengaluru in 1984.
- The Integral Coach Factory at Perampur near Chennai was set up in 1955 with Swiss collaboration.
- Rail Coach Factory at Kapurthala (Punjab) was set up in 1988.
- Bharat Movers Limited at Bengaluru also produces railways coaches.
- Most of wagons are produced in private sector. About 60% of wagons are produced in West Bengal.

Automobile Industry

- Automobile Industry contributes about 5% to GDP.
- Top four automobile companies with the highest sales:
  - Tata Motors
  - Maruti Udyog Ltd.
  - Mahindra & Mahindra Ltd.
  - Ashok Leyland Ltd.
- In medium and heavy commercial vehicles, TELCO produces over 70% of such vehicles in India.
- In passenger cars, Maruti Udyog Ltd is at the top position.
- Almost the entire production of jeeps comes from Mahindra, Mumbai.
- Indian has second largest market for two - wheelers in the world after China.

Fertilizer Industry

- The first super-phosphate factory was set up at Ranipet in Tamil Nadu in 1906.
- India is now the third largest producer of nitrogenous fertilizers in the world.
- Gujarat has more than 14% of the country's total installed capacity in India followed by Tamil Nadu (11%) and UP (9%).

Aircraft Industry

- The first aircraft industry was set up at Bengaluru in 1940 under the name of Hindustan Aircraft Ltd.
- Later, Hindustan Aircraft Ltd was merged into Aeronautics India Ltd in 1964 to form Hindustan Aeronautics Ltd.
- Different Divisions of HAL and production:
- Nashik division – MIG airframe
- Koraput division – Engine of MIG aircraft
- Hyderabad division – Electronic equipment of MIG.
- Transport aircrafts are manufactured at Kanpur.
- Recently, a factory was set up at Lucknow for producing equipment for aircraft.
- Fertilizer companies with the highest sales are – National Fertilizer Ltd, Tata Chemicals Ltd, Rashtriya Chemicals & Fertilizers Ltd (in descending order).
- India is the third largest producer and consumer of fertilizers in the world.

Cement Industry

- The Indian Cement industry is the second largest in the world after that of China.
- States with the largest cement capacity are Andhra Pradesh, Rajasthan, Madhya Pradesh and Gujarat (in descending order).

Glass Industry

- The main raw material for the industry is silica sand.
- Uttar Pradesh is the leading producer of glass in India followed by West Bengal and Maharashtra.
- Ferozabad in Agra district is the largest producer of glass, followed by Bahjoi, Naini, Hathras, Sasni and Allahabad in Uttar Pradesh.

Indian Towns Associated with Industries

Town	State	Indistries
Ahmedabad	Gujarat	Cotton Textiles
Agra	U.P.	Leather, Marble, Carpet, glass
Aligarh	U.P.	Locks, Cultery
Ankleshwar	Gujarat	Oil Fields
Ambernath	Maharashtra	Machine Tools
Anand	Gujarat	Milk and its Products
Ambala	Haryana	Scientific Instruments
Bangalore	Karnataka	Telephones Aircrafts, Motors, Cotton, Textiles, Toys
Batanagar	West Bengal	Shoes
Barielly	Uttar Pradesh	Resin Industries, Match Factory
Bhilai	Chhattisgarh	Steel Plant
Bhandara	Maharashtra	Explosives
Bhadravati	Karnataka	Iron & Steel
Bhadohi	Uttar Pradesh	Carpets
Churk	Madhya Pradesh	Cement
Cyberabad	Andhra Pradesh	Electronics, Computers, Information Technology
Chitranjan	West Bengal	Locomotive
Kolkata	West Bengal	Jute, Leather, Electric goods
Cochin	Kerala	Coffee, Coconut
Digboi	Assam	Petroleum
Darjeeling	Best Bengal	Tea
Frazabad	Madhya Pradesh	Bangal Works
Hardwar	Uttarkhand	Heavy electricals
Jamshedpur	Jharkhand	Iron & Steel, Locomotives, Railway Coaches
Jabalpur	Madhya Pradesh	Bidi Industry
Jainakot	Jammu & Kashmir	H.M.T. Watch
Kanpur	Uttar Pradesh	Cotton and Woollen mills, Leather, sugar
Katni	Madhya Pradesh	Cement
Koyna	Maharashtra	Aluminium factory
Kanchipuram	Tamil Nadu	Silk Clothes
Karnal	Haryana	Dairy product
Kandla	Gujarat	Chemical fertiliser, famous port
Khetri	Rajasthan	Copper Industries
Ludhiana	Punjab	Hosiery
Lucknow	Uttar Pradesh	Embroidery work, chicken work
Mathura	Uttar Pradesh	Oil refinery
Meerut	Uttar Pradesh	Publication work, sports goods, scissors making
Modinagar	Uttar Pradesh	Nylon thread
Nagpur	Maharashtra	Cotton mills
Nepanagar	Madhya Pradesh	Newsprint
Panna	Madhya Pradesh	Diamond Mining
Pinjore	Haryana	Hindustan Machines Tools
Raniganj	West Bengal	Coal mining
Renukoote	Uttar Pradesh	Aluminium plant
Rishikesh	Uttarkhand	Antibiotic plant
Saharanpur	Uttar Pradesh	Cigarett factory, News print
Srinagar	Jammu & Kashmir	Woolen shawls, silk, woodwork
Surat	Gujarat	Cotton textiles, Diamond Cutting
Vishakhapatnam	Andhra Pradesh	Ship building, Iron, and steel, oil refinery
Varanasi	Uttar Padesh	Rail Engines and Saari Industries

ENERGY

Conventional Energy

- Power development in India commenced with the commissioning of electricity supply in Darjeeling during 1897, followed by a hydropower station at Sivasamudram in Karnataka during 1902.
- India is the fifth largest electricity producing in the world.
- The installed power generation capacity in the country has been increased to 144564.97 MW (31 October 2007) comprising 88216MW thermal, 34391MW hydro, 6190.86MW wind and 3360 MW nuclear.

Major Power Plants

Thermal Power Plant

Power Station	Operator	Year of Establishment	Location	District	State
Talcher Super Thermal Power Station	NTPC	1995	Kaniha	Angul	Odisha
Sipat Thermal Power Plant	NTPC	2008	Sipat	Bilaspur	Chhattisgarh
Vindhyachal Super Thermal Power Station	NTPC	2013	Singrauli	Vindhya Nagar	Madhya Pradesh
Mundra Ultra Mega Power Project	Tata Power	2009	Mundra	Kutch	Gujarat
Korba Super Thermal Power Plant	NTPC	1983	Jamani Palli	Korba	Chhattisgarh
Bhusawal Thermal Power Station	MAHAG ENCO	1968	Deepnagar Jalgaon	Jalgao	Maharashtra
Satpura Thermal Power Station	MPPGCL	1967	Sarni	Betul	Madhya Pradesh
Sterlite Jharsuguda Power Station	Vedanta	2006	Jharsuguda	Jharsuguda	Odisha
Durgapur Thermal Power Station	DVC	1996	Durgapur	Bardhaman	West Bengal

Nuclear Power Plant

Power Station	Operator	Year of Establishment	Location	District	State
Tarapur Atomic Power Station	NPCIL	1969	Tarapur	Thane	Maharashtra
Rajasthan Atomic Power Station	NPCIL	1973	Rawatbhata	Chittorgarh	Rajasthan
Kakrapar Atomic Power Station	NPCIL	1993	Kakrapar	Surat	Gujarat
Kudankulam Nuclear Power Plant	NPCIL	2013	Kudankulam	Tirunelveli	Tamil Nadu
Kaiga Nuclear Power Plant	NPCIL	2000	Kaiga	Uttara Kannada	Karnataka
Madras Atomic Power Station	NPCIL	1984	Kalpakkam	Kancheepuram	Tamil Nadu
Narora Atomic Power Station	NPCIL	1991	Narora	Bulandshahar	Uttar Pradesh
Gorakhpur Atomic Power Station	NPCIL		Fatehabad	Fatehabad	Haryana

Hydro Power Plant

Power Station	Operator	Year of Establishment	Location	State
Bhakra Dam	BBMB	1963	Bilaspur	Himachal Pradesh,
Tehri Dam	THDC India Limited	2006	Tehri	Uttarakhand
Machkund	APGENCO	1955	Jeypore	Andhra Pradesh
Hirakund – I	OHPC	1957	Burla	Odisha
Saradar Sarovar-RBPH	SSNNL	2006	Navagam	Gujrat

Wind Power Plant

Power Station	Operator	Year of Establishment	Location	State
Muppandal Wind Farm	Muppandal Winds	1985	Kanyakumri	Tamil Nadu
Jaisalmer Wind Farm	Suzlon Energy	2001	Jaisalmer	Rajasthan
Brahmanvel Wind Farm	Parakh Agro Industry	2006	Dhule	Maharashtra
Dhalgaon	Grade Mission Export	2008	Sangli	Maharashtra
Damanjodi wind Plant	Suzlon Energy	2014	Koraput	Odisha

India's Major Photovoltaic (PV) Solar Power Plants

Power Station	Operator	Year of Establishment	Location	State
Charanka Solar Power Plant	GMR group	2012	Patan	Gujarat
Neemuch Solar Power Plant	Welspun Solar.	2014	Neemuch	Madhya Pradesh
Sakri Power Plant	Maharashtra state power generation company	2013	Dhule	Maharashtra
GEDCOL Solar Power Plant	Green Energy Development Corporation Ltd.	2014	Boudh district	Odisha
Dhirubhai Ambani Solar Plant	Reliance Industries	2012	Jaisalmer	Rajasthan

OTHER ENERGY SOURCES

- A five KW, geothermal pilot power plant has been commissioned at Manikaran in Kullu district of Himachal Pradesh. Puga valley in Ladakh and Tattapani in Chhattisgarh have been finalised for geothermal plant.
- In tidal energy, India has the potential of 8000-9000 MW. The Gulf of Khambhat (7000 MW), followed by Gulf of Kachchh (1000 MW) and Sunderbans (100 MW) are significant sites for tidal power. The feasibility of a tidal power project at Durgaduani creek in Sunderbans area of West Bengal is also being examined.
- One wave energy power plant has been installed at Vizhinjam near Thiruvananthapuram. Another plant is being set up in the Andaman and Nicobar Islands.
- The first plant of ocean thermal energy conversion of 100 MW is proposed to be set up off the coast of Tamil Nadu.

MAJOR PORTS

On the West Coast

1. **Cochin Port, Kerala:** It is major natural port. It deals in fertilizers, petroleum and general cargo.
2. **Jawaharlal Nehru Port, Maharashtra:** Major port in Mumbai. It is ranked among world's top 30 ports. Earlier it was called as Nhava Sheva.
3. **Kandla Port, Gujarat:** It is a tidal port and a free trade zone has been set up here. Important traffic handles are crude oil, petroleum products, edible oil, foodgrains, salt, cotton etc.
4. **Marmugao Port, Goa:** One of the oldest natural harbour on west coast. It was declared a major port. In 1963. It occupies the fifth position in terms of total quantum of traffic handled.
5. **New Mangalore Port, Karnataka:** It is an all-weather port. Iron ore of Kudremukh is being exported now here. Other items are petroleum products, fertilizers, molasses, etc. It is an Artificial Lagoon port.
6. **Port of Mumbai, Maharashtra:** Port of Mumbai has long been the principal gateway of India. Mumbai handles the maximum traffic. It is a natural harbour with wet dock. It handles over one fifth of the total traffic of ports, mostly petroleum products and dry cargo.

On the East Coast

7. **Kolkata Port, West Bengal:** Kolkata is the oldest major port in the country. Kolkata Port is India's only riverine port. It has the most sophisticated port facilities with extensive storage facility for diverse cargo.
8. **Paradip Port, Odisha:** One of India's major ports, located in Paradip. Government of India declared Paradip as the Eighth Major Port of India on 18 April 1966 making it the first major port in the east coast commissioned in Independent India. It handles iron ore and some quantities of coal and dry cargo. It is a wet dock.
9. **Port of Chennai, Tamil Nadu:** It is the second largest port in the volume of traffic handled. Important items are petroleum products, crude oil, fertilizers, iron ore and dry cargo and oldest artificial port of India. It has artificial harbour and a wet dock.
10. **Port of Visakhapatnam, Andhra Pradesh:** It is described as the Brightest Jewel of all Indian major ports for its outstanding performance and productivity. It is the deepest port. An outer harbour has been developed for exporting iron ore and a berth for crude oil is located here. It has both artificial and natural harbour.
11. **Tuticorin Port, Tamil Nadu :** Tuticorin Port is an artificial deep-sea harbour. It is an all-weather port. It handles mainly coal, salt, edible oil, dry cargo and petroleum products.
12. **Ennore Port Limited, Tamil Nadu:** It is the 12th major port and first corporatised major port in India; a Government of India undertaking. It handles coal, iron ore, LNG, chemical & other liquids, & crude since 2001. Artificial harbour is found here.
13. **Portblair–Andman Nicobar:** It is the latest addition to the major port on June 2010, the thirteen port in the country.

Minor and Intermediate Ports

There are 140 such ports which include Rediport (Maharashtra), Kakinada (Andhra Pradesh) and Calicut (Kerala). Other ports proposed to be developed as minor ports are Andaman and Nicobar, Lakshadweep and Puducherry. These ports can relieve the overloaded major ports and can be used as bases for deep-sea fishing. These ports mainly serve coastal trade and support passenger traffic where there is no proper rail or road link.

Tribal Groups of India

Tribal Group	Found in	Tribal Group	Found in
Abhor	Arunachal Pradesh	Khond	Jharkhand
Adivasi	AP, Bihar, Odisha, Jharkhand, Madhya Pradesh, Maharashtra, Rajasthan, Tamilnadu, Some Northeastern States, West Bangal, Andaman and Nicobar	Khasi	Meghalaya
Ahgani	Manipur	Kharia	Jharkhand, Odisha
Apatani	Arunachal Pradesh	Kol	Madhya Pradesh
Baiga	Madhya Pradesh	Kolam	Maharashtra, Andhra Pradesh, Telengana, MP
Bakarwal	Jammu and Kashmir	Kota	Karnataka
Bhil	M.P and Rajasthan	Kuki	Mizoram
Birhor	M.P and Bihar	Lahaula	Himachal Pradesh
Chang	Nagaland	Lepcha	Sikkim
Chenchuas	Telengana, Karnataka	Lushai	Mizoram, Manipur
Sutiya	Assam	Muria	Chhattisgarh
Gaddis	Himachal Pradesh	Miha	Rajasthan
Gallong	Arunachal Pradesh	Moplah	Malabar
Garo	Meghalaya	Munda	West Bengal, Jharkhand, Odisha, Chhattishgarh
Gond	M.P and Bihar	Nishi	Assam
Gujjar	Rajasthan	Naga	Nagaland
Irula	Tamil Nadu	Oraon	MP, Bihar and Odisha, Chhotanagpur, WB,
Jaintia	Meghalaya	Onges	Andaman & Nicobar
Jarawa	Andamans	Singpho	Assam, Arunachal Pradesh
Kanikar	Tamil Nadu and Kerala	Santhal	WB, Odisha & Bihar, Jharkhand, Assam
Kalkari	Maharashtra	Sangtam	Nagaland
Kharia	Maharashtra	Sema	Nagaland
		Sentinelese	Andaman & Nicobar
		Shompen	Andaman & Nicobar
		Toda	Tamil Nadu
		Uralis	Kerala
		Wancho	Arunachal Pradesh
		Warli	Maharashtra, Daman and Diu, Bihar, Madhaya Pradesh, West Bengal Dadra, Nagar Haveli

1. Highest Population (State)

(i) U.P. – 19.981 crore

(ii) Maharastra – 11.237 crore

(iii) Bihar – 10.409 crore

Highest Population (Union Territory)

(i) Delhi – 16787941

(ii) Puducherry – 1247953

(iii) Chandigarh – 1055450

2. Lowest Population (State)

(i) Sikkim – 610,577

(ii) Mizoram – 1,097,206

Lowest population (U.T.)
(i) Lakshadweep – 64,473
(ii) Daman & Diu – 243,247

3. Highest Literacy (State)
(i) Kerala – 94%
(ii) Mizoram – 91.3%
(iii) Goa – 88.7%
(iv) Tripura – 87.2%

4. Lowest Literacy (State)
(i) Bihar – 61.8%
(ii) Arunanchal Pradesh – 65.4%
(iii) Rajasthan – 66.1%

Highest Literacy (U.T.)
(i) Lakshedweep – 91.8%
(ii) Daman & Diu – 87.1%
(ii) Andmann & Nicobar Island – 86.6%

Lowest Literacy (U.T.)
(i) Dadara & Nagar Haveli – 76.2%
(ii) Puducherry – 85.8%

5. Highest Sex Ratio (State)
(i) Kerala – 1084
(ii) Tamil nadu – 996
(iii) Andhra pradesh – 993

Lowest Sex Ratio (State)
(i) Haryana – 879
(ii) Jammu & Kasmir – 889
(iii) Sikkim – 890

Highest Sex Ratio (U.T.)
(i) Puducherry – 1087
(ii) Lakshadweep – 947
(iii) Andmann & Nicobar Island – 876

Lowest Sex Ratio (U.T.)
(i) Daman & Diu – 618
(ii) Dadra & Nagar Haweli – 774

6. Highest Density (State)
(i) Bihar – 1106
(ii) W. Bengal – 1028
(iii) Kerala – 860

Highest Density (U.T.)
(i) Delhi – 11320
(ii) Chandigarh – 9258
(iii) Puducherry – 2547

Lowest Density (State)
(i) Arunanchal Pradesh – 17
(ii) Mizoram – 52
(iii) Sikkim – 86

Lowest Density (U.T.)
(i) Andman & Nicobar – 46
(ii) Dadra and Nagar Haweli – 700

7. Highest population growth (State)
(i) Meghalaya – 27.9
(ii) Arunanchal Pradeah – 26.0
(iii) Bihar – 25.4

Lowest population growth (State)
(i) Nagaland – (–) 0.6
(ii) Kerala – 4.9
(ii) Lakshadweep – 6.3

Highest population growth (U.T.)
(i) Dadar & Nagar Haweli – 55.90
(ii) Daman & Diu – 53.8

Lowest population growth (U.T.)
(i) Lakshadweep – 6.3
(ii) Andmann & Nicobar Island – 6.9

Ethnic Groups		
Tribes	**Race**	**Islands**
Onges	Negroid	Little Nicobar
Sentinelese	Negroid	Sentinel Island
Jarawa	Negroid	Middle & South Andaman
Andamanese	Negroid	Strait Island
Shompen	Mongloid	Great Nicobar
Nicobarese	Mongloid	Great Nicobar

Multipurpose Projects

Sr. No.	Name of the Project	River	Purpose	Beneficiary States
1.	Bhakra-Nangal Project The project consists of: (i) Bhakra dam (second highest in the world) - 518 m long, 226 high (ii) Nangal dam (iii) Nangal hydel channels (iv) 4 power houses (Biggest in Asia)	Sutlej (Hoshiarpur district in Punjab)	Power and irrigation	Punjab, Himachal Pradesh, Haryana, and Rajasthan
2.	Damodar Valley Corporation Project The project consists of: (i) Tilaiya dam (ii) Konar dam (iii) Maithon dam (iv) Panchet Hill dam (v) Power houses at Bokaro, Durgapur, and Chandrapur	Damodar	Power, irrigation, flood control	Bihar and West Bengal, shared by Madhya Pradesh

3.	Hirakund This is a dam project. The main dam is 4,800 m long, 28.9 m high (World's largest mainstream dam)	Mahanadi	Power and irrigation	Odisha
4.	Tungabhadra Project	Tungabhadra (tributary of river Krishna)	Power and irrigation	Andhra Pradesh and Karnataka
5.	Mayurakshi Project	Murali	Power and irrigation	West Bengal
6.	Nagarjunasagar Project	Krishna	Power and irrigation	Andhra Pradesh
7.	Gandak River Project	Gandak (tributary of Ganga)	Power and irrigation	Bihar, Uttar Pradesh, Nepal (Joint venture of India and Nepal)
8.	Kosi Project	Kosi	Flood control, power and irrigation	Bihar
9.	Farakka Project	Ganga, Bhagirathi	Power, irrigation, avoid accumulation of silt to improve navigation	West Bengal
10.	Beas Project Units : Beas-Sutlej link Beas dam at Pong Beas transmission system	Beas	Irrigation and power	Rajasthan, Haryana, Punjab, and Himachal Pradesh
11.	Rajasthan Canal Project	Sutlej in Punjab, Beas, and Ravi	Irrigation	Rajasthan, Punjab and Haryana
12.	Chambal Project Units (a) Gandhisagar dam (b) Rana Pratap Sagar dam (c) Jawahar Sagar dam	Chambal	Power and irrigation	Madhya Pradesh and Rajasthan
13.	Kakrapara Project	Tapti	Irrigation	Gujarat
14.	Nagpur Power Station		Koradi	Thermal power Maharashtra
15.	Ukai Project	Tapti	Power and irrigation	Gujarat
16.	Tawa Project	Tawa (Narmada)	Irrigation	Madhya Pradesh
17.	Poochampad Project	Godavari	Irrigation	Andhra Pradesh
18.	Malaprabha Project	Malaprabha	Irrigation	Karnataka
19.	Durgapur Barrage	Damodar	Irrigation, Navigation, between Kolkata and Raniganj	West Bengal and Bihar
20.	Mahi	Mahi	Irrigation	Gujarat
21.	Mahanadi Delta Project	Mahanadi	Irrigation	Orissa
22.	Idukki Project	Periyar	Hydroelectricity	Kerala
23.	Koyna Project	Koyna	Hydroelectricity	Maharashtra
24.	Upper Krishna Project	Krishna	Irrigation	Karnataka
25.	Ramaganga Multipurpose Project	Chisot stream near kala	Power and irrigation	Uttar Pradesh
26.	Matatilla project	Betwa	Multipurpose power and irrigation	Uttar Pradesh and Madhya Pradesh
27.	Tehri Dam Project	Bhilangana, Bhagirath	Hydroelectricity	Uttar Pradesh
28.	Narmada Sagar Valley Project	Narmada	–	Madhya Pradesh, Gujarat, Rajasthan, and Maharashtra
29.	Obra Power Station	Obra	Thermal power	Uttar Pradesh
30.	Rihand Scheme	Rihand	Hydroelectricity	Uttar Pradesh
31.	Kundah Project	Kundah	Hydroelectricity and irrigation	Tamil Nadu

Exercise -1

1. The iron ore mined at Bailadila is mostly
   (a) Haematite (b) Siderite
   (c) Limonite (d) Magnetite
2. Why is Gujarat, the largest producer of salt in India?
   (a) Gujarat possesses the largest dry coastal area
   (b) The sea water here is more saline
   (c) Gujarat farmers are highly skilled in making salt
   (d) Gujarat has large areas of shallow sea
3. The largest industry in India is
   (a) Textiles industry (b) Steel industry
   (c) Cement industry (d) Automobile industry
4. Among sources of power, India has largest reserves of
   (a) coal (b) oil
   (c) natural gas (d) atomic power
5. Rangap in Sikkim is famous for
   (a) bauxite (b) mica
   (c) copper (d) aluminium
6. The correct sequence in decreasing order in terms of total production of the given non-ferrous metals in India is
   (a) lead, zinc, copper, aluminium
   (b) zinc, lead, aluminium, copper
   (c) aluminium, zinc, copper, lead
   (d) aluminium, copper, zinc, lead
7. The refining capacity of crude oil is highest in the
   (a) Haldia oil refinery
   (b) Mathura oil refinery
   (c) Gujarat oil refinery
   (d) Vishakhapatnam oil refinery
8. Contact metamorphism is
   (a) small scale heating and alteration of rock by localized igneous intrusion
   (b) structural alteration of rock through pressure
   (c) large scale heating and modification of rocks at subduction zones
   (d) None of these
9. In the Indian context the term 'De-notified tribes' refers to:
   (a) tribes which are aboriginals
   (b) nomadic tribes
   (c) tribes practising shifting cultivation
   (d) tribes which were earlier classified as criminal tribes
10. Which one of the following major sea ports of India does not have a natural harbour?
    (a) Bombay (b) Cochin
    (c) Marmagao (d) Paradeep
11. The correct sequence in the ascending order of the given cities in terms of altitude above mean sea level is:
    (a) Marmugao, Mumbai, Kolkata, Chennai
    (b) Mumbai, Kolkata, Chennai, Marmugao
    (c) Chennai, Marmugao, Mumbai, Kolkata
    (d) Kolkata, Mumbai, Chennai, Marmugao
12. Which of the following is not associated with oilfields in India?
    (a) Bombay High (b) Digboi
    (c) Ankleshwar (d) Bijapur
13. In terms of the mineral resources/deposits, the leading state in India is :
    (a) Bihar (b) Madhya Pradesh
    (c) Karnataka (d) Rajasthan
14. The Central Building Research Institue is located at :
    (a) Bareily (b) Lucknow
    (c) Roorkee (d) Madurai
15. Which one of the following National Highways passes through Maharashtra, Chhattisgarh and Odisha?
    (a) NH 4 (b) NH 5
    (c) NH 6 (d) NH 7
16. Which one of the following is a 'foot loose' industry?
    (a) Paper (b) Cement
    (c) Electronics (d) Iron & Steel
17. Which one of the following pairs is not correctly matched?

Important Location (Industry/Mining)		State
(a) Himgiri	—	Uttar Pradesh
(b) Koraput	—	Orissa
(c) Palana	—	Rajasthan
(d) Nellore	—	Andhra Pradesh

18. Which one of the following cities is NOT connected by NH -3 ?
    (a) Agra (b) Bhopal
    (c) Dhule (d) Gwalior
19. Among the following Union Territories, which one has the highest density of population?
    (a) Dadra and Nagar Haveli
    (b) Daman and Diu
    (c) Lakshadweep
    (d) Pondicherry
20. The leading states in the production of cotton in India are:
    (a) Maharashtra and Gujarat
    (b) Gujarat and Andhra Pradesh
    (c) Maharashtra and Punjab
    (d) Gujarat and Punjab
21. Which one of the following Indian States is the largest producer of natural rubber ?
    (a) Tamil Nadu (b) Kerala
    (c) Assam (d) Andhra Pradesh
22. Which one of the following National Highways links Jabalpur, Nagpur, Hyderabad, Bangalore and Madurai ?
    (a) NH 5 (b) NH 7
    (c) NH 9 (d) NH 11
23. Haridwar is well-known for which one of the following industries?
    (a) Fertilizers (b) Cement
    (c) Heavy Electricals (d) Silk Textiles
24. The Nuclear Power Station Rawatbhata is in which State?
    (a) Maharashtra (b) Uttar Pradesh
    (c) Rajasthan (d) Tamil Nadu
25. Mahatma Gandhi Hydroelectric project is on which river?
    (a) Godavari (b) Sharavati
    (c) Cauvery (d) Krishna

26. The National Highway No. 7 connects which of the following?
(a) Mumbai with Varanasi
(b) Mumbai with Bhubaneshwar
(c) Delhi with Kanyakumari
(d) Varanasi with Kanyakumari

27. Among the following, which state has highest level of literacy?
(a) Mizoram (b) West Bengal
(c) Kerala (d) Punjab

28. Which among the following is the major item of export from Paradeep Port?
(a) Rice (b) Tea
(c) Fish (d) Iron ore

29. Which one of the following types of coal has highest amount of carbon and burns without smoke ?
(a) Anthracite (b) Bituminous coal
(c) Lignite (d) Peat

30. Which one among the following is a correct sequence of production of coal in the Indian States in descending order?
(a) Jharkhand – Madhya Pradesh – West Bengal – Meghalaya
(b) West Bengal – Madhya Pradesh – Jharkhand – Meghalaya
(c) Jharkhand – West Bengal – Meghalaya – Madhya Pradesh
(d) Madhya Pradesh – Jharkhand – West Bengal – Meghalaya

31. The Ruhr basin is the famous industrial region of
(a) China (b) Japan
(c) Germany (d) United Kingdom

32. Monoculture is a distinct characteristic of
(a) Commercial grain farming
(b) Shifting cultivation
(c) Subsistence farming
(d) Organic farming

33. Kimberley is famous for
(a) Gold Mining (b) Diamond mining
(c) Steel industry (d) Automobile industry

34. Which one of the following is a fossil source of energy?
(a) Wood (b) Solar radiation
(c) Tidal waves (d) Petroleum

35. The largest producer of tungsten in the world is
(a) Australia (b) China
(c) Russia (d) U.S.A.

36. Which one of the following deserts is famous for its nitrate deposits?
(a) Atacama (b) Gobi
(c) Kalahari (d) Sahara

37. The per capita CO_2 emission is the highest in
(a) China (b) India
(c) Japan (d) U.S.A.

38. Which of the following countries is the greatest producer of bauxite in the world?
(a) Argentina (b) India
(c) South Africa (d) Brazil

39. The lines of equal transport cost in the industrial location model of Alfred Weber are known as
(a) Isoline (b) Isobar
(c) Isodapen (d) Isotim

40. Krivoirog is known for
(a) Textile industry (b) Chemical industry
(c) Iron-ore mining (d) Bauxite mining

41. The largest iron-ore producing region in the U.S.A. is
(a) North East Appalachian region
(b) Albama region
(c) Lake superior region
(d) Sierra Nevada region

42. The major agricultural regions of the world were first delineated by
(a) L.D. Stamp (b) H. Bobek
(c) D. Whittlesey (d) J.E. Spencer

43. Plantation agriculture is practical mainly in the
(a) Arid region
(b) Mediterranean region
(c) Temperate region
(d) Tropical region

44. Which region is called the bread basket of the world?
(a) Temperate grassland
(b) Savanna grassland
(c) Mediterranean region
(d) Mid latitude forest

45. The Broken Hill of Australia is famous for the mining of
(a) Zinc (b) Silver
(c) Lead (d) All of these

46. Which one of the following countries is the largest producer of Geo-thermal energy in the world?
(a) Australia (b) New Zealand
(c) U.S.A. (d) U.K.

47. Katanga province of Zaire is famous for
(a) Copper (b) Coal
(c) Gold (d) Diamond

48. Which of the following crops are grown mostly under subsistence forming?
(a) Millets and Rice
(b) Cotton and Tobacco
(c) Tea and Coffee
(d) Vegetables and Fruits

49. Teak and Sal are products of
(a) Tropical dry deciduous Forest
(b) Tropical Evergreen Forests
(c) Tropical Thorn Forests
(d) Alpine Forests

50. Dapog method of rice nursery was developed in
(a) China (b) Indonesia
(c) Japan (d) Philippines

51. Which one of the following districts does not have a gold field?
(a) Anantpur (b) Kolar
(c) Raichur (d) Vishakhapatnam

52. Which one of the following iron and steel plants was established with the British collaboration?
(a) Bhilai (b) Rourkela
(c) Bokaro (d) Durgapur

53. Which one of the following is the correct sequence of the

nuclear power plants of India in the increasing order of their installed power generation capacity?
(a) Rawatbhata-Narora-Kaiga-Tarapur
(b) Narora-Kaiga-Rawatbhata-Tarapur
(c) Kaiga-Tarapur-Narora-Rawatbhata
(d) Tarapur-Narora-Kaiga-Rawatbhata

54. Rihand Valley Project is located in which one of the following states?
(a) Odisha (b) Gujarat
(c) Himachal Pradesh (d) Uttar Pradesh

55. In which of the following State is Kakrapar Nuclear Power Station located? [2008-II]
(a) Karnataka (b) Tamil Nadu
(c) Maharashtra (d) Gujarat

56. Which of the following sequences of the oil refineries of India as they occur from South to North is correct?
(a) Kochi-Mangalore-Mumbai-Koyali
(b) Koyali-Mumbai-Mangalore-Kochi
(c) Kochi-Mumbai-Mangalore-Koyali
(d) Mangalore-Kochi-Mumbai-Koyali

57. Which water body separates Australia from New Zealand?
(a) Cook Straits (b) Megallan
(c) Tasman Sea (d) Great Barrier Reef

58. Which one of the following does not have a heavy water plant?
(a) Narora (b) Sriharikota
(c) Kakrapar (d) Kota

Exercise -2

Statement Based MCQ

1. Which of the following statements are true with respect to iron ore ?
1. Limestone and coal are important for smelting iron ore.
2. More than 20 per cent iron ore deposits of the world are in India.
3. Odisha and Bihar top in the production of iron ore.
4. Iran is the largest buyer of Indian iron ore.
Select the correct answer using the code given below:
(a) 1, 2 and 3 (b) 2 and 3
(c) 3 and 4 (d) 2, 3 and 4

2. Which of the following minerals found in a natural way in the state of Chhattisgarh?
1. Bauxite 2. Dolomite
3. Iron ore 4. Tin
Select the correct answer using the code given below:
(a) 1, 2 and 3 (b) 1 and 3
(c) 2 and 4 (d) 1, 2, 3 and 4

3. Which of the following are true with regard to coal in India ?
1. Coal is found in sedimentary rocks.
2. The best quality of coal is lignite.
3. The largest and oldest coalfield in India is Raniganj.
4. The Damodar river valley is popularly known as the 'Ruhr of India'.
Which of the statements are correct?
(a) 1 and 4 (b) 1, 2 and 3
(c) 1, 3 and 4 (d) 2, 3 and 4

4. Which of the following statement(s) is/are correct?
1. Broad gauge railway engines-Varanasi.
2. Electric locomotives-Bhopal.
3. Integral Coach Factory-Calcutta.
Which of the statement(s) is/are correct?
(a) 1 only (b) 2 only
(c) 3 only (d) 1, 2 and 3

5. Which of the following is/are matched correctly?
1. Garnet gem - Kanyakumari (Tamil Nadu)
2. Corundum - Tonk (Rajasthan)
3. Gold - Chittor (Andhra Pradesh)
4. Magnesite - Salem (Tamil Nadu)
Select the correct answer using the code given below:
(a) 1 and 2 (b) 2 and 3
(c) 1, 2 and 3 (d) 2, 3 and 4

6. Which of the following is true with regard to petroleum?
1. It is found in the anticlines
2. It is found over underground water
3. It is found in wide, horizontal rocks
4. It is found over impermeable rocks
Select the correct answer using the code given below:
(a) 1 and 2 (b) 1, 2 and 4
(c) 2 and 4 (d) 2 and 3

7. Consider the following sites /monuments :
1. Champaner-Pavagadh Archaeological Park
2. Chhatrapati Shivaji Railway Station, Mumbai
3. Mahallapuram
4. Sun Temple (Konark Temple)
Which of the above are included in the World Heritage List of UNESCO?
(a) 1, 2 and 3 (b) 1, 3 and 4
(c) 2 and 4 (d) 1, 2, 3 and 4

8. Between India and East Asia, the navigation-time and distance can be greatly reduced by which of the following?
1. Deepening the Malacca straits between Malaysia and Indonesia.
2. Opening a new canal across the Kra isthmus between the Gulf of Siam and Andaman Sea.
Which of the statements given above is/are correct ?
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

9. Arrange the following states of north-east in descending order in accordance with the population density
1. Nagaland 2. Manipur
3. Tripura 4. Meghalaya
Select the correct answer:
(a) 1, 2, 3 and 4 (b) 3, 1, 2 and 4
(c) 1, 2, 4 and 3 (d) 3, 1, 4 and 2

10. Consider the following statements:
    1. Nagaland has no Scheduled Caste population.
    2. Literacy among Scheduled Caste is better than that among the Scheduled Tribes.
    3. Haryana has no Scheduled Tribe population.
    Select the correct statements:
    (a) 1, 2 and 3 (b) 1 and 3
    (c) 2 only (d) 1 only
11. Consider the following areas:
    1. Himalayas 2. Chhota Nagpur
    3. Chhattisgarh 4. Sone Valley
    What is the correct sequence of these areas in descending order of their coal reserves ?
    (a) 1, 4, 3 and 2 (b) 2, 4, 3 and 1
    (c) 1, 3, 4 and 2 (d) 2, 3, 4 and 1
12. Consider the following statements :
    1. The first newsprint plant set up in India was in Nepanagar.
    2. The first **modern** steel plant in India was set up at Bhadrawati.
    Which of these statements is/are correct ?
    (a) 1 only (b) 2 only
    (c) Both 1 and 2 (d) Neither 1 nor 2
13. Consider the following statements
    1. In India, the largest concentration of roads is found in the northern plains.
    2. The ratio of surfaced road to the total road length is lower in the northern plains .
    Which of the statements given above is/are correct?
    (a) 1 only (b) 2 only
    (c) Both 1 and 2 (d) Neither 1 nor 2
14. Which of the following are not the examples of shifting cultivation?
    Select the correct answer from the codes given below:
    1. Ladang 2. Hacienda
    3. Fazenda 4. Pondu
    (a) 1 and 2 (b) 1 and 3
    (c) 2 and 4 (d) 3 and 4
15. Which of the following is/are the characteristic/ characteristics of Indian coal?
    1. High ash content
    2. Low sulphur content
    3. Low ash fusion temperature
    Select the correct answer using the codes given below.
    (a) 1 and 2 only (b) 2 only
    (c) 1 and 3 only (d) 1, 2 and 3
16. Consider the following statements:
    1. Natural gas occurs in the Gondwana beds.
    2. Mica occurs in abundance in Kodarma.
    3. Dharwars are famous for petroleum.
    Which of the statements given above is/are correct?
    (a) 1 and 2 (b) 2 only
    (c) 2 and 3 (d) None
17. Consider the following towns of India:
    1. Bhadrachalam 2. Chanderi
    3. Kancheepuram 4. Karnal
    Which of the above are famous for the production of traditional sarees/ fabric?
    (a) 1 and 2 only (b) 2 and 3 only
    (c) 1, 2 and 3 (d) 1,3 and 4.
18. Arrange the following countries in the descending order of their wheat production and select the correct answer from the codes given below:
    1. China 2. India
    3. Russia 4. U.S.A.
    (a) 1, 2, 3, 4, (b) 1, 2, 4, 3
    (c) 2, 3, 4, 1 (d) 4, 1, 2, 3
19. Which of the following is accredited with the Geographical Indication (GI) mark?
    1. Handwoven Pashmina shawls of Kashmir.
    2. Bhagalpur Silk, Bihar.
    3. Madurai Idly, Tamil Nadu.
    4. Darjeeling Tea, West Bengal.
    Select the answer from the codes given below:
    (a) 1, 2, and 3
    (b) 2, 3, and 4
    (c) 1, 3, and 4
    (d) All of the above
20. Match the following

List I (Place)	List II (Industry)
A. Muzaffarnagar	1. Cotton textiles
B. Adoni	2. Sugar
C. Ranchi	3. Sports goods
D. Jalandhar	4. Engineering goods

    Codes

	A	B	C	D
(a)	2	1	4	3
(b)	1	3	4	2
(c)	2	3	4	1
(d)	1	4	3	2

Matching Based MCQ

DIRECTIONS (Qs. 18 to 43) : Match List-I with List-II and select the correct answer using the codes given below the lists.

21.

List-I (Aluminium Company)	List II (Location)
(A) BALCO	(1) Hirakund
(B) HINDALCO	(2) Korba
(C) Indian Aluminium Company	(3) Koraput
(D) NALCO	(4) Renukoot

    (a) A – 3 ; B – 1 ; C – 4 ; D – 2
    (b) A – 2 ; B – 4 ; C – 1 ; D – 3
    (c) A – 3 ; B – 4 ; C – 1 ; D – 2
    (d) A – 2 ; B – 1 ; C – 4 ; D – 3

22.

List-I	List-II
(A) Paper	(1) Vijaynagar
(B) Heavy Engineering	(2) Varanasi
(C) Locomotives	(3) Hatia
(D) Steel production	(4) Nepanagar

    (a) A – 3 ; B – 4 ; C – 1 ; D – 2
    (b) A – 4 ; B – 3 ; C – 2 ; D – 1
    (c) A – 3 ; B – 1 ; C – 2 ; D – 4
    (d) A – 4 ; B – 2 ; C – 1 ; D – 3

23.

List-I (Minerals)	List-II (States)
(A) Uranium	(1) Rajasthan
(B) Copper	(2) Bihar
(C) Zinc	(3) Karnataka
(D) Lignite	(4) Tamil Nadu
(E) Gold	(5) Odisha

(a) A – 1 ; B – 2 ; C – 3 ; D – 4 ; E – 5
(b) A – 2 ; B – 5 ; C – 1 ; D – 4 ; E – 3
(c) A – 4 ; B – 5 ; C – 2 ; D – 1 ; E – 3
(d) A – 5 ; B – 1 ; C – 3 ; D – 1 ; E – 2

24.

List-I (Minerals)	List-II (Areas)
(A) Gold	(1) Khetri
(B) Coal	(2) Kolar
(C) Copper	(3) Kudremukh
(D) Iron	(4) Jharia

(a) A – 2 ; B – 4 ; C – 1 ; D – 3
(b) A – 1 ; B – 2 ; C – 3 ; D – 4
(c) A – 4 ; B – 3 ; C – 2 ; D – 1
(d) A – 3 ; B – 4 ; C – 1 ; D – 2

25.

List-I Atomic power stations	List-II States
(A) Kakrapara	(1) Rajasthan
(B) Narora	(2) Gujarat
(C) Kalpakkam	(3) Tamil Nadu
(D) Tarapur	(4) Maharashtra
(E) Kota	(5) Uttar Pradesh

(a) A – 1 ; B – 2 ; C – 3 ; D – 4 ; E – 5
(b) A – 5 ; B – 4 ; C – 3 ; D – 2 ; E – 1
(c) A – 2 ; B – 5 ; C – 3 ; D – 4 ; E – 1
(d) A – 1 ; B – 4 ; C – 2 ; D – 3 ; E – 5

26.

List-I	List-II
(A) BHEL	(1) Atomic
(B) HAL	(2) Electronic
(C) SAIL	(3) Aeronautics
(D) BPCL	(4) Chemicals
(E) NPTC	(5) Iron and steel

(a) A – 2 ; B – 3 ; C – 5 ; D – 4 ; E – 1
(b) A – 5 ; B – 4 ; C – 3 ; D – 2 ; E – 1
(c) A – 1 ; B – 2 ; C – 3 ; D – 4 ; E – 5
(d) A – 4 ; B – 2 ; C – 3 ; D – 1 ; E – 5

27.

List-I Public Sector	List-II Location Undertaking
(A) Fertilizer Corporation of India	(1) Pimpri
(B) Hindustan Antibiotics Ltd.	(2) Sindri
(C) Indian Rare Earths Ltd.	(3) Nepanagar
(D) National Newsprint Ltd.	(4) Alwaye

(a) A – 2 ; B – 1 ; C – 4 ; D – 3
(b) A – 1 ; B – 2 ; C – 3 ; D – 4
(c) A – 4 ; B – 3 ; C – 2 ; D – 1
(d) A – 3 ; B – 1 ; C – 2 ; D – 4

28.

List-I	List-II
(A) Central Building Research Institute	(1) Madras
(B) Central Road Research Institute	(2) Roorkee
(C) Central Drug Research Institute	(3) Lucknow
(D) Central Leather Research Institute	(4) New Delhi
	(5) Dhanbad

(a) A – 1 ; B – 2 ; C – 3 ; D – 5
(b) A – 2 ; B – 4 ; C – 3 ; D – 1
(c) A – 4 ; B – 3 ; C – 2 ; D – 1
(d) A – 5 ; B – 4 ; C – 1 ; D – 3

29.

List-I	List-II
(A) Highest decadal growth in population	(1) Kerala
(B) Highest rural population growth rate	(2) Nagaland
(C) Lowest rural population growth rate	(3) Tamil Nadu
(D) Lowest decadal growth in population	(4) Odisha
	(5) Karnataka

(a) A – 2 ; B – 3 ; C – 4 ; D – 1
(b) A – 5 ; B – 2 ; C – 3 ; D – 1
(c) A – 2 ; B – 4 ; C – 3 ; D – 5
(d) A – 3 ; B – 4 ; C – 1 ; D – 5

30.

List-I (Industry)	List-II (Industrial Centre)
(A) Aluminium	(1) Coimbatore
(B) Heavy Electricals	(2) Renukoot
(C) Petrochemicals	(3) Vadodara
(D) Cotton Textiles	(4) Jagdishpur

(a) A – 2; B – 4; C – 3; D – 1
(b) A – 1; B – 3; C – 4; D – 2
(c) A – 1; B – 4; C – 3; D – 2
(d) A – 2; B – 3; C – 4; D – 1

31.

List-I (National Highway No.)	List-II (Cities connected)
(A) NH 5	(1) Bhopal-Jaipur
(B) NH 7	(2) Bhubaneswar- Chennai
(C) NH 9	(3) Nagpur-Varanasi
(D) NH 12	(4) Pune-Hyderabad

(a) A – 2; B – 1; C – 4; D – 3
(b) A – 4; B – 3; C – 2; D – 1
(c) A – 2; B – 3; C – 4; D – 1
(d) A – 4; B – 1; C – 2; D – 3

32.

List-I (Country)	List-II (Coal fields)
A. China	1. Pennsylvania
B. Germany	2. Saar
C. Ukraine	3. Shensi
D. U.S.A.	4. Donetz Basin

	A	B	C	D
(a)	4	2	1	3
(b)	3	2	4	1
(c)	3	1	4	2
(d)	4	3	2	1

33.

