# Mount Abu Public School

H-Block, Sector-18, Rohini, New Delhi-110085 India

# Class XI
# Geography

**Dear Students**
**Welcome to the New Academic session 2020-21**

**Before you go through this e-lesson,ensure that you have read the lesson. Mark the technical words ,Find out their meaning and note them in your register. The Various You tube links provide in the lesson will help in comprehending the concepts & make it easier for you .**

**Happy learning**

# Water in The Atmosphere

## Humidity

- Water vapour present in the air is known as humidity. It is expressed quantitatively in different ways. It is expressed in terms of grams per cubic meter. It is of two types:

**(a) Absolute Humidity:** The actual amount of water vapour present in the atmosphere is known as absolute humidity.

**(b) Relative humidity:** The percentage of moisture present in the atmosphere as compared to its full capacity at a given temperature is known as the relative humidity.

- **Saturation:** The air containing moisture to its full capacity at given temperature is known as saturation.

- **Dew point:** The temperature at which saturation occurs in a given sample of air is known as dew point.

- **Evaporation:** It is a process by which water is transformed from liquid to gaseous state.

- **Latent heat of Vapourisation:** The temperature at which the water starts evaporating is referred to as the latent heat of vapourisation.

- **Condensation:** The transformation of water vapour into water is called condensation.

- **Sublimation:** The process by which water vapour changes directly to solid is called sublimation.

- **Dew:** When the moisture is deposited in the form of water droplets on cooler surfaces of solid objects such as stones, grass blades and plant leaves, it is known as *dew*.

- **Frost:** Frost forms on cold surfaces when condensation takes place below freezing point.

- **Fog and Mist:** The *fog* is a cloud with its base at or very near to the ground. The only difference between the mist and fog is that mist contains more moisture than the fog.

- **Clouds:** Clouds is a mass of minute water droplets formed by the condensation of the water vapour in free air at considerable elevations. According to their height, expanse, density and transparency or opaqueness clouds are grouped under four types :