List-I (Iron and steel centre)	List-II (Country)
A. Cleveland	1. Canada
B. Essen	2. Russia
C. Hamilton	3. U.S.A.
D. Tula	4. Germany

	A	B	C	D
(a)	1	4	2	3
(b)	3	4	1	2
(c)	3	1	2	3
(d)	4	3	1	2

34

List-I (Mineral)	List-II (Mine)
A. Diamond	1. Butte
B. Coal	2. Kimberley
C. Cobalt	3. Katanga
D. Silver	4. Saar

	A	B	C	D
(a)	4	3	2	1
(b)	2	4	3	1
(c)	3	4	1	2
(d)	2	1	3	4

35

List-I	List-II
A. Detroit	1. Cutlery
B. Pittsburgh	2. Ship building
C. Plymouth	3. Iron and steel
D. Sheffield	4. Automobile

	A	B	C	D
(a)	4	3	1	2
(b)	2	3	1	4
(c)	3	1	4	2
(d)	4	3	2	1

36.

List-I (Crops)	List-II (Largest producer)
A. Wheat	1. Brazil
B. Cotton	2. China
C. Sugarcane	3. U.S.A.
D. Tea	4. India

	A	B	C	D
(a)	1	2	3	4
(b)	2	3	1	4
(c)	2	4	3	1
(d)	4	1	2	3

37.

List-I	List-II
A. Shifting cultivation	1. Mongolia
B. Nomadic herding	2. Australia
C. Livestock ranching	3. Tundra Region
D. Fishing and hunting	4. Amazon Basin

	A	B	C	D
(a)	1	3	2	4
(b)	4	1	2	3
(c)	3	2	1	4
(d)	4	1	3	2

38.

List-I	List-II
A. Largest producer of wheat in the world	1. U.S.A.
B. Largest producer of milk in the world	2. China
C. Largest producer of sugarcane in the world	3. India
D. Largest producer of maize in the world	4. Brazil

	A	B	C	D
(a)	1	2	4	3
(b)	2	3	4	1
(c)	3	4	2	1
(d)	1	3	2	4

39.

List-I	List-II
A. Iron and steel	1. Atlanta
B. Ship building	2. Bradford
C. Automobile	3. Cleveland
D. Woollen textile	4. Yakohama

	A	B	C	D
(a)	3	4	1	2
(b)	1	2	4	3
(c)	2	4	1	3
(d)	3	2	1	4

40.

List-I	List-II
A. Hydropower	1. France
B. Coal	2. Congo Democratic Republic
C. Petroleum	3. Poland
D. Nuclear power	4. Iraq

	A	B	C	D
(a)	2	3	4	1
(b)	3	4	1	2
(c)	1	3	2	4
(d)	4	1	3	2

41.

List-I (Industrial region)	List-II (Name of country)
A. Ruhr	1. U.S.A.
B. New England	2. Brazil
C. Kinki	3. Germany
D. Belo Horizontal	4. Japan

	A	B	C	D
(a)	3	1	4	2
(b)	2	3	1	4
(c)	4	2	3	1
(d)	1	4	2	3

42.

List-I (Minerals)	List-II (Important centres)
A. Copper	1. Butte
B. Diamond	2. Katanga
C. Gold	3. Kimberley
D. Silver	4. Witwatersrand

	A	B	C	D
(a)	2	4	3	1
(b)	2	3	4	1
(c)	1	3	2	4
(d)	3	1	4	2

43.

List-I (Industrial production)	List-II (Place of production)
(A) Brassware	(1) Kanchipuram
(B) Silk Sarees	(2) Lucknow
(C) Chikkan Embroidery	(3) Moradabad
(D) Sports Goods	(4) Jalandhar

	A	B	C	D
(a)	3	1	2	4
(b)	3	2	1	4
(c)	4	2	1	3
(d)	4	1	2	3

44. **List-I (Industrial activities)** **List-II (Explanations)**

(A) Processing activities (1) Inputs are processed goods
(B) Fabricating activities (2) Major inputs are raw material
(C) Integrative activities (3) Involve neither inputs nor outputs
(D) Administrative activities (4) Inputs are processed goods undergoing little change

	A	B	C	D
(a)	1	2	3	4
(b)	2	1	4	3
(c)	1	4	3	2
(d)	3	2	4	1

45. Match the following

List I (Multi purpose River Projects)	**List II (Hydel Power Station)**
A. Rihand	1. Hirakund
B. Gandak	2. Balmikinagar
C. Chambal	3. Pipri
D. Mahanadi	4. Kota

Codes

	A	B	C	D
(a)	3	4	2	1
(b)	1	2	4	3
(c)	3	2	4	1
(d)	1	4	2	3

46. Match the following

List I (Place)	**List II (Famous for)**
A. Balaghat	Oil field
B. Katni	Iron ore
C. Sigrauli	Manganese
D. Kalol	Bauxite
	Coal

Codes

	A	B	C	D
(a)	1	2	4	3
(b)	3	4	5	1
(c)	3	5	4	1
(d)	1	2	5	3

Hints and Explanations

EXERCISE-1

1. (a) 2. (d) 3. (a) 4. (a) 5. (c)
6. (d) 7. (c) 8. (a)
9. (a) De-notified tribes refers to tribes which are aboriginals. These tribes are extremely backward and are struggling to come out of stone age of existence. Such tribes live in forests.
10. (c) 11. (d) 12. (d) 13. (a) 14. (c)
15. (c) National Highways passes through Gujarat, Maharashtra, Chhatisgarh, Orissa, Jharkhand and West Bengal. This road is 1,949 km long.
16. (c) 17. (a)
18. (a) Agra is connected by N.H.– 2.
19. (d)
20. (a) For producion of cotton, Black soil is most suitable and in the area of Maharashtra and Gujarat black soil is found.
21. (b)
22. (b) National Highway (NH 7) deals with Varansi and Kanyakumari. It is the longest Highway of India.
23. (c) Heavy electric equipments plants was set up with Soviet assistance at Ranipur (Haridwar) with the capacity of producing 2.7 lakh KW of steam and water turbines and generators and 5.2 lakh KW of industrial electric motors.
24. (c) 25. (b) 26. (d) 27. (c) 28. (d)
29. (a) Anthracite coal has highest amount of carbon (90%) and burns without smoke.
30. (a)
31. (c) The Ruhr basin is the famous Industrial region of Germany. Formerly Germany's coal-mining region, the Ruhrgebiet forms one of the largest conurbations in Europe with 5 million residents and is now known for its diverse and vibrant cultural scene.
32. (a) Monoculture is a distinct characteristic of commercial grain farming. Monoculture is the agricultural practice of producing or growing a single crop or plant species over a wide area and for a large number of consecutive years.
33. (b) Kimberley is famous for diamond mining. The Big Hole, Open Mine or Kimberley Mine is an open-pit and underground mine in Kimberley, South Africa, and claimed to be the largest hole excavated by hand.
34. (d) 35. (b)
36. (a) Atacama deserts is famous for its nitrate deposits. The desert is littered with approximately 170 abandoned nitrate (or "saltpetre") mining towns, almost all of which were shut down decades after the invention of synthetic nitrate in Germany at the turn of the 20th century. The towns include Chacabuco, Humberstone, Santa Laura, Pedro de Valdivia, Puelma, María Elena, and Oficina Anita.
37. (a)
38. (d) Brazil is the greatest producer of bauxite in the world. Para state dominates bauxite production in Brazil accounting for 85% of overall output, while Minas Gerais produces the country's remainder.
39. (c) 40. (c) 41. (c)
42. (c) The major agricultural region of the world were first delineated by D. Whittlesey. One of the most satisfactory classifications of agricultural regions in the world was proposed by D. Whittlesey in 1936. Whittlesey employed five criteria to classify agricultural regions in the world: (a) crop and livestock combination; (b) intensity of land use; (c) processing and marketing of farm produce; (d) degree of mechanisation; and (e) types and associations of buildings and other structures associated with agriculture.
43. (d)
44. (a) Temperate grassland is called the 'bread basket' of the world. The roots of perennial grasses usually penetrate far into the soil, and grassland soil tends to be deep and fertile. In North America, the prairies were once inhabited by huge herds of bison and pronghorns, which were hunted by wolves, bears, and other predators. These herds are almost gone now, and most of the prairies have been converted into the richest agricultural region on earth.
45. (d) The Broken Hill of Australia is famous for the mining of zinc, lead and silver. Broken Hill is an isolated mining city in the far west of outback New South Wales, Australia. The world's largest mining company, BHP Billiton, has roots in the town.
46. (c) USA is the largest producer of Geo-thermal energy in the world.
47. (a) Katanga province of Zaire is famous for copper. Copper mining is an important part of the economy of Katanga province.
48. (a) Millets and Rice are grown mostly under subsistence farming. Subsistence agriculture is self-sufficiency farming in which the farmers focus on growing enough food to feed themselves and their families. The typical subsistence farm has a range of crops and animals needed by the family to feed and clothe themselves during the year.
49. (a) Teak and Sal are products of tropical dry deciduous forests. The tropical and subtropical dry broad leaf forest biome, also known as tropical dry forest, is located at tropical and subtropical latitudes. Though these forests occur in climates that are warm year-round, and may receive several hundred centimeters of rain per year, they have long dry seasons which last several months and vary with geographic location. These seasonal droughts have great impact on all living things in the forest.
50. (d) Dapog method of rice nursery was developed in Philippines. The dapog method of raising seedling originated in the Philippines and is now, fairly common in South and Southeast. The dapog nursery is constructed for the raising of seedlings without any soil whatsoever. Rice seeds contain sufficient food in the endosperm to permit the young seedling to grow for up to 14 days without receiving any outside nutrients except air, water, and sunlight. Consequently, it is possible to nurse seedlings without actually sowing them in soil.

51. (d) Vishakhapatnam does not have a gold field.
52. (d) Durgapur Steel Plant is located in Durgapur (West Bengal.) It was Set up in the late 1950s with assistance from United Kingdom. It is one of the integrated steel plants of Steel Authority of India Limited.
53. (b) 1. Narora(Uttar Pradesh)- 2 × 220 MW
    2. Kaiga(Karnataka)- 4 × 220 MW
    3. Rawatbhata(Rajasthan)- 1 × 100 MWe;1 × 200 MWe; 4 × 220 MWe
    4. Tarapur (Maharashtra)- 1400 MW
54. (d) The Rihand Dam was constructed across the Rihand River near Pipri in Sonbhadra district of Mirzapur division in 1962 for hydropower generation.
55. (d) Kakrapar Atomic Power Station is situated in Gujarat. It consists of two 220 MW pressurized water reactors with heavy water as moderator (PHWR).It was commissioned in 1993.
56. (a) The correct sequence is Kochi- Mangalore- Mumbai- Koyli
57. (c) The Tasman Sea separates Australia from New Zealand.
58. (b) Sriharikota does not have a heavy water plant. Satish Dhawan Space Centre is a rocket launch centre located in Sriharikota in Andhra Pradesh.

EXERCISE-2

1. (a) Japan is the largest importer of Indian iron ore.
2. (d) The minerals deposits in Chhatisgarh is Bauxite (96 million ton), Dolomite (606 million ton), & iron ore (2336 million ton). Tin is not found in Chhatisgarh.
3. (c) 4. (b) 5. (d) 6. (b)
7. (d) All the monuments / sites are included in World Heritage list of UNESCO. Sun Temple of Orissa, group of monuments at Mahabalipuram were included in 1985. Champaner – Pavagadh Archeological Park of Gujrat and Chhatrapati Shivaji Terminus of Maharastra are included in year 2004 in UNESCO list.
8. (b) Opening a new canal in Kra isthums can reduce the navigation time and distance. Malacca strait is the main shipping channel between the Indian Ocean and the Pacific Ocean and links India, China, Japan and South Korea. The issue of deepening of the Malacca strait is "linked" to its economic importance rather than "time of navigation and distance". The issue is that most of the ships can not pass through it and the size of the biggest ships which can enter through it is called **Malaccamax.** Now the deepening of the strait would certainly help in "Increasing the volume of the business" because ships of larger sizes can pass through it, there is no significance of distance and navigation.
9. (b) 10. (a)
11. (d) In India maximum coal reserve found in Chhota Nagpur in Jharkhand.
12. (a) First sentence is correct, second is incorrect. First modern steel plant in India was set up at Bhilai, not in Bhadrawati.
13. (c) The Northern Plains of India are expanded mainly in the state of Punjab, Haryana, Rajasthan, UP and Eastern Bihar. Here the total road length is more than total surface roads.
14. (c) Hacienda and Pondu are not the examples of shifting cultivation. Shifting cultivation is known as ladang cultivation in south east Asia. Fazendas (meaning "farms") were plantations found throughout Brazil; during the colonial period (16th - 18th centuries), they were concentrated primarily in the northeastern region, where sugar was produced.
15. (a) Indian coal has high ash content and low calorific value. It has low sulphur and low phosphorous content but high ash fusion temperature.
16. (a) Dharwar rocks are non fossilliferous rather they are metalliferous. They bear out gold, iron ore, manganese mica, cobalt, chromium, copper, tungsten, lead, nickel, precious stones and budding stones. Kodarma is a store house of mica and Gondwana beds have natural gases.
17. (b) Chanderi in Madhyapradesh and Kancheepuram in Tamil Nadu are famous for Silk sarees.
18. (b) Copper mineral located in Katanga. Diamond mineral located in Kimberley. Gold mineral located in Wit watersrand. The Witwatersrand Gold Rush was a gold rush in 1886 that led to the establishment of Johannesburg, South Africa. It was part of the Mineral Revolution. Silver located in Butte.
19. (b) The countries in the descending order of their wheat production are; China, India, U.S.A. and Russia.
20. (a) 1. Muzaffarnagar- Sugar
    2. Adoni- Cotton textile
    3. Ranchi- Engineering goods
    4. Jalandhar- Sports goods
21. (b) 22. (b) 23. (b) 24. (a) 25. (c)
26. (a) 27. (a) 28. (b) 29. (b)
30. (a) **Industry**
    Aluminium : Alwaye (Kerala), Asansol (West Bengal), Renukoot (U.P.), Belur (Karnataka), Hiradud (Orissa).
    Petrochemical : Indian Refineries Ltd (Barauni) Bihar Noohamati (Assam), Koyali oil Refinery, Koyali (Gujrat), Chochin oil Refinery Kochi (Kerala).
    Cotton Textiles : Ahmedabad (Gujrat) Bangalore, Mumbai, Kolkata, Coimbtore (Tamilnadu), Kanpur (UP), Ludhiana and Amritsar (Punjab), Indore (MP).
    Heavy Electricals : Bharat Heavy Electricals Ltd Ranipur Hardwar (Uttrakhand)
    Heavy Electricals India Ltd (Bhopal)
31. (c)

N H No.	Cities connected
NH 1	Delhi and Amritsar
NH 2	Delhi and Kolkata
NH 3	Agra and Mumbai
NH 4	Thane and Chennai
NH 5	Behragoda and Chennai
NH 6	Dhulia and Kolkata
NH 7	Varanasi and Kanyakumari
NH 8	Delhi and Mumbai
NH 9	Pune and Vijaywada
NH 10	Delhi and Fazilka

32. (b) Shensi is the coal field of China. It is a province of the People's Republic of China, officially part of the northwest China region. Saar is known as the coal mining in Germany. The Saarland is one of Germany's sixteen federal states. Its capital is at Saarbrücken. Donetz Basin is the coal field of

Ukraine. It comprises the Donbas Foldbelt, which is the uplifted and compressionally deformed part of the Pripyat–Dniepr–Donets (PDD) Basin. Pennsylvania is known for coal mining in U.S.A. Pennsylvania, officially the Commonwealth of Pennsylvania, is a U.S. state that is located in the northeastern and mid-Atlantic regions of the United States, and the Great Lakes region.

33. (b) Regarding to the Iron and steel centre, Cleveland is located in U.S.A. Essen is located in Germany. Hamilton is located in Canada. Tula is located in Russia.

34. (b) Diamond extracts from the Kimberley mines. The first diamond found in South Africa, was discovered less than 30 miles away and within a few years, the mining town of Kimberley. Coal founded in Saar region. In the past, a coal mining was an important branch of industry. Cobalt founded in Katanga region. Katanga is one of the provinces of the Democratic Republic of the Congo. The eastern part of the province is a rich mining region, which supplies cobalt, copper, tin, radium, uranium, and diamonds. The region's capital, Lubumbashi, is the second largest city in the Congo. Silver founded in Butte. Butte is a census-designated place (CDP) in Matanuska-Susitna Borough, Alaska, United States.

35. (a) Cutlery industry located in Plymouth. Ship building industry located in Shefield. Iron and steel industry located in Pittsburgh. Automobile industry located in Detroit.

36. (b) China is the largest producer of wheat. Roughly two-thirds of the total wheat production came from the north China plain and nearly another third from the central provinces. Winter wheat accounts for about 94% of China's total wheat output. U.S.A. is the largest producer of cotton. In its January report, USDA estimated a '13-14 US crop of 13.19 million bales. Upland production was estimated at 12.55 million bales and extra-long staple production at 636,000 bales. Brazil is the largest producer of sugarcane. Brazil's sugarcane industry association UNICA estimates Brazil's sugar cane production in 2012/13 at 531.4 million ton which is 8% up from the 493.2 million ton produced in 2011/12. India is the largest producer of tea. Tea Board of India shows that during January to August, tea production has risen by 6.2% to 705 million kg in 2013.

37. (b) Shifting cultivation practices in Amazon Basin. Nomadic herding practices in Mangolia. Live stock ranching belongs to Australia. Fishing and hunting belongs to Tundra region.

38. (b) Largest producer of wheat in the world is China. Largest producer of milk in the world is India. Largest producer of sugarcane in the world is Brazil. Largest producer of maize in the world is U.S.A.

39. (a) Iron and steel industry belongs to Cleveland. Ship building industry belongs to Yakohama. Automobile industry belongs to Atlanta. Woollen textile industry belongs to Bradford.

40. (a) Hydropower associated with Congo Democratic Republic. The Democratic Republic of the Congo has reserves of petroleum, natural gas, coal, and a potential hydroelectric power generating capacity of around 100,000 MW. The Inga Dam, alone on the Congo River, has the potential capacity to generate 40,000 to 45,000 MW of electric power, sufficient to supply the electricity needs of the whole southern Africa region. Coal associated with Poland. Today Poland's coal industry is among the most competitive in Europe, providing jobs to over 100,000 people in the country. Poland is now the 9th largest hard coal producer in the world and the largest coal producer in the EU. It is also the 8th largest coking coal exporter in the world. Petroleum associated with Iraq. In 2006, Iraq's oil production averaged 2.0 million barrels per day (320×103 m3/d), down from around 2.6 Mbbl/d (410×103 m3/d) of production prior to the coalition invasion in 2003. Iraq's reserve to production ratio is 158 years. Nuclear power associated with France. France derives over 75% of its electricity from nuclear energy. This is due to a long-standing policy based on energy security.

41. (a) Ruhr industrial region belongs to Germany. New England industrial region belongs to U.S.A. Kinki industrial region belongs to Japan. Belo Horizonte industrial region belongs to Brazil.

42. (d) Geographical Indications of Goods are defined as that aspect of industrial property which refer to the geographical indication referring to a country or to a place situated therein as being the country or place of origin of that product. Typically, such a name conveys an assurance of quality and distinctiveness which is essentially attributable to the fact of its origin in that defined geographical locality, region or country. Under Articles 1 (2) and 10 of the Paris Convention for the Protection of Industrial Property, geographical indications are covered as an element of IPRs. They are also covered under Articles 22 to 24 of the Trade Related Aspects of Intellectual Property Rights (TRIPS) Agreement, which was part of the Agreements concluding the Uruguay Round of GATT negotiations. India, as a member of the World Trade Organization (WTO), enacted the Geographical Indications of Goods (Registration & Protection)Act, 1999 has come into force with effect from 15th September 2003.

43. (a)

44. (b)

45. (c) 1. Rihand - Pipri
2. Gandak- Balmikinagar
3. Chambal- Kota
4. Mahanadi- Hirakund

46. (b) About 80% of the manganese production in India comes from Balaghat District of Madhya Pradesh.
Katni (Madhya Pradesh) is famous for Bauxite mines.Singrauli Coalfield is spread across the districts of Singrauli(Madhya Pradesh). Most of the coal is dispatched to pithead power plants as Singrauli Super Thermal Power Station, Rihand Thermal Power Station and Vindhyachal Thermal Power Station etc.
Kalol in Gujaratis famous for its oil fields.

ECOLOGY AND ENVIRONMENT

ECOLOGY AND ENVIRONMENT

1 Chapter

Introduction

In this chapter we will study about Environment, their biodiversity, i.e. different species of plants and animals in their habitats and their relation and interaction with environments. We will also learn about different environmental issues and their effects on ecosystem, i.e. plants, animals, their habitats and climates all around them.

Ecosystem

An ecosystem is a functional unit of nature consisting of abiotic and biotic factors, where the living organisms interact among themselves and also with their physical environment (abiotic factors).

I. Abiotic Component (Habitat and Environment)

Abiotic components of ecosystem are the nonliving features of ecosystem on which the living organism depends. It is basically referred to the physical environment and its numerous interacting variables, e.g. inorganic subsances and climatic factors.

A. Inorganic Substances

Inorganic substances are generally associated with nonliving things.

Bio-geochemical Cycle

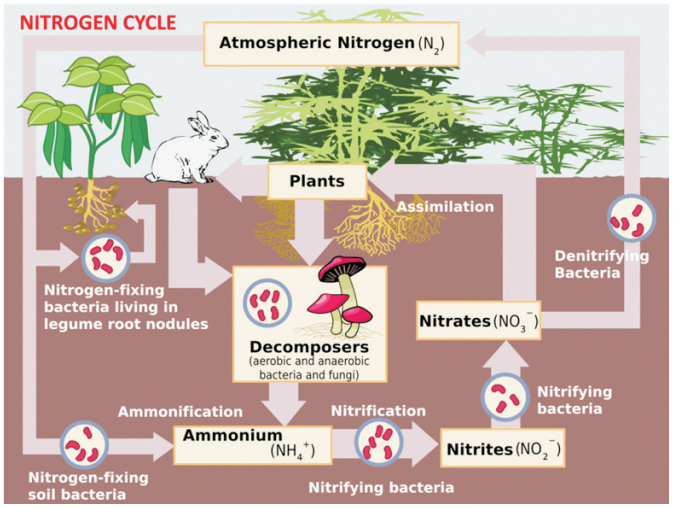
It refers to the circulation of chemical nutrients such as carbon, oxygen, nitrogen, phosphorus, calcium, and water etc. through the biological and physical world. In other words the chemical element get recycled while moving through both biotic (biosphere) and abiotic (lithosphere, atmosphere, and hydrosphere) compartments of Earth. It's a circular series of reaction where the chemical element gets back to its original position for joining the cycle again and again. The most well known cycles in the lists are:

- Nitrogen Cycle
- Oxygen Cycle
- Carbon dioxide Cycles
- Water Cycle
- Phosphorous Cycles

(a) Nitrogen & (N_2) Cycle

Nitrogen cycle is a process by which nitrogen is converted between its various chemical forms. 78% of earth atmosphere is nitrogen. Nitrogen cycle is necessary because plants cannot absorb nitrogen directly; they can only absorb in the form of *nitrate*. Nitrogen cycle have 5 important processes, i.e. fixation, ammonification, nitrification, assimilation and denitrification.

1. **Nitrogen fixation**
   It is the process of conversion of nitrogen(N_2) to ammonia (NH3) because it is the only method by which organisms can attain nitrogen through atmosphere. Bacteria called *Rhizobium* fix nitrogen, be residing in the roots of plants making root nodules
2. **Nitrification**
   It is the process of conversion of ammonia (NH_3) to nitrate (NO_{3-})
   NH_3 ------→ NO_2 ------→ NO_3-
3. **Assimilation**
   It is done by plants roots. Since nitrogen is present in nitrate form it is absorbed along with water from the soil and then converted into organic matter by plants.
4. **Ammonification**
   It is the process of conversion of organic nitrogen compounds to NH_3. Urea and uric acid are excreted by animals in soil along with nitrogen components, these components are converted into ammonia by bacteria, like-Bacteria---→ nitrification----→assimilation
5. **Denitrification**
   It is the reduction of NO_3- to gaseous nitrogen N_2. It is done by denitrifying bacteria(*Pseudomonas*) which convert nitrates/nitrites into elemental nitrogen, which escapes to atmosphere completing the cycle.



(b) Oxygen & (O_2) Cycle

- Oxygen is a very important element for the existence of all flora and fauna. Atmosphere contains 21% of oxygen.
- The main source of oxygen is atmosphere. Plants and animals absorb oxygen through respiration either from water or air and leaves through photosynthesis.
- In respiration process some of the oxygen returns to the atmosphere in the form of carbon dioxide and water vapour. During the process of photosynthesis gaseous oxygen is released completing the oxygen cycle.
- The source of ozone is the oxygen in the atmosphere. Ozone layer protects the living being from the UV radiation which reaches the earth.
- By burning fossil fuels man decreases the amount of oxygen in the atmosphere and increases the carbon dioxide content.

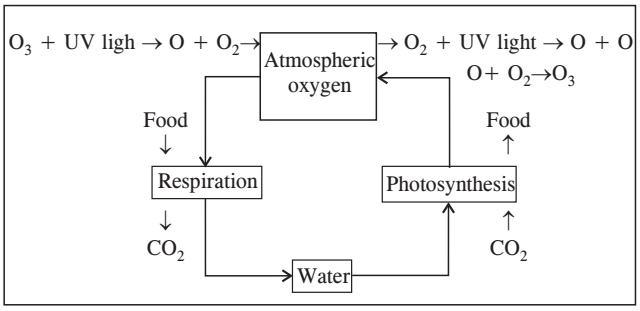


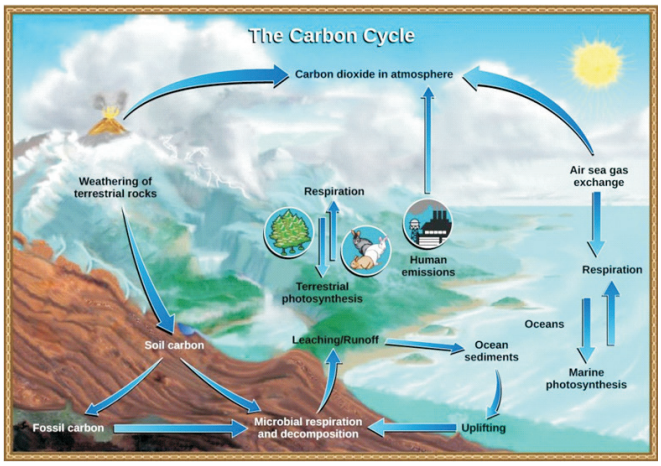
Fig. Oxygen Cycle

As the oxygen concentration in the atmosphere remains constant at 21%, it is likely that natural degradation of ozone must occur to maintain the ozone : oxygen equilibrium. The oxygen cycle is affected most by human activities such as running of automobiles and consumption of fossil fuels, thus releasing more carbon dioxide in the atmosphere.

(c) Carbon dioxide (CO_2) Cycle

Carbon constitutes 49% of the dry weight of an organism, ocean constitutes 71% and atmosphere only constitutes 1% of carbon. Carbon cycle occurs through atmosphere, ocean and through living and dead organisms, decomposers. CO_2 is given out by respiration and fixed into organic matter by the process of photosynthesis. Process can be explained in following steps:

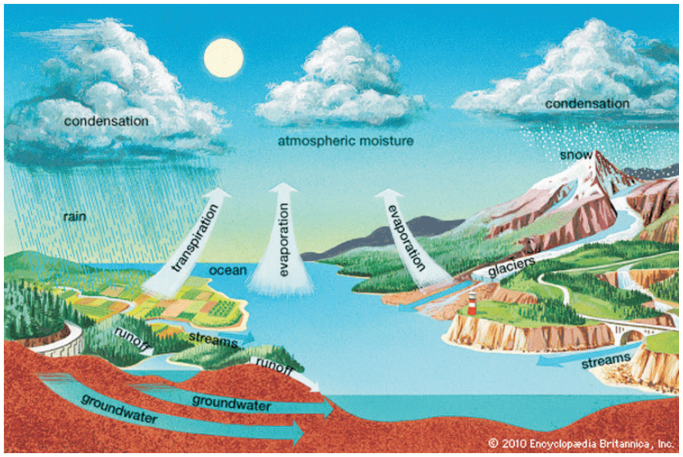
- Through the process of photosynthesis carbon enters into living world in the form of carbon dioxide.
- This organic compound (food) is then passed from the producers to the consumers (herbivores & carnivores).
- By the process of respiration or decomposition of dead bodies of plant and animals by decomposers this carbon returns back to the surrounding medium.
- Recycling of carbon is also done by the burning of fossil fuels.



(d) Water & (H_2O) Cycle

There is a continuous exchange of water between living organisms, air, land and sea. Steps of water cycle can be explained as:

- Evaporation of water takes place from oceans, rivers and lakes which takes water into atmosphere in the form of vapours.
- Clouds and water is formed when these vaporized water is cooled and condensed.
- Ultimately these cooled water vapour return to earth as rain and snow.
- Thus, hydrological cycle is the continuous and balanced process of evaporation, precipitation, transpiration and runoff of water.

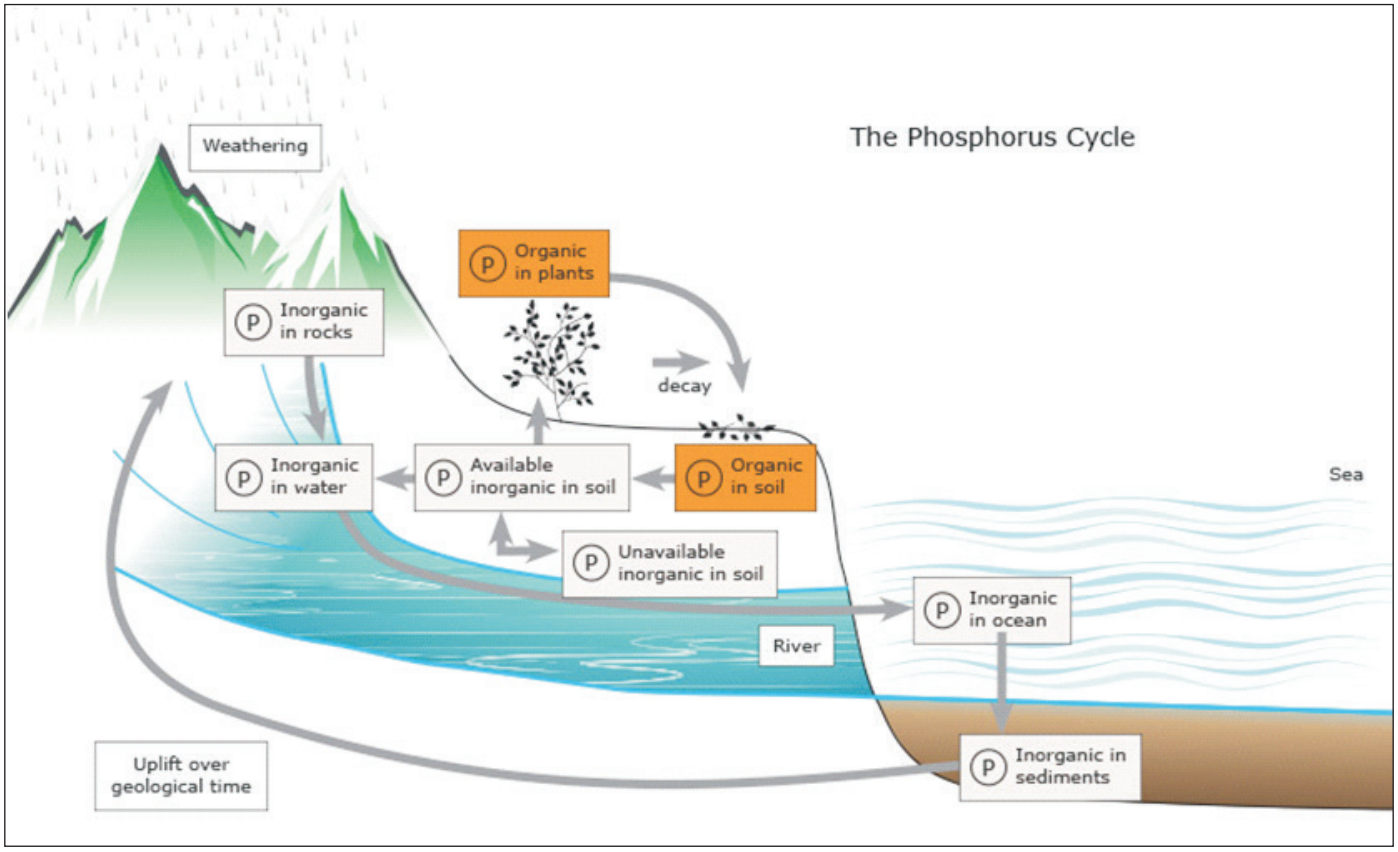


Water Cycle

(e) Phosphorus & its cycles

- Phosphorus cycle is also called as sedimentary cycle because the main reservoir is rocks and the earth crust.
- Weathering of these rocks leads to release of Phosphorus and its absorption by plants roots, which in turn gets transferred to higher tropic levels.

- Excretory material of birds on rocks called Guano is also source of Phosphorus. Phosphates are available in rocks and soil in organic form in lithosphere.
- They are converted into organo phosphates by plants. Phosphates are also added into soil by phosphatic fertilizers.
- There is an excess algae growth which leads to eutrophication when soluble phosphates reach rivers and streams from agricultural land rich in phosphates.
- Return of phosphates to the Earth is by the decay of plant and animal matter and subsequent absorption.
- Phosphorus moves in a cycle through rocks, water, soil and sediments and organisms.



Human activities and their influence on biogeochemical cycles and climate change

As an important biotic element of earth, human being plays a major role in influencing the biogeochemical cycles directly or indirectly. In recent years there has been a growing awareness of the extent to which human activities, such as deforestation and fossil fuel burning has been affecting the environment processes negatively so as the natural cycles. These changes in atmospheric processes are disturbing a variety of cycles in ecosystem services that humans depend upon.

Biogeochemical cycles are always considered as a state of equilibrium that is a balance in the cyclic process of the elements between spheres. However, overall balance may involve elements distributed on a global scale and that is why a disruption in one cycle causes a disruption in all other cycles. The impact can be assessed and analysed through number of such incidents such as:

- **Use of phosphorus fertilizers or commercial synthetic fertilizers** has affected the phosphorus and nitrogen cycles. Sometimes plants unable to utilize all of the phosphate fertilizer applied to them and as a consequence, much of it is lost from the land through the water run-off. The phosphate in the water is eventually precipitated as sediments at the bottom of the water body. In certain lakes and ponds this may be redissolved and recycled as a problem nutrient. Other important sources of phosphate are in the out flows from municipal sewage treatment plants. Without an expensive tertiary treatment, the phosphate in sewage is not removed during various treatment operations. Again an extra amount of phosphate enters the water.
- **Mining of Fossil fuels** have greatly impacted the carbon cycle where fossil fuels have been mined from the earth crust. Carbon dioxide is number one green house gas contributing to global warming and climate change. Additionally, clearing of vegetation that serve as carbon sinks has increased the concentration of carbondioxide in the atmosphere.
- **Production of Sulphur dioxide has** an impact on the sulfur cycle is primarily in the production ofsulfur dioxide (SO_2) from industry (e.g. burning coal) and the internal combustion engine. Sulfur dioxide can precipitate onto surfaces where it can be oxidized to sulphate in the soil (it is also toxic to some plants), reduced to sulphide in the atmosphere, or oxidized to sulphate in the atmosphere as sulphiric acid (a principal component of acid rain). Sulphur compounds play a big role in the climate system because they are important for the formation of clouds.

Additionally, a lot of sulphur is brought into the air by volcanic eruptions. A strong eruption can emit particles up to the stratosphere hence leading to cooling down of the planet.

Cultivation of legumes and use of nitrogen fertilizers:

As a result of extensive cultivation of legumes, creation of chemical fertilizers, and pollution emitted by vehicles and industrial plants, human beings have more than doubled the annual transfer of nitrogen into biologically available forms. Humans have significantly contributed to the transfer of nitrogen gases from Earth to the atmosphere, and from the land to aquatic systems through four main processes:

- The application of nitrogen fertilizers to crops has caused increased rates of denitrification and leaching of nitrate into groundwater. The additional nitrogen entering the groundwater system eventually flows into streams, rivers, lakes, and estuaries. In these systems, the added nitrogen can lead to eutrophication.
- Increased deposition of nitrogen from atmospheric sources because of fossil fuel combustion and forest burning. Both of these processes release a variety of solid forms of nitrogen through combustion.
- Livestock ranching. Livestock release a large amounts of ammonia into the environment from their wastes. This nitrogen enters the soil system and then the hydrologic system through leaching, groundwater flow, and runoff.
- Sewage waste and septic tank leaching.

Much of the nitrogen applied to agricultural and urban areas ultimately enters rivers and near shore coastal systems. In near shore marine systems, increases in nitrogen can often lead to

(i) *anoxia* (*no oxygen*) *or hypoxia* (*low oxygen*)

(ii) altered biodiversity

(iii) changes in food-web structure, and

(v) general habitat degradation.

(vi) One common consequence of increased nitrogen is an increase in harmful algal blooms (howarth 2008).

(vii) Toxic blooms of certain types of dinoflagellates have been associated with high fish and shelfish mortality in some areas. Even without such economically catastrophic effects, the addition of nitrogen can lead to changes in biodiversity and species composition that may lead to changes in overall ecosystem function. Some have even suggested that alterations to the nitrogen cycle may lead to an increased risk of parasitic and infectious diseases among humans and wildlife.

Additionally, increases in nitrogen in aquatic systems can lead to increased *acidification* in freshwater ecosystems.

B. Climatic Factors

Climatic factors are the environmental factors which influence the growth and development of plants, condition in which living organism lives etc. they are defined below:

(a) Light

- The main supply of energy for organisms in ecosystem is sunlight which is an important abiotic factor.
- Through the process of photosynthesis plants with chlorophyll can change light energy to chemical energy. The chemical energy formed is hence stored as complex organic substance (food).
- Besides visible energy electromagnetic spectrum of solar radiation includes UV, infrared radiation (heat) and radio waves.
- Both UV light and infrared radiation are abiotic factors of high importance for ecosystems. To differentiate between flowers insects use UV.
- UV light also works in controlling some biochemical reactions that could be dangerous for the living beings; besides, UV light annihilates pathogens and can cause favorable mutations in all life forms.

(b) Temperature

- Atmospheric temperature of the place depends upon the slope, altitude, latitude, topography, etc. temperature lowers as we go from equator to poles – tropical, subtropical, temperate and arctic.
- Organisms living in tropical regions are called megatherms, in subtropical regions are called mesotherms, in temperate regions are called mucrotherms, and in arctic regions are called hekisthotherms.
- Following are the examples of temperature change in ecosystems: fruit tree such as peach require cold period so that they can blossom in springs, in winters deciduous trees loss their leaves and enter in dormancy etc.

(c) Pressure

- Atmospheric pressure is the pressure caused by the weight of the atmosphere. Atmospheric pressure decreases with the height and is felt maximum at the surface.
- It is measured by the instrument called barometer.
- All organisms can survive only in a specific range of atmospheric pressure and when the air pressure is low in the higher altitudes it becomes difficult for some species to breathe because of the insufficient oxygen present in the higher altitudes.
- In the depth of the oceans the atmospheric pressure increases with the increasing depth and again this makes only definite types of animals and plants to survive in certain specific ocean regions.

(d) Humidity

- Humidity is the water vapor or water in gaseous form present in the atmosphere. It can also be defined as: molecules of water/unit volume.
- It is measured by Hygrometer. Humidity is of three types:
- Specific humidity: it is defined as the ratio of weight of moist vapour to the weight of moist air.
- Absolute humidity: it is the mass or weight of vapour per unit volume of air.
- Relative humidity: it measures the current absolute humidity relative to the maximum for that temperature. It is measured in percentage.
- It affects water loss from plants (transpiration rate) and evaporation from animals; relative humidity (%) expressed as the amount of water vapour in the air compared to what the air would hold if completely saturated at that temperature.

(e) Miscellaneous

Some other climatic factors include water, soil and chemical components.

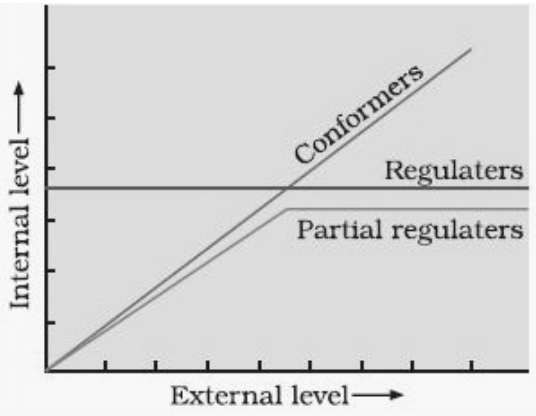
How do organisms Respond to Abiotic Factors:

The fitness of a species in a particular environment depends upon the efficiency of all physiological and biochemical processes within the body.

Some of the animals maintain their body temperature or osmotic concentration of body fluid to the optimum level and maintain a constant internal environment (a process called **Homeostasis**). Their performance is the maximum regardless of the weather conditions outside the body. To maximize the working efficiency, human uses artificial means, like air conditioner, in summer, or heaters / blowers, in winter. The animals, however, have natural means, mainly physiological, to manage such stressful conditions .

There are 3- categories of animals that have specific ways to respond to external environment (or abiotic factors) .

1. Conformers
2. Regulators
3. Partial regulators



Response of organisms to abiotic factors

1. Conformers

Majority of the animals (up to 99%) and nearly all plants, cannot maintain a constant internal environment. Their body temperature and osmotic concentration changes according to the surrounding conditions . Such animal and plants are called *Conformers*. Both, the thermal regulation and osmo- regulation are energetically expensive processes, that's why such a vast number of animals have not adopted such ways to maintain a constant internal environment.

2. Regulators

Some animals maintain their homeostasis by physiological or behavioural means. All birds and mammals (Homeothermic or Warm blooded) and a few lower vertebrates and invertebrates can maintain constant body temperature and constant osmotic concentration regardless of the surrounding conditions. Such organisms are called *Regulators*.

Human constantly maintain their body temperature at 37°C. When it is hot outside (in summer) we start sweating (primarily for cooling the body) and when the surrounding temperature is lower than the body temperature (in winter), we start shivering .The muscle contraction produces heat to raise the body temperature.

3. Partial regulators

If the stressful condition are localized, the animals can '*escape in place*' and migrate to nearby region, having better environmental conditions. If the unfavourable conditions are for a shorter duration then the animals can '*escape in time*' and avoid those conditions suspending their activities. such organisms are partial regulators.

Based upon the situation, the partial regulators may proceed for migration or for suspension of body activities.

(i) Migration : The animal can move away temporally from a stressful environment to a more hospitable area and return when the environmental conditional are favourable. Every winter thousands of birds migrate from Siberia (extremely cold) to Keoladeo National Park in Bharatpur (Rajasthan)

(ii) Suspension of body activities : During unfavourable conditions the lower plants, fungi and bacteria, produce thick– walled spores which germinate when the environmental condition are favourable . The seeds and the other vegetative reproductive -structures of higher plants similarly undergo '***dormancy***' and reduce their metabolic activities when the conditions are unfavourable, and form new plant when the moisture and the temperature conditions are suitable

The animals that cannot migrate, avoid the stressful condition for the time period (*escape in time*) and undergo either Hibernation (in winter), *e.g.*, Bear ; or ***Aestivation*** (in summer), *e.g.* snail and few fishes. Frog undergoes hibernation in winter and aestivation in summer.

When the condition are unfavourable, many species of zooplanktons, in lakes and pond, are known to enter '***diapause***', *i.e.*, a stage of suspended development . Such diapauses also occur in eggs, larvae or pupae of insects in adverse conditions and breaking occurs when favourable conditions returns. The diapauses, *i.e.* arrested development, in insects may depend upon the photoperiod, temperature and the hormonal conditions.

Population

The population is a group of individuals of a particular species, which potentially interbreed and live in a well defined geographical area, and also share or compete for similar resources.

For ecological point of view a group of asexual individuals is also known as population.

Examples of populations are

1. Tigers in a national park
2. Rats in an abandoned building

The population has certain attributes or peculiar features which are not represented by the individuals. The important attributes are *Life expectancy, sex ratio, birth rate, death rate, age distribution* etc.

Birth or Natality rate – It is the number of births per thousand of a population per year. It can also be represented in percentage, or per capita, i.e., per individual.

If there were 50 lotus plants in a pond last year. This year the population has increased to 58 due to reproduction, then birth rate per capita can be calculated as

58 – 50 = 8

8/ 50 = 0.16 offspring per lotus per year

Or per capita birth rate per year = 0.16

Death or Mortality rate – It is the number of deaths occurring in a population of one thousand per year.

This can also be represented in percentage or per capita.

If in a population of 50 house flies, 5 died in a week, then the per capita death rate per week can be calculated as 5/ 50 = 0.1

- **Population growth** – The gross value of population growth is calculated as the difference of birth rate and death rate.
- **Dispersal –** The movement of the individuals in or out of the population affects the size of population. The movement of individuals into a population is called **Immigration**, and movement, out of the population is called **Emigration**.
- A set of local populations connected by dispersing individuals is called a **Metapopulation**.
- The *accurate population growth* involves migrant individuals also, which means the -
- **Population growth = (Birth rate + Immigrants) – (Death rate + Emigrants)**
- **Zero Population Growth** – When birth rate equals death rate, and the growth of the population is Zero, i.e. the size of the population remains constant, it is called Zero Population Growth or **Demographic Transition**. Considering migration, at zero population growth :
- **Birth rate + immigrants = Death rate + emigrants**
- Bio-Index number – It is the ratio of birth rate to the death rate. In case of Zero population growth the bio-index number is one

$$\textbf{Bio-index number} = \frac{\text{Birth rate}}{\text{Death rate}}$$

- **Population size :** The population size may range from few individuals to millions depending upon species, geographical area, impact of predators, outcome of competition and effect of pesticides etc. Sometimes the population size is either too big to measure or meaningless, then the size is more technically called as population density.
- The **population density** can be defined as the number of individuals per square unit area (in terrestrial organisms) or per cubic unit area (in aquatic or aerial organisms). Sometimes the population density is not required and only Relative density serves the purpose. For example, the fish caught per trap in a lake can be used as population density.

Growth Models

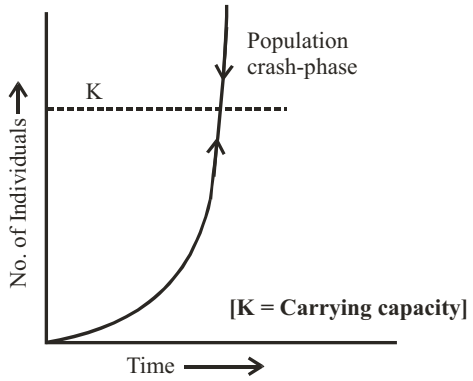
The growth of population with time shows specific and predictable patterns. The 2-common patterns are

1. Exponential or geometric growth pattern
2. Logistic growth pattern

1. Exponential growth

When resources like food and space etc. in a habitat are unlimited, each species realizes its full reproductive or biotic potential and grows in an exponential or geometric fashion. For example if a reindeer population (N) is allowed to grow in a predator free environment, the population in time 't' grows beyond carrying capacity and forms 'J' shaped growth pattern/ curve. Such growth also occurs in algal bloom, insects during rainy season and *Paramecium* (doubling every day)

Thus under unlimited resources and absence of check any species can grow exponentially. Even the slowest breeder, elephant (gestation period –22 months) can grow to enormous number.



Population Growth Curve (J - shaped)

If the population size is 'N' and birth rate and death rate per capita are respectively 'b' and 'd', then the change in population size, i.e., increase or decrease during a unit time period 't' , will be

$$\frac{dN}{dt} = (b - d) \times N$$

If (b – d) = r, then $\frac{dN}{dt} = rN$

Here 'r' is called '**Intrinsic rate of natural increase**' or **Biotic potential (maximum capacity of reproduction),** Which indicates the impact of biotic and abiotic factors in population growth. The value of 'r' for human population in 1981 in India was 0.02.

The integral form of exponential growth equation is

$\mathbf{Nt = N_0 e^{rt}}$

Nt = Population density after time 't'

N_0 = Population density at time zero, '0'

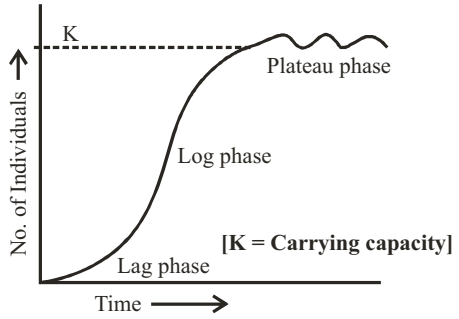
r = Intrinsic rate of natural increase

e = the base of natural logarithms (2.718..)

2. Logistic growth

In nature no species has unlimited resources at its disposal to permit exponential growth. There starts competition between individuals for limited resources. The population growing in a habitat initially shows 'lag phase', followed by phases of acceleration or deceleration (*log phase*) and finally the stage of **asymptote-** when population density reaches carrying capacity (plateau phase or stationary phase).

If the population density 'N' is plotted against time 't', the result is **'S' shaped** growth pattern/ curve (**Sigmoid curve).**



Population Growth Curve (Sigmoid, S-shaped)

This type of growth pattern is also called as **'Verhulst-Pearl logistic growth'** and can be represented as following equation

$$\frac{dN}{dt} = rN\left(\frac{K-N}{K}\right)$$

K = Nature's carrying capacity in that habitat

(K – N)/ K or 1– N/ K = environmental resistance

Carrying capacity (K) – It can be defined as the maximum number of individuals which the environment can support or sustain. Hence, it is the capacity of environment and not of individuals.

The carrying capacity of the environment depends upon 3-components, i.e.

(i) Productive system – It includes cropland, orchard etc. to provide food and fibres.

(ii) Protective system – It includes forest, ocean etc. which regulate temperature and humidity.

(iii) Waste assimilative system – It includes the generation of waste material in water, air and soil.

Population Interactions

Thus in nature, plants, animals and microbes do not and cannot live in isolation but interact in various ways to form biological community. The interspecific associations arise from the interaction of populations of different species. Such associations can be beneficial, harmful (detrimental) or neutral (neither beneficial nor harmful).

Following are different interspecific associations/ interactions. The '+' indicates beneficial interaction, '–-' detrimental and '0' neutral interaction.

Population Interactions

S.N.	Name of interaction	Species A	Species B
1.	Parasitism	+	–
2.	Commensalism	+	0
3.	Mutualism	+	+
4	Predation	+	–
5	Competition	–	–
6	Amensalism	–	0

Parasitism

In this interaction one species (Parasite) is benefitted and the other (Host) is harmed (+, –). The parasitism ensures free **lodging** and free **meals**. Many parasites are host specific while others can parasitize on various species of host.

The hosts evolve special mechanisms to reject or resist the parasite. The parasite on the other hand evolves the mechanisms to counteract and neutralize their effects.

Majority of the parasites harm the hosts by reducing their growth, reproduction, survival and population density. They may also make the host physically weak and vulnerable to predation. The parasites can be of 3-types

1. Ectoparasite 2. Endoparasite
3. Brood parasite

The **ectoparasites** live or feed on the external surface of the host. The most familiar examples are lice and bed bug on human, tick on dogs and leech on cattle. The mosquitoes cannot be considered as true ectoparasites, since they take only meal from the host-body, and do not make lodging. Amongst plants the common example is **Cuscuta,** which has lost both chlorophyll and leaves during evolution and parasitizes hedge plants. The other parasites are copepods, *Petromyzon* and hagfishes, for which the hosts are marine fishes.

Bed bug

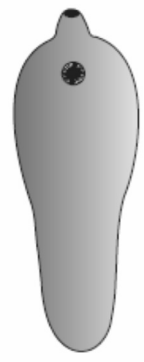
Petromyzon on fish

Tick-Dog

The **endoparasites** live inside the body of the host. Their morphological and anatomical features are greatly simplified, but their life cycles are more complex because of their extreme specialization. Their reproductive potential is very high. They can be **monogenetic** (involving single host) or **digenetic** (involving two hosts). The common monogenetic endoparasites are *Ascaris* (round worm) and *Entamoeba* in small and large intestine respectively. The familiar digenetic endoparasites are *Taenia* (tape worm) and *Fasciola* (liver fluke) in intestine and liver respectively. The *Plasmodium* is also a digenetic endoparasite in human and female *Anopheles* mosquito. The filarial worm is similarly a lymph parasite.

The koel or cockoo is a **brood parasite** and lays the eggs in the nest of the host, crow, who incubates them. The eggs of the parasitic bird has evolved resemblances with the host's eggs in colour and shape and size.

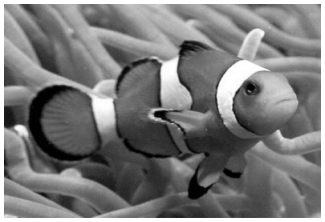
Ascaris Male



Liver fluke

Commensalism

In commensalism one species is benefitted and other is neutral i.e., neither benefitted nor harmed (+ , 0). The association of '*egret and the cattle*' is the classical example of commensalism. As the cattle move during grazing, they stir up and flush out the insects from the vegetation which otherwise be difficult for the egret to find and catch. Here the cattle gets no benefit from egret. The examples of commensalisms are 'clown fish hiding in the colony of sea anemone', 'orchid growing as an epiphyte on mango tree' and the 'barnacle growing on the back of whale'. Here, sea anemone, mango tree and whale derive no benefit from the association.



Clown fish with sea anemone

Egret and Buffalo

Mutualism

In this interaction both the species are benefitted (+, +). **Lichens** is such relationship between fungus and photosynthetic algae/ cyanobacteria. The **Mycorrhizae** is also a similar association between fungus and the roots of higher plants. The fungi here, helps the plant in absorption of essential nutrients from the soil, while plant provides the food to the fungus. In plant-animal association there has occurred co-evolution of mutualism. In many species of fig trees there is a close one-to-one relationship with the species of wasp, for pollination. The female wasp pollinates the fig inflorescence while searching for suitable site for egg laying (oviposition). She lays the eggs inside the fruit and the seeds of the fruit are also consumed by the developing larvae of the wasp. Thus, both are mutually benefitted.

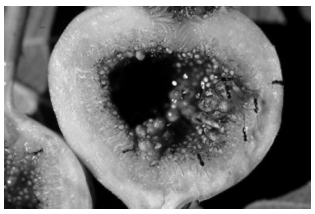


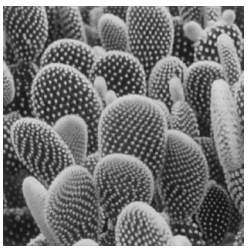
Fig and Wasp

Ophrys (Orchid)

Predation

Like parasitism, in this interspecific interaction also one species is benefitted and the other is harmed (+, –). The common examples of predator and prey are, Tiger and deer, cat and mouse, and lion and zebra. In a broader ecological sense the sparrow feeding on seed, or the herbivorous animals eating plants, are also predators. The predators have following important roles in the community.

1. They (herbivores) act as a conduit for transferring energy, fixed by plants, to higher trophic levels.
2. They keep prey population under check. Otherwise, the prey may achieve high population density to make the ecosystem unstable.



Prickly pear

Lantana

3. Predation also reduces competition amongst preys species and maintains species diversity. (When *Pisaster* (star fish), a predator, was removed from American pacific coast, about 10 species of invertebrates got extincted because of interspecific competition).

Competition

It is defined as an interspecific process in which the fitness of one species (measured in terms of 'r') is significantly lower in the presence of another species. It is (–, –) relationship. Charles Darwin also considered the interspecific competition a potent force in organic evolution. The competition generally occurs when closely related species compete for the same but limiting or depleting resources.

The competition may ever occur when resources like food and space etc. are abundant, since the feeding efficiency of one species may be reduced due to interfering presence of other species. This competition is called **interference Competition.**

Gause's 'competition exclusion principle' states that two closely related species competing for the same resource cannot co-exist indefinitely and the competitively inferior will be eventually eliminated. This is, however, true only when resources are limited.

Amensalism

In this association one species is harmed but the other remains neutral (–, 0). For example the fungus, *Penicillium notatum* growing close to bacteria, like Staphlococcus, kills the bacteria due to the secretion of penicillin, whereas the fungus remains unaffected. Similarly the leaves falling from the tree either kill or adversely affect the growth of the seedling population underneath the tree.

Ecological Niche

Ecological Niche : It is the interactions between a species and the its biotic and abiotic environment, which represents a very basic and fundamental ecological concept. Every niche has two sides; one indicates the effects of environment on a species and other indicates effect of species on the environment. If we give more emphasis on the above given aspect within one framework then ecological niche can be defined as an ecological space where species can live and utilize the environmental resources and perform its functions.

It can be defined as a collective set of roles and characteristic that an organism plays in the environment.

Niche as ecological function of the species

Every species has some particular role in an ecosystem and that same role can be fulfilled by different species in different places. Charles Elton, has emphasized the functional role of species. This is the functional niche which can be referred to a species position in food webs and trophic chains.

Fundamental and realized niche

Hutchinson gave the idea of fundamental niche in which he indicated that as, a multidimensional cloud of favorable conditions determined by all abiotic and biotic components where the species can reproduce and flourish, whereas the realized niche is a subset of fundamental niche.

Competitive exclusion principle: This principle was formulated by the biologist G.F. Gause. According to which no species can occupy the same niche at the same time.

Resource partitioning:

It is a concept of niche separation which is ensured by species coexistence. According to Gause's principle no two species can coexist on the same limiting resource. Species avoid competition by partitioning resources and habitat among themselves.

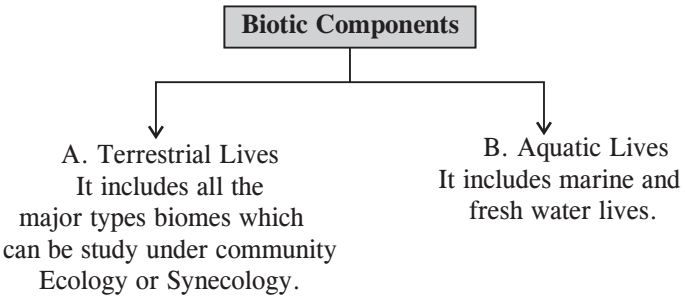
Intra-specific competition and inter-specific

Intra-specific competition can occur between the same species that have nearly identical niche. If natural resources are limited then that can check the population abundance distribution and density due to intra-specific competition.

Inter-specific competition can restrict the size and distribution of competing population as two different species compete for the same natural resource of an ecosystem for example Lion and Leopard shows inter-specific competition as both have the common pray.

II. Biotic Components (Biodiversity)

Biotic components are the living organism which shapes the ecosystem and comes regularly in contact with each other.



A. Terrestrial Lives

Community Ecology or Synecology:

Community ecology is a study of pattern and processes involving at least two species on many spatial and temporal scale which include the distribution, structure, abundance, demography, and interactions between coexisting populations.

Biomes: Biome is a large ecosystem that have common characteristic due to similar climates and can be found over a range of continent. In other words biomes are large natural eco-system wherein we study the total assemblage of plant and animal communities. Though a biome includes both plant and animal communities but a biome is usually identified and named on the basis of its dominant vegetation. Most of the ecologists have recognized at least nine different biomes.

Land biome include Tropical rain forest Coniferous forest, Temperate broad leaf deciduous forest, Mediterranean forest, Tropical deciduous forest, Tropical scrub, Grassland, Tundra and Desert.

1. **Tropical rainforest:** Tropical rainforest are the earth's most complex biome and have great diversity of plants and animals. It is located between the tropic of cancer and tropic of Capricorn. It covers around 5% of the earth's land surface and has 50% of all known species of the earth. These forests have average temperature of 20-25˚C which can varies throughout the year. The primary productivity is high but has low net primary productivity. The important characteristics of tropical rainforest that has low nutrient in soil but has tight cycling of nutrients, all the nutrients are present in the buttresses of the trees. Species diversity is highest in the tropical rainforest. Drip tips facilitate drainage of precipitation from the leaves make it rain even when it is not raining. In this forestStrangler are the plants present as an epiphytes in the canopy and send their roots downward to the forest floor. The fig family is well represented among the stranglers.
2. **Coniferous forest:** Coniferous forest is mainly consists of evergreen gymnosperms with needle shaped leaves. It is the largest biome on the Earth. Soil of the forest is thin, nutrient poor and acidic as conifer needles get decomposed here and bacterial activity is slowed down at lower pH. Precipitation is primarily in the form of snow 40-100 cm annually and temperature ranges from 0˚C to 5˚C. There are two types of Coniferous trees: Northern Boreal Forest and Temperate Coniferous Forest.

   Northern Coniferous Forest: South of the tundra and to the north of deciduous forests & grasslands between 50˚C to 60˚C N latitude in Canada Europe.

   Temperate Coniferous Forest: Lower latitude of North America, Europe and Asia in high elevation of mountain.
3. **Temperate Broadleaf Deciduous Forest :** Such type of forest is mostly found in western and central Europe Eastern Asia and eastern North America. The stratum in the forest is trees, understory shrubs, herbaceous sub-stratum and ground layer. Broadleaf forest has moderate to high rainfall and temperature, and the average precipitation being 700mm and average temperature being 10.8˚C. Broadleaf trees are dominated with trees such as Oak, Maple and Fagus etc.
4. **Mediterranean Forest :** Located in the west coastal regions between 30° and 40° North and South latitude (mild temperate region) usually surrounded by desert and grassland. Mediterranean forest has hot and dry season in the summer, and cool and moist winter season. Average precipitation is 262 mm and average temperature in the forest is 14.7°C. In such forest plants moves to the dormant condition during dry summer and spiny shrub dominate at that time.
5. **Tropical deciduous Forest or Tropical dry Forest:** Such types of forest are found on the fringes of the tropical rainforest. These forests rank second after tropical rainforest in species richness. Common tree species are Shorea robusta, Tectona grandis, Hopea odorata and Dipterocarpus indicus etc.
6. **Tropical scrub:** Such forest has low tree vegetation type that grow in hot somewhat dry to semiarid lowlands

between desert and Savanna on the one hand and tropical deciduous forest and tropical rain forest on the other hand.

7. **The Grassland :** It is found in all ranges of climate from mesic to xeric and from cold to warm condition. They are generally open and continuous in fairly flat areas dominated by grasses. They experience wide range of temperature from about -20˚C to 30˚C in extreme winter and warm summer. There are two main division of grassland:

   Temperate grassland: Such types of grassland have cold winters and warm summers. Summer temperature ranges to 38˚C in summer and as low as -40˚C in winter. Various species of grassland which include purple needle grass, blue grass, and buffalo grass are found here. Located between temperate forest at high latitude and desert at subtropical latitude and nown by different names in different parts of the world as:

   The Prairies of the great plains of North America

   The Pampas of South America

   The Veldt of South Africa

   The Steppes of Central Euraisa

   The Savanna in Africa

8. **Tundra:** Tundra is the world coldest and driest biome. This type of biome is totally snow covered vegetation at mountain tops. Soils are rich in organic matter due to slow decomposition rate and it is also one among the Earth's three major carbon dioxide sink. There are three types of tundra- 1. Arctic Tundra 2. Antarctic Tundra 3. The Alpine Tundra

9. **Desert :** Desert biome is the driest of all the biome and is located at 30˚ North & South and cover about one fifth of the Earth's surface Most of the desert receive about 250 mm of rain . Due to poor canopy and sparse distribution of plants. The leaf area index is less than one and productivity is also less. Most of the desert receive about 250 mm of rain per year as compared to rainforest which receive over 2,000 mm. The largest desert on Earth is Antarctica. They are classified into:

- **Arid deserts:** these types of deserts are found in North-America, South-America, Africa, and Southern Asia where there is low latitudes. Here generally the temperature is hot and dry with few occurrence of rainfall in winters. In daytime it is very hot as there are no clouds to cover the Earth. The soil here is mostly sand or coarse and rocky. Here vegetation is mostly shrubs and small trees and leaves are adapted to retain water. Here the animals are generally active during night.
- **Semi-arid deserts:** These deserts are found in North-America, Europe, Russia and Northern Asia. Here also there is low rainfall during winters. Here animals can be found in daytime but under the tress or shades.
- **Coastal deserts:** these deserts are found in areas which are warmer to cooler such as in Neotropic and Nearctic area. Here the summers are long and warmer while the winters are short and cold. Here the sand consists of alkaline and the soil is porous so that rain water can enter the ground. Mostly the vegetation here is thick foliage with good water retention quality. The roots of these plants re near to the surface so that they can get water before water drains to the soil. Animals of these deserts comprise rough skinned amphibians, birds of prey, scavenger mammal's reptiles and insects. Animals here are largely nocturnal during the warmer months.
- **Cold deserts:** they are the deserts which occur mainly in the cold regions. Here the temperature during the warmest month is 10 C. they are mostly covered with snow and ice and due to this they do not support life. Animals in the cold desert are burrowers, even the carnivores and reptiles, which even though cold-blooded, have made their homes in the cold desert. Antarctica is the largest cold desert.

B. Aquatic Lives

Aquatic lives are present in Marine and freshwater ecosystem.

1. Sea Life

Sea regions are broadly divided into coral reefs, estuaries and oceans.

- **Oceans:** they are the biggest and the most varied of the ecosystem. Most of the oxygen in the atmosphere is generated by the algae. Here salt water evaporates and turns to rain which in turn falls on land. Large amount of carbon dioxide is absorbed by the algae in the atmosphere. Inter - tidal zone is the zone which connect ocean to the land. Only few species exist in rocky coastal areas as very few tides reach there.
- **Other oceanic zones:** deep sea which is also called benthic zone is the host to slit, sand and slowly decomposing organisms. Sunlight does not reach these areas so these areas are very cold. There are only few plants here and animals include starfish, anemones, sponges, amongst others, as well as several micro-organisms. Abyssal zone is the deepest part of the ocean. Fishes such as oddities and many species of invertebrates are found here.
- **Coral Reefs:** they are the marine ridges and mounds which are formed due to the decomposition of calcium carbonate of living organisms. Coral consist of animal and algae tissues. It is a living organism. Corals use tentacles to catch microorganisms like animals do and feed by the process of photosynthesis like plants. The coral reef is also host to other species such as starfish, octopi and other mollusks. Coral animals cannot live in water cooler than 65 °F (18 °C), therefore coral reefs are found mostly in warm, shallow, and tropical seas.
- **Estuaries:** transition area between river and sea is called estuary. They are highly productive and rich in nutrients. There are many different names of estuaries like bays, sounds, inlets, harbors, and sloughs.

2. Fresh water Life

The name freshwater is due to the less salt content in them. They exist in various forms such as lakes, rivers, ponds, swamps or wetland and are host to wide variety of plants and animals.

- **Lakes:** lakes are the water bodies which can exists for centuries other than others like ponds which dry up frequently. The littoral zone, which is close to the shore, is host to a extensive range of species due to its warm and shallow environment. Several species of invertebrates, crustaceans, plants and amphibians bloom in this environment and in turn offer food for predators such as birds, reptiles and other creatures inhabiting the shoreline.
- **Wetlands:** large variety of flora and fauna grows in other still water bodies or wetlands like swamps, glades and marshes. Trees such as Cypress which are highly adaptable to high humidity of this region also grow in wetland. Other plants such as pond lilies and sedges also grow here. Animals found here are different types of reptiles, mammals, amphibians and birds and hundreds of insects. Starting point of rivers and streams are mostly snow and ice melting and spring. At the end they end up in ocean or other water body. Flora and fauna are different here from the lakes and ponds as the water is continuously flowing. Depending upon water temperature and the exposure of riverbank to the sunlight small fishes such as river trout and crayfish can be found in several areas. Salmon and other vigorous fishes can be found in cold areas while fishes like catfish, carp, and other bottom feeders can be found in warm areas which are rich in sediments and decaying matter. River plants comprise floating weeds and algae, mostly found forming around rocks and submerged tree roots.

  The area where freshwater meets saltwater, is called an estuary; this area generally features distinctive features, trees and algae, seaweed, wetland flora, and several species of invertebrates, birds, reptiles and crustaceans congregate into a composite ecosystem, serving as a trade center to the world's aquatic biomes.

Exercise -1

1. What is true of ecosystem?
   (a) primary consumers are least dependent upon producers
   (b) primary consumers out-number producers
   (c) producers are more than primary consumers
   (d) secondary consumers are the largest and most powerful.
2. Homeostasis is
   (a) tendency of biological systems to change with change in environment
   (b) tendency of biological systems to resist change
   (c) disturbance of self regulatory system and natural controls
   (d) biotic materials used in homeopathic medicines.
3. Food chain in which microorganisms breakdown the food formed by primary producers is
   (a) parasitic food chain
   (b) detritus food chain
   (c) consumer food chain
   (d) predator food chain.
4. If we completely remove the decomposers from an ecosystem, its functioning will be adversely affected, because
   (a) mineral movement will be blocked
   (b) the rate of decomposition will be very high
   (c) energy flow will be blocked
   (d) herbivores will not receive solar energy.
5. The abundance of a species population, within its habitat, is called
   (a) relative density (b) regional density
   (c) absolute density (d) niche density.
6. The primary succession refers to the development of communities on a
   (a) forest clearing after devastating fire
   (b) newly-exposed habitat with no record of earlier vegetation
   (c) freshly cleared crop field
   (d) pond, freshly filled with water after a dry phase.
7. Which one of the following pairs is correctly matched?
   (a) parasitism – intra-specific relationship
   (b) uricotelism – aquatic habitat
   (c) excessive perspiration – xeric adaptation
   (d) stream lined body – aquatic adaptation.
8. The 'niche' of a species is meant for
   (a) habitat and specific functions of a species
   (b) specific place where an organism lives
   (c) specific species function and its competitive power
   (d) none of these.
9. Certain characteristic demographic developing countries are
   (a) high fertility, low or rapidly fall rate, rapid population growth and age distribution
   (b) high fertility, high density, mortality rate and a very young age
   (c) high infant mortality, low fertility population growth and a very distribution
   (d) high mortality, high density, uneven growth and a very old age distribution.
10. What is a keystone species?
    (a) a species which makes up only a small proportion of the total biomass of a community, yet has a huge impact community's organization and s
    (b) a common species that has plenty of biomass yet has a fairly low impact on the community organization
    (c) a rare species that has minimal impact on the biomass and on other species in the community
    (d) a dominant species that constitutes a large proportion of the biomass and which affects many other species.
11. The population of an insect species shows an explosive increase in numbers during rainy season followed by its disappearance at the end of the season. What does this show?
    (a) the food plants mature and die at the end of the rainy season
    (b) its population growth curve is of J-type
    (c) the population of its predators increases enormously
    (d) S-shaped or sigmoid growth of this insect.
12. Which one of the following statements is correct?
    (a) Both Azotobacter and Rhizobium fix atmospheric nitrogen in root nodules of plants.
    (b) Cyanobacteria such as Anabaena and Nostoc are important mobilizers of phosphates and for plant nutrition in soil
    (c) At present it is not possible to grow maize without chemical fertilizers
    (d) Extensive use of chemical fertilizers may lead to eutrophication of nearby water bodies.
13. Atmospheric nitrogen is converted to nitrogen oxides
    (a) when fossil fuels are burned at high combustion temperatures.
    (b) if the sun is shining brightly and there is a temperature inversion.
    (c) on cloudy days when carbon and soot levels are unusually high.
    (d) if radon gas is present when gasoline is burned in automobiles.
14. Having covered millions of acres of grasslands, the toxic weed leafy spurge has caused serious damage to the lower regions of Himachal. Being toxic in nature it is avoid by both cattle and horses alike. Leafy spurge has spread completely across many neighboring states of Uttaranchal. If left uncontrolled in these states, leafy spurge populations will
    (a) keep growing indefinitely.
    (b) reach their carrying capacity.
    (c) shift from a S-curve to a constant rate of growth.
    (d) shift from an S-shaped curve to a *J-shaped* growth curve.
15. Some beetles escape from a ship and fly to a small island covered with grass but with no trees or beetle predators. As the beetles feed, they destroy all the grasses. But with abundant food, the beetle population soars, doubling in size every month. After about a year, the population crashes as thousands of beetles have destroyed almost

all of the plants and there is little left to feed the large population. This scenario best illustrates
(a) constant growth followed by equilibrium.
(b) a population that has stabilized near its carrying capacity.
(c) exponential growth followed by a population crash.
(d) logistic growth ending at its carrying capacity.

16. Which of the following is NOT true regarding biotic potential?
(a) Environmental resistance factors such as disease and available space can prevent a population from maximizing its biotic potential
(b) The biotic potential is the average rate of growth of a population over time
(c) The ratio of males to females in a population is a characteristic that is used to determine biotic potential
(d) The number of individuals of re-productive age in a population is a parameter used to determine biotic potential.

17. Which one of the following statements about the carbon, phosphorus, and nitrogen cycles is true ?
(a) The major source of carbon used by plants is the soil
(b) The major source of nitrogen used by plants is the air.
(c) Phosphorus has no atmospheric component.
(d) Bacteria drive the phosphorus cycle.

18. Energy
(a) and nutrients flow through ecosystems.
(b) and nutrients ecosystem within ecosystems.
(c) cycles within ecosystem nutrients flow through ecosystems.
(d) flows through and nutrients cycle within ecosystems

19. Flea beetles alone arc unlikely to eliminate all of the leafy spurge in a region.
Instead, the number of leafy spurge plants and the number of flea beetles in a particular community may stabilize. At this point, the leafy spurge and flea beetle populations:
(a) have exhibited exponential growth followed by a crash.
(b) have experienced constant growth.
(c) are still experiencing exponential growth
(d) are experiencing environmental resistance

20. Humans often manipulate the environment in ways that decrease the overall ecosystem capital because
(a) short term gains are often local while long-term losses in regulating and cultural services are experienced regionally.
(b) short term gains are often regional while long-term losses in regulating and cultural services are experienced locally.
(c) long term gains are often local while short term losses in regulating and cultural services are experienced regionally.
(d) long term gains are often regional while short-term losses in regulating and cultural services are experienced locally.

21. Primary productivity of the open oceans is very limited because of
(a) the shortage of water.
(b) the shortage of light.
(c) the shortage of nutrients.
(d) low temperature.

22. The economic gap between developing and industrialized countries may best be narrowed by
(a) the adoption of democratic forms of government in developing countries.
(b) industrialized countries increasing shipments of food supplies to developing countries.
(c) industrialized countries harvesting more natural resources in developing countries.
(d) stabilizing population growth in developing countries.

23. Certain communities frequently have worms, clams shrimp, and many other organisms clustered together. These communities nestle around hydrothermal vents where super heated water, springs from the bottom of the ocean. The bacteria present in these communities have special enzyme that allows them to form organic matter through chemosynthesis. They are found off the shore in Japan, deep in the ocean where no sunlight can penetrate. In this unusual ecosystem :
(a) there is no photosynthesis
(b) no energy is transferred between trophic levels
(c) temperature is the most important biotic factor
(d) producers eat consumers

24. Biomes with permafrost are most likely:
(a) covered in coniferous forests at high latitudes.
(b) in temperate zones with deciduous trees.
(c) located near the poles and without any trees.
(d) located at high altitudes nearest the equator.

25. Consumers that eat plants rely upon
(a) chemical energy stored in organic molecules produced by photosythesis.
(b) kinetic energy stored in organic molecules produced by photosynthesis.
(c) photosynthesis to convert potential energy to kinetic energy.
(d) entropy to generate heat to drive kinetic processes in their bodies.

26. Creation of sustainable ecosystems can be achieved through
(a) a reduction in world population growth.
(b) decreasing poverty so that people are not consumed of immediate needs (food, shelter) and can focus more on human's long-term impact on the environment.
(c) decreased human consumption of everything, and thus a lower production of waste.
(d) all of the above

27. Deciding to use a natural enemies approach to control the mites that infect her crops, a farmer purchases 10,000 ladybugs in the spring and spreads them over her 100 acre fields. This represents the use of natural:
(a) predators (b) parasitoids
(c) pathogens (d) plant-eaters

28. Deep in the ocean off the shore of Japan, are communities nestled around hydro thermal vents where super heated water, springs from the bottom of the ocean. No sunlight ever penetrates to these deep regions. In these communities, bacteria have special enzymes that allow them to form organic matter by chemosynthesis. These communities frequently have worms, clams, shrimp,

and many other organisms clustered together. In such a system, fish feed on shrimp that feed on the bacteria. This food chain represents a:
(a) tertiary consumer eating a secondary consumer eating a primary consumer.
(b) primary consumer eating a secondary consumer eating a tertiary consumer.
(c) consumer eating a producer which then consumes chemoautotrophic bacteria.
(d) secondary consumer eating a primary consumer which then eats a producer.

29. Density-independent factors such as earthquakes and hurricanes are:
(a) abiotic factors that maintain a population near equilibrium.
(b) biotic factors that maintain a population near equilibrium.
(c) abiotic factors that are not involved in maintaining a population near its equilibrium.
(d) biotic factors that are not involved in maintaining a population near its equilibrium.

30. Developing a new form of ecological pest control, researchers engineer crops to produce the pheromones of the pest. The crops now produce the pest pheromone, overwhelming the fields and causing the male pests to fail to find a mate. This new form of ecological pest control combines:
(a) natural enemies and cultural control.
(b) cultural and natural enemies control.
(c) genetic and cultural control.
(d) genetic and natural chemical control.

31. Dung beetles feeding on the waste of cattle, grazing on hay in a field, represent
(a) a decomposer feeding on the wastes of a consumer eating a producer.
(b) a producer feeding on the wastes of a producer eating a consumer.
(c) a producer feeding on the wastes of a consumer eating a producer.
(d) a consumer feeding on the wastes of a decomposer eating a producer.

32. Ecosystem sustainability primarily results from the
(a) relationships between the organisms in an ecosystem.
(b) number of predators found in the ecosystem.
(c) frequency of fires or other natural disasters in an ecosystem.
(d) total amount of biomass that exists in an ecosystem.

33. Ecotones
(a) contain only species found in the bordering ecosystems.
(b) have the same abiotic characteristics as the bordering ecosystems.
(c) consist of two or more landscapes.
(d) are transitional regions between ecosystems.

34. Energy transfer between trophic levels in aquatic systems is generally
(a) less efficient than terrestrial food pyramids.
(b) less efficient than a detritus food web because aquatic systems lack fungi.
(c) inverted, in which more energy is transferred from one trophic level up to the next.
(d) more efficient than terrestrial food pyramids.

35. For more than 20 years, scientists have been analyzing expected climate change and the impact on crops grown in particular regions. For example, states that typically plant corn and soybeans may need to switch to growing cotton. Such a change is an example of :
(a) mitigation (b) a cap-and-trade policy
(c) adaptation (d) stabilization wedge

36. In a forest, deer, raccoons, squirrels, and other animals eat and find shelter. A detritus food web occurs as their wastes accumulate on the forest floor. In this detritus web
(a) deer and raccoons function as the producers.
(b) fungi and earthworms function as producers.
(c) decomposers function as consumers.
(d) the deer and raccoons represent decomposers.

37. In an ecosystem with many similar species, we typically find
(a) intense interspecific competition for food.
(b) competitors using different resources.
(c) intense interspecific competition for nesting sites.
(d) adaptations for battles and interspecific competition.

38. In an ecosystem, the replacement of one new species for another because of direct competition for the same resources defines
(a) intraspecific competition.
(b) the competitive exclusion principle.
(c) character displacement.
(d) resource partitioning.

39. Maintaining sustainable human exploitation of ecosystem capital will be increasingly difficult because of
(a) the over reliance on grains and other plants as a significant portion of the human diet.
(b) the expanding number of viral and bacterial human diseases.
(c) the growing human population on Earth.
(d) decreases in worldwide ocean levels.

40. Persistent organic pollutants (POPs) reach toxic levels in organisms in natural ecosystems in large part because of biomagnification, in which the highest concentrations of POPs are found in
(a) primary producers (b) secondary producers
(c) primary consumers (d) secondary consumers

41. Some birds have been seen to consume certain soils in what is called geophagy. In some cases, the soils help the birds digest toxins that occur in their diets. These birds eating soil represent a member of the
(a) biosphere consuming a component of the lithosphere.
(b) hydrosphere consuming a component of the atmosphere.
(c) lithosphere consuming a component of the biosphere.
(d) atmosphere consuming a component of the hydrosphere.

42. The cattle were removed from a field and shrubs and bushes were seen dotting the grass-covered hillsides. A few years later, small pine trees and then larger deciduous trees appeared. Now, there are so many trees and shaded regions it is difficult to tell that this was once a field. What once was an open pasture on a long abandoned

farm has changed over time, without the direct influence of human. In this wooded region that was once pasture, a mature forest of towering trees has taken over. However, change is still apparent, as a large patch of young shrubs and small trees are growing where several large trees were toppled by a storm several years ago. Collectively, this wooded regions represents
(a) a climax ecosystem (b) primary succession
(c) a sustained biome (d) intermediate succession

43. What once was an open pasture on a long abandoned farm has changed over time, without the direct influence of humans. After the cattle had been removed, shrubs and bushes could be seen dotting the grass-covered hillsides. A few years later, small pine trees and then larger deciduous trees appeared. Now, there are so many trees and shaded regions it is difficult to tell that this was once a field. The changes in this field, from grasses to shrubs to trees, represent
(a) ecological succession
(b) climax production
(c) biological evolution
(d) ecological adaptation

44. Which of the following represents a type of mutualism?
(a) A red-tailed hawk pounces on a field mouse for dinner.
(b) A large herd of zebra graze lazily across the broad savannah
(c) A mosquito draws a blood meal from the back of an elk.
(d) A nectar-feeding bat swoops in to drink nectar from some flowers.

45. Which one of the following illustrates interspecific competition?
(a) The largest wolves in a pack are the first to feed on a freshly killed deer.
(b) Two honeybees from the same colony converge on a flower to collect pollen & nectar.
(c) Advertising its nectar with red colors, a columbine flower attracts a hummingbird for a meal.
(d) Standing near the dead antelope, vultures wait for the lions to finish their meal.

46. Why are there so few ecosystems with more than four levels of consumers?
(a) because biomass decreases by about 90% at each level moving up.
(b) because top consumers compete with and kill each other with increasing population size.
(c) because consumers at these highest levels typically form social groups that stop reproducing at high densities.
(d) because predators at the highest levels simply are not intelligent enough to hunt other top predators.

47. Regulating and cultural services provided by natural ecosystems
(a) are typically the most economically valued components of ecosystems.
(b) are public goods usually provided by markets.
(c) include goods such as fresh water, wild foods, and livestock.
(d) are essential but difficult to value in monetary terms.

48. The phrase "ecosystem capital" is better than the phrase "natural resources" because ecosystem capital
(a) includes the ecological value of natural ecosystems.
(b) includes the economic value of an ecosystem's goods and services.
(c) does not include the value of natural ecosystems.
(d) does not include the economic value of an ecosystem's goods and services.

49. A sandy and saline area is the natural habitat of an Indian animal species. The animal has no predators in that area but its existence is threatened due to the destruction of its habitat. Which one of the following could be that animal?
(a) Indian wild buffalo (b) Indian wild ass
(c) Indian wild boar (d) Indian gazelle

50. In addition to global climate change, humans are negatively impacting coral reefs by
(a) destructive harvesting of fish for food or pets.
(b) using large amounts of coral rock to pave roads.
(c) destroying large regions of coral reefs for commercial aquaculture.
(d) introducing alien species that are thought to be more productive.

51. The concept of sustainable development relates to
(a) consumption levels
(b) exhaustible resources
(c) social equity
(d) Intergenerational equity

52. The variability among living organisms from all sources including terrestrial, marine and other ecosystems and the ecological complexes of which they are part which includes diversity within species, between species of ecosystems refers to
(a) geographical diversity
(b) zoological diversity
(c) ecological diversity
(d) biological diversity

53. 'Population dividend' refers to
(a) total number of population
(b) youthful age structure of a population
(c) relatively high proportion of experienced aged people
(d) migration from richer region to poorer region

54. Inclusion strategy does not focus on
(a) reduction of inequality
(b) reduction of poverty
(c) diversifying livelihood for tribal population
(d) getting poorer countries close

55. Which one of the following is the best description of the term 'ecosystem'? (CSAT 2015-1)
(a) A community of organisms interacting with one another.
(b) That part of the Earth which is inhabited by living organisms.
(c) A community of organisms together with the environment in which they live
(d) The flora and fauna of a geographical area

Exercise -2

Statement Based MCQ

1. Which of the following groups contains only easily biodegradable items?
   1. Grass, flower and leather
   2. Grass, wood and plastic
   3. Fruits, peel cake and lime juice
   4. Cake, wood and grass.

   Which of the above is/are correct?
   (a) 1 and 2 (b) 2 and 3
   (c) 1, 3 and 4 (d) All of these
2. Consider the following statements :
   1. The amount of usable energy remains constant as it is passed from one trophic level to another.
   2. The energy within an ecosystem is fixed and never changes.

   Which of these statement(s) is/are correct ?
   (a) 1 only (b) 2 only
   (c) Both 1 and 2 (d) Neither 1 nor 2
3. Select the correct combination of statements (I - IV) regarding the characteristics of productivity.
   1. The rate of biomass production is called productivity and is expressed in terms of a kcal m^{-2}.
   2. Gross primary productivity is rate of production of biomass during photosynthesis.
   3. Gross primary productivity minus respiration loss is called net primary productivity.
   4. Primary productivity depends only on the plant species inhabiting a particular area.

   Which of the following statement(s) is/are correct?
   (a) 1,2 and 3 (b) 2 and 3
   (c) 2, 3 and 4 (d) 2 and 4
4. Food chains differ from food webs in that
   1. food chains are single sequence of who eats whom in a community.
   2. food chains better represent the entire community.
   3. food webs represent the complex interaction among food chains.
   4. food chain is the flow of energy in a population.

   Which of the following statement(s) is/are correct?
   (a) 1 and 2 (b) 1 and 3
   (c) 1, 2 and 3 (d) 1, 2, 3 and 4
5. Which of following is/are tend (s) in ecological succession ?
   1. An increase in complexity of species
   2. An increase in productivity
   3. An increase in community stability and species diversity
   4. A decrease in nonliving organic materials.

   Which of the above is/are correct?
   (a) 1 and 2 (b) 1 and 4
   (c) 1, 3 and 3 (d) 1, 2, 3 and 4
6. Which of the following include(s) ecosystem services ?
   1. Purification of air and water by forests
   2. Forests mitigate droughts and flood
   3. Forests act as store house of carbon
   4. Forests influence hydrological cycle

   Which of the above is/are correct?
   (a) 1 and 3 (b) 1 and 4
   (c) 1, 2 and 3 (d) 1, 2, 3 and 4
7. Which one is not the dynamic aspect of an ecosystem?
   1. Producers and mineral cycles
   2. Consumers and mineral cycles
   3. Producers and energy flow
   4. Energy flow and mineral cycles

   Which of the above is/are correct?
   (a) 1 and 2 (b) 2 and 4
   (c) 1, 2 and 3 (d) All of these
8. Which of the following statements are true about ecosystem? Select the correct answer from the codes:
   1. Ecosystem comprises both biotic and abiotic components.
   2. Solar radiation is the main driving force of the ecosystem.
   3. Ecosystem is a closed system.
   4. Ecosystem does not have its own productivity

   Codes:
   (a) 1 and 2 (b) 2 and 3
   (c) 1 and 3 (d) 3 and 4
9. Which of the following are the incorrect statements about 'Keystone species'.
   1. Keystone species are the small-sized plants and organisms which have large effect on the environment.
   2. Keystone species play critical role in maintaining the structure of an ecological community.
   3. Keystone species do not generally affect other organisms.
   (a) 1 and 2 (b) 2 and 3
   (c) 1 and 3 (d) All are correct
10. Which of the following are correct statements about light in aquatic environments?
    1. Water selectively reflects and absorbs certain wavelengths of light.
    2. Photosynthetic organisms that live in deep water probably utilize red light.
    3. Light intensity is an important abiotic factor in limiting the distribution of photosynthetic organisms.
    (a) 1 only (b) 2 only
    (c) 1 and 3 only (d) 2 and 3 only
11. The producers in ecosystems include which of the following?
    1. prokaryotes 2. algae
    3. plants
    (a) 1 only (b) 2 only
    (c) 3 only (d) 1, 2, and 3
12. Aquatic primary productivity is often limited by which of the following?
    1. light 2. nutrients
    3. pressure
    (a) 2 only (b) 3 only
    (c) 1 and 2 only (d) 1, 2, and 3
13. Consider the following statements:
    1. Interactions between the two organism in which one organism kills sand feed on the second organisms, is called Parasitism.
    2. Mutualism is the way two organisms of different species biologically interact in a relationship in which each individual derives a fitness benefit.

Which of the statements given above is/are true?
(a) 1 only (b) 2 only
(c) 1 and 2 both (d) None

14. Consider the following:
1. Bioaccumulation is the increases in concentration of a pollutant from the environment to the first organism in a food chain.
2. Biomagnification is then increases in concentration of pollutant from one link in a food chain to another.
Which of the statements given above is/are true?
(a) 1 only (b) 2 only
(c) 1 and 2 both (d) None

15. Consider the following statements:
1. In ecology, an ecosystem is a naturally occurring assemblage of organism (plant, animal and other living organism - also referred to as a biotic community of biocoenosis) living together with their environment (or biotope), function as a unit of sorts.
2. The term "ecosystem" first coined by Arthur Tansely.
Which of the statements given above is/are correct?
(a) 1 only (b) 2 only
(c) 1 and 2 both (d) None

16. Which of the following statements is true?
1. Circulation of energy in the biosphere ecosystem is cyclical.
2. Circulation of matter in the biosphere ecosystem is unidirectional.
Select the correct answer using the codes given below:
(a) 1 only (b) 2 only
(c) 1 and 2 only (d) None

17. Consider the following statements :
1. Waste are of two types, biodegradable and non-biodegradable.
2. Blue-green algae are producers.
3. Biodegradable wastes should be separated and kept in blue colour bins for garbage collectors.
Which of these statement(s) is/are correct ?
(a) 1 and 2 (b) 2 and 3
(c) 1, 2 and 3 (d) None

18. Not all parasitism involves feeding on the body of the host. The exception is
1. Ectoparasitism 2. Endopasitism
3. Parasitoids 4. Brood Parasitism
Choose the option from the codes given below:
(a) 1 only (b) 2 only
(c) 3 only (d) 4 only

19. What factor does not contribute to the rapid loss of nutrients from terrestrial ecosystems?
1. Clear cutting native forests
2. Early seral stages
3. Climax communities
4. Low diversity
Choose the correct option from the codes given below:
(a) 1 and 2 (b) 2 and 3
(c) 3 only (d) 3 and 4

20. When two organisms attempt to utilize the same resource, the result is:
1. A fundamental niche
2. Competition
3. Commensalism
4. Mutualism
Choose the correct option from the codes given below:
(a) 1 and 2 (b) 2 only
(c) 3 and 4 (d) 1, 2, 3 and 4

21. With reference to food chains in ecosystems, consider the following statements:
1. A food chain illustrates the order in which a chain of organisms feed upon each other.
2. Food chains are found within the populations of a species.
3. A food chain illustrates the numbers of each organism which are eaten by others.
Which of the statements given above is/are correct?
(a) 1 only (b) 1 and 2 only
(c) 1, 2 and 3 (d) None

22. With reference to the food chains in ecosystems, which of the following kinds of organism is/are known as decomposer organism/organisms?
1. Virus 2. Fungi
3. Bacteria
Select the correct answer using the codes given below.
(a) 1 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

23. Consider the following :
1. Bats 2. Bears
3. Rodents
The phenomenon of hibernation can be observed in which of the above kinds of animals?
(a) 1 and 2 only
(b) 2 only
(c) 1, 2 and 3
(d) Hibernation cannot be observed in any of the above

24. Which of the following adds/add carbon dioxide to the carbon cycle on the planet Earth?
1. Volcanic action
2. Respiration
3. Photosynthesis
4. Decay of organic matter
Select the correct answer using the code given below.
(a) 1 and 3 only (b) 2 only
(c) 1, 2 and 4 only (d) 1, 2, 3 and 4

25. With reference to two non-conventional energy sources called 'coalbed methane' and 'shale gas', consider the following statements :
1. Coalbed methane is the pure methane gas extracted from coal seams, while shale gas is a mixture of propane and butane only that can be extracted from fine-grained sedimentary rocks.
2. In India, abundant coalbed methane sources exist, but so far no shale gas sources have been found.
Which of the statements given above is/are correct?
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

26. The study of relationship of living organism with each other and with their environment is called ____.
1. Economy
2. Ecology
3. Geography
4. Environment
Which among the following defines the statement
(a) 1 only (b) 2 only
(c) 3 only (d) 4 only

27. Consider the following statement related to Abiotic
1. Abiotic components of ecosystem are the living features of ecosystem on which the living organism depends.
2. Abiotic component is referred to the physical environment and its numerous interacting variables.

Which among the following statement is correct
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) None of the Above

28. What is the name of processes of Nitrogen cycle?
1. Nitrogen Fixation
2. Nitrification
3. Assimilation
4. Denitrification
Choose the correct option
(a) 1 and 2 (b) 3 and 4
(c) 1, 2, 3 (d) 1, 2, 3, 4

29. Which equation explains Nitrification?
1. $NH_3 \rightarrow NO_2 \rightarrow NO_3$-
2. $NH_3 \rightarrow NO_3 \rightarrow NO_2$-
3. $NH_3 \rightarrow NO_4 \rightarrow NO_2$-
Select the correct answer from the following codes
(a) 1 only (b) 2 only
(c) 3 only (d) All of the Above

30. Atmosphere contains 21% of which gas?
1. Nitrogen
2. Oxygen
3. Phosphorous
(a) 1 only (b) 2 only
(c) 3 only (d) None of the Above

31. What is the purpose of Ozone layer?
1. Protects UV rays to reach on earth
2. Helps UV rays to reach earth
3. The source of ozone is the oxygen in the atmosphere
Choose the correct code
(a) 1 and 2 (b) 2 and 3
(c) 1 and 3 (d) 1, 2, 3

32. Consider the following statements
1. Burning fossil fuel decreases oxygen in atmosphere
2. Burning fossil fuel increases carbon dioxide
3. The main source of oxygen is atmosphere
Which among the following code is incorrect?
(a) 1 only (b) 2 only
(c) 3 only (d) None of the Above

33. How is the oxygen cycle effected?
1. Human activities
2. Running of automobiles
3. Consumption of fossil fuels
Choose the correct code
(a) 1 and 2 (b) 2 and 3
(c) 1 and 3 (d) 1, 2, 3

34. With reference to the process of photosynthesis for carbon dioxide, which of the following statement is correct?
1. Through the process of photosynthesis carbon enters into non-living world in the form of carbon dioxide.
2. Recycling of carbon is done by the burning of fossil fuels.
Select the correct answer from the following codes
(a) 1 Only (b) 2 only
(c) 1 and 2 (d) Neither of the Above

35. Which of the following is not involved in the continuous water exchange?
1. Stones 2. Air
3. Land 4. Sea
Choose the correct code
(a) 1 only (b) 2 only
(c) 1 and 2 (d) 3 and 4

36. Consider the following statement
1. Evaporation takes water into atmosphere in the form of vapours.
2. Clouds are formed when the vaporized water is cooled and condensed.
Which of the following statement is correct?
(a) 1 only (b) 2 only
(c) 1 and 2 (d) None of the Above

37. Name the elements that help in creating phosphorous cycle?
1. Rocks 2. Earth crust
3. Air 4. Water
Choose the correct code
(a) 1 and 2 (b) 3 and 4
(c) 1 and 3 (d) 1 and 4

38. Why phosphorous is not found in atmosphere?
1. It doesn't combine well with other elements
2. It just cannot be found
3. The sun evaporates it
4. At normal temperatures and pressure, phosphorous is at a liquid state
Choose the correct code from the following statement regarding phosphorous
(a) 1 only (b) 2 only
(c) 3 only (d) 4 only

39. How does phosphorous enter plants in the soil?
1. Photosynthesis 2. Water in the soil
3. Rocks on the sand
Choose the correct answer
(a) 1 only (b) 2 only
(c) 3 only (d) 1, 2, 3

40. What is the impact of human on phosphorous cycle?
1. Killing plants
2. No impact
3. Pollution
4. Use fertilizers that are not natural
Choose the correct code
(a) 1 only (b) 2 only
(c) 3 only (d) 4 only

41. Megatherms is defines as
1. Organisms living in tropical regions
2. Organisms living in subtropical regions
3. Organisms living in temperate regions
Choose the correct definition of Megatherms
(a) 1 only (b) 2 only
(c) 3 only (d) None of the Above

42. Consider the following related to humidity
1. Humidity is the water vapor present in the atmosphere.
2. Humidity is measured by barometer
3. Humidity is defined as molecules of water/unit volume
Choose the correct code
(a) 1 and 2 (b) 2 and 3
(c) 1 and 3 (d) 1, 2, 3

43. ____ are the living organism that shapes the ecosystem and comes regularly in contact with each other.
(a) Abiotic components
(b) Biotic componenets
(c) Antibiotic components
(d) None of the Above

44. Consider the following statement in regards to ecosystem
1. Components of an ecosystem include Biotic
2. Components of an ecosystem include Abiotic
Which of the following statement is correct?
(a) 1 only (b) 2 only
(c) 1 and 2 (d) None of the Above

45. The process of cycling of minerals and components through the ecosystem is called_____
    1. Biological cycle
    2. Biogeochemical cycle
    3. Biochemical cycle
    Choose the correct code
    (a) 1 only (b) 2 only
    (c) 3 only (d) None of the Above
46. Name the forest that is found in Asia, Europe.
    1. Boreal Forest
    2. Temperate Deciduous Forests
    3. Tropical or Rainforests
    Choose the correct name
    (a) 1 only (b) 2 only
    (c) 3 only (d) All of the Above
47. Consider the following statement
    1. The soil of Temperate Deciduous forests is richer than boreal forests.
    2. Temperate Deciduous forests are mostly found in the equatorial belt of the plant.
    Which statement is incorrect?
    (a) 1 only (b) 2 only
    (c) 1 and 2 (d) None of the Above
48. Which forest does not see winter season?
    1. Boreal Forest
    2. Temperate Deciduous Forests
    3. Tropical Forest
    Choose the correct code
    (a) 1 only (b) 1 and 2
    (c) 1, 2, 3 (d) 3 only
49. How much desert area exists on the planet?
    (a) One third (b) Half
    (c) One fifth (d) One fourth
50. Marine lives are found in which place?
    1. Ocean
    2. Lake
    3. Ponds
    4. Sand
    Choose the correct code
    (a) 1, 2 (b) 3, 4
    (c) 1, 2, 3 (d) 1, 2, 3, 4
51. Consider the following statement
    1. Most of the oxygen in the atmosphere is generated by the algae.
    2. Evaporation of salt and water turns into rain
    3. Large amount of carbon dioxide is absorbed by the algae in the atmosphere.
    Which statement is incorrect?
    (a) 1 only (b) 2 only
    (c) 3 only (d) None of the Above
52. The water that has less content of salt is called _____.
    1. Sea
    2. Fresh water
    3. Oil
    Choose the correct code
    (a) 1 only (b) 2 only
    (c) 3 only (d) All of the Above
53. Consider the following statement
    1. Atmospheric temperature of the place depends upon the slope, altitude, latitude, topography.
    2. Temperature increases as we go from equator to poles.
    3. Temperature lowers as we go from equator to poles
    Choose the incorrect statement
    (a) 1 only (b) 2 only
    (c) 3 only (d) None of the Above
54. Consider the following statements
    1. Three-fourth of the earth surface is covered by water but less than 3% is fresh water used for human consumption.
    2. Of the total fresh water available, Ice-cap has highest share of 2% followed by ground water 0.68%.
    Select the correct answer using the code given below.
    (a) 1 only (b) 2 only
    (c) 1 and 2 (d) Neither of the Above
55. With reference to phosphorus cycling, consider the following statements
    1. The natural reservoir of phosphorus is atmosphere, which contains phosphorus in the form of phosphates.
    2. Herbivores and other animals obtain phosphorus from plants.
    3. Unlike carbon cycle, there is no respiratory release of phosphorus into atmosphere.
    Which of the statements given above is/are correct?
    (a) 1 and 2 (b) 2 and 3
    (c) 1 and 3 (d) 1, 2, 3
56. What is the name of the cycle where the continuous and balanced process of evaporation, precipitation, transpiration and runoff of water takes place.
    1. Hydrological
    2. Tropological
    3. Hyper logical
    Choose the correct option
    (a) 1 only (b) 2 only
    (c) 3 only (d) None of the Above
57. With reference to ecosystem stability, consider the following statements
    1. A diverse and complex ecosystem is more stable.
    2. Ecosystem stability increases with decrease in number of links in food web.
    Which of the statements given above is/are correct
    (a) 1 only (b) 2 only
    (c) and 2 (d) None of the Above
58. Water in a wetland can be
    1. Fresh
    2. Brackish
    3. Static
    Select the correct answer using the codes given below.
    (a) 1 and 2 (b) 1 and 3
    (c) 2 and 3 (d) 1, 2 and 3
59. Consider the following statement related to humidity
    1. Specific humidity
    2. Absolute humidity
    3. Relative humidity
    4. Non relative humidity
    Which among the following is not the type of humidity?
    (a) 1 only (b) 2 only
    (c) 3 only (d) 4 only
60. Consider the following statement
    1. Steppe is found in low latitudes and middle latitudes.
    2. Prairies are humid and densely covered tall grasslands
    3. Savanna are the areas of thick high grasses
    Choose the correct code
    (a) 1 only (b) 2 only
    (c) 3 only (d) 1, 2, 3

Hints and Explanations

EXERCISE-1

1. (c) An ecosystem may be defined as a structural and functional unit of the biosphere comprising living organisms and their non-living environment that interact by means of food chains and chemical cycles resulting in energy flow, biotic diversity and material cycling to form a stable, self supporting system.
   The organisms in an ecosystem are classified into 3 main categories-producers, consumers and decomposers. The consumers utilize materials and energy stored by the producers. Decomposers obtain their food molecules from the organic materials of dead producers and consumers. In a true ecosystem, producers are more than consumers (herbivores and carnivores).
2. (b) The ability to maintain a steady state within constantly changing environment is essential for the survival of living systems. The maintenance of a constant internal environment is called homeostasis.
3. (b) The dead organic matter of plant or animal is called as detritus. While a part of it remains on the soil surface as litter, the other part enters the soil. Many animals such as protozoan's, nematodes, insects etc. depend on detritus and hence they are called as detrivores. Even the human beings are detrivores when they eat cooked food. From detritus, the chain proceeds to detrivores, then to carnivores and finally to top carnivores.
4. (a) Decomposers are aprotrophs which decompose the organic remains by secreting extracellular digestive enzymes. They are also known as mineralisers as they release minerals trapped in organic remains. So in the absence of microorganisms the flow of mineral will stop.
5. (d) Niche is specific part of habitat occupied by individuals of a species which is circumsribed by its range of tolerance, range of movement, microclimate, type of food and its availability, shelter, type of predator, and timing of activity. A habitat has several ecological niches and supports a number of species. An ecological niche is used by a single species. Two or more species cannot use the same niche despite having a mutualistic association. The abundances of a species population within its habitat is called niche density.
6. (b) When succession begins on an area which has not been previously being occupied by a community e.g. a new exposed rock area, sand dunes, new islands, deltas, shore or recent lava flow, it is known as primary succession. The first group of organisms (plants or animals) which become established in such an area is termed the pioneer community.
7. (d) Streaming body is a secondary aquatic adaption. It is found in animals that live permanently in water but most of them are amphibious in nature. The stream lined body consists of compression of head, body and tail into a curved stream lined form.
   There is no protruberance over the body so that the animal can move easily through water. Parasitism is a relationship between two organisms of different species in which one organism called parasite obtains its food directly from another living organism called host.
   In xeric adaptation perspiration is reduced to conserve water. Uricotelism is characteristic of terrestrial animals which excrete uric acid.
8. (a) Niche is specific part of habitat occupied by individuals of a species which is circumscribed by its range of tolerance, range of movement, microclimate, type of food and its availability, shelter, type of predator, and timing of activity.
   A habitat has several ecological niches and supports a number of species. An ecological niche is used by a single species. Two or more species cannot use the same niche despite having a mutualistic association.
9. (a) In developing countries the conditions are becoming better for survival of human beings. So the mortality rate or the number of individuals dying per unit of time is low.
   Mortality or the average number of individuals produced by a population in a unit of time is high. So that there is rapid population growth and there are more individuals in the pre-reproductive age group. So there is young age distribution.
10. (a) Keystone species are those species which has significant and disproportionately large influence on the community structure and characteristics. It has often considerably low abundance and biomass as compared to dominant species. Removal of such species causes serious disruption in structure and function of community.

11.	(b)	12.	(d)	13.	(a)	14.	(b)	15.	(c)
16.	(b)	17.	(c)	18.	(d)	19.	(d)	20.	(a)
21.	(c)	22.	(d)	23.	(a)	24.	(c)	25.	(a)
26.	(d)	27.	(a)	28.	(d)	29.	(c)	30.	(d)
31.	(a)	32.	(a)	33.	(d)	34.	(c)	35.	(c)
36.	(a)	37.	(b)	38.	(b)	39.	(c)	40.	(d)
41.	(a)	42.	(a)	43	(a)	44.	(d)	45.	(d)
46.	(a)	47.	(d)	48.	(a)	49.	(b)	50.	(a)

51. (d) Intergenerational equity is a concept that says that humans 'hold the natural and cultural environment of the Earth in common both with other members of the present generation and with other generations, past and future. It means that we inherit the Earth from previous generations and have an obligation to pass it on in reasonable condition to future generations. The goal of sustainable development is Intergenerational equity.
52. (d) Biological diversity is used to refer to the total number of different species on Earth. A collection of this biodiversity would include human beings,

Bengal tigers, sugar maples, oyster mushrooms, bacteria, and the millions of other living organisms found on Earth.

53. (b) Population dividend or Demographic dividend refers to a period - usually 20 to 30 years - when fertility rates fall due to significant reductions in child and infant mortality rates. It occurs when the proportion of working people in the total population is high because this indicates that more people have the potential to be productive and contribute to growth of the economy.

54. (d)

55. (a) An ecosystem includes all of the living things (plants, animals and organisms) in a given area, interacting with each other, and also with their non-living environments (weather, earth, sun, soil, climate, atmosphere).

EXERCISE-2

1. (c) 2. (d) 3. (b) 4. (a) 5. (c)
6. (d) 7. (c)

8. (a) Ecosystem is the dynamic community of living organism with physical environment. Thus, it comprises of both biotic and abiotic components. Solar energy is the ultimate source of energy in it, so is the main driving force. Dynamic energy transfers occur making it an open system. The autotrophs make the ecosystem's biotic components self-sufficient.

9. (c) Keystone species are not necessarily small sized though they put great effect on the environment. They play very critical role in maintaining the structure of an ecological community by affecting many other organisms. An ecosystem may experience a dramatic shift if a keystone species is removed, even though that species may be small part of the ecosystem by measures of biomass or productivity.

10. (c) 11. (d) 12. (c)

13. (b) In Parasitism, the parasite does not kill the host rather it derives its nutrition from the host in which the later is not affected. The interaction in which an organism kills the other for food is called Predation.

14. (c) Bioaccumulation refers to the accumulation of substances, such as pesticides, or other organic chemicals in an organism. Bioaccumulation occurs when an organism absorbs a toxic substance at a rate greater than that at which the substance is lost. Biological magnification often refers to the process whereby certain substances such as pesticides or heavy metals move up the food chain.

15. (c) Sir Arthur Tansley first used the term ecosystem in 1935.

16. (d) Circulation of energy in the biosphere ecosystem is unidirectional, it is derived from the sun and goes through one trophic level to another. The matter however circulated in cyclic manner.

17. (a) Biodegradable wastes should be separated and kept in green colour bins for garbage collectors.

18. (d) Brood parasites are organisms that use the strategy of brood parasitism, a kind of kleptoparasitism found among birds, fish or insects, involving the manipulation and use of host individuals either of the same (intraspecific brood-parasitism) or different species (interspecific brood-parasitism) to raise the young of the brood-parasite.

19. (c) In ecology, climax community, or climatic climax community, is a historic term that expressed a biological community of plants and animals and fungi which, through the process of ecological succession — the development of vegetation in an area over time — had reached a steady state. This equilibrium was thought to occur because the climax community is composed of species best adapted to average conditions in that area.

20. (b) Since a community comprises all the species that occur at a particular location, one of the most important things about communities is how the species interact with one another.
Four different types of interactions between different species (inter specific interactions) have been identified:
Competition -Two organisms mutually harm one another
Predator–prey or parasite–host- One organism benefits, the other is harmed
Mutualism- Both organisms benefit
Commensalism- One organism benefits, the other is not affected

21. (a) A food chain illustrates the order in which a chain of organisms feed upon each other.
A food chain is the sequence of who eats whom in a biological community to obtain nutrition.
Sample:- Grassland Biome
GRASS > GRASS HOPPER > RAT > SNAKE > HAWK

22. (b) 23. (c) 24. (c) 25. (d)

26. (b) The branch of science which deals with the study of relation between plants and animals to each other along with their environments is called ecology.

27. (b) Abiotic components of ecosystem are the nonliving features of ecosystem on which the living organism depends. It is basically referred to the physical environment and its numerous interacting variables.

28. (d) Nitrogen cycle is necessary because Plants cannot absorb nitrogen directly instead it is absorbed in the form of nitrate. Nitrogen cycle have 5 important processes i.e. fixation, ammonification, nitrification, assimilation and denitrification.

29. (a) Nitrification is the process of conversion of ammonia.

30. (b) Atmosphere contains 21% of Oxygen.

31. (c) The source of ozone is the oxygen in the atmosphere. Ozone layer protects the living being from the UV radiation which reaches the earth.

32. (d) Oxygen is a very important element for the existence of all flora and fauna. Atmosphere contains 21% of oxygen. The main source of oxygen is atmosphere. Plants and animals absorb oxygen through respiration either from water or air and leaves

through photosynthesis. In respiration process some of the oxygen returns to the atmosphere in the form of carbon dioxide and water vapour. During the process of photosynthesis gaseous oxygen is released completing the oxygen cycle.The source of ozone is the oxygen in the atmosphere. Ozone layer protects the living being from the UV radiation which reaches the earth. By burning fossil fuels man decreases the amount of oxygen in the atmosphere and increases the carbon dioxide content.

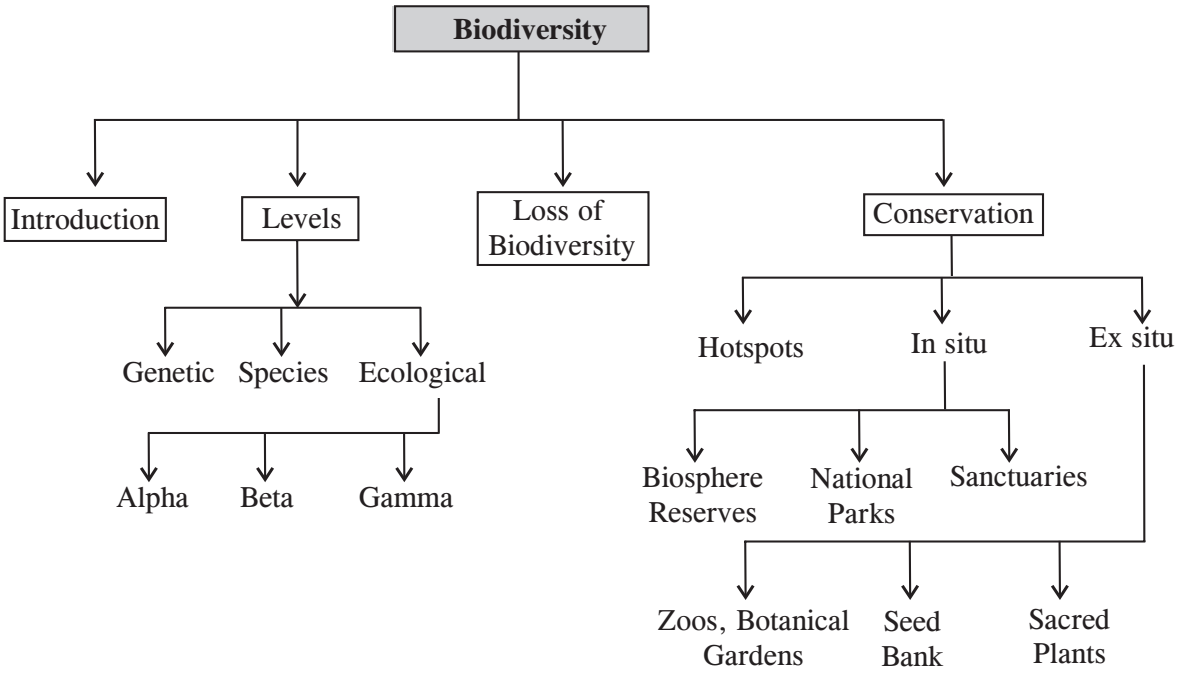
33. (d) The oxygen concentration in atmosphere is 21%. The oxygen cycle is effected by human activities such as running automobiles and consumption of fossil fuels which release more carbon dioxide in the atmosphere.
34. (b) Process of photosynthesis of carbon dioxide is explained in following steps:
    - Through the process of photosynthesis carbon enters into living world in the form of carbon dioxide.
    - This organic compound (food) is then passed from the producers to the consumers (herbivores & carnivores).
    - By the process of respiration or decomposition of dead bodies of plant and animals by decomposers this carbon returns back to the surrounding medium.
    - Recycling of carbon is also done by the burning of fossil fuels.
35. (a) There is a continuous exchange of water between living organisms, air, land and sea.
36. (c) Evaporation of water takes place from oceans, rivers and lakes which takes water into atmosphere in the form of vapours. Clouds and water is formed when these vaporized water is cooled and condensed.
37. (a) Phosphorus cycle is also called as sedimentary cycle because the main reservoir is rocks and the earth crust.
38. (d) Phosphorous is not found in atmosphere because at normal temperature and pressure phosphorous is at a liquid state.
39. (b) Phosphorous enters into the soil through water.
40. (d) Human use fertilizers that are not natural which impact phosphorous cycle.
41. (a) Organisms living in tropical regions are called regions are called mesotherms, in temperate regions are called regions are called hekisthotherms.
42. (c) Humidity is the water vapor or water in gaseous form present in the atmosphere. It can also be defined as molecules of water/unit volume. It is measured by Hygrometer.
43. (b) Biotic components are the living organism that shapes the ecosystem and comes regularly in contact with each other.
44. (c) Components of an ecosystem include Biotic and Abiotic.
45. (b) The cycles (carbon and nitrogen cycle) involves phases of weathering of rocks, uptake and storage by organisms and return to the pool of soil, the atmosphere or ocean sediments.
46. (a) Boreal or taiga forests forests are found in Asia, Europe, Siberia and North America where there are shorter and warmer summers with longer winters.
47. (a) Tropical or Rainforests are mostly found in the equatorial belt of the plant.
48. (d) Tropical or Rainforests are found in the equatorial belt of the plant. There is no winter season in these forests, sunlight fall for 12 hours and seasons is mostly rainy or dry with small change in the temperature.
49. (c) Desert covers one fifth of the planet.
50. (c) Marine lives are the plants, animals and living organisms which are found oceans, lakes, ponds etc.
51. (d) Oceans: they are the biggest and the most varied of the ecosystem. Most of the oxygen in the atmosphere is generated by the algae. Here salt water evaporates and turns to rain which in turn falls on land. Large amount of carbon dioxide is absorbed by the algae in the atmosphere. Inter - tidal zone is the zone which connect ocean to the land. Only few species exist in rocky coastal areas as very few tides reach there.
52. (b) The water that has less content of salt is called fresh water.
53. (b) Atmospheric temperature of the place depends upon the slope, altitude, latitude, topography, etc. temperature lowers as we go from equator to poles – tropical, subtropical, temperate and arctic.
54. (c) Three-fourth of the earth surface is covered by water but less than 3% is fresh water used for human consumption. Of the total fresh water available, Ice-cap has highest share of 2% followed by ground water 0.68%.
55. (b) Herbivores and other animals obtain phosphorus from plants. There is no respiratory release of phosphorus into atmosphere.
56. (a) Hydrological cycle is the continuous and balanced process of evaporation, precipitation, transpiration and runoff of water.
57. (a) Diversity increases the resilience of the system to outside invasions of exotic organisms. So statement 1 is correct. A large number of interacting feeding links provide alternative channels for energy flow and this generates a wide variety of adjustments of population to environment changes and stresses within the ecosystem. Therefore, ecosystem stability increases with increase in number of links in food web.
58. (d) The Ramsar definition of wetlands is fairly wide, including “areas of marine water the depth of which at low tide does not exceed six meters” as well as fish ponds, rice paddies and salt pans. wetlands can be freshwater as well. Freshwater wetlands are not connected to the ocean. They can be found along the boundaries of streams, lakes, ponds or even in large shallow holes that fill up with rainwater. Freshwater wetlands may stay wet all year long, or the water may evaporate during the dry season.
59. (d) Humidity is of 3 types: Specific, Absolute, Relative
60. (d) Steppe is found in low latitudes and middle latitudes. Prairies are humid and densely covered tall grasslands. Savanna are the areas of thick high grasses.

2 Chapter

BIODIVERSITY

Introduction

Biodiversity mean diversity of heterogeneity at all levels of biological organisation, i.e from Micro molecules of the cells to the Biomass. The word Biodiversity was popularized by the sociologist Edward Wilson.



Biodiversity is the existence of a wide variety of plant and animal species in their natural environments, which is the aim of conservationists. Who are mainly concerned about indiscriminate destruction of rainforests and other habitats.

Important Levels of Biodiversity are

1. Genetic diversity

It is the diversity at genetic level, or at subspecies level, i.e. below species level, in a single species.

The genetic diversity helps the population to adapt. If a population has more diversity it can adapt better to the changed environmental conditions. The low diversity leads to uniformity. The genetic variability is therefore, considered to be the raw material for speciation.

2. Species diversity

The measurement of species diversity is its richness, i.e. the number of species per unit area. The greater is the species richness the more will be the species diversity. In nature, the number and kind of species, as well as the number of individual per species, vary, and this leads to greater diversity.

3. Ecological diversity

It is the diversity at community level. It can be of 3-types

(a) Alpha (α) diversity : It is the diversity of organisms within the same community or habitat.

(b) Beta (β) diversity : It is the diversity between communities or different habitats. Higher the heterogenecity in the altitude, Humidity and Temperature of a region, the greater will be the dissimilarity between communities, and higher will be the diversity.

(c) Gamma (γ) diversity : It is the diversity of organisms over the entire geographical area, covering several ecosystems or habitats and various trophic levels and food webs. Such diversity is most stable and productive.

Biodiversity of India:

As per available data, the varieties of species living on the earth are 1753739. Out of the above species, 134781 are residing in India although surface area of India is 2% of the earth's surface. Wild life Institute of India has divided it into ten biogeographical regions and twenty five biotic provinces.

Biogeographical regions are:

(i) Trans Himalayas,
(ii) Gangetic plain,
(iii) Desert,
(iv) Semiarid zone;
(v) Western Ghats;
(vi) Deccan peninsula,
(vii) North eastern zone,
(viii) Coastal lands
(ix) Himalayas,
(x) Islands.

India is one of the twelve mega diversity nations of the world due to the following reasons:

(i) It has 7.3% of the global fauna and 10.88% of global flora as per the data collected by Ministry of Environment and forest.
(ii) It has 350 different mammals, 1200 species of birds-453 different reptiles, 182 amphibians and 45,000 plants spices.
(iii) It has 50,000 known species of insects which include 13,000 butterflies and moths.
(iv) It has 10 different biogeographical regions and 25 biotic provinces having varieties of lands and species.
(v) In addition to geographical distribution, geological events in the land mass provide high level of biological diversity.
(vi) Several crops arose in the country and spread throughout the world.
(vii) There is wide variety of domestic animals like cows, buffaloes, goats, sheep, pigs, horses etc.
(viii) The marine biota includes sea weeds, fishes, crustaceans, molluses, corals, reptiles etc.
(ix) There are a number of hot spots (namely Eastern Ghats, Western Ghats, North Eastern hills etc.).

IUCN at a glance

- Founded in 1948 as the world's first global environmental organisation
- Today the largest professional global conservation network
- A leading authority on the environment and sustainable development
- More than 1,200 member organizations including 200+ government and 900+ non-government organizations
- Almost 11,000 voluntary scientists and experts, grouped in sixCommissions in some 160 countries
- IUCN's work is supported by over 1,000 staff in 45 offices and hundreds of partners in public, NGO and private sectors around the world. The Union's headquarters are located in Gland, near Geneva, in Switzerland.
- A neutral forum for governments, NGOs, scientists, business and local communities to find practical solutions to conservation and development challenges
- Thousands of field projects and activities around the world
- Governance by a Council elected by member organizations every four years at the IUCN World Conservation Congress
- Funded by governments, bilateral and multilateral agencies, foundations, member organisations and corporations
- Official Observer Status at the United Nations General Assembly

The **IUCN Red List** of Threatened Species™ provides taxonomic, conservation status and distribution information on plants, fungi and animals that have been globally evaluated using the IUCN Red List Categories and Criteria. This system is designed to determine the relative risk of extinction, and the main purpose of the IUCN Red List is to catalogue and highlight those plants and animals that are facing a higher risk of global extinction (i.e. those listed as **Critically Endangered, Endangered and Vulnerable**). The IUCN Red List also includes information on plants, fungi and animals that are categorized as **Extinct** or **Extinct in the Wild**; on taxa that cannot be evaluated because of insufficient information (i.e., are **Data Deficient**); and on plants, fungi and animals that are either close to meeting the threatened thresholds or that would be threatened were it not for an ongoing taxon-specific conservation programme (i.e., are **Near Threatened**).

The IUCN Red List of Threatened Species is widely recognized as the most comprehensive, objective global approach for evaluating the conservation status of plant and animal species. The IUCN Red List was updated three times in 2015. The IUCN Red List now includes 79,837 assessed species, of which 23,250 are threatened with extinction, with habitat loss and degradation identified as the main threat to more than 80% of species assessed.

Red data book

A Red Data Book contains lists of species whose continued existence is threatened. Species are classified into different

categories of perceived risk. Each Red Data Book usually deals with a specific group of animals or plants (e. reptiles, insects, mosses). They are now being published in many different countries and provide useful information on the threat status of the species.

By the end of 2014 India had 988 threatened species on the list, which lists critically endangered, endangered and vulnerable species. In 2013, the number was 973. With 659 species in 2008, the increase over seven years is 50 per cent, in part due to better research identifying more threatened species and deforestation. (The Hindu, 2015)

Indian elephant, Bengal tiger, Indian lion, Indian Rhino, Gaur, lion tailed macaque, Tibetan Antelope, Ganga river dolphin, the Nilgiri Tahr, snow leopard, dhole, black buck, great Indian bustard, forest owlet, white – winged duck and many more are the most endangered animals in India.

ENDANGERED SPECIES IN INDIA

Birds

- White-bellied heron
- Great Indian bustard (Ardeotis nigriceps)
- Forest owlet (Athene blewitti)
- Baer's pochard (Aythya baeri)
- Spoon-billed sandpiper (Eurynorhynchus pygmeus)
- Siberian crane (Grus leucogeranus)
- White-rumped vulture (Gyps bengalensis)
- Indian vulture (Gyps indicus)
- Slender-billed vulture (Gyps tenuirostris)
- Bengal florican (Houbaropsis bengalensis)
- Himalayan quail (Ophrysia superciliosa)
- Jerdon's courser (Rhinoptilus bitorquatus)
- Pink-headed duck (Rhodonessa caryophyllacea)
- Red-headed vulture (Sarcogyps calvus)
- Sociable lapwing (Vanellus gregarius)
- Bugun liocichla (Liocichla bugunorum)

Fish

- Knifetooth sawfish (Anoxypristis cuspidata)
- Pondicherry shark (Carcharhinus hemiodon)
- Ganges shark (Glyphis gangeticus)
- Deccan labeo (Labeo potail)
- Largetooth sawfish (Pristis microdon)
- Longcomb sawfish (Pristis zijsron)
- Humpback mahseer

Reptiles and Amphibians

- Northern river terrapin (Batagur baska)
- Red-crowned roofed turtle (Batagur kachuga)
- Hawksbill sea turtle (Eretmochelys imbricata)
- Gharial (Gavialis gangeticus)
- Ghats wart frog (Fejervarya murthii)
- Gundia Indian frog (Indirana gundia)
- Toad-skinned frog (Indirana phrynoderma)
- Charles Darwin's frog (Ingerana charlesdarwini)
- Rao's torrent frog (Micrixalus kottigeharensis)
- Amboli bush frog (Pseudophilautus amboli)
- White-spotted bush frog (Raorchestes chalazodes)
- Griet bush frog (Raorchestes griet)
- Munnar bush frog (Raorchestes munnarensis)
- Ponmudi bush frog (Raorchestes ponmudi)
- Sacred Grove bush frog (Raorchestes sanctisilvaticus)
- Shillong bubble-nest frog (Raorchestes shillongensis)
- Resplendent shrubfrog (Raorchestes resplendens)
- Anaimalai flying frog (Rhacophorus pseudomalabaricus)
- Patinghe Indian gecko (Geckoella jeyporensis)

Mammals

- Asiatic cheetah (Acinonyx jubatus venaticus)
- Namdapha flying squirrel (Biswamoyopterus biswasi)
- Himalayan wolf (Canis himalayensis)
- Andaman Shrew (Crocidura andamanensis)
- Jenkins' shrew (Crocidura jenkinsi)
- Nicobar shrew (Crocidura nicobarica)
- Northern Sumatran rhinoceros (Dicerorhinus sumatrensis lasiotis)
- Kondana soft-furred rat (Millardia kondana)
- Pygmy hog (Porcula salvania)
- Indian Javan rhinoceros (Rhinoceros sondaicus inermis)
- Malabar large-spotted civet (Viverra civettina)
- Elvira rat (Cremnomys elvira)
- Chinese pangolin (Manis pentadactyla)
- Kashmir stag (Cervus canadensis hanglu)

Coral

- Fire corals (Millepora boschmai)
- Spiders
- Rameshwaram Ornamental or Parachute Spider (Poecilotheria hanumavilasumica)
- Gooty Tarantula, Metallic Tarantula or (Poecilotheria metallica)

CITES

CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.

For many years CITES has been among the conservation agreements with the largest membership, with now 181 Parties. Roughly 5,600 species of animals and 30,000 species of plants are protected by CITES against over-exploitation through international trade. They are listed in the three CITES Appendices. The species are grouped in the Appendices according to how threatened they are by international trade. They include some whole groups, such as primates, cetaceans (whales, dolphins and porpoises), sea turtles, parrots, corals, cacti and orchids. However, in some cases only a subspecies or geographically separate population of a species (for example the population of just one country) is listed.

Ministry of Environment, Forests and Climate Change (INDIA)

The Ministry of Environment & Forests (MoEF) is the nodal agency in the Central Government for overseeing the implementation of India's environment and forest policies and programmes relating to conservation of the country's natural resources including lakes and rivers, its biodiversity, forests and wildlife, ensuring the welfare of animals and prevention and abatement of pollution. While implementing these policies and programmes, the Ministry is guided by the principle of sustainable development. The Ministry is also the nodal agency for the United Nations Environment Programme (UNEP), South Asia Co-operative Environment

Programme (SACEP), International Centre for Integrated Mountain Development (ICIMOD) and the United Nations Conference on Environment and Development (UNCED). The Ministry also coordinates with multilateral bodies such as the Commission on Sustainable Development (CSD), Global Environment Facility (GEF) and regional bodies such as Economic and Social Council for Asia and Pacific (ESCAP) and South Asian Association for Regional Cooperation (SAARC) on matters pertaining to environment.

The broad objectives of the Ministry are:

- Conservation and survey of flora, fauna, forests and wildlife
- Prevention and control of pollution
- Afforestation and regeneration of degraded areas
- Protection of environment, and
- Ensuring the welfare of animals.

National biodiversity authority

The Biological Diversity Act 2002 came into force in 2003. The Act extents to the whole of India. The objectives of the Act are conservation, sustainable utilization and fair and equitable sharing of benefits arising out of the use of biological resources and associated knowledge. The Act is being implemented in a three tiered institutional structures (NBA at National level, State Biodiversity Board at State level and Biodiversity Management Committee at local level).

The NBA is a body corporate established in accordance with the provisions of Sec.8 of the Biological Diversity Act, 2002, at Chennai w.e.f. 1st October 2003. It is an autonomous, statutory and regulatory organization which is intended to implement the provisions of Biological Diversity Act, 2002. The main objectives of NBA are: –

- To regulate access to biological resources of the country to conserve and sustainable use of biological diversity.
- To respect and protect the knowledge of local communities related to biodiversity.
- To secure sharing of benefits with the local people as conservers of biological resources and holders of knowledge and information relating to the use of biological resources.
- Conservation and development of area of importance from the view point of biological diversity by declaring them as biological diversity heritage sites.
- Protection and rehabilitation of threatened species; involvement of institutions of state government in the broad scheme of implementation of the Biological Diversity Act through constitution of committees.

Centres of Excellence (in India)

- Centre for Environment Education (CEE), Ahmedabad .
- CPR Environmental Education Centre (CPREEC), Chennai.
- Centre for Ecological Sciences (CES), Indian Institute of Science (IISc), Bengaluru.
- Centre of Mining Environment (CME), Indian School of Mines, Dhanbad.
- Salim Ali Centre for Ornithology and Natural History (SACON), Coimbatore.
- Centre for Environment Management of Degraded Ecosystem (CEMDE), University of Delhi, Delhi.
- Madras School of Economics (MSE), Chennai.
- Foundation for Revitalization of Local Health Traditions (FRLHT), Bengaluru.

The Tropical Botanic Garden and Research Institute (TBGRI), Thiruvananthapuram .

Centre for Animals and Environment, CARTMAN, Bengaluru.

Loss of Biodiversity

There is continuous loss of the earth' treasure of species. For example, the colonization of tropical pacific Islands by human has led to extinction of more than 2000 species of native birds.

The Red list of IUCN documented the extinction of 784 species in last 500 years. The last 20 years witnessed the disappearance of 27 species.

Some important examples of recent extinctions are-

Dodo (Mauritius), *Quagga* (Africa), *Thylacine* (Australia), *Steller Sea-cow* (Russia), and subspecies of Tiger, like *bali, javan* and *caspian*.

Presently, more than 15,500 species world–wide are facing the threat of extinction. This includes 32% of amphibian species, 23% of mammalian species and 12% of birds' species. About 31% of the gymnosperms species are also facing the extinction. The amphibians are however, more vulnerable in such cases.

Causes of loss of biodiversity

The accelerated rate of species-extinction is largely due to human activities. There are 4-major causes, called **'The Evil Quartet',** for the loss of biodiversity –

1. Habitat loss and fragmentation
2. Over-exploitation
3. Invasion of Alien or exotic species
4. Co-extinctions

1. Habitat loss and fragmentation

The cutting trees and burning of forest destroys the natural habitat of a species. The construction of mines, dams, harbors, industries and buildings for human settlement has also affected the biodiversity. *The Habitat destruction is the primary and major reason for the loss of biodiversity*. The tropical rain forest is the example of the habitat loss where forest covering has been reduced from 14% of land surface to 6%.

The Amazon rain forest, called '*The Lungs of the Planet'*, which harbors millions of species, is being cleared for cultivating soybean or developing grasslands for raising cattle. The pollution is also the factor for degradation of habitat.

When large habitats are broken into small fragments due to various human activities, the population of migratory animals, mammals and birds, that require a large territory, are adversely affected.

2. Over-exploitation

When human need turns to human greed, for food and shelter, it leads to overexploitation of natural resources. Many species – extinction, like that of Stellar sea-cow and Passenger pigeon, in last 500 years, are due to over-exploitation by humans. Many marine fishes are also being over harvested. Over fishing from a water body, or over harvesting a product is just like *'killing a goose laying golden eggs'.*

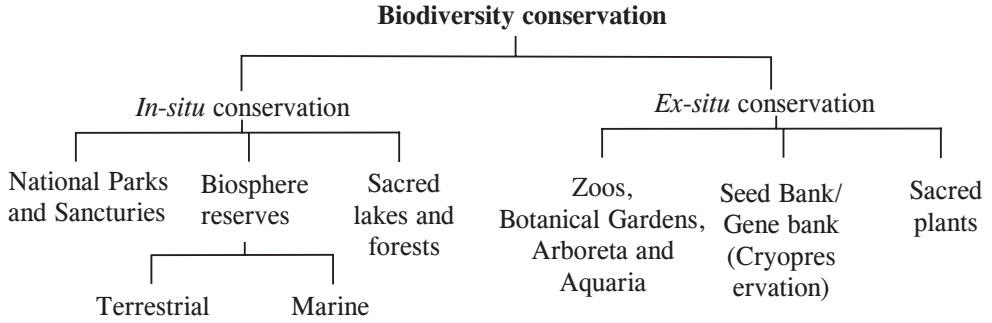
3. Invasion of Alien or exotic species

When alien species are introduced into an explored area, some of the species turn invasive and cause decline or extinction of indigenous species. For example –

- Introduction of **Nile perch** into lake Victoria (E. Africa) led to the extinction of more than 200 species of Cichlid fish in the lake
- Introduction of weed species, like **Carrot grass** (*Parthenium),* Lantana and **water hyacinth** (*Eicchornia*) has posed threat to the native species and damage to environment.
- The illegal introduction of **African cat fish** (*Clarias gariepinus*) for aquaculture purposes into the river has threatened indigenous cat fishes.

4. Co-extinctions

Whenever a plant or animal species becomes extinct, its obligatory-associated species also becomes extinct. For example, when a host species becomes extinct, the parasite also meets the same fate. In case of '*plant pollinator mutualism'* the extinction of one species leads to the extinction of the other.



1. In situ conservation

In such conservation the endangered species are protected in their natural habitat with entire ecosystem. The conservationists, on global basis, have identified certain ***Biodiversity Hot Spots*** (with high level of species richness and high degree of endemism).

(The endemic species are the ones which are confined to a particular region and are not found any where else) The hot spots are also the regions of accelerated habitat loss.

Hot spots are the areas with high density of biodiversity or mega diversity which are most threatened at present. The concept was developed by environmental scientist Norman Myers of Oxford University in the United Kingdom in an attempt to identify priority areas for biodiversity conservation. Around the world, 35 areas qualify as hotspots. They represent just 2.3% of Earth's land surface,but they support more than half of the world's plant species as endemics — *i.e.*, species found no place else — and nearly 43% of bird, mammal, reptile and amphibian species as endemics.

The number of such hot spots is now 34. These hot spots cover only 1 to 2 percent of earth's land area,

To qualify as a biodiversity hotspot, a region must meet two strict criteria:

- It must have at least 1,500 vascular plants as endemics — which is to say, it must have a high percentage of plant life found nowhere else on the planet. A hotspot, in other words, is irreplaceable.
- It must have 30% or less of its original natural vegetation. In other words, it must be threatened.

The 3-biodiversity hot spots of India, that cover rich-biodiversity regions, are

1. Western Ghat
2. Himalaya
3. Indo-Burma

The *in situ* conservation, in India, is done through 15– **Biosphere reserves, 90-National Parks,** more than 450 **sanctuaries** and several **Sacred Groves** or the tracts of forests.

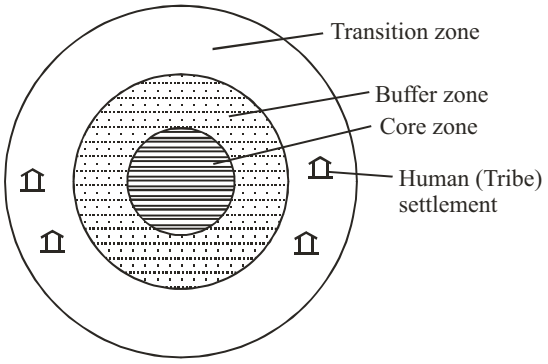
1. Biosphere reserves

They represent natural biomes which contain unique biological communities. They include land as well as coastal environment. Biosphere reserves were created under **MAB** (Man and Biosphere) programme of **UNESCO** in 1971. Till May 2000 there were 408 biosphere reserves in 94 countries of the world. In India there are 15 biosphere reserves. There are 3-zones in a biosphere reserve.

(a) Core (natural) zone – It is inner most zone which is legally protected and completely undisturbed from human interference,

(b) Buffer zone - In this zone limited human activity is allowed for research and education purposes.

(c) Transition (manipulation) zone – It is the outermost zone of biosphere reserve in which large number of human activities are permitted, eg. Cultivation, domestication, harvesting of natural product, grazing, forestry, settlement and recreation etc. In this zone the traditional life style of tribals is protected with their live-stock.



Different zones of a Terrestrial Biosphere reserve

Functions of biosphere reserves

1. For conservation of landscape, ecosystem and genetic resources.
2. For economic development.
3. For scientific research , education and for exchange of information at national and global level.

In India the first biosphere reserve, **Nilgiri** was declared in **1986**. It includes parts of Karnataka, Kerala and Tamilnadu. The list of biosphere reserves of India is given below :-

1. Nilgiri
2. Nandadevi
3. Uttrakhand
4. Nokrek (Meghalaya)
5. Andamans
6. Simlipal (Orissa)
7. Kaziranga (Assam)
8. Gulf of Mannar (T.N)
9. Thar Desert
10. Sundarbans (W.B.)
11. Kanha (M.P.)
12. Runn of Kutch (Guj)
13. Nicobar
14. Manas (Assam)
15. Namdapha (Ar. P.)

2. National Parks

They are reserved for the betterment of wild life, both **fauna and flora.** In national parks private ownership is not allowed. The grazing, cultivation, forestry etc. is also not permitted. The first national park of the world, Yellow stone, in U.S.A., was founded in 1872.

Important state wise national parks of India are –

Jammu and Kashmir - Dachigam, Salim Ali
Assam - Kaziranga, Manas*
Meghalaya - Nokrek
West Bengal - Sunderbans
Bihar - Hazaribagh, Palamau*
Uttaranchal - Corbett* (Hailey), Nanda Devi, Valley of flowers, Rajaji
U. P. - Dudhwa*
Gujrat - Gir, Marine
Rajasthan - Sariska*, Ranthambore*, Desert
Madhya Pradesh - Kanha* , Sanjay, Madhav, Panna, Bandhavgarh*, Van Vihar, Fossil
Orissa - Simlipal
Karnataka - Bandipur*
Kerala - Silent Valley, Periyar*

*These national parks are running **Tiger Project** also. *(The maximum national parks are present in Madhya Pradesh).*

3. Sanctuaries

In sanctuaries the protection is given to **fauna** only**.** The activity like harvesting of timber, collection of forest products and private ownership rights are permitted so long as they do not interfere with the well being of the animals. The important wild life sanctuaries are Chilka wild life sanctuary (**Orissa**), Bharatpur Bird Sanctuary (**Rajasthan**), Sultanpur Bird sanctuary (**Haryana**) and Jalpara sanctuary (**West Bengal**). Maximum sanctuaries belong to Andaman and Nicobar.

The **Project Tiger** was launched in India in year **1973** with the assistance of **WWF** (World Wild life Fund) after the recommendation of **IBWL** (Indian Board of Wild Life). At present there are more than 20 tiger projects. (**WWF** after its silver jubilee in 1986 has been renamed as **World Fund for Nature (WFN)**. The symbol of **WWF** is **Giant Panda**.

In India National Parks and Sanctuaries were created after formulation of **Wild life (protection) act** in **1972**. (This act was amended in 1991).

4. The sacred groves are found in Khasi and Jaintia hills (Meghalaya), Aravalli hills (Rajasthan), Western ghats (Karnataka and Maharashtra) and Sarguja, Chanda and Bastar areas of Madhya Pradesh.

National Parks in India

Name	State	Notability
Bandipur National Park (1974)	Karnataka	Chital, gray langurs, Indian giant squirrel, Gaur, leopard, Sambar deer, indian elephants, honey buzzard, red-headed vulture and other animals.
Bannerghatta National Park (Bannerghatta Biological Park) (1974)	Karnataka	White Tiger, Royal Bengal Tiger, Bear, other animals
Betla National Park (1986)	Jharkhand	Tiger, Sloth Bear, Peacock, Elephant, Sambar deer, mouse deer and other animals.
Bhitarkanika National Park (1988)	Odisha	Mangroves, Saltwater crocodile, white crocodile, Indian python, black ibis, wild pigs, rhesus monkeys, chital and other animals
Buxa Tiger Reserve (1992)	West Bengal	Tiger
Dachigam National Park (1981)	J&K	Only area where Kashmir stag is found
Dudhwa National Park (1977)	U.P	Swamp deer, sambar deer, barking deer, spotted deer, hog deer, tiger, Indian rhinoceros,
Gir Forest National Park (1965)	Gujarat	Asiatic lion

Great Himalayan National Park (1984)	Himachal Pradesh,	UNESCO World Heritage Site
Gulf of Mannar Marine National Park (1980)	Tamil Nadu	Green turtles and Olive Ridley turtles and whales.
Indravati National Park (1981)	Chhattisgarh	Wild Asian Buffalo, Tiger Reserve, Hill Mynas
Jaldapara National Park (2012)	West Bengal	Indian one horned rhinoceros
Jim Corbett National Park (1936)	Uttarakhand	Tiger
Kanha National Park (1955)	M. P.	Swamp Deer, Tigers
Kaziranga National Park (1905)	Assam	Indian rhinoceros, UNESCO World Heritage Site
Keibul Lamjao National Park (1977)	Manipur	only floating park in the world
Keoladeo National Park (1981)	Rajasthan	UNESCO World Heritage Site
Manas National Park (1990)	Assam	UNESCO World Heritage Site
Mandla Plant Fossils National Park (1983)	M. P	Plant Fossils National Park
Marine National Park, Gulf of Kutch (1980)	Gujarat	70 species of sponges, Coral 52 species along with puffer fishes, sea horse and sting ray
Namdapha National Park (1974)	Arunachal Pradesh	Snow Leopards, Clouded Leopards, Common Leopards and Tigers
Nanda Devi National Park (1982)	Uttarakhand	UNESCO World Heritage Site
Neora Valley National Park (1986)	West Bengal	clouded leopard, red panda and musk deer
Nokrek National Park (1986)	Meghalaya	UNESCO World Biosphere Reserve
Periyar National Park (1982)	Kerala	Tigers
Ranthambore National Park (1981)	Rajasthan	Tigers, Leopards, Striped Hyenas, Sambar deer and Chital.
Sariska Tiger Reserve (1955)	Rajasthan	Tiger
Simlipal National Park (1980)	Odisha	Tiger, Leopard, Asian elephant, Sambar, Barking deer, Gaur, Jungle cat, Wild boar, and other animals.
Sultanpur National Park (1989)	Haryana	Siberian crane, greater flamingo, ruff, black-winged stilt, common teal, northern pintail, and yellow wagtail.
Sundarbans National Park (1984)	West Bengal	UNESCO World Heritage Site
Valley of Flowers National Park (1982)	Uttarakhand	Flying squirrel, Himalayan black bear, red fox, Himalayan weaseland Himalayan yellow-throated marten, and Himalayan goral

Wild Life Sanctuaries

India has 515 animal sanctuaries referred to as wildlife sanctuaries category IV protected areas. Among these, the 48 tiger reserves are governed by Project Tiger, and are of special significance in the conservation of the tiger.

WILD LIFE SANCTUARIES IN INDIA

Name of the Sanctuaries	Location	Major Species
Gir Wild Life Sanctuary	Sasan Gir, Junagadh, Amreli	Lion, Leopard, Chausinga, Chital, Hyena, Sambar, Chinkara, Herpetofauna, Crocodiles and birds
Wild Ass Sanctuary	Little Rann of Kachchh	Wild Ass, Chinkara, Blue bull, Houbara bustard, Wolf, Waterfowls, Herpetofauna
Hingolgadh Sanctuary	Hingolgadh, Rajkot	Chinkara, Blue bull, Wolf, Hyena, Fox, Birds, Herpetofauna
Marine Sanctuary	Gulf of Kachchh, Jamnagar	Sponges, Corals, Jellyfish, Sea horse, Octopus,Oyster, Pearloyster, Starfish, Lobster, Dolphin, Dugong, waterfowls
Simlipal Sactuary	Odisha	Elephant, Tiger, Leopard, Gaur, Cheetal
Kutch Desert Sanctuary	Great Rann of Kachchh	Chinkara, Hyena, Fox, Flamingo, Pelicans & other waterfowls, Herpetofauna
Rampara Sanctuary	Rampara, Rajkot	Blue bull, Chinkara, Wolf, Fox, Jackal, Birds, Herpetofauna
Ghana Bird Sanctuary	Rajasthan	Water Bird, Black-buck, Cheetal, Sambar
Panchmarhi	Madhya Pradesh	Tiger, Panther, Sambhar, Nilgai, Baskeng, Deer
Dandeli Sanctuary	Karnataka	Tiger, Panther, Elephant, Cheetal, Sanbhar, Wild Boar
Kutch Bustard Sanctuary	Near Naliya, Kachchh	Great Indian Bustard, Lesser Florican, Houbara bustard, Chinkara, Blue bull, Herpetofauna

Biosphere reserves in India Area-wise

Name	State	Key Fauna
Nilgiri Biosphere Reserve	Tamil Nadu, Kerala and Karnataka	Nilgiri tahr, lion-tailed macaque
Nanda Devi National Park & Biosphere Reserve	Uttarakhand	
Gulf of Mannar	Tamil Nadu	Dugong or sea cow
Nokrek	Meghalaya	Red panda
Sundarbans	West Bengal	Royal Bengal tiger
Manas	Assam	Golden langur, red panda
Simlipal	Odisha	Gaur, royal Bengal tiger, elephant
Dihang-Dibang	Arunachal Pradesh	
Pachmarhi Biosphere Reserve	Madhya Pradesh	Giant squirrel, flying squirrel
Achanakmar-Amarkantak Biosphere Reserve	Madhya Pradesh, Chhattisgarh	Four horned antelope (Tetracerus quadricornis), Indian wild dog (Cuon alpinus), Saras crane (Grus antigone), Asian white-backed vulture (Gyps bengalensis), Sacred grove bush frog (Philautus sanctisilvaticus)
Great Rann of Kutch	Gujarat	Indian wild ass

Cold Desert	Himachal Pradesh	Snow leopard
Khangchendzonga	Sikkim	Snow leopard, red panda
AgasthyamalI Biosphere Reserve	Kerala, Tamil Nadu	Nilgiri tahr, elephants
Great Nicobar Biosphere Reserve	Andaman and Nicobar Islands	Saltwater crocodile
Dibru-Saikhowa	Assam	Golden langur
Seshachalam Hills	Andhra Pradesh	
Panna	Madhya Pradesh	Tiger, chital, chinkara, sambhar and sloth bear

2. Ex situ conservation

In such type of conservation the threatened animals and plants are taken out of their natural habitat and are protected in special parks or areas like, **Zoological parks, Wild life safari parks** and **Botanical gardens*** etc. The *ex situ* conservation also includes

- **Cryopreservation** of gametes of threatened species in viable and fertile form.
- Fertilization of eggs *in vitro* and propagation of plants through '**Tissue culture methods'**
- Preservation of seeds through **Seed banks**

The historic conservation on Biodiversity, '**The Earth Summt'** was held in **Rio de Janeiro** (Brazil) in 1992. In a follow-up, in 2002, through '**World Summit on Sustainable development'** in **Johannaesburg** (S. Africa), one hundred and ninety countries pledged their commitment for a significant reduction in current rate of biodiversity-loss at global, regional and local level, by 2010. The next summit for the cause of biodiversity is to be held in 2012.

(***Botanical gardens** – There are about 1500 botanical gardens and **arboreta** (a place where specific species of trees or shrubs are cultivated for research or display) in the world. They contain more than 80000 species. Some botanical gardens also have facilities of seed bank and tissue culture.)

Animal Welfare

People for the Ethical Treatment of Animals (PETA)

It is a non-profitable American animal rights organization based in Norfolk, Virginia. Led by Ingrid Newkirk, its international president, founded in 1980 with a slogan of "Animals are not ours to eat, wear, experiment on, use for entertainment, or abuse in any other way." It focuses its attention on the four areas in which the largest numbers of animals suffer the most intensely for the longest periods of time: on factory farms, in the clothing trade, in laboratories, and in the entertainment industry.

World Wide Fund for Nature

The organisation was conceived in Morges, Switzerland (29, April, 1961). It is an international non-governmental organization in nature. Works in the field related to biodiversity conservation, and the reduction of humanity's footprint on the environment. It is the world's largest conservation organization with the slogan of "For a Living Planet." The method of its working involves Lobbying Research and Consultancy. Basically it's a charitable trust. WWF's giant panda logo originated from a panda named Chi Chi. It has been designed by Sir Peter Scott from preliminary sketches made by Gerald Watterson.

The main missions of WWF are as follows:

- conserving the world's biological diversity
- ensuring that the use of renewable natural resources is sustainable
- Promoting the reduction of pollution and wasteful consumption.

At present WWF's current strategy of achieving its mission which is related to restoring populations of 36 species (species or species groups that are important for their ecosystem or to people, including elephants, tunas, whales, dolphins and porpoises), and ecological footprint in 6 areas (carbon emissions, cropland, grazing land, fishing, forestry and water).

Animal Welfare Board of India

Functions

- To keep the law in force in India for the Prevention of Cruelty to Animals under constant study and to advise the government on the amendments to be undertaken in any such law from time to time.
- To advise the Central Government on the making of rules under the Act with a view to preventing unnecessary pain or suffering to animals and transported.
- To advise in the design of vehicles so as to lessen the burden on draught animals.
- To take all such steps as the Board may think fit for amelioration of animals by encouraging, or providing for the construction of sheds, water troughs and the like and by providing for veterinary assistance to animals.
- To advise in the design of slaughter houses or its maintenance.

India Initiative towards Animal protection

Project Tiger an government of India initiative for conserving its national animal, the tiger. The project was launched in 1973. Since then the no of tiger reserve has been increased from 9 to 47 which accounts for 2.08% the total geographical area of our country. The area of tiger projects have been developed on core/buffer strategy. The core areas are legally termed as National Parks and the buffering areas are a mixture of forest and non-forest land managed as a multiple used area. The project aims at fostering an exclusive tiger agenda in the core areas of tiger reserves, with an inclusive people oriented agenda in the buffer

Project Rhino was joint venture of the Assam Forest Department and Wildlife Trust of India - InternationalFund for Animal Welfare (WTI-IFAW) and initiated in February 2006 with the trans location of a hand-raised rhino calf to Manas Wildlife Sanctuary. The projects aims at repopulatimg the one horn rhino by displacing them to Manas wild life sanctuary from Kaziranga National Park. The whole project is supported by Bodoland Territorial Council and the Assam Forest Department.

Project Crocodile Conservation was launched in 1975 in different States for protecting the endangered crocodile species like

Gharial, Gavialis gangeticus; Mugger crocodile, Crocodylus palustris and Saltwater crocodile, Crocodylus were on the verge of extinction by the seventies. The funds and technical support for the project came from UNDP/ FAO through the Government of India.

Project Elephant (PE) is a central government initiative to provide financial and technical support to major elephant bearing states of India. It was launched in February 1992. It aims at protecting the elephants, their habitat and corridor. It also looks after the human elephant issues. It is implemented in 13 States / UTs, viz. Andhra pradesh, Arunachal Pradesh, Assam, Jharkhand, Karnataka, Kerala, Meghalaya, Nagaland, Orissa, Tamil Nadu, Uttranchal, Uttar Pradesh and West Bengal.

SAVE (Saving Asia's Vultures from Extinction) is a consortium of regional and international organization to co-ordinate conservation, campaigning and fundraising activities to help the plight of south Asia's vultures. The key strategies of vulture conservation SAVE is involved in a wide range of conservation activities across South Asia including:

- breeding vultures in captivity so that their offspring can be released back in to the wild when the environment is free from diclofenac
- an active advocacy programme targeting the vets and farmers using diclofenac
- legislation controlling the manufacture and sale of veterinary drugs
- in-situ conservation actions focused around the small but key remaining vulture populations in the wild
- an active research programme that underpins these activities and monitors their effectiveness

Project Dolphin Gangetic river dolphins is India's national aquatic animal and is often known as the 'Tiger of the Ganges'. This dolphin species is an indicator animal which represent healthy river ecosystem in a same position as a tiger in a forest. Their population is estimated to be less than 2,000 in the country. Some of the major threats are habitat fragmentation due to construction of dams and barrages, direct killing, indiscriminate fishing and pollution of rivers.

For conservation of dolphins, India's first Dolphin Community Reserve established in West Bengal to protect the endangered mammal, Gangetic river dolphins. The reserve would be set up in the Hooghly River between Malda and Sundarbans as per provisions of Wildlife Protection Act, 1972. State Forest department also has announced that it would also conduct a census to estimate the population of dolphins.

Exercise -1

1. A keystone species
   (a) has a disproportionately large impact on an ecosystem.
   (b) typically reduces overall diversity of an ecosystem.
   (c) is typically an herbivore.
   (d) is an example of amensalism.
2. Extinction of a weaker species by an aggressive alien species is the results of
   (a) Endemism of weaker species
   (b) Habitat loss
   (c) The Domino Effect
   (d) All of the above.
3. In the Lower Himalayan Mountains, several species of salamander, an amphibian, live in or near a stream. The largest species lives in the stream and along its edges, a smaller species lives on land within a meter or two of the stream, and a smaller species lives about 3-5 meters away from the stream. In this region, these three salamander species are using
   (a) different niches within the same habitat
   (b) the same niche and microhabitat
   (c) the same landscape but different ecosystems
   (d) the same habitat but different niches
4. Invasive species are dangerous because
   (a) they are almost all predators, disturbing ecological relationships by eating other species.
   (b) they carry viruses that spread disease in new ecosystems.
   (c) the native species have not evolved with these organisms.
   (d) they tend to be secretive, going unnoticed in their new ecosystems.
5. Protection and preservation of endangered species away from their natural habitat under human care in zoos, nurseries and laboratories is known as
   (a) In-situ conservation
   (b) Ex-situ conservation
   (c) Biodiversity conservation
   (d) None of the above
6. Protection of biodiversity around the world requires:
   (a) basic science to produce government policies and laws that then must be enforced.
   (b) changes to social structure and political organizations that drive basic science.
   (c) new technologies and techniques that are still being developed.
   (d) the introduction of new species into new regions to spread a species range.
7. Within biological communities, some species are important in determining the ability of a large number of other species to persist in the community. Such species are called
   (a) Keystone species (b) Allopatric species
   (c) Sympatric species (d) Threatened species
8. The diversity and productivity or coral reefs is most similar to that of
   (a) desert environments (b) a natural prairie.
   (c) tropic rain forests (d) a river system.
9. The risk of introducing a natural enemy to control an invasive species is that
   (a) it might drive the invasive species to extinction.
   (b) the natural enemy might also become a pest.
   (c) the natural enemy might evolve into a new species
   (d) the natural enemy may introduce genetic diversity into the invasive species.
10. Biodiversity is important because:
    (a) it is necessary to maintain ecosystems.
    (b) humans can use new sources of food.
    (c) without certain species, photosynthesis may not be possible.
    (d) certain species are necessary to provide oxygen in the atmosphere.
11. Compared to forests using sustainable forest management, commercial forests managed for maximum sustainable yield of commercially valuable species will
    (a) support more biological diversity.
    (b) be more resistant to pests.
    (c) produce a greater variety of wood.
    (d) have greater erosion problems.
12. Endemic species are:
    (a) secure groups that show the least risk of extinction.
    (b) limited to just one habitat.
    (c) widely distributed, found especially on large continents.
    (d) usually the dominant species within an ecosystem.
12. The greatest loss of biodiversity in the last two centuries has resulted from:
    (a) the introduction of alien species to new ecosystems.
    (b) the use of fossil fuels to power transportation and electrical production.
    (c) the physical alteration of habitats.
    (d) the use of rivers, lakes, and oceans for transportation.
14. Which of the following represents the greatest conservation of the genetic hank?
    (a) the human genome center, analyzing the components of the human genome.
    (b) seed banks that store seeds of thousands of plants from around the world.

(c) the field of proteomics, investigating the many ways the proteins function in organisms.
(d) all of the varieties of corn wheat, and rice currently serving as crops.

15. Which one of the following groups of animals belongs to the category of endangered species ?
(a) Great Indian Bustard, Musk Deer, Red Panda and Asiatic Wild Ass
(b) Kashmir Stag, Cheetal, Blue Bull and Great Indian Bustard
(c) Snow Leopard, Swamp Deer, Rhesus Monkey and Saras (Crane)
(d) Lion-tailed Macaque, Blue Bull, Hanuman Langur and Cheetal

16. Which one of the following national parks is located near Chamoli?
(a) Dudhwa National Park
(b) Great Himalayan Park
(c) Jim Corbett National Park
(d) Nanda Devi National Park

17. Which one of the following is included in the world list of biosphere reserves by UNESCO?
(a) Kinnaur Region (b) Spiti Valley
(c) Nallamalai Hills (d) Sunderbans

18. Which one of the following is a global biodiversity hotspot in India?
(a) Western Ghats
(b) Western Himalayas
(c) Eastern Ghats
(d) Northern Himalayas

19. In which one of the following states is Ranganathittu Bird Sanctuary located?
(a) Tamil Nadu (b) Kerala
(c) Karnataka (d) Andhra Pradesh

20. For which one of the following is Sualkuchi famous?
(a) Bird sanctuary (b) Temple city
(c) Silk centre (d) Hill station

21. Which one of the following is the correct sequence of the given tiger reserves of India from North to South?
(a) Dudwa-Kanha-Indravati-Bandipur
(b) Kanha-Bandipur-Dudwa-Indravati
(c) Indravati-Kanha-Dudwa-Bandipur
(d) Dudwa-Kanha-Bandipur-Indravati

22. Kanha National Park belongs to which one among the following biogeographical areas in the world?
(a) Tropical Sub-humid Forests
(b) Tropical Humid Forests
(c) Tropical Dry Forests
(d) Tropical Moist Forests

23. In wildlife conservation which one among the following best defines an 'endemic species'?
(a) When the critical number of a species declines in a forest due to parasitic attack
(b) A species which is cosmopolitan and can be commonly found in biosphere
(c) An endangered species which is found in a few restricted areas on the Earth
(d) A species confined to a particular region and not found anywhere else

24. Veliconda hills, which is a part of Eastern Ghats, is situated in
(a) Odisha (b) Tamil Nadu
(c) Karnataka (d Andhra Pradesh

25. Biodiversity is richer in
(a) tropical regions (b) polar regions
(c) temperate regions (d) oceans

26. Which one of the following National Parks has a climate that varies from tropical to subtropical, temperate and arctic? [CSAT 2015-1]
(a) Khangchendzonga National Park
(b) Nandadevi National Park
(c) Neora Valley National Park
(d) Namdapha National Park

27. In India, in which one of the following types of forests is teak a dominant tree species? [CSAT 2015-1]
(a) Tropical moist deciduous forest
(b) Tropical rain forest
(c) Tropical thorn scrub forest
(d) Temperate forest with grasslands

28. Which of the following National Parks is unique in being a swamp with floating vegetation that supports a rich biodiversity? [CSAT 2015-1]
(a) Bhitarkanika National Park
(b) Keibul Lamjao National Park
(c) Keoladeo Ghana National Park
(d) Sultanpur National Park

29. Which one of the following is the national aquatic animal of India? [CSAT 2015-1]
(a) Saltwater crocodile (b) Olive ridley turtle
(c) Gangetic dolphin (d) Gharial

Exercise -2

Statement Based MCQ

1. Consider the following pairs

Protected area		Well-known for
1. Bhiterkanika, Odisha	—	Salt Water Crocodile
2. Desert National Park, Rajasthan	—	Great Indian Bustard
3. Eravikulam, Kerala	—	Hoolak Gibbon

Which of the pairs given above is / are correctly matched ?
(a) 1 only (b) 1 and 2
(c) 2 only (d) 1, 2 and 3

2. Three of the following criteria have contributed to the recognition of Western Ghats , Sri Lanka and Indo Burma regions as hotspots of biodiversity
1. Species richness
2. Vegetation density
3. Endemism
4. Ethno-botanical importance
5. Threat perception
6. Adaption of flora and fauna to warm and humid conditions

Which three of the above are correct criteria in this context?
(a) 1, 2 and 6 (b) 2, 4 and 6
(c) 1, 3 and 5 (d) 3, 4 and 6

3. Consider the following statements
1. Biodiversity hotspots are located only in tropical regions.
2. India has four biodiversity hotspots i.e., Eastern Himalayas, Western Himalayas, Western Ghats and Andaman and Nicobar Islands.

Which of the statements given above is / are correct?
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

4. The "Red Data Books'' published by the International Union for Conservation of Nature and Natural resources (IUCN) contain lists of ?
1. Endemic plant and animal species present in the biodiversity hotspots.
2. Threatened plant and animal species.
3. Protected sites for conservation of nature and natural resources in various countries.

Select the correct answer using the codes given below:
(a) 1 and 3 (b) 2 only
(c) 2 and 3 (d) 3 only

5. How does National Biodiversity Authority (NBA) help in protecting the Indian agriculture?
1. NBA checks the biopiracy and protects the indigenous and traditional genetic resources.
2. National Biodiversity Authority (NBA) directly monitors and supervises the scientific research on genetic modification of crop plants.
3. Application for Intellectual Property Rights related to genetic/biological resources can not be made without the approval of NBA.

Which of the statements given above is/are correct?
(a) 1 only (b) 1 and 2 only
(c) 1 and 3 only (d) 1, 2 and 3

6. Consider the following protected areas:
1. Bandipur 2. Bhitarkanika
3. Manas 4. Sunderbans

Which of the above are declared Tiger Reserves?
(a) 1 and 2 only (b) 1, 3 and 4 only
(c) 2, 3 and 4 only (d) 1, 2, 3 and 4

7. Which of the following can be threats to the biodiversity of a geographical area?
1. Global warming
2. Fragmentation of habitat
3. Invasion of alien species
4. Promotion of vegetarianism

Select the correct answer using the codes given below:
(a) 1 and 2 only (b) 2 and 3 only
(c) 1, 2 and 3 only (d) 1, 2, 3 and 4 only

8. Biodiversity forms the basis for human existence in the following ways:
1. Soil formation
2. Prevention of soil erosion
3. Recycling of waste
4. Pollination of crops

Select the correct answer using the codes given below:
(a) 1, 2 and 3 only (b) 2, 3 and 4 only
(c) 1 and 4 only (d) 1, 2, 3 and 4

9. Which of the following regions of India have been designated as biodiversity hotspots?
Select the correct answer from the codes given below:
1. Eastern Himalaya 2. Eastern Ghat
3. Western Ghat 4. Western Himalaya

Codes:
(a) 1 and 2 only (b) 1 and 3 only
(c) 2 and 4 only (d) 3 and 4 only

10. The steps taken by the Government of India for conversion endangered species are
1. The Central Government has enacted the Wild Life (Protection) Act, 1972 for protection of wildlife including birds.
2. Wetland (Conservation and Management) Rules 2010 have been framed for protection of wetlands, in the States, which are habitats of birds.
3. Wildlife Crime Control Bureau has been established for control of illegal trade in wildlife, including endangered species of birds and their parts and products.

4. The Centrally Sponsored Scheme of National Plan for Conservation of Aquatic Eco-System also provides assistance to the States for management of wetlands including Ramsar sites in the country.

Select the answer from the codes given below-

(a) 1, 2, and 3 (b) 2, 3, and 4
(c) 1, 3, and 4 (d) All of the above

11. Consider the following statements
1. Tree Foundation, an NGO engaged in conservation of the sea turtle found more than 100 dead Olive Ridley Turtles in the shores of Nagapattinam.
2. The Olive Ridley turtles find the coastline of Nagapattinam as a favourable nesting habitat and that's why they reach to the shore from December to March every year.
3. The Olive Ridley looks very similar to the Kemp's Riddle, but has a deeper body and slightly up-turned edges to its carapace (shell).
4. Olive Ridley weighs around 45 kilograms and are 70cm in size and this makes them the smallest of the sea turtles along with Kemp riddles.

Which of the following statements are correct?

(a) 1, 2 and 3 (b) 2, 3 and
(c) 1, 3 and 4 (d) All of the above

12. Which of the following statement is/are correct?
1. First Climate Change theatre in India (second theatre in the world) was opened at Pusa, New Delhi in January 2014.
2. The Inter-governmental Panel on Climate Change (IPCC) UN report on 17 January 2014 reported that during 2000 to 2010, the CO2 has grown by 2.2 percent per year and this rise is almost twice higher from the growth of the period of 1970 to 2000.

Answer from the codes given below:

(a) 1 only (b) 2 only
(c) 1 and 2 only (d) None of these

13. Which of the following two criteria have to be met in order to qualify as a 'biodiversity hotspot' on the world hotspots map?
1. The region must contain at last 0.5% or 1500 species of vascular plants as endemic species.
2. The region has to have lost at least 70% of its primary vegetation.

Which of the statements given above is/are correct?

(a) 1 only (b) 2 only
(c) 1 and 2 both (d) None

14. Sumatran rhino populations have declined steadily to a point near extinction. Because of its population decline, this unusual forest dwelling rhino is near its :
1. carrying capacity
2. officially listed as threatened
3. critical number
4. officially listed as endangered

Which of the above is/are correct?

(a) 1 and 2 (b) 3 and 4
(c) 1 and 3 (d) 2 and 3

15. Which of the following can be threats to the biodiversity of a geographical area?
1. Global warming
2. Fragmentation of habitat
3. Invasion of alien species
4. Promotion of vegetarianism

Select the correct answer using the codes given below:

(a) 1, 2 and 3 (b) 2 and 3
(c) 1 and 4 (d) 1, 2, 3 and 4

16. The "Red Data Books'' published by the International Union for Conservation of Nature and Natural resources (IUCN) contain lists of ?
1. Endemic plant and animal species present in the biodiversity hotspots.
2. Threatened plant and animal species.
3. Protected sites for conservation of nature and natural resources in various countries.

Select the correct answer using the codes given below:

(a) 1 and 3 (b) 2 only
(c) 2 and 3 (d) 3 only

17. Consider the following statements:
1. The boundaries of a National Park are defined by legislation.
2. A Biosphere Reserve is declared to conserve a few specific species of flora and fauna.
3. In a Wildlife Sanctuary, limited biotic interference is permitted.

Which of the statements given above is / correct ?

(a) 1 only (b) 2 and 3
(c) 1 and 3 (d) 1, 2 and 3

18. One Carbon Credit is defined as ____ .
1. Credit permit to release one ton of carbon dioxide.
2. providing loans to establish a unit which produces carbon dioxide for industrial use.
3. Finding out one new business which can use and recycle greenhouse gases.

Which of the following statements(s) is/are correct?

(a) 3 only (b) 2 only
(c) 1 only (d) 1, 2 and 3

19. How does National Biodiversity Authority (NBA) help in protecting the Indian agriculture?
1. NBA checks the biopiracy and protects the indigenous and traditional genetic resources.
2. NBA directly monitors and supervises the scientific research on genetic modification of crop plants.
3. Application for Intellectual Property Rights related to genetic/biological resources cannot be made without the approval of NBA.

Which of the statements given above is /are correct?

(a) 1only (b) 2 and 3
(c) 1 and 3 (d) 1, 2 and 3

20. Three of the following criteria have contributed to the recognition of Western Ghats , Sri Lanka and Indo Burma regions as hotspots of biodiversity
    1. Species richness
    2. Vegetation density
    3. Endemism
    4. Ethno-botanical importance
    5. Threat perception
    6. Adaption of flora and fauna to warm and humid conditions

    Which three of the above are correct criteria in this context?
    (a) 1, 2 and 6 (b) 2, 4 and 6
    (c) 1, 3 and 5 (d) 3, 4 and 6

21. Biodiversity forms the basis for human existence in the following ways
    1. Soil formation
    2. Prevention of soil erosion
    3. Recycling of waste
    4. Pollination of crops

    Select the correct answer using the codes given below:
    (a) 1,2 and 3 (b) 2, 3 and 4
    (c) 1 and 4 (d) 1, 2, 3 and 4

22. Which of the following can be threats to the biodiversity of a geographical area?
    1. Global warming
    2. Fragmentation of habitat
    3. Invasion of alien species
    4. Promotion of vegetarianism

    Select the correct answer using the codes given below :
    (a) 1, 2 and 3 (b) 2 and 3
    (c) 1 and 4 (d) 1, 2, 3 and 4

23. Consider the following statements :
    1. The boundaries of a National Park are defined by legislation.
    2. A Biosphere Reserve is declared to conserve a few specific species of flora and fauna.
    3. In a Wildlife Sanctuary, limited biotic interference is permitted.

    Which of the statements given above is / correct ?
    (a) 1 only (b) 2 and 3
    (c) 1 and 3 (d) 1, 2 and 3

24. In which of the following States is lion-tailed macaque found in its natural habitat?
    1. Tamil Nadu 2. Kerala
    3. Karnataka 4. Andhra Pradesh

    Select the correct answer using the codes given below.
    (a) 1, 2 and 3 only (b) 2 only
    (c) 1, 3 and 4 only (d) 1, 2, 3 and 4

25. Consider the following:
    1. Star tortoise 2. Monitor lizard
    3. Pygmy hog 4. Spider monkey

    Which of the above are naturally found in India?
    (a) 1, 2 and 3 only (b) 2 and 3 only
    (c) 1 and 4 only (d) 1, 2, 3 and 4

26. Consider the following fauna of India:
    1. Gharial 2. Leatherback turtle
    3. Swamp deer

    Which of the above is/are endangered?
    (a) 1 and 2 only (b) 3 only
    (c) 1, 2 and 3 (d) None

27. If you walk through countryside, you are likely to see some birds stalking alongside the cattle to seize the insects disturbed by their movement through grasses.
    Which of the following is/are such bird/birds?
    1. Painted Stork 2. Common Myna
    3. Black-necked Crane

    Select the correct answer using the code given below.
    (a) 1 and 2 (b) 2 only
    (c) 2 and 3 (d) 3 only

28. With reference to the International Union for Conservation of Nature and Natural Resources (IUCN) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which of the following statements is/are correct? [CSAT 2015-1]
    1. IUCN is an organ of the United Nations and CITES is an international agreement between governments.
    2. IUCN runs thousands of field projects around the world to better manage natural environments.
    3. CITES is legally binding on the States that have joined it, but this Convention does not take the place of national laws.

    Select the correct answer using the code given below.
    (a) 1 only (b) 2 and 3 only
    (c) 1 and 3 only (d) 1, 2 and 3

29. With reference to an organization known as 'Birdlife International', which of the following statements is/are correct? [CSAT 2015-1]
    1. It is a Global Partnership of Conservation Organizations.
    2. The concept of 'biodiversity hotspots' originated from this organization.
    3. It identifies the sites known/referred to as 'Important Bird and Biodiversity Areas'.

    Select the correct answer using the code given below.
    (a) 1 only (b) 2 and 3 only
    (c) 1 and 3 only (d) 1, 2 and 3

30. Consider the following sanctuaries of India
    1. Periyar 2. Dachigam
    3. Sariska 4. Kanha

    Which one among the following is the correct sequence of location of the above sanctuaries from South to North?
    (a) 1, 4, 2, 3 (b) 4, 1, 3, 2
    (c) 1, 4, 3, 2 (d) 3, 1, 4, 2

31. Which of the following are UNESCO recognised world heritage sites?
    1. Caves of Ajanta.
    2. Temple and Caves at Ellora.
    3. Mandapas of Mahabalipurarn.
    4. Caves of Kanheri.

Select the correct answer using the codes given below

(a) 1 and 4 (b) 1, 2 and 3

(c) 1, 3 and 4 (d) 2, 3 and 4

32. Consider the following statements

1. Jim Corbett National Park is the oldest national park of india.
2. It was one of the nine tiger reserves created at the launch of the Project Tiger in 1973.
3. Initially it was named as 'Hailey National Park'.

Which of the statements given above are correct?

(a) 1 and 2 (b) All of these

(c) 2 and 3 (d) 1 and 3

Matching Based MCQ

Directions (Q. 33 to 38): Match List-I with List-II and select the correct answer using the codes given below the lists.

33.

List-I	List-II
A. Biodiversity	1. G. Tansley
B. Wildlife	2. E.O. Wilson
C. Ecosystem	3. E. Haeckel
D. Ecology	4. W.T. Hornaday

Codes:

	A	B	C	D
(a)	2	4	3	1
(b)	2	4	1	3
(c)	4	2	3	1
(d)	4	2	1	3

34. Consider the following pairs:

1. Nokrek Bio-sphere Reserve : Garo Hills
2. Logtak (Loktak) Lake : Barail Range
3. Namdapha National Park : Dafla Hills

Which of the above pairs is/are correctly matched?

(a) 1 only (b) 2 and 3 only

(c) 1, 2 and 3 (d) None

35. Consider the following pairs :

1. Dampa Tiger Reserve : Mizoram
2. Gumti Wildlife Sanctuary : Sikkim
3. Saramati Peak : Nagaland

Which of the above pairs is/are correctly matched?

(a) 1 only (b) 2 and 3 only

(c) 1 and 3 only (d) 1, 2 and 3

36.

List-I (Malor Biome)	**List-II (Physical characterstics)**
A. The Northern most of the Temperate Formations	1. Foristically poor (i.e., a continuous belt across North America and Northern Eurasia)
B. Arctic Tundra Vegetation	2. Boreal Forest
C. Marine	3. Pelagic division
D. The Terrestrial Biomes of the Tropics	4. Savanna woodland
	5. Soviet Steppe and North American Prairie

Select the correct option from the codes given below:

	A	B	C	D
(a)	2	4	3	1
(b)	2	1	3	4
(c)	4	3	5	2
(d)	4	1	3	2

37. Match the following

List I (Biosphere Reserve)	List II (Places)
A. Manas	1. Meghalaya
B. Pachmarhi	2. Asom
C. Nokrek	3. Madhya Pradesh
D. Achanakmar Amarkantak	4. Chhattisgarh

Codes

	A	B	C	D		A	B	C	D
(a)	4	3	1	2	(b)	2	1	3	4
(c)	4	1	3	2	(d)	2	3	1	4

38. Match the following

List I (Biosphere Reserve)	List II (State)
A. Nilgiri	1. Odisha
B. Manas	2. Madhya Pradesh
C. Panchmarhi	3. Tamul Nadu
D. Simes lipal	4. Asom

Codes

	A	B	C	D		A	B	C	D
(a)	3	2	4	1	(b)	1	4	2	3
(c)	3	4	2	1	(d)	1	2	4	3

Hints and Explanations

EXERCISE-2

1. (a) 2. (a) 3. (a) 4. (c) 5. (d)
6. (a) 7. (a) 8. (c) 9. (b) 10. (a)
11. (d) 12. (b) 13. (c) 14. (b)

15. (a) Red Panda and Asiatic Wild Ass, are endangered species.
16. (d) The Nanda Devi National Park is a national park situated around the peak of Nanda Devi(7,816 m) in Uttarakhand.
17. (d) The Sundarbans is the largest single block of tidal halophytic mangrove forest in the world. The Sundarban forest lies in the vast delta on the Bay of Bengal formed by the super confluence of the Ganges, Padma, Brahmaputra and Meghna rivers across southern Bangladesh. It is a UNESCO World Heritage Site.
18. (a) Western Ghats are UNESCO World Heritage Site and is one of the eight "hottest hotspots" of biological diversity in the world.
19. (c) Ranganathittu Bird Sanctuary is located in Karnataka.
20. (c) Sualkuchi is located in Assam. This is the textile center of Assam. Muga silk and Pat silk along with Eri silk and Endi cloth from this region is famous for its quality.
21. (a) 1. Dudwa National park - Uttar Pradesh
    2. Kanha National Park- Madhya Pradesh
    3. Indravati National Park - Chattisgarh
    4. Bandipur National Park- Karnataka
22. (c) Kanha National Park belongs to tropical moist dry deciduous forest. It is a tiger reserve of India and the largest national park of Madhya Pradesh.
23. (d) An endemic species is one whose habitat is restricted to a particular area. The term could refer to an animal, a plant, a fungus, or even a microorganism. Some of the endemic species in India are Grey-headed Bulbul, Malabar Lark, Nilgiri Flycatcher and Grey Jungle fowl etc.
24. (d) Veliconda Hills are situated in southeastern Andhra Pradesh state. They form the eastern flank of the Eastern Ghats.
25. (a) Biodiversity is richer in tropical regions. Biodiversity is a measure of the health of ecosystems. Greater biodiversity implies greater health. Biodiversity is in part a function of climate. In terrestrial habitats, tropical regions are typically rich whereas Polar Regions support fewer species.
26. (d) Namdapha National Park is located in Arunachal Pradesh. The climate of this area varies from tropical to subtropical, temperate and arctic. It is tropical and subtropical in southern regions and arctic type found in northern part of the park.
27. (a) The tropical moist deciduous forests are found in Sahyadris, the north-eastern parts of the peninsula and along the foothills of the Himalayas. Teak and sal are found in these forests.
28. (b) The Keibul Lamjao National Park is a national park located in Manipur. It is 40 km in area and the only floating park in the world which is located in North East India, and an integral part of Loktak Lake.
29. (c) The Gangetic dolphins have been declared as the National Aquatic Animal of India .River Dolphin is the National Aquatic Animal of India. The Ministry of Environment and Forests notified the Ganges River Dolphin as the National Aquatic Animal on 18th May 2010. This mammal is also said to represent the purity of the holy Ganga as it can only survive in pure and fresh water.

EXERCISE-2

1. (b)
   - Bhiterkanika, Odisha is a protected area for salt water crocodile, where breeding is the main purpose of that protected area.
   - Great Indian Bustard is protected in desert area of Rajasthan.
   - The Eravikulam National Park was established to protect the Nilgiri tahir (wild goat) species.
2. (c) To qualify as a hotspot, a region must meet two strict criteria: it must contain at least 1,500 species of vascular plants (> 0.5 percent of the world's total) as endemics, and it has to have lost at least 70 percent of its original habitat. So we choose Species richness as well as Endemism. Along with this Threat perception is necessary to take, because it makes the base of this concept. Adaptation of flora is an arbitrary option, Ethno-botanical importance does nothing with the Biodiversity Hotspot selection criteria, vegetation Density is also discarded.
3. (d) Biodiversity hot spots are located in temperate regions and hotspots are present in eastern Himalayas, Western Ghats and Andaman Islands.
4. (b) The red data book is contain only 8 lists of threatened plant and animal species.
5. (c) The National Biodiversity Authority (NBA) an autonomous body was established in 2003 to implement India's Biological Diversity Act (2002).
6. (b) Bandipur National Park, a tiger reserve is located in the south Indian state of Karnataka.
   Manas National Park or Manas Wildlife Sanctuary is a National Park, UNESCO Natural World Heritage site, a Project Tiger Reserve, an Elephant Reserve and a Biosphere Reserve in Assam. The Sundarban National Park is a National Park, Tiger Reserve,

and a Biosphere Reserve in India. It is a part of the Sundarbans on the Ganges Delta of India and Bangladesh.

Bhitarkanika National Park is a national park located in the Kendrapara District Odisha, which is not specifically for Tiger reserve.

7. (a) Global Warming, fragmentation of habitat and invasion of alien species can be threats to the bio-diversity of a geographical area.

8. (d) Biological diversity helps in the formation and maintenance of soil structure and the retention of moisture and nutrient levels. Trees on the other hand, lower the water table and remove deposited salt from the upper soil horizons.

9. (b) A biodiversity hotspot is a biogeographic region with a significant reservoir of biodiversity that is under threat from humans. Around the world, as many as 25 areas qualify to be the hotspots. Out of which India has 2 hotspots: Eastern Himalayas and Western Ghats.

10. (d) For conversion endangered species Wildlife Crime Control Bureau has been established for control of illegal trade in wildlife, including endangered species of birds and their parts and products. Research and monitoring activities on birds are promoted by the Government through reputed research organizations. Wildlife Institute of India, Bombay Natural History society and Salim Ali Centre for Ornithology and Natural History are some of the research organizations undertaking research on conservation of birds. The Indian government has banned the veterinary use of diclofenac drug that has caused rapid decline in vulture population across the Indian Subcontinent. Conservation Breeding Programmes to conserve these vulture species have been initiated at Pinjore (Haryana), Buxa (West Bengal) and Rani, Guwahati (Assam) by the Bombay Natural History Society.

11. (d) The Olive Ridley turtles are rusty coloured carapace and have slightly smaller head and shell than the Kemp turtles. These Olive Ridley turtles generally occur through the Antilles, around the north coast of South America, in West Africa, the Indian Ocean, Australia and Southeast Asia. As per the reports the populations of Olive Riddles have declined in Pakistan, Myanmar, Malaysia and Thailand, and possibly on the east coast of India, south of Orissa and in the Andaman and Nicobar islands.

12. (b) First Climate Change theatre was opened at Pushpa Gujral Science City in Kapurthala, Punjab on 16 January 2014. The theatre will educate people on climate change. This is the second theatre in the world to be opened after Canada. The theatre is 18 metre in diameter and it is set up in a dome-shaped building with a seating capacity of 125 persons. The 25-minute film shows what worst can happen if humans do not take action on current or impending problems which could threaten civilization. The film starts by giving a glimpse of future - floods, droughts, earthquakes and other natural disasters.

13. (c) To qualify as a biodiversity hotspot on Myers 2000 edition of the hotspot-map, a region must meet two strict criteria: it must contain at least 0.5% or 1,500 species of vascular plants as endemics, and it has to have lost at least 70% of its primary vegetation.

14. (b) The Sumatran Rhino Crisis Summit opened with the shocking news that rather than 130-190 Sumatran rhinos as previously estimated, there are in fact fewer than 100 individual animals.

15. (a) Except promotion of vegetarianism all other acts are threats to the biodiversity of a geographical area.

16. (b) The red data book contains only 8 lists of threatened plant and animal species.

17. (c) The fix boundary of national park is described in Wild Life Protection Act, 1972 and the actual area of the national park is notified by state government. A biosphere reserve conserves an ecosystem and not just few specific species of plants and animals.

18. (c) A carbon credit is a generic term for any tradable certificate or permit representing the right to emit one tonne of carbon dioxide or the mass of another greenhouse gas with a carbon dioxide equivalent (tCO2e) equivalent to one tonne of carbon dioxide.

19. (d) National Biodiversity Authority (NBA) checks the biopiracy and protects the indigeneous and traditional genetic resources. It directly monitors and supervises the scientific research on genetic modification of crop plants application for intellectual property Rights related to genetic biological resources cannot be made without the approval of NBA.

20. (c) To qualify as a hotspot, a region must meet two strict criteria: it must contain at least 1,500 species of vascular plants (> 0.5 percent of the world's total) as endemics, and it has to have lost at least 70 percent of its original habitat. So we choose Species richness as well as Endemism. Along with this Threat perception is necessary to take, because it makes the base of this concept. Adaptation of flora is an arbitrary option, Ethno-botanical importance does nothing with the Biodiversity Hotspot selection criteria, vegetation Density is also discarded.

21. (d) Biological diversity helps in the formation and maintenance of soil structure and the retention of moisture and nutrient levels. Biodiversity supports ecosystem services including air quality, climate water purification, pollination, and prevention of erosion.

22. (a) Except promotion of vegetarianism all other acts are threats to the biodiversity of a geographical area.
23. (c) The fix boundary of national park is described in Wild Life Protection Act, 1972 and the actual area of the national park is notified by state government. A biosphere reserve conserves an ecosystem and not just few specific species of plants and animals.
24. (a) Lion-tailed Macaques are found in the mountain forests scattered across three Indian states stated above. The lion-tailed Macaques are endangered as per IUCN.
25. (a) Star tortoise is found in India in the dry and scrub forests. Pygmy Hog is an endangered species found in Assam. Only 150 animals are left. Monitor Lizard is found in India, Sri Lanka and Pakistan. Spider Monkey is the inhabitant of tropical forests of Central and South America.
26. (c) Gharial is critically endangered according to IUCN. Overhunting for skin and trophies, habitat loss due to construction of dams and barrages has been the reason for their decline. Leather back turtles are endangered due to human carelessness. Swamp deer occupies a place in the list of the endangered species of the world. Deforestation, draining of swamps and marshes for farming has led to the destruction of their natural habitat.
27. (b) Common Myna are birds stalking alongside the cattle to seize the insects disturbed by their movement through grasses. The common myna is readily identified by the brown body, black hooded head and the bare yellow patch behind the eye.
28. (b) IUCN is not an organ of UN. It has observer and consultative status at the United Nations.
29. (c) BirdLife international is a global partnership of conservation organisations that strives to conserve birds, their habitats and global biodiversity. It is working with people towards sustainability in the use of natural resources. It is the World's largest partnership of conservation organisations, with over 120 partner organizations. An Important Bird and Biodiversity Area (IBA) is an area recognized as being globally important habitat for the conservation of bird populations. The program was developed and sites are identified by BirdLife International.
30. (c) Periyar National Park and Wildlife Sanctuary is a protected area in the districts of Idukki and Pathanamthitta in Kerala.
    Kanha National Park is one of the tiger reserves of India and the largest national park of Madhya Pradesh.
    The Sariska Tiger Reserve is an Indian national park located in the Alwar district of Rajasthan.
    Dachigam National Park is located in Jammu and Kashmir.
31. (b)
32. (b) All statements are correct.
33. (b) The concept of biodiversity was propounded by E.O. Wilson. The concept of wildlife was propounded by W. Hornaday. The concept of Ecosystem propounded by G. Tansley. The concept of Ecology was propounded by E. Haeckel.
34. (a) Nokrek Biosphere Reserve is situated in Garo Hills in Meghalaya. Logtak Lake is in Manipur. Barail Range is in Assam. Though Namdapha National Park and Dafla Hill both are in Arunachal Pradesh, the two are separate entities.
35. (c) Dampa Tiger Reserve, the largest wildlife sanctuary in Mizoram. Saramati peak is in Nagaland. It is located near Tuensang town with a height of 3,826 m. Gumti Wildlife Sanctuary is famous wildlife reserve in Tripura.
36. (b)
37. (d) 1. Manas- Asom
    2. Pachmarhi - Madhya Pradesh
    3. Nokrek - Meghalaya
    4. Achanakmar-Amarkantak- Chhattisgarh,
38. (c) The Nilgiri Biosphere Reserve is an International Biosphere Reserve in the Western Ghats and Nilgiri Hills ranges of South India. Manas Wildlife Sanctuary is situated in Assam and UNESCO Natural World Heritage site which is a Project Tiger Reserve.The Panchmarhi Biosphere Reserve is situated in the Satpura Range of Madhya Pradesh state.Simlipal National Park is a national park and a tiger reserve situated in the Indian state of Odisha.

3 Chapter

ENVIRONMENTAL ISSUES

Introduction

Environmental issues are harmful effects of human activity on the biophysical environment. Environmentalism, a social and environmental movement, addresses environmental issues through advocacy, education and activism.

Our environment is constantly changing, which no one can deny. With these great environment changes, it becomes highly important for us to become increasingly aware of the environmental problems as well. With a monumental inundation of natural disasters, warming and cooling periods, different types of weather forms and much more, people should be aware of what types of environmental problems our Earth is facing.

Our planet is on the verge of a severe environmental crisis. Current environmental problems make us susceptible to disasters and tragedies, now as well as in the future. We are in a phase of planetary emergency, with environmental problems blooming around us. Unless we address the various issues proactively and sincerely we are surely going to be wrecked with these disasters. All the current environmental problems need urgent attention.

DIFFERENT ENVIRONMENTAL ISSUES AND ITS EFFECT ON CLIMATE

Environmental issues are increasing day by day and it has a very adverse effect on climate. Some of the Environmental issues are discussed below:

Global Warming

Climate changes like global warming are the result of human practices like emission of Greenhouse gases. Global warming leads to rising temperatures of the oceans and the earth's surface causing melting of polar ice caps, rise in sea levels and also unnatural patterns of precipitation such as flash *floods*, excessive snow or desertification.

Effects of Global Warming

The Intergovernmental Panel on Climate Change (IPCC) was established in 1988 by the World Meteorological Organization **(WMO)** and the United Nations Environment Programme (UNEP) in recognition of the problem of global warming. IPCC has estimated the following effects of global warming:

- Earth's temperature will rise by 1-30°C in next few decades, leading to extreme weather changes (heat waves, hurricanes and severe winters), changes in ocean currents and marine life. The largest glacier chain in the tropics is melting fast because of rising temperatures and peaks are turning brown. This trend is endangering future water supplies. Glaciers serve agriculture, hydel plants and feed rivers that supply water to the sprawling cities and shanty towns on Peru's bone-dry Pacific coast. **Quelccaya**, in southern Peru, the world's largest tropical ice-cap, is retreating at about 200 feet per year, up from 20 feet per year in the 1960s. **Lonnie Thompson,** a leading glacier expert of Ohio State University, monitoring glacier retreat on the Andes, Himalayas and Kilimanjaro, said that the rate of ice loss in glaciers all over the world is actually accelerating.
- If CO_2 concentration doubles, Earth's temperature may rise by 50°C. Coastal areas will see a rise in water levels by 0.5 - 5.0 feet due to melting of mountain glaciers, polar ice-caps, etc.

- Islands like **Maldives** would get submerged. In 1999, two uninhabited islands in the South Pacific (**Tebua Tarawa and Abanuea**) were submerged by rising sea levels, and two neighboring inhabited islands (**Kiribati** *and* **Tuvalu**) are on the brink of submersion as well.
- The biggest glacier in the **Peruvian Andes** was retreating by 5 meters per year some 20 years ago; today it is shrinking by 33 meters per year. The second largest glacier on Earth, the Greenland ice sheet, is thinning at an unprecedented rate of one meter each year.
- The Arctic Sea ice has thinned by 40% in the last two decades, while Mount Everest is losing height at the rate of 1.5 meters per year.

As global warming's, terrifying threat increases, our planet's nations come together at the paries climate conference (2015) to fight for our future.

In the wake of the paries conference America must lead the fight against global warming. We need to embrace clean energy and leave our dirty fossil fuels in the ground.

Here are five key steps president Obama and other U.S. leaders should take to protect our planet.

(i) Suppost a just, ambitions and binding international climate treaty:

Under the paris framework and beyond, the U.S. should back efforts to end fossil fuel use in developed nations by 2050.

(ii) Strengthen the clean power plan:

The U.S. needs to move rapidly away from all fossil fuels and toward wildlife-friendly sources of clean energy.

(iii) Cut pollution from airoplanes and other unregulated sources:

The Environmental protection Agency acknowledges that airoplane pollution endangers our climate.

(iv) Halt new fossil fuel development in America's oceans and on our public lands:

Ending new fossil fuel leasing on public lands and offshore areas controlled by the U.S. would keep upto 450 billion tons of green house gases from polluting the atmosphere, according, to a recent analysis prepared for the centre by scientists at *Ecoshift*.

(v) Crack down on fossil fuel exports and transport

We must halt the dangerous push to send America's dirty fossil fuels abroad.

Green House Effect

The Earth gets energy from the sun in the form of sunlight. The Earth's surface absorbs some of this energy and heats up. That's why the surface of a road can feel hot even after the sun has gone down because it has absorbed a lot of energy from the sun. The Earth cools down by giving off a different form of energy, called infrared radiation. But before all this radiation can escape to outer space, greenhouse gases in the atmosphere absorb some of it, which makes the atmosphere warmer. As the atmosphere gets warmer, it makes the Earth's surface warmer, too. Without this Greenhouse effect the Earth would be at least 30 degrees cooler, in which life would not exist.

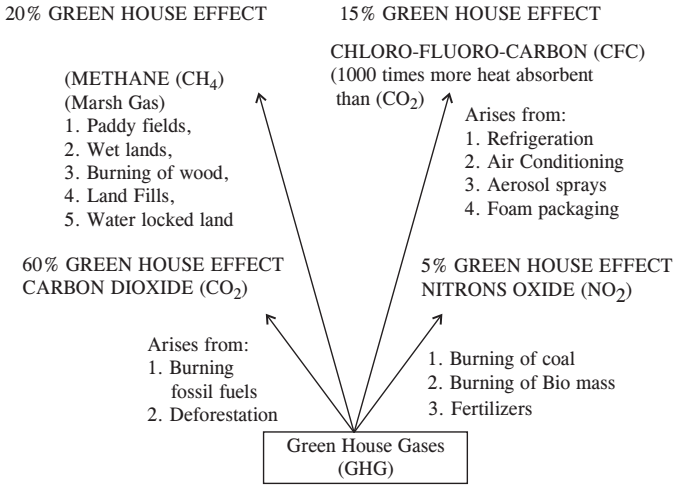
Greenhouse Gases

A greenhouse gas (GHG) is a gas in an atmosphere that absorbs and emits radiation within the thermal infrared range. This process is the fundamental cause of the greenhouse effect. The primary greenhouse gases in Earth's atmosphere are *water vapour*, *carbon dioxide*, *methane*, *nitrous oxide*, *ozone*, and *chlorofluorocarbons*.

- **Water vapour** contributes to 36-72% of Greenhouse effect.
- **Carbon Dioxide** (CO_2) arises from burning fossil fuels and as a result of deforestation. It contributes to 9-26% of Greenhouse effect. It is the primary greenhouse gas emitted through human activities.
- **Methane** (CH_4), also called "*Marsh gas*", arises from rice paddies, wetlands, enteric fermentation in cattle, burning of wood, and landfills. It is responsible for about 4-9% of Greenhouse effect.
- **Nitrous Oxide** (NO_2) contributes (5%) which arises from coal burning, biomass burning, and breakdown of chemical fertilizers.
- **Chlorofluorocarbons** (*CFCs*) and their replacements (15%) are 1000 times more heat absorbent than carbon dioxide. They reach the atmosphere from *refrigeration* and *air conditioning*, *aerosol sprays*, and *foam packaging industry*.
- **Ozone contributes** to 3-7% of Greenhouse effect. The largest net source of tropospheric ozone is influx from the stratosphere. Large amounts of ozone are also produced in the troposphere by photochemical reactions, the amounts increasing with high levels of air pollution.

Unfortunately, recent human activities such as burning fossil fuels to run automobiles, heat homes and businesses, and power factories are causing increased concentrations of greenhouse gases, thereby resulting in more heat being trapped. The planet is losing less heat and, as a result we are beginning to experience Global Warming.

Estimates indicate there has been a 25% increase in CO_2, concentration in the last 100 years and this is expected to double in the next 50 years, e.g. **Brazil** alone contributes billions of tons of CO_2, every year due to *deforestation*.



Ozone depletion

Ozone (O_3) is a gas found throughout the atmosphere, but most highly concentrated in the stratosphere, between *10 and 50 km* above the sea level, where it is known as the "*Ozone layer*".

- This Ozone layer forms a *protective shield* for the earth from the harmful *ultra-violet radiation* from outer space, particularly *UV-B* rays which affects *DNA molecules*, causing damage to the outer surface of plants and animals and also marine life. In humans it causes skin cancer, eye cataracts and is a general immuno-suppressant.
- **"Ozone Holes"** were first discovered over *Antarctica* by the British Antarctica Survey in *1983*. Levels of ozone are dropping very fast, resulting in parts of the layer becoming thin and 'holes' developing because only a small percentage of O, gets naturally replenished every year.
- In **1974, Mario Molina** and Sherwood Roland of the **University of California** discovered that a group of synthetic chemical substances known as *CFCs* and *HCFCs* destroy ozone in the stratosphere. These chemicals are inert, non-flammable, non-toxic, and lighter than air and can remain intact for years. They contain Chlorine and Fluorine, common being CFC-ll, CFC-12, CFC-22 and CFC- 13.
- **'Halons'** containing **'Bromine'** and used in the fire-fighting industry, are 100 times more potent than CFCs. CFCs are commonly used in Air-conditioners and the Refrigeration industry (Freon gas), aerosol propellants (in perfumes and deodorants), in the foam packaging industry (Styropor, Thermocol) and as solvents for greases and glues.
- Compounds like Carbon Tetrachloride and Methyl Chloroform are also found to release Chlorine (Halogens) which ultimately destroy the stratospheric Ozone.
- Du Pont (USA) and ICI (UK) have developed certain substitutes like HFC (Hydrofluorocarbon) and HCFC (Hydro-Chloro-Fluoro Carbon), e.g. HCFC-123 which contain less Chlorine than CFC, but these are not effective, permanent solutions.
- Cheaper alternatives for refrigeration being developed are Propane and Ammonia as coolants, which are completely environment friendly.

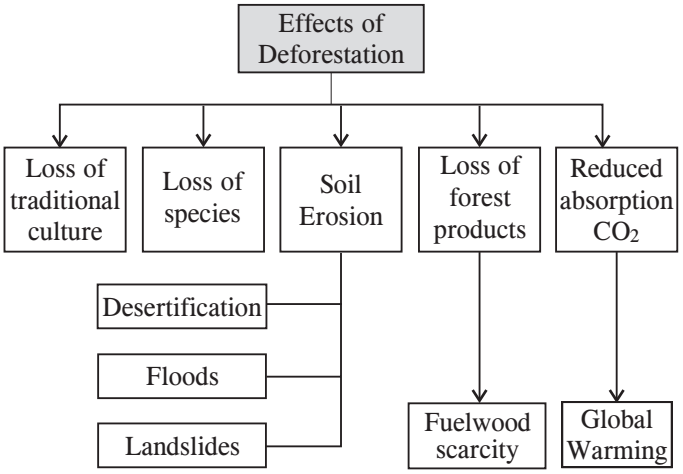
Deforestation

The process of clearance of forest by burning or logging is called deforestation. The main reasons for deforestation are trees or derived charcoal are used as, or sold, for fuel or as a commodity, while cleared land is used as grassland for livestock, plantations of commodities, and settlements. Deforested areas usually sustain extensive adverse soil erosion and regularly damage into wasteland.

Causes of deforestation

There are numerous causes of deforestation such as

(i) Expansion of farming land
(ii) Logging and fuel wood
(iii) Overgrazing
(iv) Fires
(v) Mining
(vi) urbanization/Industrialization and Infra-structure.
(vii) Air Pollution
(viii) Wars and role of military
(ix) Tourism
(x) Over population and poverty
(xi) land rights, land tenure and inequitable land distribution resources
(xii) Economic, i.e. development/land conversion value, fiscal policies, etc.
(xiii) Under valuing the forest
(xiv) Corruption and political cause



Strategies to reduce deforestation

Strategies to reduce deforestation should be a combination of pro-active role of national, state, municipalities, civil societies and private sector in the following ways-

(i) Reducing Population growth
(ii) Reducing emissions from deforestation and forest degradation
(iii) Increase the area and standard of management of protected areas
(iv) Increase the area of forest reserved for timber production
(v) launch the mass awareness programme regarding value of forest.
(vi) Encouraging substitutes
(vii) Increase area of forest plantation
(viii) Government initiatives through policies and action-plan
(ix) Participatory forest management and rights
(x) Increase investment in research, education and extension
(xi) Improve the information base and monitoring

Air Pollution

The main issue among environmentalists and researchers especially in developed countries is *air pollution*.

- The main pollutants of air pollution are *particulate matter*, *PAHs*, *lead*, ground-level *ozone*, *heavy metals*, *Sulphur dioxide*, *benzene*, *carbon monoxide* and *nitrogen dioxide*.

- Air pollution is also responsible for climate change due to the higher greenhouse effect, acid rain, and the depletion of the ozone layer that constitute important global environmental problems.
- Air pollution is the main reason of ill health and death by natural and man-made sources.
- Tobacco smoke, house cleaning items, insecticides industries, automobiles, power generation, combustion of solid fuels for cooking, poor maintenance of cars and other automobile, etc. are the main cause of air pollution.
- Air pollution can be of two types: *indoor* and *outdoor*.
- *Indoor air pollution* is restricted to buildings only. It is the amount of chemical, biological and physical contaminants in the air inside a building. Building materials, central heating and cooling devices, painting colours, stoves, gas heater, and tobacco smoke, etc. are the examples of indoor air pollution.
- Release of several air pollutants into the atmosphere which causes severe threat to living organisms or upsetting the functioning of environment is called outdoor air pollution.

Contributors of Pollutants

- There are natural pollutants of air like animal decay.
- Volcanic eruptions release more sulphur fumes than all power plants and all industries in the world.
- Lightning bolts create nitrogen oxides just as automobiles and industrial furnaces do.
- Trees emit hydrocarbons called **terpenes** causing bluish haze.

Effects

- There is mounting evidence that our whole planet is affected by pollution. The South Pole seems fairly clean because 90 % of earth's population lives in northern hemisphere. Yet in 1985 scientists detected a major hole in protective ozone screen over Antarctica.
- The North Pole, on the other hand, resembles a cool town. In winter when the Arctic is tilted into long nights and the sun cannot generate cleansing winds and precipitation, the largest single mass of pollution sits atop the globe like a dirty cap composed of mixture of gases and particles, sulphates and soot.
- Tracing pollutants has become a vital necessity as air currents do not respect political boundaries. Many countries are blaming their neighbors for polluting their air space. Air pollutants weaken the trees and then they are killed by drought and pathogens. Trees weakened by climatic variations are finished off by air pollution. Perhaps the most controversial issue of the decade is *acid rain*. We are trying to understand the full effects on an atmosphere acidified by burning fossil fuel.

For millions of years the ingredients of such substances have been cycling through the ecosystem, constantly changing their form. They pass in animal and plant tissues, sink in sea, return to the earth and are vaulted aloft in some geologic event to begin the cycle again. An atom of oxygen completes this cycle generally once in 2000 years. We are in the midst of a chemical revolution in which some 65,000 commercial compounds enter our environment each year. Some are proven carcinogens. A modern city suffers from many air pollutants which form a complex mixture of smog.

Pollutants and their Effects

Sr. No.	Pollutant	Origin	Effect
1.	Arsenic (As)	Coal, oil furnaces, glass factories	Lung and skin cancer
2.	Benzene (C_6H_6)	Refineries, motor vehicles	Leukemia
3.	Cadmium (Cd)	Smelters, coals, oil furnaces	Damage to lung, kidney, bones
4.	Chlorine (Cl)	Chemical Industries, volcanic activities	Causes irritation
5.	Carbon monoxide (CO)	Motor vehicles, smelters, coal steel plants	Starves body of oxygen, damages heart
6.	Fluoride (F)	Smelters, steel plants	Mottles teeth in children
7.	Hydrocarbons	Unburnt gasolene fumes, motor vehicles	Combines with nitrogen oxides in sunlight to form smog, causes irritation in eyes and nose
8.	Formaldehyde (HCHO)	Chemical plants	Allergenic, carcinogenic, headaches, burning sensation in the throat, and can aggravate *asthma symptoms*
9.	HCl (Hydrogen chloride)	Incinerators	Irritates eyes and lungs
10.	Hydrogen fluoride (HF)	Fertilizer plants Smelters	Irritates skin, eyes, mucous membrane
11.	Mercury (Hg)	Coal, smelters oil furnaces	Tremors, nerve troubles
12.	Nitric acid (HNO_3)	Formed from NO_2 causes acid rain	Respiratory diseases
13.	Nitrous acid (HNO_3)	Formed from NO_2 and water vapour	Respiratory disease
14.	Hydrogen sulphide (H_2S)	Refineries, Pulp mills	Nausea, irritates eyes
15.	Sulphuric acid (H_2SO_4)	Formed from SO_2 in sunlight with	Respiratory diseases hydroxyl ions
16.	Manganese (Mn)	Steel and sulphur dioxide power plants	Parkinson's diseases
17.	Nickel (Ni)	Smelters, coal, oil	Lung Cancer furnaces
18.	Nitric Oxide (NO)	Motor Vehicles, coal, oil furnaces	Oxidizes to NO_2

19.	Nitrogen dioxide (NO_2)	Formed in Sunlight from NO	Bronchitis Loss of resistance to influenza forms Ozone
20.	Ozone (O_3)	Ground level ozone formed from nitrogen oxides (NO_x) and volatile organic compounds (VOCs)	Asthma, irritates eyes sunlight from nitrogen oxides and hydrocarbons
21.	Lead (Pb)	Motor vehicles, high smelters	Brain damage
22.	Silicon Tetra fluoride (SiF_4)	Chemical plants	Lung diseases
23.	Sulfur dioxide (SO_2)	Smelters Coal, Oil furnaces	Irritates eyes, breathing problems

Prevention of air pollution

Air pollution can be reduced with the help of-

(i) using smokeless sources of energy like smokeless stoves, biogas, solar and wind energy

(ii) using devices for filtering smoke in chimneys of factories and power houses

(iii) Planting more trees

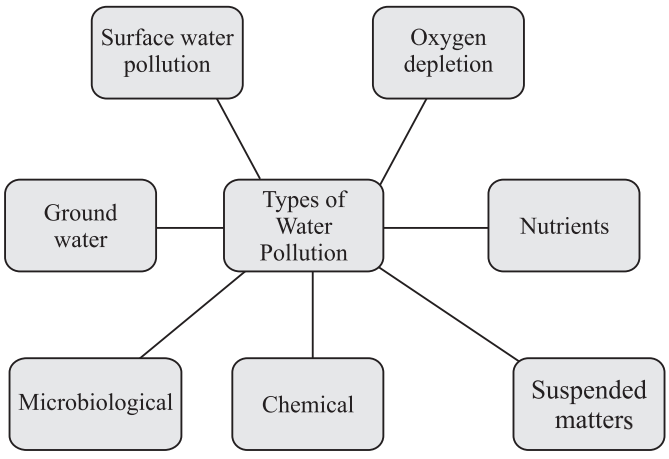
(iv) Locating industries away from residential areas

(v) Strictly checking pollution levels in automobiles exhaust emission.

Water Pollution

- Water pollution is a kind of pollution which involves the contamination of water sources or bodies on which several aquatic animals depends on for their life support.
- Polluted water comprises of Industrial discharged wastes, sewage water, and rain water pollution.
- Quality of soil and vegetation is affected by the polluted water. Pollutants in water comprise a extensive kind of chemicals, pathogens, and physical chemistry or sensory changes. Many of the chemical substances are toxic or even dangerous.
- Pathogens can produce water borne disease in humans and animals.
- Polluted water is discharged in water polluting the aquatic flora and fauna.
- Washing clothes near lakes and rivers is one of the reason of water pollution since, detergents cause a condition called **"Eutrophication"** which blocks sunlight from entering inside that water body thus reducing oxygen standards in the water and causing an inhabitable environment.

Types of Water Pollution based on causes & pollutants



Diseases caused by Water Pollution

The most common water pollution diseases involve digestive system and infections diseases, it may cause many others like-

(a) *Infections diseases caused by pathogens* from animal fecal origins involving :- Typhoid, Giardiasis, Amoebiasis, Ascariasis, Hookworm

(b) *Diseases caused by polluted beach water* :- Gastroenteritis, Diarrhea, Encephalitis stomach craps and aches, vomiting, Hepatites, Respiratory infections

(c) Liver damage and cancer caused by chlorinated solvents, MTBE.

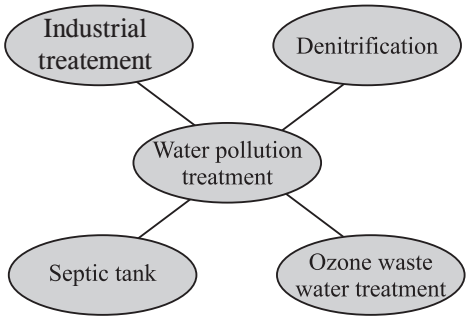
(d) Kidney damage caused by a series of chemicals found in contaminated water.

(e) Neurological problems due to pesticides (eg. DDT)

(f) Reproductive and endocrine damage

(g) Bathing in polluted water causes rashes, ear aches and pink eyes.

Water Pollution treatment



Water can be treated by many ways, i.e. denitrification, industrial treatment, Septic tank and Ozone waste water treatment. Raw sewage should be treated in water treatment plant before releasing it in environment. In water treatment plant sewage goes through many chambers and chemical processes which reduce its toxicity. Denitrification is an ecological method to prevent the discharge of nitrates in soil, and stops ground water pollution with nutrients. Septic tanks treat sewage at the place where it is located and used to treat sewage from an individual building. Untreated sewage from a property streams into the septic tank and the solids are separated from the liquid. Breaking of pollutants into water sources is done by ozone generator. By using Ultraviolet radiation and Electric discharge field oxygen is converted into ozone by the generators.

BOD (Biochemical Oxygen Demand)

BOD (Biochemical Oxygen Demand), also often referred to as biological oxygen demand, is a test performed to measure the potential of wastewater and other waters to deplete the oxygen level of receiving waters. In other words, the BOD test is performed to determine what effect dirty water, containing bacteria and organic materials, will have on animal and plant life when released into a stream or lake. When there is an abundance of bacteria and organic materials, the bacteria will take in oxygen in order to breakdown these molecules. If bacteria are taking in large amounts of oxygen, this will have a detrimental effect on the surrounding ecosystem. On the contrary, when there are low levels of organic waste in the water, there are fewer bacteria present, the BOD will be lower and the dissolved oxygen levels higher. In wastewater treatment plants, they often calculate the percentage removal of BOD to determine the efficiency of the treatment process. For this reason, BOD is sometimes referred to as a water contaminant.

A BOD level of 1-2 ppm is considered very good. There will not be much organic waste present in the water supply. A water supply with a BOD level of 3-5 ppm is considered moderately clean. In water with a BOD level of 6-9 ppm, the water is considered somewhat polluted because there is usually organic matter present and bacteria are decomposing this waste. At BOD levels of 100 ppm or greater, the water supply is considered very polluted with organic waste.

A **pH** of 6.5 to 8.2 is optimal for most organisms. Rapidly growing algae or submerged aquatic vegetation remove CO_2 from the water during photosynthesis, significantly increasing pH levels. pH levels $>$ 9.0 begin to be harmful to salmonids (trout) and perch. Rainwater naturally has a pH of 5.5; pH $<$ 5.5 is harmful to freshwater shrimp, snails, and clams; metals normally trapped in sediments may be released into the acidified water.

Acidic $<$ 6.5 pH **Basic $>$ 7.5 pH**

Sound Pollution

Unwanted sounds created by humans, animals and machines which disturbs the environment and humans is called as sound pollution. The word noise comes from the Latin word *nausea* meaning *seasickness*.

Sources of Sound

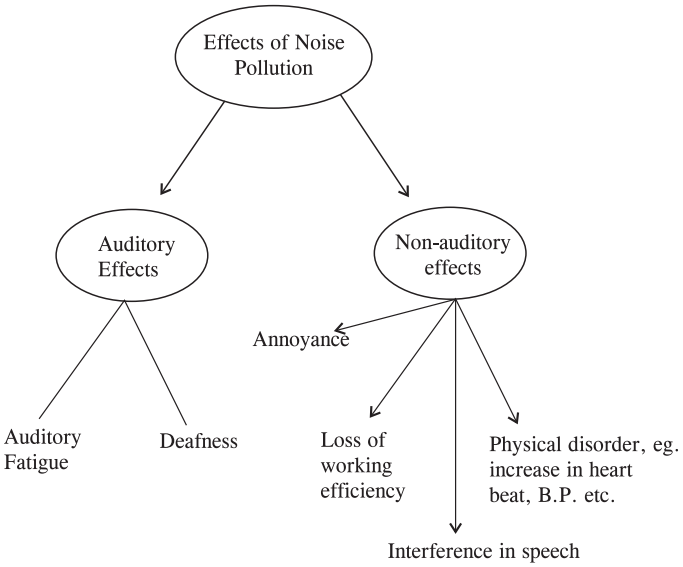
The main source of noise is transportation system including rail noise, aircraft noise and vehicle noise. People leaving near factories experience sound pollution because of the unwanted sounds coming from factories. Other sources of sound pollution are car alarms, emergency service sirens, office equipment, factory machinery, construction work, grounds keeping equipment, barking of dogs, appliances, power tools, lighting hum, audio entertainment systems, loudspeakers, and noisy people. Use of loudspeakers for political purposes and other purposes is also the cause of sound pollution.

Measurement of sound

Sound pollution is measured in *decibels*.Humans can't sleep at 45 decibels; hearing begins to damage in 85 decibels and pain in ears start at 120 decibels.

Effects of sound pollution

Health and behaviour of humans are disturbed by the noise pollution. Unwanted sounds can damage physiological and psychological health. Sound pollution can cause annoyance and aggression, hypertension, high stress levels, tinnitus, hearing loss, sleep disturbances, and other harmful effects. Due to increase in sound level there can be lack of concentration at work which can lead to low productivity and performance. High sound levels can increase in cardiovascular effects in humans which is very dangerous for health.



Central Government's Regulation & Control of Noise Pollution

These regulations are meant for the following :

(i) Implementation of noise standards in different zones/ areas.

(ii) Restrict the use of loud-speakers.

(iii) Restrict the over-usage of horns , sound creating equipments for construction and fire-crackers.

(iv) Allotting responsibility to state pollution control boards and central pollution control board to provide data about the noise pollution, so that measures may be taken to control noise pollution.

Agro-chemicals & Its effect

Agro chemicals are developed by the use of modern technology that depends on inorganic fertilizers and pesticides. Excess use of these fertilizers can lead to immediate harmful effect or can also be long lasting. Although many benefits are there by the use of agro chemicals which are related to increase yield of plants and animal crops and less wastage during storing. These profits are substantial. In combination with genetically enhanced varieties of crop species, agrochemicals have made significant contributions to the accomplishments of the "green revolution." However there are certain environmental and ecological damages also related to the use of agro chemicals. For example excess use of fertilizers can contaminate the ground water with nitrate, making it unfit for the consumption of humans

and livestock. If there is large concentration of nitrogen in water it can poison animals by immobilizing some hemoglobin in blood and hence reducing the ability to transport oxygen. However if the fertilizers are in the water such as streams, lakes, etc. can cause an increased productivity of those aquatic ecosystems, a problem known as eutrophication. Due to eutrophication there can be excessive growth of algae, wide mortality of fish and other aquatic animals and a bad taste of water.

There can be many environmental problems due to the use of pesticides. As we all know that pesticides are used to reduce the abundance of species of pets. But while using pesticides humans also come in contact with them which are harmful to them. When the entire fields are spayed with pesticides by the use of tractor or airplane or helicopter many non-targeted organisms come in contact with the pesticides. This happens on the treated site, and also on nearby off-sites as a result of "drift" of the sprayed agrochemical. These non-target contacts cause several unnecessary poisonings and deaths of organisms that are not agricultural pests.

There is a global contamination of environment with pesticides such as *DDT*, *Dieldrin*, and *Aldrin*.This contamination includes the extensive presence of pesticide residues in almost all wildlife, well water, food, and even in humans. Residues of some of the chemicals used in animal husbandry are also thought by some people to be a problem, for example, when traces of antibiotics and bovine growth hormones arise in consumer products such as meat or milk.

The worst examples of the use of pesticides are the use of DDT. Modern use of pesticides includes the use of pesticides that are less persistent than DDT and related chlorinated hydrocarbon.

However humans are also at the risk of the use of some pesticides. There are about almost one million pesticides poisoning all over the world with nearly 20,000 fatalities. About one-half of the human poisonings happen in poorer, less-developed countries, even though these places account for only 20% of the world's use of pesticides. This is due to the illiteracy in these countries and to negligent enforcement of regulations about the use of pesticides.

Example of the damage cause by the pesticides to humans includes *Bhopal tragedy* in India which occurred in *1984*, in the area of a factory that was manufacturing an *agricultural insecticide*. In that case, there was an accidental discharge of about 45 tons (40 tonnes) of deadly *methyl isocyanate* vapor to the atmosphere. This agrochemical-related emission caused the deaths of about 3,000 people, and more than 20,000 others were seriously injured.

Researchers are continuously searching for non-chemical means of dealing with several of these agricultural requirements. Organic methods are been invented in enhancing the soil fertility and dealing with pests. Therefore, modern agricultural industries will continue to depend on heavily on the use of agrochemicals to achieve their problems of fertility, soil quality, and pests.

Acid Rain

Acid rain is a rain or any other form of precipitation that is unusually acidic, meaning that it possesses elevated levels of hydrogen ions (low pH). The term **"acid rain"** was coined in *1872* by **Robert Angus Smith,** after a link was established between *sulfur dioxide* (SO_2) emissions from the burning of coal in Manchester and acidification of nearby rainfall. *Rainfall with pH less than 5.6 is called Acid rain*.

Sources of Acid Rain

- Acid rain is caused by a chemical reaction that starts when sulfur dioxide and nitrogen oxides are released into the air.
- These compounds can rise very high into the atmosphere, where they mix and react with water, oxygen, and other chemicals to form more acidic pollutants, called as acid rain. Sulfur dioxide and nitrogen oxides are highly soluble in water and can be carried very far by the wind.
- Consequently, the two compounds can travel long distances where they become part of the rain, sleet, snow, and fog that humans experience on specific days.
- Though there are few natural causes also for acid rain, but still human activities are considered to be the main cause of acid rain.
- During last few decades, human beings have released various chemicals into the air, which has altogether changed the composition of gases in the atmosphere. Power plants release huge amount of sulfur dioxide and nitrogen oxides when they burn fossil fuels, like coal, to produce electricity. Additionally, the exhaust from light and heavy vehicles releases nitrogen oxides and sulfur dioxide into the air. These pollutants are the main cause of acid rain.

Effects of Acid Rain

- Acid rain leads to acidification of water bodies such as lakes and streams. It contributes to the damage of trees at high elevations (e.g. red spruce trees at the height of 2,000 feet and above) and many sensitive forest soils.
- Additionally, acid rain stimulates the decay of building materials and paints. Before reaching the earth, sulfur dioxide and nitrogen oxide gases and their particulate matter derivatives (**sulfates** and **nitrates**) lead to visibility degradation and harm people health.
- Acid rain has been held responsible for ruining the marble walls and pillars of one of the Seven Wonders of the World, *Taj Mahal* in India.
- Acid rain reacts with calcium to form calcium bicarbonate, which can be easily washed away.
- **St. Paul's Cathedral in London** and the Statue of Liberty in New York are known to be few victims of acid rain. As the concentration of Sulphur dioxide is increasing in the air of Delhi, there may be a danger of corrosion of the Red Fort and similar other historical buildings and monuments made up of stones.
- In Calcutta also, architectures such as the marble-built Victoria Memorial Hall may be in similar danger in the near future.

Measures to control Acid Rain

Some of the major procedures that must be followed to control acid rain are as follows:

- Reduce amount of sulphur dioxide and oxides of nitrogen released into the atmosphere.
- Use cleaners fuels
- Flue (waste) gas desulphurisation (FGD)
- Use other sources of electricity (i.e. nuclear power, hydro-electricity, wind energy, geothermal energy, and solar energy).
- Reduce the effects of Acid Rain by liming the soil and water.

Solid Waste Management

Solid waste management is one of the major challenges faced by many countries around the globe. Inadequate collection, recycling or treatment and uncontrolled disposal of waste in dumps can lead to severe hazards, such as *health risks* and *environmental pollution*.

No other pollutant is discussed about more vociferously among environmentalists, politicians and the people at large than the garbage which is the *bulky plastic* and refuse heap variety trash that accumulates in different corners of the cities. These piles are quite often taller than the city halls. What we throw away is the closest we come to the pollution problem as we rarely see the acid rain or spot those CFCs.

The growing accumulation of garbage reduces the land values, increases truck traffic, and ruins health, aesthetics and the necessities of life - the air we breathe and the water we drink.

Sources

Solid waste refers to the non-liquid waste materials arising from domestic (*garbage debris* and night soil) activities, trade and commercial activities (hazardous and non-hazardous) industrial activities, agricultural activities, mining and public services (office and hospital wastes).

Effects

It may be emphasized that unsanitary disposal and utilization of wastes result in high incidence of illness and death from *faecal borne diseases*. The faecal borne diseases are *bacillary dysentery*, *typhoid fever* and *enteritis*. Therefore, it is necessary to provide adequate and sanitary measures of disposal of wastes.

Types of Wastes

Urban wastes are discarded as organic and inorganic substances in the form of solid, semi-solid, liquid and gases, which are residues or derivatives of human, vegetable material and industry. These wastes are broadly classified into the following categories:

- HOUSEHOLD WASTES: Waste generated in the preparation and consumption of food, human excreta, generally termed as garbage.
- COMMERCIAL WASTES: These wastes include a high proportion of paper, cardboards and plastics. They result from activities in office buildings, stores, markets, theatres, hospitals, and restaurants.
- INDUSTRIAL WASTES: Wastes due to different types of production activities. This category of waste, contains, hazardous wastes that are harmful to human beings and hence should be stored and treated separately.
- EFFLUENT WASTES: Domestic as well as industrial effluents that contaminate river water if allowed to flow unchecked.
- CITY WASTES: All the waste resulting from the maintenance of streets, roads, parks, and schools, paper, dry leaves, animal wastes, sludge, carcasses of small animals and slaughter house wastes. The responsibility of the solid waste management department is only to look after the disposal of domestic wastes, city wastes and the domestic sewage.

Method of Collection

The 90% of the refuse is collected from refuse bins and 10% of the refuse is collected by house to house collection method, as described below.

- *Refuse storage*: which may sometimes require delivery of refuse by the householder over a considerable distance.
- Where the householder delivers the refuse to the vehicle at the time of collection.
- Door-to-door collection, where the collector enters the premises and collects the refuse and the householder is not involved in the collection process.

Radioactive Waste Management

Radioactive waste which arises from civil nuclear activities as well as from defense related nuclear weapon activities, poses a terrible problem for handling and keeping the environment to be safe to the present and future generations. The techniques used emphasizes on waste minimization and volume reduction. Nuclear waste is categorized into high, intermediate and low levels depending on the level of radioactivity in it.

Spent fuel is stored for long time to reduce the level of radioactivity in it and then reprocessed at reprocessing plants for gathering fissile elements. The generation of high level waste is at reprocessing plants. The amount of this waste in our country is much lesser due to our adoption of the closed fuel cycle. High level waste produced from the reprocessing plant is vitrified into a glassy form, enclosed in multiple barrier vessels and stored for a temporary period of three to four decades in engineered vaults with essential observation services. After cooling down in these storage facilities, waste vessels will be stored for long term in deep geological repositories.

Reprocessing and Waste Management plants are currently being operated by Bhabha Atomic Research Centre (BARC).

Harmful Effects

Radioactive wastes have the harmful effects in the following ways:

(i) Pollutes the earth to a dangerous level of toxicity.
(ii) Are absorbed in water and then enter in living beings through food chains.
(iii) Emit harmful radiations which damage cells, tissues and Red blood corpuscles (RBC).
(iv) Can cause cancer, leukemia, etc.
(v) Are threats for aquatic life.

Control Measures for Radioactive wastes

With respect to control of the materials composition radioactive waste can be grouped into:

(i) The treatment and packaging has to be performed according to a qualified process.

(ii) Conditioned waste products being qualified with respect to the radiological requirements.

(iii) Legacy waste products need to be qualified by sport checking according to composition requirements.

Plastic Waste Management

Plastics have become an indispensable part of our daily lives. Invented in 1935, they are wonderful products of polymer chemistry produced from the by- products of petroleum refining. They are classified as into two main categories:

- **Thermoplastics:** They are substances that become plastic on heating. A plastic material can be repeatedly melted or softened by heat without change of properties. This property makes it possible to recycle the used plastic articles.
- **Thermosetting plastics:** Plastics that have once been subjected to heat and pressure, lose their plasticity.

Environmental aspects of Plastic Manufacturing

All the varieties of plastics are manufactured from *petrochemical* based *hydrocarbons*. These hydrocarbons, and the plastic manufacturing processes involved possess environmentally critical characteristics.

The raw materials and intermediate products used in the manufacture of *Polyvinyl chloride* (PVC) - Ethylene, Chlorine, Hydrogen chloride, Vinyl Chloride Monomer (VCM), and Ethylene Dichloride (EDC) — are known hazardous materials. Additives, fillers, and coloring pigments used in plastic goods can also exhibit hazardous properties.

Environmental issues

- Escape of gaseous hydrocarbons, chlorine, and hydrogen chloride gas into the atmosphere.
- Waste-water from the processes and wash-waters can carry pollutants.
- Dioxins can be liberated due to mishaps in the process.
- Most significant health and safety issue in the manufacture of PVC is the exposure of plant operators to Vinyl Chloride Monomer (VCM). In earlier days over exposure of workers to high concentrations of VCM was found to increase the risk of angiosar-coma of the liver — a rare cancer of the blood vessels of the liver. Exposure levels are now monitored and controlled; fugitive emissions are avoided by good house-keeping in the plastic industry, greatly reducing the VCM-related health problems.
- Fire hazards in plastic industry and in godowns storing plastic goods release toxic dioxins. PVC being a very widely used plastic in electrical cable insulation, and building construction has a high fire risk, one particular advantage of PVC is that it does not itself burn, but is charred by the heat of a fire. If there are no other fuels present; it will self-extinguish. This is one of the strengths of PVC in the electrical cabling and building construction industry.

Heavy-Metal Pollution from Plastics

Lead and *cadmium* compounds are added as stabilizers in PVC. Manufacturing these chemicals are used in the manufacture of soft plastic items such as vinyl flooring sheets, soft toys, etc. to increase their durability. Lead and cadmium can leach out during human contact, or when disposed in land-fills. Incineration of such rejected plastic items produces ash with high heavy metal content. Use of lead compounds in the manufacturing process can be a potential hazard to workers in the PVC industry. *Lead and cadmium are known neurotoxins* and *nephrotoxins respectively*. Neurotoxins damage the *nervous system*, whereas nephrotoxins affect the kidneys. Strict adherence to process controls in industry, and quality control of products can greatly reduce the risk of heavy-metal pollution.

Nature of Plastics

Articles made of plastics are environment friendly if properly used and handled. Plastics are *non-biodegradable* because of their chemical structure. They cannot be bio-chemically decomposed by the microbes and as such, there is no threat of pollution. Being non-biodegradable they become virtually inert materials and remain in the environment for very long periods. They obstruct the natural and man-made activities in a physical way and do not easily participate in any reactions. These activities can be avoided by little care and common sense while discarding used plastics. That proves the fact that plastic, an 'environment friendly' product has been made an enemy by the callousness of humans. It is the misuse or abuse of plastic that is creating problems and not the plastics that are derived from the depths of Mother Earth.

The importance of plastic should be seen in their utility some of their uses and contributions to the environment are presented below.

Use Negative effects of not using plastics, and using other materials

(i) Carry bags and packing amount environment

If paper is used in place of plastic, a great amount of biomass has to be extracted either from Natural forests or commercial wood plantations for paper-making. In any case either environment loses greenery. Instead, the nutrients circulated these plants and trees could be used for producing food. Further, manufacturing of paper in pulp and paper mills produces large quantities of highly polluting waste-waters, which are difficult and expensive to treat and clean of their pollution effects. If discharged without treatment they pose an equally big threat as that of unscientific discarding of plastics to the environment.

(ii) Food packaging using plastics

Milk Supply: In earlier days milk supplied in glass bottles which involved Jobs, like supply the milk and then next day, to collect and transport back empty bottles to the dairy plant. Thus the glass bottles were adding to transportation cost and transport related air pollution problems. Now more milk can be transported per truck in plastic sachets whereas glass bottles used to occupy large space as they were bulky and heavy. Loading and unloading of milk bottles and empty bottles was

also difficult, and required more labour. Elaborate washing of milk bottles for refilling was another big job. Bottle washing was consuming large quantity of scarce fresh water releasing highly polluted wastewater adding to water treatment costs. If discharged without treatment wastes create severe pollution problems including odour. Use of plastic sachets for milk transportation has eliminated these problems. Earlier dairies used to receive complaints of milk getting spoiled due to improper washing of bottles, which does not happen with plastic sachets. Food packaging: food ingredients, precooked and ready to cook and use foods are widely available in the market and are popular in cities. Plastics are the mainstay of the packaged food industry.

(iii) Drinking water suppliedin plastic bottle

Drinking water outside the home was a big menace earlier.
It is a recognized fact that drinking contaminated or unsafe water is a major cause for spread of contagious diseases.
Though expensive, packaged water bottles have reduced the risk of contamination.

(iv) In the field of medicine and health services

Before the advent of plastic injection syringes and needles, glucose bottles and many other glass appliances had to be sterilized and reused in hospitals. There was always a risk of improper sterilization, which had the potential for spreading infection. This could have happened even in blood collected in bottled. Imagine the use of improperly sterilized glass articles in a scenario where HIV-AIDS infected patients are handled. Disposable syringes, blood sachets and many other hospital items made of plastic have greatly reduced the risks and hazards of contamination.

(v) Water supply pipes and Industrial piping

Transportation of water in PVC pipes is very common as it has several advantages over conventional G1 Pipes.

- They are light and plumbing work is easy
- Corrosion problem is eliminated and hence corrosion related contamination of water is avoided and life of the pipes increases.
- Inner surface of pipes may be made smooth to reduce friction losses, thus saving on electricity bills and conserving energy. In industries whenever aggressive chemicals are to be transported PVC pipes of different varieties are used. PVC containers are commonly used for storage of water and many industrial chemicals.

(vi) Construction material

Plastics are extensively used as construction materials such as doors and windows house hold. Articles such as chairs, table holding racks, bucket and more. Use of plastics is reducing the burden on conventional materials such as wood and metals.If these are all the advantages of using plastics, why so much of a hue and cry is being raised about the ill effects of plastics on the environment? In this regard we have to recognize the fact that plastic is not the culprit; it is humans and society who, after use of plastics, discard them indiscriminately into the environment creating problems that are easily avoidable.

Problems Arising from Indiscriminate Discarding of used Plastics, particularly Carry Bags

Thin plastic carry bags are found strewn everywhere on land, water bodies and in drains. They have become a main component of municipal solid waste. Being non-biodegradable, they stay in the environment for very long periods. Several ill effects of these plastic items have been recognized:

- They choke storm water drains, often causing overflow of storm water on roads.
- Some people have a callous attitude of dumping solid wastes including plastic carry bags into the sewer system with utter disregard to the consequences. This happens when manhole covers are missing, extending an invitation for people to dump the garbage into them. The obvious effect is the *choking of sewers*.
- It is a common scene to sight floating plastic bags of various colours in vicinity of towns, preventing the entry of sunlight into the water, thus hindering, photosynthesis process, which is a source of oxygen supply for the fish life. Direct transfer of molecular oxygen into water is also affected. Another aspect of inadequate presence of dissolved oxygen in such water bodies is the development of anaerobic conditions leading to foul odours.
- Plastic carry bags often end up in agricultural fields directly or indirectly when domestic solid wastes stored in plastic bags are used as manure along with cattle dung. During tilling they get embedded in the soil and cannot be removed easily. Labour costs hinders removal of their plastics, thereby leaving them in the soil. They obstruct the root zone activities reducing the agricultural productivity. Being non-biodegradable they remain in the soil for a very long time, thus affecting the farm economy.
- Attracted by food left-over in plastic carry bag in marriage halls, religious places, tourist places large catering houses, cows and other domestic animals eat them. The plastic accumulated in their digestive system, often resulting in their death.

Prevention of Plastic-Disposal — Related Problems

Do not burn the plastics. They are valuable resource. Also gaseous emissions from combustion of plastics pollute the air and some of them are considered to be toxic. Combustion of plastics, particularly in high temperature incinerators produces (**Dioxins)** and (**Furan)** as by-products. (**Dioxins)** are a family of more than 75 different chlorinated hydrocarbons while Plastic or PVC – polyvinyl chloride is a chlorinated hydrocarbon. Some of them are highly toxic and are persistent chemicals that stay in the environment for a very long period. (**Furans)** (e.g. Furfuran) a colorless liquid, with a low boiling point of 320°C- used as an intermediate chemical in manufacture of synthetic resins are also toxic in nature.

Recycling

The best way to tackle the plastic-disposal problem is to adopt suitable methods for collection and conveyance of plastic

articles and practice recycling. With proper quality control, reprocessed plastics can be made as good as first- generation products are cheaper than good reprocessed plastic goods. Methods should be devised to make up this extra cost through taxes or subsidy. The extra monetary expenses involved in purifying the used plastic may become small compared to the environmental burden imposed by indiscriminate discarding of plastics.

Should Plastics be banned?

Some environmental activists are arguing in favour of completely banning low-end plastic items and recycled plastics. This is not very sound thinking particularly in India. Thousands of families are dependent on the collection of plastic wastes and small-scale reprocessing. Besides, more area would be deforested to supply raw materials to paper manufacturing industries for producing packing paper and carry bags.

Government Regulations on Manufacture and Use of Recycled Plastics

The Ministry of Environment and Forests issued the Recycled Plastics Manufacture and Usage Rules 1999, and amended it in 2003 under the Environment (Protection) Act, 1986 for regulating and managing plastic carry bags and containers. Salient features of the Rules are:-

- No vendor shall use carry bags and containers of recycled plastics for storing carrying and / or packaging of foodstuffs.
- Carry bags and Container used for packaging of foodstuff shall be made of virgin plastic and of natural shade or white.
- Carry bags and Container made from recycled plastics must be manufactured using pigments and colorants as per IS: 9833/ 1981 notified by the Bureau of Indian Standards (BIS);
- Minimum thickness of Carry bags made of virgin or recycled plastics must not be less than 20 microns.
- Manufactures of recycled carry bag shall code/ mark carry bags and containers as per IS: 14534: 1998 and mark them as "Recycled "along with percentage of recycled material.
- Manufactures shall print on words packet containing carry bags the words "Recycled marital" or "Virgin Plastics' as the case may be.
- No vendor shall use carry bags made of virgin or recycled plastic below 8 × 12 inches {20 × 30 cm} in size; and 50 bags of such will have minimum weight of 105 grams; and proportionate increase in weight to the increased size of the carry bags; for selling any commodity.
- Every occupier manufacturing carry bags or containers shall apply in prescribed form to the State Pollution Control Board/Pollution Control Committee for grant of Registration and renewal of Registration.
- The State Pollution Control Board / Pollution Committee shall issue and renew the Registration after ascertaining that the unite meets the norms prescribed under these rules and also possesses a valid cosset under Air and Water Act as per requirements of the State Pollution Control Board / Pollution Control Committee.
- The prescribed authority of enforcement of provisions relating to use, collection, segregation, transpiration and disposal is with District collector, Deputy Commissioner of the concerned district, where no such Authority has been constituted by the State Government/Union Territory administration under any law regarding non-biodegradable garbage.
- SPCB's / PCC's are the prescribed authority for enforcement of provisions relating to manufacture and recycling.

Difficulties in Recycling

Almost the entire content of the discarded plastics is made up of thin carry bags and small food-packaging pouches. Laminations made on books, electronic goods, compact discs, cassettes, and many consumer goods add to this problem. The tendency of people particularly house wives is to preserve the thick large bags and discard the thin carry bags with the domestic garbage. Once they get mixed up with the garbage these carry bags are difficult to separate. Cost of retrieval becomes more. Even the rag pickers do not find it attractive to collect the carry bags. If housewives, shopkeepers, and other users discard the carry bags in a container for periodic collection by some designated agency for recycling, the problem of plastics in environment can be greatly reduced.

Bio-degradable Plastics

An alternative to the plastic disposal problem has evolved in the form of 'Bio-degradable plastics'. It is possible to collect these items along with the municipal solid waste (MSW) for suitable disposal. MSW collection and disposal is not satisfactory in most of the towns in India. The bio-degradable plastics will add to the already piling up municipal garbage. The immediate benefits of recovery and recycle of normal plastics is also lost if bio-degradable plastics are introduced. As of now, compared to normal plastic, the bio-degradable plastics are expensive and the technology for manufacture is not easily available. It may be possible to treat bio-degradable plastics in countries where solid waste management systems are working satisfactorily and extensively.

Reuse of Plastics

Mixing shredded PVC bags with asphalt for *road making* has been experimented with reasonable success. *Rope-making* using fiber removed from knitted cement bags is done in rural areas. These ropes are used in farming activities.

Mercury Pollution

Mercury pollution arises from a variety of sources. There is mercury mining although this is overwhelmingly now only in China and some Central Asian countries such as Kyrgyzstan. It is also very heavily used in artisanal and small-scale gold mining to separate gold from the ore. Mercury is used in the chemical and petrochemical industries and also in household products like compact fluorescent lamps (CFLs) and thermometers. Mercury emissions to the atmosphere also take place from coal-fired power plants. Mercury is present in industrial effluents that are let into water bodies and the sea and enters the human food chain through the consumption of fish. This is, in fact, what caused the disaster at Minamata in the 1950s. Contaminated

sites including old mines, landfills and waste disposal locations are also important sources of mercury pollution.

India dragged its feet a bit, but in the end signed up to the Minamata Convention on Mercury on 30 September, a year after it was adopted. The Minamata Convention gives India five years to control and, where feasible, to reduce emissions from new power plants and 10 years to do so for existing power plants.

The Minamata Convention on Mercury is a global treaty to protect human health and the environment from the adverse effects of mercury. It was agreed at the fifth session of the Intergovernmental Negotiating Committee in Geneva, Switzerland at 7 a.m. on the morning of Saturday, 19 January 2013.

The major highlights of the Minamata Convention on Mercury include a ban on new mercury mines, the phase-out of existing ones, control measures on air emissions, and the international regulation of the informal sector for artisanal and small-scale gold mining.

EARTH HOUR

WWF's Earth Hour is an annual global celebration where people switch off their lights for one hour to show they care about the future of our planet. This year's celebrations will be on Saturday 19 March from 8.30 pm to 9.30 pm.

Since it first began in Sydney Australia in 2007, the number of countries taking part in Earth Hour has grown to an incredible 172 countries and territories.

India joined the Earth Hour campaign in 2009 and over the years has seen an exponential growth in participation across cities, towns and even far-flung villages of rural India. Iconic monuments of the country like the Rashtrapati Bhawan, Gateway of India, India Gate, Howrah Bridge and the Victoria Memorial, among others, switch off their non-essential lights in support of this global campaign.

ECO SENSITIVE ZONES

The concept of ecologically sensitive areas is very much an Indian invention, rooted in attempts by civil society to use the EPA to promote sustainable development alongside protection of the natural heritage. The term 'Ecologically Fragile Area' was first used in 1991 for Dahanu Taluka in Maharashtra, followed by the declaration of other ESAs like Mahabaleshwar-Panchgani and Matheran. These are all initiatives of civil society organisations or are a consequence of a resolution of the Indian Board for Wildlife in 2002 to protect areas up to 10 kilometres from the boundaries of wildlife sanctuaries and national parks.

Initially, there were no guidelines available on what areas may be considered ecologically sensitive, nor on working out an appropriate management regime. These issues were addressed in 2000 by the Pronab Sen Committee. The Sen Committee's foremost criterion for identification of ESA is endemism. Western Ghats harbours well over two thousand endemic species of flowering plants, fish, frogs, birds and mammals amongst the better known groups of organisms, and thousands more amongst less studied groups. Amongst themselves these span the entire Western Ghats and all conceivable habitats, including highly disturbed ones. The Western Ghats region also qualifies as an ESA under several other Sen Committee criteria.

Under ESZ, commercial mining, polluting industries and large hydro-power projects are prohibited as per the ministry guidelines. At present the 29 ESZ notified by the Central government are spread across Haryana, Gujarat, Jharkhand, Karnataka, Sikkim, Goa, Maharasthra, Rajasthan, Gujarat and Uttarakhand.

INTERNATIONAL CONVENTIONAL FOR CLIMATE CHANGE

Convention	Place	Crucial documents
United nation Conference on environment and Development or Earth Summit (1992)	Rio de Janeiro, Brazil	Draft Earth Charter Convention on climate change and Biological Diversity Convention on Forest Agenda 21
The United Nations Framework Convention on Climate Change (1994)	Kyoto, Japan	Gather and share information on greenhouse gas emissions, national policies and best practices Launch national strategies for addressing greenhouse gas emissions and adapting to expected impacts, including the provision of financial and technological support to developing countries Cooperate in preparing for adaptation to the impacts of climate change
Convention on Biological Diversity (1993)		The conservation of biological diversity The sustainable use of the components of biological diversity The fair and equitable sharing of the benefits arising out of the utilization of genetic resources
Ramsar Convention on Wetland (1971)	Ramsar, Iran	Halt the worldwide loss of wetlands and To conserve, use and management, those that remain. This requires international cooperation, policy making, capacity building and technology transfer.

Convention on International Trade in Endangered Species of Wild Fauna and Flora (1963)	Washington, U.S.A.	Help in conservation of species
International Tropical Timber Organization (1983)	Geneva	Provide an effective framework for cooperation between tropical timber producers and consumers To encourage the development of national policies aimed at sustainable utilization Conservation of tropical forests and their genetic resources
United Nations Forum on Forests (2000)		Implementation of agreements and foster a common understanding on sustainable forest management; To provide policy development and dialogue among Governments and international organizations, To enhance cooperation To foster international cooperation and To monitor, assess and report on progress of the above functions and objectives To strengthen political commitment to the management, conservation and sustainable development.
Global tiger forum (1994)	New Delhi, India	Set up to embark on a worldwide campaign to save the wild tiger
Stockholm Convention on Persistent Organic Pollutants (2001)	Stockholm, Sweden	It develops a risk management evaluation Determines whether the substance fulfills POP screening. Manage and dispose of POPs wastes in an environmentally sound manner
Basel Convention on the Control of Trans boundary Movements of Hazardous Wastes and Their Disposal (1989)	Basel, Switzerland	To reduce hazardous waste generation and promote environmental sound management system for their disposal. Restrict trans boundary movement of such wastes and Provide regulatory system applying to cases where such movement is allowable.
United Nations Convention to Combat Desertification (1994)		promotes a global response to desertification, land degradation and drought
International Whaling Commission (1946)	Washington, D.C., United States,	to keep under review and revise as necessary the measures laid down in the Schedule to the Convention which govern the conduct of whaling throughout the world
Montreal Protocol on Substances that Deplete the Ozone Layer (1987)	Helsinki, Finland	Play role in controlling the ozone depletion

COP

The UNFCCC entered into force on 21 March 1994. Today, it has near-universal membership. The 195 countries that have ratified the Convention are called Parties to the Convention. The COP is the supreme decision-making body of the Convention. All States that are Parties to the Convention are represented at the COP, at which they review the implementation of the Convention and any other legal instruments that the COP adopts and take decisions necessary to promote the effective implementation of the Convention, including institutional and administrative arrangements.

The COP meets every year, unless the Parties decide otherwise. The first COP meeting was held in Berlin, Germany in March, 1995.

COP (from 2009-2015)

15th session	7th- 18th Sec. 2009	Copenhagen (Denmark)
16th session	29th Nov. -10th Dec. 2010	Cancun (Mexico)
17th session	28th Nov.-09th Dec. 2011	Durban (South Africa)
18th session	26th Nov.- 7th Dec. 2012	Doha (Qatar)
19th session	11th Nov. - 22nd Nov. 2013	Warsaw (Poland)
20th session	1st – 12th Sec. 2014	Lima (Peru)
21st session	30th Nov. - 11th Dec. 2015	Paris (France)

Cop 21 Agreement - In Brief

- Reaffirm the goal of limiting global temperature increase well below 2 degrees Celsius, while urging efforts to limit the increase to 1.5 degrees;
- Establish binding commitments by all parties to make "nationally determined contributions" (NDCs), and to pursue domestic measures aimed at achieving them;
- Commit all countries to report regularly on their emissions and "progress made in implementing and achieving" their NDCs, and to undergo international review;

- Commit all countries to submit new NDCs every five years, with the clear expectation that they will "represent a progression" beyond previous ones;
- Reaffirm the binding obligations of developed countries under the UNFCCC to support the efforts of developing countries, while for the first time encouraging voluntary contributions by developing countries too;
- Extend the current goal of mobilizing $100 billion a year in support by 2020 through 2025, with a new, higher goal to be set for the period after 2025;
- Extend a mechanism to address "loss and damage" resulting from climate change, which explicitly will not "involve or provide a basis for any liability or compensation"
- Require parties engaging in international emissions trading to avoid "double counting;"
- Call for a new mechanism, similar to the Clean Development Mechanism under the Kyoto Protocol, enabling emission reductions in one country to be counted toward another country's NDC.

Environmental Acts

- The Water (Prevention and Control of Pollution) Act, 1974
- The Water (Prevention and Control of Pollution) Rules, 1975
- The Water (Prevention and Control of Pollution) Cess Act, 1977
- The Water (Prevention and Control of Pollution) Cess Rules, 1978
- The Air (Prevention and Control of Pollution) Act, 1981
- The Air (Prevention and Control of Pollution) Rules, 1982
- The Environment (Protection) Act, 1986
- The Environment (Protection) Rules, 1986
- Hazardous Wastes (Management and Handling) Rules, 1989
- Manufacture, Storage and Import of Hazardous Chemical Rules, 1989
- The Forest (Conservation) Act, 1980
- The Forest (Conservation) Rules, 1981
- The Wildlife Protection Act, 1972
- The Wildlife (Transactions and Taxidermy) Rules, 1973
- The Wildlife (Stock Declaration) Central Rules, 1973
- The Wildlife (Protection) Licensing (Additional Matters for Consideration) Rules, 1983
- The Wildlife (Protection) Rules, 1995
- The Wildlife (Specified Plants - Conditions for Possession by Licensee) Rules, 1995
- The Public Liability Insurance Act, 1991
- The Public Liability Insurance Rules, 1991
- The National Environment Tribunal Act, 199
- The National Environment Appellate Authority Act, 1997

Exercise -1

1. Green house effect is warming due to
   (a) infra-red rays reaching earth
   (b) moisture layer in atmosphere
   (c) increase in temperature due to increase in carbon dioxide concentration of atmosphere
   (d) ozone layer of atmosphere.
2. Acid rain is due to increase in atmospheric concentration of
   (a) ozone and dust (b) CO_2 and CO
   (c) SO_2 and CO (d) SO_2 and NO_2.
3. The two great industrial tragedies namely, MIC and Chernobyl tragedies respectively occurred where and at which time?
   (a) Bhopal 1984, Ukrain 1986
   (b) Bhopal 1986, Russia 1988
   (c) Bhopal 1984, Ukrain 1990
   (d) Bhopal 1984, Ukrain 1988
4. If there was no CO_2 in the earth's atmosphere, the temperature of earth's surface would be
   (a) higher than the present
   (b) dependent on the amount of oxygen in the atmosphere
   (c) same as present
   (d) less than the present.
5. How carbon monoxide, emitted by automobiles, prevents transport of oxygen in the body tissues?
   (a) by forming a stable compound with haemoglobin
   (b) by obstructing the reaction of oxygen with haemoglobin
   (c) by changing oxygen into carbon dioxide
   (d) by destroying the haemoglobin.
6. What is B.O.D.?
   (a) The amount of O_2 utilized by organisms in water
   (b) The amount of O_2 utilized by micro-organisms for decomposition
   (c) The total amount of P_2 present in water
   (d) All of the above.
7. Which one of the following pairs is mismatched?
   (a) fossil fuel burning – release of CO_2
   (b) nuclear power – radioactive wastes
   (c) solar energy – greenhouse effect
   (d) biomass burning – release of CO_2.
8. Acid rain concentrated in the eastern portions of the United States is primarily the result of
   (a) nuclear power plants in the region
   (b) coal-burning power plants in the Midwest
   (c) hydro electric power plants in northeastern Canada
   (d) off-shore oil drilling rigs along the east coast of the United States
9. Alien species that cause the most harm are those that
   (a) struggle to fit into new ecosystems and eventually die out.
   (b) eventually become naturalized
   (c) become invasive
   (d) become agricultural products
10. Environmental pollutants such as PCB's contaminate oceans and other aquatic systems. Plankton in the ocean become contaminated by PCB's and pass this along through the food chain. A pregnant woman has been cautioned to limit her consumption of food that may be high in PCBs. If she consumes food from a nearby contaminated ocean, we would expect that the most contaminated foods would be:
    (a) shrimp
    (b) clams
    (c) fish that eat shrimp
    (d) kelp and other ocean plants
11. In clean water the concentration of
    (a) BOD is low but DO is high
    (b) Both BOD and DO are high
    (c) BOD is high but DO is low
    (d) Both BOD and DO are low
12. Examining an old abandoned home several months after a flood, a relief worker suddenly experiences difficulty breathing.
    At the hospital she learns that she experienced:
    (a) a chronic respiratory illness more common in the developed world.
    (b) a chronic respiratory illness more common in the developing world.
    (c) an acute respiratory illness more common in the developed world.
    (d) an acute respiratory illness more common in the developing world.
13. Harmful algal booms appear to be linked to unusually high levels of nutrient pollution. Which of the following is the most likely source of nutrient pollution in a river drainage system associated with an algal bloom?
    (a) a coal-fired power plant
    (b) a nuclear power plant
    (c) chicken and hog farms
    (d) a large shopping mall
14. Health problems associated with indoor air pollution in developing countries is most commonly associated with:
    (a) chlorine gas released from tap water.
    (b) the use of biofuels for cooking and heating.
    (c) poor hygiene and sanitation inside the home.
    (d) the widespread use of pesticides to control disease vectors.
15 The formation of ozone hole in the Antarctic region has been a cause of concern. What could be the reason for the formation of this hole ?
    (a) Presence of prominent tropo-spheric turbulence; and inflow of chlorofluorocarbons.
    (b) Presence of prominent polar front and stratospheric clouds; and inflow of chlorofluorocarbons.
    (c) Absence of polar front and stratospheric clouds; and inflow of methane and chlorofluorocarbons.
    (d) Increased temperature at polar region due to global warming.

16. Recent studies indicate that two of the most dangerous components of air pollution around major cities in the developed nations are:
    (a) fine particles and sulfur pollution.
    (b) carbon monoxide and ozone.
    (c) lead and volatile organic compounds.
    (d) *radon* and carbon monoxide.
17. The decline of the polar ice caps because of increasing temperatures at the poles will
    (a) increase the amount of fresh water available for human use.
    (b) decrease the largest reserve of fresh water on Earth.
    (c) increase the amount of fresh water available in aquifers.
    (d) decrease global sea levels.
18. The developed countries of the world have contributed the most to global climate change. By applying the polluter pays and equity principles, we would expect that the:
    (a) developed countries will provide funds for adaptations in the developing countries.
    (b) developing countries will provide funds for adaptations in the developed countries.
    (c) precautionary principle will guide the payment of compensation to developed countries.
    (d) stabilization wedge approach to global climate change will help to equalize the funds for adaptations.
19. The evolution of pesticide resistance resurgence, and secondary-pest outbreaks are only some of the problems that result from reliance on
    (a) crop rotation and biological controls, which disrupt the natural dynamics of ecosystems.
    (b) pesticides, creating the need to alternate between a pesticide and an herbicide every other year.
    (c) rodenticides to kill weeds and insect pests and prevent the spread of viral diseases.
    (d) pesticides, creating a never-ending pesticide treadmill requiring new pest-fighting strategies.
20. The most dramatic temperature shifts in the past few decades have been
    (a) on land near the equator.
    (b) in the oceans nearest the equator.
    (c) in the north and south polar regions.
    (d) in the innermost regions of the North. American and African continents.
21. The most effective way to reduce GHG emissions is to increase
    (a) the production of electric cars.
    (b) energy efficiency and renewable energy.
    (c) our reliance on widely available natural gas
    (d) the use of coal gasification plants and scrubber technologies to reduce sulfur emissions.
22. The most likely sustainable solutions of ecological problems are
    (a) Incorporate the concerns of economists, ecologists, and sociologists.
    (b) emphasize ecology over all other fields.
    (c) emphasize economics over all other fields.
    (d) emphasize ecological and social is - "Use over economic concerns.
23. The negative impacts of ozone pollution on forests are expected to increase as
    (a) ocean levels rise and wind patterns shift.
    (b) organisms spread northward because of warming climate conditions.
    (c) the increasing demand for timber further stresses the growth of trees,
    (d) temperatures increase and precipitation becomes more unpredictable.
24. The pesticide that directly attacks the nervous system is
    (a) Aldrin (b) DDT
    (c) Organic Phosphates (d) None of the above
25. The pesticides that also function as endocrine disruptors cause disease by
    (a) causing excessive secretion of stomach acids.
    (b) mimicking the effects of estrogenic hormones.
    (c) causing muscle spasms and cramping in major muscle groups.
    (d) greatly reducing the ability of the intestines to absorb nutrients.
26. The quality of the final treated wastewater effluent from a modern treatment plant is typically:
    (a) lower in organic and nutrient content than the body of water into which it is discharged.
    (b) lower in organic content but higher in nutrient content than the body of water into which it is discharged.
    (c) higher in organic and nutrient content than the body of water into which it is discharged.
    (d) higher in organic content but lower in nutrient content than the body of water into which it is discharged.
27. Brightly colored antique children's toys from before 1970 may be colored with paints that are contaminated with:
    (a) heavy metals
    (b) toxic plastic compounds.
    (c) synthetic organic compounds.
    (d) synthetic inorganic compounds.
28. By design, the molecules that resist biodegradation and include some of the most problematic persistent organic pollutants are the :
    (a) synthetic organic compounds
    (b) synthetic inorganic compounds
    (c) recycled heavy metals
    (d) chlorinated heavy metals
29. Carcinogens arc dangerous because they affect
    (a) oxygen-carrying red blood cells.
    (b) the ability of the lining of the lungs to absorb oxygen.
    (c) DNA molecules inside cells.
    (d) the ability to absorb nutrients in the wall of the intestines.
30. CFCs primarily contribute to the destruction of the ozone by:
    (a) producing chlorinated gases that reflect back a significant amount of ultraviolet light.
    (b) releasing carbon monoxide into the stratosphere, which reacts with the oxygen in ozone.

(c) releasing gases into the stratosphere that block the enzymes that create ozone.
(d) contributing chlorine, which acts as a catalyst in the breakdown of ozone.

31. At an international conference on global climate change, a representative of a developing country admits that each year, his country contributes the same amount of green-house gases to the atmosphere as a particular developed nation. However, he argues that because his country has only 10% of the wealth of that developed nation, the developed nation should pay much more of the costs of adaptation. This representatives arguments illustrate the:
(a) polluter pays principle.
(b) precautionary principle.
(c) equity principle.
(d) conservation of the commons principle.

32. Concerned with the expensive disposal their hazardous wastes, a company learns that it can purchase another chemical that will neutralize the company's hazardous wastes into a nontoxic form. The strategy used by this company is most consistent with which of the following hazardous-waste disposal system methods ?
(a) secure landfill
(b) deep-well injection
(c) on-site surface impoundment
(d) best-demonstrated available technology

33. Freshwater becomes polluted:
(a) by oil spills in ocean water moving inland.
(b) primarily by contaminants from aquifers moving to surface waters.
(c) as a result of eutrophication.
(d) from runoff associated with urban areas chemicals used in farming in rural areas.

34. In developing countries, contaminated water is responsible for the deaths of more than 1.6 million people. Contributing to this problem is the use of
(a) groundwater for consumption and the disposal of human sewage.
(b) groundwater for consumption and the disposal of human sewage in surface waters.
(c) surface waters for consumption and the disposal of human sewage.
(d) surface waters for consumption and the disposal of human sewage in groundwater.

35. In general, temperatures along an ocean coastline vary less than temperatures 100 miles inland. This moderation of temperatures along coastlines is because
(a) as the oceans evaporate it cools off the coastlines.
(b) the sun shines more intensely away from the ocean coastlines
(c) ocean temperatures change more quickly than air temperatures.
(d) ocean temperatures do not change as quickly as air temperatures.

36. Ozone levels increase in the atmosphere when volatile organic compounds (VOCs) are present because:
(a) less nitric oxide is available to react with ozone.
(b) VOCs react with atmospheric nitrogen to form ozone.
(c) VOCs release ozone when they are broken apart by solar energy.
(d) more carbon dioxide is available to contribute additional oxygen for ozone formation.

37. The greatest progress in reducing atmospheric levels of lead pollution resulted from
(a) the elimination of leaded gas.
(b) the switch from lead to graphite in pencils.
(c) the development of new types of batteries that use lithium instead of lead.
(d) new types of lead scrubbers on smokestacks that removed lead from the air.

38. The inside of a car or greenhouse would not heat up as much in the presence of sunshine if
(a) air was circulated within the car or within the greenhouse.
(b) infrared radiation passed through glass as easily as sunlight.
(c) infrared radiation could not pass through glass as easily as sunlight.
(d) sunlight could pass through glass more easily than through air.

39. Villagers living in a heavily forested region surrounding a remote district in Punjab decided to reduce air pollution in their village. In thc autumn season, after the leaves had fallen from the trees, the villagers blew all of the dead leaves into the village pond. About 8 months later, they noticed a large number of dead fish in the pond. What is the most likely cause of the fish kill?
(a) the dead leaves released poisons that killed the fish.
(b) the decomposing leaves depleted the levels of oxygen.
(c) bacteria fed on the leaves and then the bacteria infected the fish.
(d) carbon dioxide from the decaying leaves reached toxic levels and killed the fish.

40. Which of the following represents an alarming positive feedback loop of global warming ?
(a) increasing temperature raise humidity, which further increases temperatures.
(b) decreased pH of the ocean increases the rate at which carbon dioxide is absorbed by the oceans from the atmosphere.
(c) increased use of fossil fuels adds sulfate aerosols into the atmosphere, which traps more heat.
(d) increased levels of atmospheric carbon dioxide increases photosynthesis, which further increases carbon dioxide atmospheric levels.

41. Which one of the following generally increases the pollution of the air?
(a) bright sunlight.
(b) generation of hydroxyl radicals.
(c) sea salt aerosols entering the air over an ocean.
(d) gases released by a volcanic eruption.

42. Wood pellets are produced from the waste sawdust of lumber and paper mills. Home-heating stoves burning these pellets can heat homes directly, instead of relying on other energy sources. Heating your home with wood pellets is :

(a) sustainable, less polluting, and about 3 times as efficient as heating a home using electricity from a coal-fired power plant.
(b) sustainable, slightly more polluting, and is about 30% more efficient than using electricity from a coal-fired power plant.
(c) not sustainable but is less polluting and is about as efficient as using electricity from a coal-fired power plant.
(d) not sustainable and actually pollutes more than using electricity from a coal-fired power plant.

43. The Clean Development Mechanism (CDM), a mechanism to reduce greenhouse gas emission as per Kyoto Protocol implies that
(a) industrial countries receive carbon credits by funding carbon saving projects in another relatively affluent nation
(b) industrial countries reduce their carbon emission by using environment friendly technology in production
(c) developed countries invest in carbon reduction in developing countries and receive carbon credit in return
(d) developed nations purchase carbon credit from other nations

44. A gardener applied heavy doses of the same insecticide to his garden for two consecutive years to kill squash bugs. During the third year, the man called in an expert to explain why he had an abundance of new pests that were destroying her garden. The expert explained that the abundant new pests were largely due to his previous use of a insecticide in a phenomenon known as
(a) pesticide resistance
(b) secondary-pest outbreak
(c) triennial pest emergence
(d) bounce back resurgence

45. A gardener has a large garden and decides this year he will not let the pests get beyond control. At the earliest sign of insect pests, he applies an organic insecticide and continues to apply it every month throughout the growing season. The next year he decides not to use any insecticides, thinking that he must have eliminated the pests with the prior year's treatments. Unfortunately, the pests reappear in numbers greater than he has ever seen before, and his plants are destroyed. Investigating this phenomenon, he learns that he has just experienced a phenomenon known as
(a) resurgence (b) pesticide resistance
(c) natural selection (d) emergence

46. Moss invades and establishes itself on bare rock, accumulating the beginnings of soil. After several years, enough soil has become established that grasses begin to grow where there was once bare rock.
Without the moss building up soil, the grasses would have had no chance. The mosses changed the environment enough to permit grasses to grow in a process called:
(a) sublimation. (b) facilitation.
(c) regeneration. (d) improvisation.

47. Most of the wheat, rice and corn raised in the world has resulted from genetic engineering of one sort or another, either by crossing certain varieties or deliberately transferring genes using transgenic techniques. These methods select for plants that produce their own defenses against pests with chemicals or physical barriers. Helping to feed the world, this represents an example of :
(a) cultural control
(b) natural enemies control
(c) genetic control
(d) natural chemical control

48. The eagle predators, the amount of acorns produced annually, nesting sites in the trees, and cold winter temperatures limits the squirrel population in the Punjab region. The many factors listed above that can affect the squirrel population represent:
(a) environmental resistance.
(b) the carrying capacity of the squirrel population.
(c) the squirrel's life history.
(d) the biotic potential of the squirrel population.

49. The most widespread negative health impact of air pollution is the
(a) destruction of the cellular component of the immune system.
(b) loss of the ability to absorb vital nutrients by thc digestive system.
(c) disruption of the signaling processes of the endocrine system.
(d) chronic stress that weakens many systems of the body.

50. The population of a particular type of fish, called Kubani found and in the Chilka lake only, is under heavy fishing pressure. If too many Kubians are caught, its population will crash and future years of fishing Kubani will suffer. Kubani can exhibit logistic growth under certain circumstances. Assuming logistic growth, it would be best to manage Kubani population by permitting the harvesting of just enough fish to keep the Kubani population.
(a) at 1/10 of its carrying capacity.
(b) at half its carrying capacity.
(c) at its full carrying capacity.
(d) above its carrying capacity.

51. In the lower regions of Uttaranchal, a toxic weed called leafy spurge was accidentally introduced and has grown and spread rapidly, covering millions of acres of grasslands. Leafy spurge is generally avoided by cattle and horses and may be toxic to them. Thus, grasslands where leafy spurge has spread has been damaged by the invasion of this plant. Plants such as leafy spurge can double their population size every year in part because of their efficient production of large amounts of seeds. Populations that can double every year, such as leafy spurge.
(a) can do so endlessly, eventually covering all of the land on Earth.
(b) exhibit constant growth increasing by the same amount every year.
(c) exhibit a state of equilibrium when they are spreading.
(d) exhibit exponential growth as they spread to new regions.

52. Which one of the following statements best reflects the overall position of current science on the role of biodiversity in ecosystems?
(a) The more species in an ecosystem, the greater the biomass production.
(b) The more species in an ecosystem, the greater the drought resistance.
(c) The effects of biodiversity on the functioning of an ecosystem are not consistent.
(d) Almost every species in an ecosystem is essential to maintain the overall ecosystem.

53. Widely applying pesticides may lead to resurgence and secondary-pest outbreak because:
(a) the insecticide also killed the natural predators of the pests.
(b) the plants have now lost their ability to fight the pests.
(c) pesticides typically harm plants in ways that take several years to appear.
(d) new species that are more resistant to insecticides have evolved.

54. Protection of endangered species by preserving the entire ecosystem is known as:
(a) In-situ conservation
(b) Ex-situ conservation
(c) Biodiversity conservation
(d) None of the above

55. Ramsar Convention 1971 aimed at the conservation of
(a) Wasteland (b) Wetland
(c) Desert (d) All of the above

56. Building on scientific research and careful measurements, the 1987 Montreal Protocol represented :
(a) global stewardship to limit the destruction of the ozone.
(b) agreements to maintain sustainable levels of agricultural productivity.
(c) sound science to better understand the impact of acid precipitation.
(d) stewardship by the Canadian government to limit the production of greenhouse gases.

57. Over the past 20 years, vultures in India and Pakistan have declined by more than 95% due to :
(a) increased hunting and fear from villagers that the vultures will kill their domestic cattle.
(b) the destruction of their nesting habitat in cliffs bordering the Indus River.
(c) the spread of respiratory viruses common in domestic chickens.
(d) the widespread use of an anti-inflammatory drug in cattle that were eaten by vultures.

58. 'El Nino' associated with the formation of the South West Monsoon of India is
(a) an abnormally warm ocean current
(b) a periodic warm air-mass
(c) a periodic warm wind
(d) a periodic low pressure centre

59. Ozone holes are more pronounced at the
(a) Equator (b) Tropic of Cancer
(c) Tropic of Capricorn (d) Poles

60. Acid rains are produced by
(a) excess NO_2 and SO_2 from burning fossil fuels
(b) excess production of NH_3 by industry and coal gas
(c) excess release of carbon monoxide by incomplete combustion
(d) excess formation of CO_2 by combustion and animal respiration. (1988, 89)

61. 'BioCarbon Fund Initiative for Sustainable Forest Landscapes' is managed by the **(CSAT 2015-I)**
(a) Asian Development Bank
(b) International Monetary Fund
(c) United Nations Environment Programme
(d) World Bank

62. Which one of the following is associated with the issue of control and phasing out of the use of ozone-depleting substances? **(CSAT 2015-I)**
(a) Bretton Woods Conference
(b) Montreal Protocol
(c) Kyoto Protocol
(d) Nagoya Protocol

63. What is Rio+20 Conference, of ten mentioned in the news? **(CSAT 2015-I)**
(a) It is the United Nations Conference on Sustainable Development
(b) It is a Ministerial Meeting of the World Trade Organization
(c) It is a Conference of the Inter-governmental Panel on Climate Change
(d) It is a Conference of the Member Countries of the Convention on Biological Diversity

64. Which of the following statements regarding 'Green Climate Fund' is/are correct? **(CSAT 2015-I)**
1. It is intended to assist the developing countries in adaptation and mitigation practices to counter climate change.
2. It is founded under the aegis of UNEP, OECD, Asian Development Bank and World Bank.

Select the correct answer using the code given below.
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Exercise -2

Statement Based MCQ

1. Biomass gasification is considered to be one of the sustainable solutions to the power crisis in India. In this context, which of the following statements is/are correct?
   1. Coconut shells, groundnut shells and rice husk can be used in biomass gasification.
   2. The combustible gases generated from biomass gasification consist of hydrogen and carbon dioxide only.
   3. The combustible gases generated from biomass gasification can be used for direct heat generation but not in internal combustion engines.

   Select the correct answer using the codes given below :
   (a) 1 only (b) 2 and 3
   (c) 1 and 3 (d) 1, 2 and 3
2. Eutrophication in the Chesapeake Bay along the eastern edge of Maryland bas resulted in low oxygen levels in the water and alteration of food webs. The cause of this eutrophication appears to be pollution that contains high levels of:
   1. nitrogen 2. carbon
   3. phosphorus 4. sulphur

   Which of the above is/are correct?
   (a) 1 and 3 (b) 2 and 4
   (c) 1, 2 and 3 (d) All of these
3. Consider the following statements:
   1. Kyoto protocol came into force in the year 2005.
   2. Kyoto protocol deals primarily with the depletion of the ozone layer.
   3. Methane as a green house gas is more harmful than carbon dioxide.

   Which of the statements given above is/are correct?
   (a) 1 and 2 (b) 1 and 3
   (c) 1 only (d) 3 only
4. Compared to 50 years ago, the thinning ozone layer has produced dramatic increases in cases of :
   1. asthma 2. color blindness
   3. cataracts 4. skin cancer

   Which of the above is/are correct?
   (a) 1 and 2 (b) 3 and 4
   (c) 1, 2 and 3 (d) All of these
5. If atmospheric carbon dioxide was eliminated from our atmosphere, we would expect that :
   1. the Earth would cool considerably
   2. photosynthesis would dramatically increase
   3. the Earth would heat up considerably
   4. photosynthesis would dramatically decrease

   Which of the above is/are correct?
   (a) 1 and 2 (b) 2 and 3
   (c) 1 and 4 (d) 2 and 4
6. Due to their extensive rice cultivation, some regions may be contributing to global warming. To what possible reason/reasons is this attributable ?
   1. The anaerobic conditions associated with rice cultivation cause the emission of methane.
   2. When nitrogen based fertilizers are used, nitrous oxide is emitted from the cultivated soil.

   Which of the statements given above is / are correct ?
   (a) 1 only (b) 2 only
   (c) Both 1 and 2 (d) Neither 1 nor 2
7. Gases commonly referred as green house gases are :
   1. CH_4 2. CO_2
   3. CFC 4. NH_3

   Which of the above is/are correct?
   (a) 1 and 4 (b) 2 and 3
   (c) 1, 2 and 3 (d) All of these
8. Fertilizers cause
   1. eutrophication of water bodies
   2. survival of most microorganisms
   3. destruction of crumb structure of soil
   4. all the above

   Which of the above is/are correct?
   (a) 1 and 3 (b) 2 and 4
   (c) 1, 2 and 3 (d) All of these
9. Chipko movement is
   1. A movement of political strength held in Assam under the supervision of Rajeev Gandhi
   2. A environment movement held in uttarakhand under the guidance of sunderlal bahuguve.
   3. A movement for independence under the guidance of Nehruji
   4. A movement of independence under the guidance of Gandhi ji.

   Which of the following statements(s) is/are correct?
   (a) 1 only (b) 2 only
   (c) 3 only (d) Both 1 and 4
10. Eutrophication of a lake most likely is the result of
    1. Elevated nitrogen gas level in water.
    2. Elevated phosphorus levels in water.
    3. Excessive concentration of CO_2.
    4. A decrease in oxygen content of the water.

    Which of the above is/are correct?
    (a) 1 only (b) 1 and 3
    (c) 1 and 2 (d) 1 and 4
11. Ozone layer can be destroyed by pollutants such as
    1. Hydro carbons 2. Carbon mono oxide
    3. Sulphur dioxide 4. Nitrogen oxides
    (a) 1 and 2 (b) 2 and 3
    (c) 1 and 3 (d) 1 and 4
12. Climatologist warm of a tipping point when global temperature trigger catastrophic events and rise levels rise more than 50 feets. What would cause the sea level rise so greatly and how much warmer does the world need to get for this tripping point to happen
    1. 1°C
    2. 3°C
    3. Melting of Greenland ice sheet
    4. thermal expansion of oceans

Which of the above is/are correct?
(a) 1 and 3 (b) 1 and 3
(c) 2 and 3 (d) 2 and 4

13. One Carbon Credit is defined as ____ .
1. Credit permit to release one ton of carbon dioxide.
2. providing loans to establish a unit which produces carbon dioxide for industrial use.
3. Finding out one new business which can use and recycle greenhouse gases.

Which of the following statements(s) is/are correct?
(a) 3 only (b) 2 only
(c) 1 only (d) All 1, 2 and 3

14. Humans have contributed to habitat destruction by
1. clearing land for farming
2. excessive use of chemicals
3. producing green-house gases through use of fossil fuels
4. exploitation of land and water for mining of scarce resources

Which of the above is/are correct?
(a) 1 and 2 (b) 2 and 3
(c) 1, 2 and 3 (d) All of these

15. Global climate change threatens coral reefs by
1. increasing the temperature
2. decreasing the temperature
3. increasing the pH of the oceans
4. decreasing the pH of the oceans

Which of the above is/are correct?
(a) 1 and 2 (b) 2 and 3
(c) 1 and 4 (d) 2 and 4

16. The acidification of oceans is increasing. Why is this phenomenon a cause of concern?
1. The growth and survival of calcareous phytoplankton will be adversely affected.
2. The growth and survival of coral reefs will be adversely affected.
3. The survival of some animals that have phytoplanktonic larvae will be adversely affected.
4. The cloud seeding and formation of clouds will be adversely affected.

Which of the statements given above is /are correct?
(a) 1, 2 and 3 (b) 2 only
(c) 1 and 3 (d) 1, 2, 3 and 4

17. Which of the following countries suffer from the acid rains?
1. Canada 2. France
3. Norway 4. Germany

Select the correct answers from the codes given below:
Codes:
(a) 1 and 2 (b) 1 and 3
(c) 2 and 3 (d) 3 and 4

18. Which of the following statements about Radioactive pollution are correct?
1. It causes genetic changes in the animals.
2. It causes disbalance among different minerals in the soil.
3. It hinders blood circulation.
4. It causes cancers.

Select the correct answer from the codes given below:
Codes:
(a) 1 and 2 (b) 1 and 4
(c) 1, 3 and 4 (d) 2, 3 and 4

19. Which of the following conditions indicate the impact of global warming?
1. Melting of glaciers
2. Rise in sea level
3. Changes in weather conditions
4. Rise in global temperature

Select the correct answer from the codes given below:
Codes:
(a) 1 and 2 (b) 1, 2 and 3
(c) 2, 3 and 4 (d) 1, 2, 3 and 4

20. As per National Aeronautics and Space Adminis-tration (NASA) research scientists found that concentrations of mercury near the ground level had increased in the Arctic Sea by mercury-pumping reaction which takes place because -
1. of open water in a lead is much warmer than the air above it.
2. of the temperature difference, the air above the lead churns like the air above a boiling pot.
3. the mixing is so strong that it actually pulls down mercury from a higher layer of the atmosphere to near the surface.

Select the answer from the codes given below-
(a) 1 only (b) 1 and 2 only
(c) 2 and 3 only (d) All of the above

21. A new nuclear waste disposal strategy announced by United States include-
1. a “pilot interim store” will become operational in 2021
2. a larger “full-scale interim store” will open be open by 2025
3. an underground disposal facility to be established by 2048 to permanently dispose of the material.
4. a new organisation will be established to manage the siting, development and operation of the future waste stores.

Select the answer from the codes given below-
(a) 1, 2 and 3 (b) 2, 3 and 4
(c) 1, 3 and 4 (d) All of the above

22. Which of the following statements are correct ?
1. A new study has found that changes in solar activity contributed no more than 10 per cent to global warming in the 20th century published in the journal Environmental Research Letters.
2. It has been proposed that cosmic rays may have a role in cooling the earth by encouraging clouds to form, which subsequently reflect the sun’s rays back into space.
3. Researchers found high correlation between cosmic rays and global temperatures occurring every 22 years.

Select the answer from the codes given below-
(a) 1 only (b) 1 and 2 only
(c) 2 and 3 only (d) All of the above

23. There is a concern, over the increases in harmful algal blooms in the seawaters of India. What could be the causative factors for this phenomenon?
1. Discharge of nutrients from the estuaries.
2. Run-off from the land during the monsoon.
3. Upwelling in the seas.
Select the correct answer from the codes given below:
(a) 1 only (b) 1 and 2
(c) 2 and 3 (d) 1, 2 and 3

24. With reference to India, consider the following Central Acts
1. Import and Export (Control) Act, 1947
2. Mining and Mineral Development (Regulation) Act, 1957
3. Customs Act, 1962
4. Indian Forest Act, 1927
Which of the above Acts have relevance to/bearing on the biodiversity conservation in the country ?
(a) 1 and 3 (b) 2,3 and 4
(c) 1,2,3 and 4 (d) None

25. Biomass gasification is considered to be one of the sustainable solutions to the power crisis in India. In this context, which of the following statements is/are correct?
1. Coconut shells, groundnut shells and rice husk can be used in biomass gasification.
2. The combustible gases generated from biomass gasification consist of hydrogen and carbon dioxide only.
3. The combustible gases generated from biomass gasification can be used for direct heat generation but not in internal combustion engines.
Select the correct answer using the codes given below :
(a) 1 only (b) 2 and 3
(c) 1 and 3 (d) 1, 2 and 3

26. The safest method for biomedical waste disposal is:
1. Incineration
2. Autoclaving
3. Sharp pit encapsulation
4. Precipitation
Which of the above is/are correct?
(a) 1 and 2 (b) 1 and 3
(c) 1, 2 and 3 (d) 1, 2, 3 and 4

27. Forests that experience high levels of acid precipitation expose trees to soil that has :
1. more dissolved calcium
2. more dissolved aluminium
3. less dissolved calcium
4. less dissolved aluminium
Which of the above is/are correct?
(a) 1 and 2 (b) 2 and 3
(c) 1 and 4 (d) 2 and 4

28. Excessive exposure of humans to UV-rays results in
1. damage to immune system
2. damage to lungs
3. skin cancer
4. peptic ulcers
Which of the above is/are correct?
(a) 1 and 2 (b) 2 and 3
(c) 1 and 3 (d) 2 and 4

29 Gases commonly referred as green house gases are :
1. CH_4 2. CO_2
3. CFC 4. NH_3
Which of the above is/are correct?
(a) 1 and 4 (b) 2 and 3
(c) 1, 2 and 3 (d) 1, 2, 3 and 4

30. Climatologist warn of a tipping point when global temperature trigger catastrophic events and rise levels rise more than 50 feets. What would cause the sea level rise so greatly and how much warmer does the world need to get for this tripping point to happen
1. 1°C
2. 3°C
3. Melting of Greenland ice sheet
4. thermal expansion of oceans
Which of the above is/are correct?
(a) 1 and 3 (b) 1 and 3
(c) 2 and 3 (d) 2 and 4

31. Due to improper/ indiscriminate disposal of old and used computers or their parts, which of the following are released into the environment as e-waste?
1. Beryllium 2. Cadmium
3. Chromium 4. Heptachlor
5. Mercury 6. Lead
7. Plutonium
Select the correct answer using the codes given below.
(a) 1, 3, 4, 6 and 7 only (b) 1, 2, 3, 5 and 6 only
(c) 2, 4, 5 and 7 only (d) 1, 2, 3, 4, 5, 6 and 7

32. Which of the following can be found as pollutants in the drinking water in some parts of India?
1. Arsenic 2. Sorbitol
3. Fluoride 4. Formaldehyde
5. Uranium
Select the correct answer using the codes given below.
(a) 1 and 3 only (b) 2, 4 and 5 only
(c) 1, 3 and 5 only (d) 1, 2, 3, 4 and 5

33. Consider the following international agreements :
1. The International Treaty on Plant Genetic Resources for Food and Agriculture
2. The United Nations Convention to Combat Desertification
3. The World Heritage Convention
Which of the above has/have a bearing on the biodiversity?
(a) 1 and 2 only (b) 3 only
(c) 1 and 3 only (d) 1, 2 and 3

34. Consider the following statements regarding 'Earth Hour':
1. It is an initiative of UNEP and UNESCO.
2. It is a movement in which the participants switch off the lights for one hour on a certain day every year.
3. It is a movement to raise the awareness about the climate change and the need to save the planet.
Which of the statements given above is/are correct?
(a) 1 and 3 only (b) 2 only
(c) 2 and 3 only (d) 1, 2 and 3

35. With reference to a conservation organization called "Wetlands International', which of the following statements is/ are correct?

1. It is an intergovernmental organization formed by the countries which are signatories to Ramsar Convention.
2. It works at the field level to develop and mobilize knowledge, and use the practical experience to advocate for better policies.

Select the correct answer using the code given below.
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

36. Other than poaching, what are the possible reasons for the decline in the population of Ganges River Dolphins?
1. Construction of dams and barrages on rivers
2. Increase in the population of crocodiles in rivers
3. Getting trapped in fishing nets accidentally
4. Use of synthetic fertilizers and other agricultural chemicals in crop-fields in the vicinity of rivers

Select the correct answer using the code given below.
(a) 1 and 2 only (b) 2 and 3 only
(c) 1, 3 and 4 only (d) 1, 2, 3 and 4

37. Brominated flame retardants are used in many household products like mattresses and upholstery. Why is there some concern about their use?
1. They are highly resistant to degradation in the environment.
2. They are able to accumulate in humans and animals.

Select the correct answer using the code given below.
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

38. With reference to 'Eco-Sensitive Zones', which of the following statements is/are correct?
1. Eco-Sensitive Zones are the areas that are declared under the Wildlife (Protection) Act, 1972.
2. The purpose of the declaration of Eco-Sensitive Zones is to prohibit all kinds of human activities in those zones except agriculture.

Select the correct answer using the code given below.
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

39. Consider the following statements :
1. Animal Welfare Board of India is established under the Environment (Protection) Act, 1986.
2. National Tiger Conservation Authority is a statutory body.
3. National Ganga River Basin Authority is chaired by the Prime Minister.

Which of the statements given above is/are correct?
(a) 1 only (b) 2 and 3 only
(c) 2 only (d) 1, 2 and 3

40. Which of the following have coral reefs?
1. Andaman and Nicobar Islands
2. Gulf of Kachchh
3. Gulf of Mannar
4. Sunderbans

Select the correct answer using the code given below.
(a) 1, 2 and 3 only (b) 2 and 4 only
(c) 1 and 3 only (d) 1, 2, 3 and 4

41. In India, the problem of soil erosion is associated with which of the following?
1. Terrace cultivation
2. Deforestation
3. Tropical climate

Select the correct answer using the code given below.
(a) 1 and 2 only (b) 2 only
(c) 1 and 3 only (d) 1, 2 and 3

42. The scientific view is that the increase in global temperature should not exceed 2 °C above pre-industrial level. If the global temperature increases beyond 3 °C above the pre-industrial level, what can be its possible impact/impacts on the world?
1. Terrestrial biosphere tends toward a net carbon source.
2. Widespread coral mortality will occur.
3. All the global wetlands will permanently disappear.
4. Cultivation of cereals will not be possible anywhere in the world.

Select the correct answer using the code given below.
(a) 1 only (b) 1 and 2 only
(c) 2, 3 and 4 only (d) 1, 2, 3 and 4

43. Which of the following are some important pollutants released by steel industry in India?
1. Oxides of sulphur 2. Oxides of nitrogen
3. Carbon monoxide 4. Carbon dioxide

Select the correct answer using the code given below.
(a) 1, 3 and 4 only (b) 1and 3 only
(c) 1 and 4 only (d) 1, 2, 3 and 4

44. Global climate change threatens coral reefs by
1. increasing the temperature
2. decreasing the temperature
3. increasing the pH of the oceans
4. decreasing the pH of the oceans

Which of the above is/are correct?
(a) 1 and 2 (b) 2 and 3
(c) 1 and 4 (d) 2 and 4

45. With reference to 'Forest Carbon Partnership Facility', which of the following statements is/ are correct?
1. It is a global partnership of governments, businesses, civil society and indigenous peoples.
2. It provides financial aid to universities, individual scientists and institutions involved in scientific forestry research to develop eco-friendly and climate adaptation technologies for sustainable forest management.
3. It assists the countries in their 'REDD+ (Reducing Emissions from Deforestation and Forest Degradation+)' efforts by providing them with financial and technical assistance.

Select the correct answer using the code given below.
(a) 1 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

46. With reference to 'dugong', a mammal found in India, which of the following statements is/an; correct?
1. It is a herbivorous marine animal.
2. It is found along the entire coast of India.
3. It is given legal protection under Schedule I of the Wildlife (Protection) Act, 1972.

Select the correct answer using the code given below.
(a) 1 and 2 (b) 2 only
(c) 1 and 3 (d) 3 only

47. What are the effects that IPCC has predicted regarding global warming?
I. Earth's temperature will rise by 1-30°C in next few decades, leading to extreme weather changes (heat waves, hurricanes and severe winters), changes in ocean currents and marine life.
II. If CO_2 concentration doubles, Earth's temperature may rise by 50°C.
III. The biggest glacier in the Peruvian Andes was retreating by 5 meters per year some 20 years ago; today it is shrinking by 33 meters per year.
IV. The Arctic Sea ice has thinned by 40% in the last two decades, while Mount Everest is losing height at the rate of 1.5 meters per year.
(a) Only I (b) I & II
(c) Only III (d) All the above

48. Which statement is correct regarding the steps taken to reduce global warming?
I. Cleaning up and gasification of coal (for which technology is available) will result in lesser pollution.
II. Increased use of natural gas contains only half of the carbon and no Sulphur.
III. Renewable energy sources, such as wind, solar, photo-voltaic and fuel cells, tidal, etc.
IV. Manufacture of fuel-efficient vehicles.
(a) I & II (b) Only III
(c) Only II (d) All the above

49. Which statement is correct regarding greenhouse gases?
I. A greenhouse gas (GHG) is a gas in an atmosphere that absorbs and emits radiation within the thermal infrared range
II. Water vapour contributes to 36-72% of Greenhouse effect
III. Nitrous Oxide contributes to about 10% of Greenhouse effect
IV. Ozone contributes to 3-7% of Greenhouse effect
(a) I & II (b) I, II & III
(c) I, II & IV (d) All the above

50. Ozone layer in the outer atmosphere helps in:
I. Reflecting radio waves and makes radio communication possible
II. Absorbing U-V radiations
III. Regulating the temperature of atmosphere
IV. Absorbing cosmic ray particles
(a) I & II (b) Only II
(c) Only III (d) All the above

51. Ozone depletion would impact the plant community in several ways. These include :
I. Increase in photosynthesis
II. Decline in water use efficiency
III. Decline in yield of plants
(a) I & II (b) Only III
(c) II & III (d) All the above

52. Nitrogen Oxide is responsible for the depletion of Ozone layer, which of following is source of Nitrogen Oxide?
I. Industrial emission
II. Fertilizers which are used in agricultural activities
III. Thermonuclear weapons
(a) I & II (b) Only III
(c) Only II (d) All the above

53. Which of the following statement is correct regarding CFC's and HCFC's?
I. These chemicals are inert, non-flammable, non-toxic, and lighter than air and can remain intact for years
II. CFCs are commonly used in Air-conditioners and the Refrigeration industry (Freon gas), aerosol propellants (in perfumes and deodorants), in the foam packaging industry (Styropor, Thermocol) and as solvents for greases and glues.
III. They contain Chlorine and Fluorine, common being CFC-ll, CFC-12, CFC-22 and CFC- 13.
(a) I & II (b) II & III
(c) Only III (d) All the above

54. Which statement is correct regarding deforestation?
I. The process of clearance of forest by burning or logging is called deforestation
II. The main reasons for deforestation are trees or derived charcoal are used as, or sold, for fuel or as a commodity, while cleared land is used as grassland for livestock, plantations of commodities, and settlements.
III. Deforested areas usually sustain extensive adverse soil erosion and regularly damage into wasteland.
(a) I & II (b) II & III
(c) Only III (d) All the above

55. Deforestation includes which of the following?
I. Felling, and removal of forest litter
II. Browsing
III. Grazing and trampling of seedlings
IV. Repeated lopping
Select the correct answer:
(a) Only I (b) I and III
(c) III and IV (d) All the above

56. Consider the following statements
I. As a greenhouse gas (GHG) methane is even more harmful than carbon dioxide
II. Methane has been included in the list of six GHGs in Kyoto Protocol.
Which of the statements given above is/are correct?
(a) Only I (b) Only II
(c) Both I & II

57. Increased level of carbon dioxide in the atmosphere would impact the plants in many ways. These can be:
I. Decrease in photosynthetic productivity of plants
II. Proliferation of weeds
III. Increase in number of insects and other pests.
(a) I & II (b) II only
(c) II & III (d) All the above

58. Relative contributions of CO_2, CH_4, CFCs and N2O towards global warming are:
I. 50 %, 30 %, 10 % , and 10 % respectively
II. 60%, 20%, 14%, and 6% respectively
III. 40 %, 30%, 20% and 10% respectively
IV. None of the above
(a) Only II (b) Only III
(c) Only I (d) None of the above

59. What is denitrification?
I. It prevents the discharge of nitrates in soil, and stops ground water pollution with nutrients.
II. In this solids are separated from the liquid
III. In this sewage goes through many chambers and chemical processes which reduce its toxicity.
(a) I & II (b) Only I
(c) II & III (d) All the above

60. Which statement is correct regarding noise pollution?
I. The word noise comes from the Latin word nausea meaning seasickness.
II. The main source of noise is transportation system including rail noise, aircraft noise and vehicle noise
III. Sound pollution is measured in decibels
(a) I & II (b) II & III
(c) Only III (d) All the above

61. Chlorofluorocarbons, known as ozone-depleting substances, are used:
I. In the production of plastic foams
II. In the production of tubeless tyres
III. In cleaning certain electronic components
IV. As pressurizing agents in aerosol cans
(a) Only I (b) I, III & IV
(c) II & III (d) All the above

62. Which of the following gases are responsible for acid rain in environment?
I. Carbon dioxide and nitrogen
II. Carbon monoxide and carbon dioxide
III. Ozone and carbon dioxide
IV. Nitrous oxide and Sulphur dioxide
(a) I & II (b) Only II
(c) Only IV (d) All the above

63. Spraying of DDT on crops causes pollution of:
I. Soil and Water
II. Air and Soil
III. Crops and Air
IV. Air and Water
(a) I & II (b) II & III
(c) Only I (d) All the above

64. Which statement is correct regarding Agro-Chemicals?
I. Agro chemicals are developed by the use of modern technology that depends on inorganic fertilizers and pesticides
II. Excess use of these fertilizers can lead to immediate harmful effect or can also be long lasting.
III. In combination with genetically enhanced varieties of crop species, agrochemicals have made significant contributions to the accomplishments of the "green revolution."
(a) I & II (b) Only II
(c) Only III (d) All the above

65. Which statement is correct regarding acid rain?
I. Acid rain is caused by a chemical reaction that starts when sulfur dioxide (SO_2) and nitrogen oxides (NO_2) are released into the air
II. Sulfur dioxide and nitrogen oxides are highly soluble in water and can be carried very far by the wind
III. Power plants release huge amount of sulfur dioxide and nitrogen oxides when they burn fossil fuels, like coal, to produce electricity which can cause acid rain
(a) I & II (b) II & III
(c) Only III (d) All the above

66. Acid rain reacting with calcium forms:
I. Calcium bicarbonate
II. Calcium Nitrate
III. Calcium Sulphate
IV. Calcium Carbonate
(a) I & IV (b) Only I
(c) Only II (d) Only III

67. What among the below is/are the cause of ground water contamination?
I. Septic tanks II. Septic tanks
III. Landfills
(a) Only II (b) I & III
(c) II & III (d) All the above

68. Which statement is correct regarding Ozone Hole?
I. Ozone destruction rate is equal to the its formation rate
II. Ozone formation and destruction keep on happening
III. Ozone destruction rate is higher than its formation rate
(a) I & II (b) II & III
(c) Only III (d) Only I

69. Which statement is not true regarding Ozone?
I. Ozone is covered under Montreal Protocol.
II. Montreal protocol binds countries to adopt measures to curb ozone depleting substances.
III. HFC was used to replace ozone depleting substances.
IV. Ozone is also covered under Kyoto Protocol.
(a) I & II (b) Only III
(c) Only IV (d) II & III

70. Which of the following is not the feedback of the example in which human activity is responsible for the global climatic changes in the temperature?
I. Global warming causes snow to melt in polar regions
II. Global warming causes increased rainfall, plant growth and photosynthesis
III. Global warming causes increased CO_2 release from biomass decomposition
IV. Tropical deforestation causes warming and drying so that remaining forests begin to decline
(a) I & II (b) Only iii
(c) Only II (d) II & IV

71. What is effluent waste?
I. This category of waste, contains, hazardous wastes that are harmful to human beings and hence should be stored and treated separately.
II. These wastes include a high proportion of paper, cardboards and plastics.
III. Domestic as well as industrial effluents that contaminate river water if allowed to flow unchecked.
IV. All the waste resulting from the maintenance of streets, roads, parks, and schools, paper, dry leaves, animal wastes, sludge, carcasses of small animals and slaughter house wastes.

(a) I & II (b) Only III
(c) Only IV (d) II & IV

72. What are the methods of collection of solid wastes?
I. Refuse storage which may sometimes require delivery of refuse by the householder over a considerable distance
II. Door-to-door collection, where the collector enters the premises and collects the refuse and the householder is not involved in the collection process.
III. Dumping in river or stream
(a) I & II (b) Only II
(c) Only I (d) All the above

73. Which statement is correct regarding radioactive waste material?
I. This arises from civil nuclear activities as well as from defense related nuclear weapon activities
II. The techniques used emphasizes on waste minimization and volume reduction
III. Nuclear waste is categorized into high, intermediate and low levels depending on the level of radioactivity in it
(a) I & III (b) Only III
(c) Only I (d) All the above

74. Which statement is correct regarding the disposal of High level waste produced from radioactive material?
I. High level waste produced from the reprocessing plant is vitrified into a glassy form, enclosed in multiple barrier vessels
II. They are stored for a temporary period of three to four decades in engineered vaults with essential observation services
III. After cooling down in these storage facilities, waste vessels will be stored for long term in deep geological repositories
(a) I & II (b) Only II
(c) Only III (d) All the above

75. Which statement is correct regarding plastic waste management?
I. Plastic was invented in 1960
II. They are the products of polymer chemistry produced from the by- products of petroleum refining
III. They are characterized into thermoplastics and thermosetting plastics
(a) I & II (b) II & III
(c) Only III (d) All the above

76. Which sentence is correct regarding the manufacturing of plastic?
I. All the varieties of plastics are manufactured from petrochemical based hydrocarbons
II. The raw materials and intermediate products used in the manufacture of Polyvinyl chloride (PVC) - Ethylene, Chlorine, Hydrogen chloride, Vinyl Chloride Monomer (VCM), and Ethylene Dichloride (EDC) — are known hazardous materials
III. Additives, fillers, and coloring pigments used in plastic goods can also exhibit non-hazardous properties
(a) I & II (b) Only ii
(c) Only III (d) All the above

77. What are the environmental issues regarding the manufacturing of plastics?
I. Escape of gaseous hydrocarbons, chlorine, and hydrogen chloride gas into the atmosphere.
II. Waste-water from the processes and wash-waters can carry pollutants.
III. Dioxins can be liberated due to mishaps in the process.
IV. Health and safety issue in the manufacture of PVC is the exposure of plant operators to Vinyl Chloride Monomer (VCM)
(a) I & II (b) II & III
(c) Only IV (d) All the above

78. What are the advantages of using PVC in Water supply pipes and Industrial piping over GI pipes?
I. They are heavy and plumbing work is difficult
II. Corrosion problem is eliminated and hence corrosion related contamination of water is avoided and life of the pipes increases
III. Inner surface of pipes may be made smooth to reduce friction losses, thus saving on electricity bills and conserving energy
(a) I & II (b) II & III
(c) Only III (d) All the above

79. What are the problems from Indiscriminate Discarding of used Plastics?
I. They choke storm water drains, often causing overflow of storm water on roads.
II. Being non-biodegradable they remain in the soil for a very long time, thus affecting the farm economy
III. Direct transfer of molecular oxygen into water is also affected
(a) I & II (b) Only II
(c) Only III (d) All the above

80. Which statement is correct regarding the rule of the Forests issued the Recycled Plastics Manufacture and Usage Rules 1999 which was amended in 2003 under the Environment (Protection) Act, 1986?
I. No vendor shall use carry bags and containers of recycled plastics for storing carrying and / or packaging of foodstuffs
II. Carry bags and Container used for packaging of foodstuff shall be made of virgin plastic and of natural shade or white
III. Minimum thickness of Carry bags made of virgin or recycled plastics must not be less than 20 microns
(a) I & II (b) II & III
(c) Only III (d) All the above

81. What is the main health risks associated with greater UV radiation through the atmosphere due to depletion of stratospheric ozone?
I. Increased skin cancer
II. Damage to eyes
III. Increased liver cancer
IV. Reduced immune system
(a) I & II (b) III
(c) II & III (d) All the above

82. What are the negative effect regarding bio degradable plastics?
I. The bio-degradable plastics will add to the already piling up municipal garbage
II. bio-degradable plastics are expensive and the technology for manufacture is not easily available
(a) only I (b) only II
(c) Both I & II (d) only III

83. Which of the following reasons does not help regulate global carbon dioxide concentrations?
I. Alterations in rainfall patterns
II. Storing carbon in the soil and biomass
III. Absorbing carbon dioxide for photosynthesis
IV. Releasing carbon dioxide following decay
(a) I & II (b) II & III
(c) Only I (d) All the above

84. The main function of ozone layer is:
I. Heating the stratosphere
II. Maintaining the temperature of atmosphere
III. Absorbing the ultraviolet solar radiation
(a) I & II (b) Only II
(c) Only III (d) All the above

85. Which statement is correct regarding methane?
I. Methane (CH_4), also called "Marsh gas"
II. It arises from rice paddies, wetlands, enteric fermentation in cattle, burning of wood, and landfills
III. It is responsible for about 4-9% of Greenhouse effect.
(a) I & II (b) II & III
(c) Only III (d) All the above

86. Which statement is correct regarding CFC's?
I. They are 1000 times more heat absorbent than carbon dioxide
II. They reach the atmosphere from refrigeration & air conditioning, aerosol sprays, and foam packaging industry.
III. They are responsible for 30% of greenhouse effect
(a) I & II (b) II & III
(c) Only III (d) All the above

87. Consider the following statements regarding Ozone:
I. Ozone contributes to 3-7% of Greenhouse effect
II. The largest net source of tropospheric ozone is influx from the stratosphere
III. Large amounts of ozone are also produced in the troposphere by photochemical reactions, the amounts increasing with high levels of air pollution.
(a) I & II (b) II & III
(c) Only III (d) All the above

88. What are the causes of deforestation?
I. Population growth and overpopulationand urbanization
II. Globalization
III. Dishonesty of government institutions
(a) Only I (b) Only II
(c) I & II (d) All the above

89. Which statement is correct regarding acid rain?
I. The term "acid rain" was coined in 1972 by Robert Angus Smith
II. Rainfall with pH less than 5.6 is called Acid rain.
III. Acid rain is caused by a chemical reaction that starts when sulfur dioxide (SO_2) and nitrogen oxides (NOX) are released into the air
(a) I & II (b) Only II
(c) II & III (d) All the above

90. Lead and cadmium compounds are added as stabilizers in PVC. Which statement is correct regarding lead and cadmium?
I. Lead and cadmium can leach out during human contact, or when disposed in land-fills
II. Lead and cadmium are known neurotoxins and nephrotoxins respectively
III. These chemicals are used in the manufacture of soft plastic items such as vinyl flooring sheets, soft toys etc. to increase their durability
(a) I & II (b) II & III
(c) Only III (d) All the above

Hints and Explanations

1. (c) The mean global temperature rise by 2° – 6°c and the concentration of carbon dioxide increases in the troposphere upto 600 ppm. Hence, the surface of the earth becomes warm which causes global warming. The phenomenon is similar to that of green house in which the glass enclosed atmosphere gets heated up due to its insulation from the rest of the environment. Hence, global warming is also known as green house effect and the gases responsible for it are called green house gases e.g CH_4, CO_2 etc.
2. (d) SO_2 and NO when present in large quantities dissolved in water vapour form sulphuric acid and nitric acid which dissolve in rain water resulting in acid rain (H_2SO_4) and (HNO_3) which in turn causes great damage to forests and vegetation.
3. (a) The Bhopal gas tragedy occurred on 3rd Dec. 1984 in which methyl isocyanate gas was released from a fertilizer manufacturing plant of Union Carbide causing death of approximately 2500 persons. Chernobyl disaster occurred on April 26, 1986, from an explosion at the chernobvl power station which released a huge radioactive cloud into the atmosphere in Ukrain.
4. (d) Carbon dioxide is one of the important green house gas. It allows the shorter wavelength of infra red radiations to pass through it but does not allow these radiations to leave the earth's atmosphere. This results in warming of the atmosphere. If the amount of CO_2decreases then there will not be any increase in temperature.
5. (a)
6. (b) Strength of sewage or degree of water pollution is measured in terms of BOD (Biochemical Oxygen Demand) value. BOD may be defined as, 'number of milligrams of O_2required for decomposition of one litre of waste or water by decomposing microorganisms (bacteria)'.
7. (c) Due to heavy industrilization and transportation (modernization), CO_2 concentration is increasing day by day in the atmosphere. CO_2 has capacity for absorbing heat radiations and thus increases temperature. This increase in global temperature (global warming) is mainly due to CO_2 concentration is called green house effect. Complete combustion of fossil fuels and biomass releases carbon dioxide. Nuclear power plants releases radioactive wastes.

8.	(b)	9.	(c)	10.	(b)	11.	(a)	12.	(c)
13.	(c)	14.	(b)	15.	(b)	16.	(a)	17.	(b)
18.	(a)	19.	(d)	20.	(c)	21.	(b)	22.	(a)
23.	(d)	24.	(a)	25.	(b)	26.	(a)	27.	(a)
28.	(a)	29.	(c)	30.	(d)	31.	(c)	32.	(d)
33.	(d)	34.	(c)	35.	(d)	36.	(a)	37.	(a)
38.	(b)	39.	(b)	40.	(a)	41.	(d)	42.	(a)

43. (b) The Kyoto protocol is a protocol to the United Nations Framework convention on climate change aimed at fighting global warming. This protokol adopted on 11 December 1997 in Kyoto, Japan. Under the protocol 37 countries commit themselves to a reduction of four greenhouse gases and two groups of gases.

44.	(b)	45.	(a)	46.	(b)	47.	(c)	48.	(a)
49.	(d)	50.	(b)	51.	(d)	52.	(c)	53.	(a)
54.	(b)	55.	(b)	56.	(a)	57.	(d)		

58. (a) 'El Nino' is a warm ocean current. The term El Niño refers to the large-scale oceanatmosphere climate interaction linked to a periodic warming in sea surface temperatures across the central and east-central Equatorial Pacific.
59. (d) Ozone holes are more pronounced at the polar regions especially over Antarctica.
60. (a) Acid rain refers to the precipitation with a pH of less than 5. It is a mixture of H_2SO_4 and HNO_3, the ratio of the two acids vary depending on the relative quantities of sulphur oxides and nitrogen oxides present in the atmosphere. These oxides are mainly produced by combustion of fossil fuels, smelters, industries, power plants, automobile exhausts etc.
61. (d) Housed within the Carbon Finance Unit of the World Bank, the Bio Carbon Fund is a public-private sector initiative mobilizing financing to help for development of projects that sequester or conserve carbon in forest and agro-ecosystems. It was created in 2004.
62. (b) The Montreal Protocol is an international treaty designed to protect the ozone layer by phasing out the production of numerous substances that are responsible for ozone depletion.
63. (a) The United Nations Conference on Environment and Development (UNCED), also known as the Rio Summit or Earth Summit. It was a major United Nations conference held in Rio de Janeiro from 3 to 14 June 1992. In 2012, the United Nations Conference on Sustainable Development was also held in Rio, and is also commonly called Rio+20 or Rio Earth Summit 2012.
64. (a) The Green Climate Fund (GCF) is a fund within the framework of the UNFCCC founded as a mechanism to redistribute money from the developed to the developing world, in order to assist the developing countries in adaptation and mitigation practices to counter climate change. The Fund is governed by the GCF Board. The assets of the GCF will be administered by a trustee only for the purpose of, and in accordance with, the relevant decisions of the GCF Board. The World Bank was invited by the COP to serve as the interim trustee of the GCF, subject to a review three years after operation of the Fund.

EXERCISE-2

1. (c) Coconut shells, groundnut shells and rice husk can be used in biomass gassfication.
Combustible gases generated from biomass gasification can be used for direct heat generation but not in internal combustion engines.
2. (a)
3. (b) The protocol was initially adopted on 11th December 1997. But it entered into force on 16th February 2005, after Kyoto, Japan. So, it is called Kyoto protocol.
Kyoto protocol deals with reducing the green house gases emission to a level at least 5% below 1990 level. Methane is more effective or harmful green house gas than carbon dioxide.
4. (b) 5. (c)
6. (c) Methane and nitrous oxide are the two green house gases emitted from rice field. In rice field, the flooding a field cuts off the oxygen supply from atmosphere resulting anaerobic condition which emittes methane and nitrogen fertilizer which generally used in rice field for high production, emits nitrous oxide by the reaction with atmospheric oxygen.
7. (c) 8. (a) 9. (b) 10. (c) 11. (d)
12. (c) 13. (c) 14. (d) 15. (c) 16. (a)
17. (b) United States and Canada are the countries which are mostly affected by acid rain because of high number of factories, power plants and large number of automotive plants. Europe, Poland, Germany, Czech Republic, Sweden, Norway and Finland are affected because of British and European factories. In Asia, India and China are mostly affected mainly because of the large number of factories.
18. (b) Radioactive contamination or pollution causes severe life- threatening consequences in organisms. Because of the radioactive decay of the contaminants, which emit harmful ionising radiation such as alpha or beta particles, gamma rays or neutrons, genetic mutations occur which are hereditary. Carcinogenic contaminants cause cancers.
19. (d) Global warming is the increase in the global temperature. It has put many negative impacts on glaciers causing them to start melting, so, rise of sea level. Unpredictable weather conditions prevailing in some geographical areas are some of the other effects of global warming.
20. (d) Almost all of the mercury in the Arctic atmosphere is transported there in gaseous form from sources in areas farther south, from sources such as wildfires, coal burning and gold mining. Scientists have long known that mercury in the air near ground level undergoes complex chemical reactions that deposit the element on the surface. Once the mercury is completely removed from the air, these reactions stop. However, this newly discovered mixing ice forces down additional mercury to restart and sustains the reactions.
21. (d) The schedule is meant to reduce the growth of the US government's liabilities under the 1982 Nuclear Waste Policy Act, under which it was to begin taking spent reactor fuel from power companies in 1998. About 68,000 tonnes of used reactor fuel remains at 72 different power plant sites across the country, with the Department of Energy (DoE) reimbursing power companies the cost. The current production rate of spent fuel is 2,000 tonnes a year. The two interim facilities will accept used reactor fuel at a rate faster than this in order to reduce gradually the inventory at power companies.
22. (b) The Researchers found a small correlation between cosmic rays and global temperatures occurring every 22 years; however, the changing cosmic ray rate lagged behind the change in temperatures by between one and two years, suggesting that the cause might not be down to cosmic rays and cloud formation but might be due to the direct effects of the sun. By comparing the small oscillations in the cosmic ray rate, which were taken from data from two neutron monitors, and temperature with the overall trends in both since 1955, the research team found that less than 14 per cent of the global warming seen during this period could be attributable to solar activity.
23. (d) There is no single factor which cause an algal bloom. A combination of optimum factors such as the presence of good nutrients, warm temperatures, surface runoff, upwelling in the sea can all contribute harmfull algal blooms.
24. (c) Imports and Exports (Control) Act, 1947 and the Foreign Trade (Development and Regulation) Ordinance, 1992 (Ord. 11 of 1992) got repealed with the enactment of Foreign Trade (Development And Regulation) Act, 1992. But still the answer remains the same because the new act also has "bearing" on biodiversity conservation.
25. (c) Coconut shells, groundnut shells and rice husk can be used in biomass gasification.
Combustible gases generated from biomass gasification can be used for direct heat generation but not in internal combustion engines.
26. (b) Autoclaves use pressurized steam to destroy microorganisms, and are the most dependable systems available for the decontamination of laboratory waste and the sterilization of laboratory glassware, media, and reagents. For efficient heat transfer, steam must flush the air out of the autoclave chamber. Before using the autoclave, check the drain screen at the bottom of the chamber and clean if blocked. If the sieve is blocked with debris, a layer of air may form at the bottom of the autoclave, preventing efficient operation.
27. (b) Forests that experience high levels of acid precipitation expose trees to soil that has more dissolved aluminum and less dissolved calcium.
28. (c) Prolonged human exposure to solar UV radiation may result in acute and chronic health effects on the skin, eye and immune system. Over the longer

term, UV radiation induces degenerative changes in cells of the skin, fibrous tissue and blood vessels leading to premature skin aging, photodermatoses and actinic keratoses.

29. (c) Greenhouse gases are those that can absorb and emit infrared radiation, but not radiation in or near the visible spectrum. In order, the most abundant greenhouse gases in Earth's atmosphere are:
    - Water vapor (H_2O)
    - Carbon dioxide (CO_2)
    - Methane (CH_4)
    - Nitrous oxide (N_2O)
    - Ozone (O_3)
    - CFCs
30. (c) Greenland ice sheet melt water, which moves to the sea under the ice in contact with the land surface, may transport solids or dissolved material such as iron to the ocean. Measurements of the amount of available iron in melt water from the Greenland ice sheet shows that extensive melting of the ice sheet might add an amount of iron to the Atlantic Ocean equivalent to that added by airborne dust. This would increase biological activity in the Atlantic.
31. (b) Electronic waste or E-waste has ferrous and non-ferrous metals both. Non-ferrous metals like copper, aluminium, silver, gold, platinum, palladium etc. The presence of elements like lead, mercury arsenic, cadmium, selenium and hexavalent chromium are classified as hazardous waste.
32. (a) Drinking water in some parts of India has contaminants like Arsenic, Fluoride other than many other contaminants. The sources of Arsenic are run off from orchards. The sources of fluoride are erosion of natural deposits, discharge from fertilizers and aluminum factories.
33. (d) The International Treaty on Plant Genetic Resources for Food and Agriculture aims at guaranteeing food security through the conservation, exchange and sustainable use of the world's plant genetic resources for food and agriculture. The United Nations Convention to Combat Desertification is a Convention to combat desertification and mitigate the effects of drought. The World Heritage Convention is concerned with the protection of the world cultural and natural heritage.All three of them have a bearing on the biodiversity.
34. (c) Earth Hour is a worldwide movement for the planet organized by the World Wide Fund for Nature (WWF). The event is held worldwide annually encouraging individuals, communities, households and businesses to turn off their non-essential lights for one hour, from 8:30 to 9:30 p.m. to raise the awareness about the climate change and the need to save the planet.
35. (b) This organization is in partnership but not formed by Ramsar convention. The organization was formed in 1954 and Ramsar convention was signed in 1971. "Wetlands International", It is an intergovernmental organization formed by the countries which are signatories to Ramsar Convention.It works at the field level to develop and mobilize knowledge, and use the practical experience to advocate for better policies.
36. (c) Statement 1, 3 and 4 are correct as per wwf and environment ministry.
37. (c) Brominated flame retardants used in many household products are highly resistant to degradation in the environment and they are able to accumulate in humans and animals.
38. (d) Eco-sensitive zones are the ecologically important areas designated to be protected from industrial pollution and unregulated development under the Environment Protection Act of 1986. Only environmentally hazardous human activities are prohibited in those areas. Therefore, both the statements are incorrect.
39. (b) The Animal Welfare Board of India was established in 1962 under Section 4 of The Prevention of Cruelty to Animals Act, 1960. The National Tiger Conservation Authority is set up under the Chairmanship of the Minister for Environment and Forests and is a statutory body. National Ganga River Basin Authority was established by the Central Government of India, on 20 February 2009. The Prime Minister is the chair of the Authority.
40. (a) Coral reefs are diverse underwater ecosystems held together by calcium carbonate structures secreted by corals. Andaman & Nicobar,Gulf of Kachchh and Gulf of Mannar have coral reefs. However Sunderbans do not have coral reef.
41. (b) In India, the problem of soil erosion is associated with deforestataion .Terace cultivation helps in less erosion of soil.
42. (b) If the global temperature increases beyond 3°C above the pre-industrial level then Terrestrial biosphere tends toward a net carbon source and Widespread coral mortality will occur.
43. (d) In steel furnace coke reacts with iron to release pollutants like Oxides of sulphur, Oxides of nitrogen, Carbon monoxide & Carbon dioxide.
44. (c) Global climate change threatens coral reef by increasing the temperature and decreasing the ph level of the ocean. Much of the carbon dioxide that enters the atmosphere dissolves into the ocean. In fact, the oceans have absorbed about 1/3 of the carbon dioxide produced from human activities since 1800 and about 1/2 of the carbon dioxide produced by burning fossil fuels (Sabine et al. 2004). As carbon dioxide in the ocean increases, ocean pH decreases or becomes more acidic.
45. (c) The Forest Carbon Partnership Facility is a global partnership of governments, businesses, civil society, and Indigenous Peoples focused on reducing emissions from deforestation and forest degradation, forest carbon stock conservation, the sustainable management of forests, and the enhancement of forest carbon stocks in developing countries (activities commonly referred to as REDD+).

46. (c) The dugong is a medium-sized marine mammal. Dugong is listed under schedule 1 of India Wildlife Protection Act, 1972. In 2008, a MoU was signed between the Ministry of Environment and Forests and the Government of India, in order to conserve dugongs. In fact the highest level of legal protection is accorded to dugongs in India.
47. (d) 48. (d)
49. (c) Nitrous Oxide (NO2) (5%) arises from coal burning, biomass burning, and breakdown of chemical fertilizers.
50. (b)
51. (c) Photosynthesis would decrease as increased UV radiations (due to ozone depletion) would make it difficult for leaves of green plants to exchange gases with the atmosphere. Due to increased temperature consequent upon increased UV radiation, the evaporation rate of surface water will increase and soil moisture would decrease leading to drying of agricultural crops and hence reduced yield.
52. (d)
53. (d) CFCs and HCFCs destroy ozone in the stratosphere. These chemicals are inert, non-flammable, non-toxic, and lighter than air and can remain intact for years. They contain Chlorine and Fluorine, common being CFC-ll, CFC-12, CFC-22 and CFC- 13.
54. (d) The process of clearance of forest by burning or logging is called deforestation. The main reasons for deforestation are trees or derived charcoal are used as, or sold, for fuel or as (a) commodity, while cleared land is used as grassland for livestock, plantations of commodities, and settlements. Deforested areas usually sustain extensive adverse soil erosion and regularly damage into wasteland.
55. (d) Deforestation is the removal of vegetation in (a) forest to the extent that it no longer supports its natural flora and fauna. Deforestation is (a) very broad term, which consists of cutting of trees including repeated lopping, felling, and removal of forest litter, browsing, grazing and trampling of seedlings.
56. (c) The six main greenhouse gases are – • Carbon dioxide (CO_2); • Methane (CH_4); • Nitrous oxide (N_2O); • Hydrofluorocarbons (HFCs); • Perfluorocarbons (PFCs); and • Sulphur hexafluoride (SF_6). Methane (CH_4) is the second most important greenhouse gas. CH_4 is more potent than CO_2 because the radiative forcing produced per molecule is greater. In addition, the infrared window is less saturated in the range of wavelengths of radiation absorbed by CH_4, so more molecules may fill in the region.
57. (c)
58. (a) CO_2 is largest contributor towards global warming.
59. (b) 60. (d) 61. (b) 62. (c)
63. (c) spraying of DDT in soil results in the pollution of soil and water.
64. (d) Agro chemicals are developed by the use of modern technology that depends on inorganic fertilizers and pesticides. Excess use of these fertilizers can lead to immediate harmful effect or can also be long lasting. Although many benefits are there by the use of agro chemicals which are related to increase yield of plants and animal crops and less wastage during storing. These profits are substantial.
65. (d)
66. (b) Acid rain reacts with calcium to form calcium bicarbonate, which can be easily washed away.
67. (d) 68. (b) 69. (c) 70. (c)
71. (c) Domestic as well as industrial effluents that contaminate river water if allowed to flow unchecked.
72. (a) Refuse storage: which may sometimes require delivery of refuse by the householder over (a) considerable distance. Where the householder delivers the refuse to the vehicle at the time of collection. Door-to-door collection, where the collector enters the premises and collects the refuse and the householder is not involved in the collection process.
73. (d) Radioactive waste which arises from civil nuclear activities as well as from defense related nuclear weapon activities, poses a terrible problem for handling and keeping the environment to be safe to the present and future generations. The techniques used emphasizes on waste minimization and volume reduction. Nuclear waste is categorized into high, intermediate and low levels depending on the level of radioactivity in it.
74. (d) High level waste produced from the reprocessing plant is vitrified into a glassy form, enclosed in multiple barrier vessels and stored for a temporary period of three to four decades in engineered vaults with essential observation services. After cooling down in these storage facilities, waste vessels will be stored for long term in deep geological repositories.
75. (d) Plastics have become an indispensable part of our daily lives. Invented in 1935, they are wonderful products of polymer chemistry produced from the by- products of petroleum refining. They are classified as into two main categories
76. (a) All the varieties of plastics are manufactured from petrochemical based hydrocarbons. These hydrocarbons, and the plastic manufacturing processes involved possess environmentally critical characteristics. The raw materials and intermediate products used in the manufacture of Polyvinyl chloride (PVC) - Ethylene, Chlorine, Hydrogen chloride, Vinyl Chloride Monomer (VCM), and Ethylene Dichloride (EDC) — are known hazardous materials. Additives, fillers, and coloring pigments used in plastic goods can also exhibit hazardous properties.
77. (d) 78. (b) 79. (d)
80. (d) No vendor shall use carry bags and containers of recycled plastics for storing carrying and / or packaging of foodstuffs, Carry bags and Container used for packaging of foodstuff shall be made of virgin plastic and of natural shade or white, Carry

bags and Container made from recycled plastics must be manufactured using pigments and colorants as per IS: 9833/ 1981 notified by the Bureau of Indian Standards (BIS), Minimum thickness of Carry bags made of virgin or recycled plastics must not be less than 20 microns.

81. (b)
82. (c) The bio-degradable plastics will add to the already piling up municipal garbage. The immediate benefits of recovery and recycle of normal plastics is also lost if bio-degradable plastics are introduced. As of now, compared to normal plastic, the bio-degradable plastics are expensive and the technology for manufacture is not easily available. It may be possible to treat bio-degradable plastics in countries where solid waste management systems are working satisfactorily and extensively.
83. (c)
84. (c) The main function of the ozone gas found in the ozonosphere is to absorb the ultraviolet solar radiation. Ozone absorbs the ultraviolet solar radiation and through this process, the most harmful ultraviolet radiation is effectively filtered, thus safeguarding life at earth.
85. (d) Methane (CH_4), also called "Marsh gas", arises from rice paddies, wetlands, enteric fermentation in cattle, burning of wood, and landfills. It is responsible for about 4-9% of Greenhouse effect.
86. (a) Chlorofluorocarbons (CFCs) and their replacements (15%) are 1000 times more heat absorbent than carbon dioxide. They reach the atmosphere from refrigeration & air conditioning, aerosol sprays, and foam packaging industry
87. (d) Ozone contributes to 3-7% of Greenhouse effect. The largest net source of tropospheric ozone is influx from the stratosphere. Large amounts of ozone are also produced in the troposphere by photochemical reactions, the amounts increasing with high levels of air pollution.
88. (d) There are numerous causes of current deforestation such as dishonesty of government institutions, the imbalanced distribution of wealth and power, population growth and overpopulation, and urbanization. Globalization is also main cause of deforestation, though there are cases in which the effects of globalization have supported localized forest recuperate.
89. (c) Acid rain is a rain or any other form of precipitation that is unusually acidic, meaning that it possesses elevated levels of hydrogen ions (low pH). The term "acid rain" was coined in 1872 by Robert Angus Smith, after a link was established between sulfur dioxide (SO_2) emissions from the burning of coal in Manchester and acidification of nearby rainfall. Rainfall with pH less than 5.6 is called Acid rain.
90. (d) Lead and cadmium compounds are added as stabilizers in PVC. These chemicals are used in the manufacture of soft plastic items such as vinyl flooring sheets, soft toys etc. to increase their durability. Lead and cadmium can leach out during human contact, or when disposed in land-fills. Incineration of such rejected plastic items produces ash with high heavy metal content. Use of lead compounds in the manufacturing process can be (a) potential hazard to workers in the PVC industry. Lead and cadmium are known neurotoxins and nephrotoxins respectively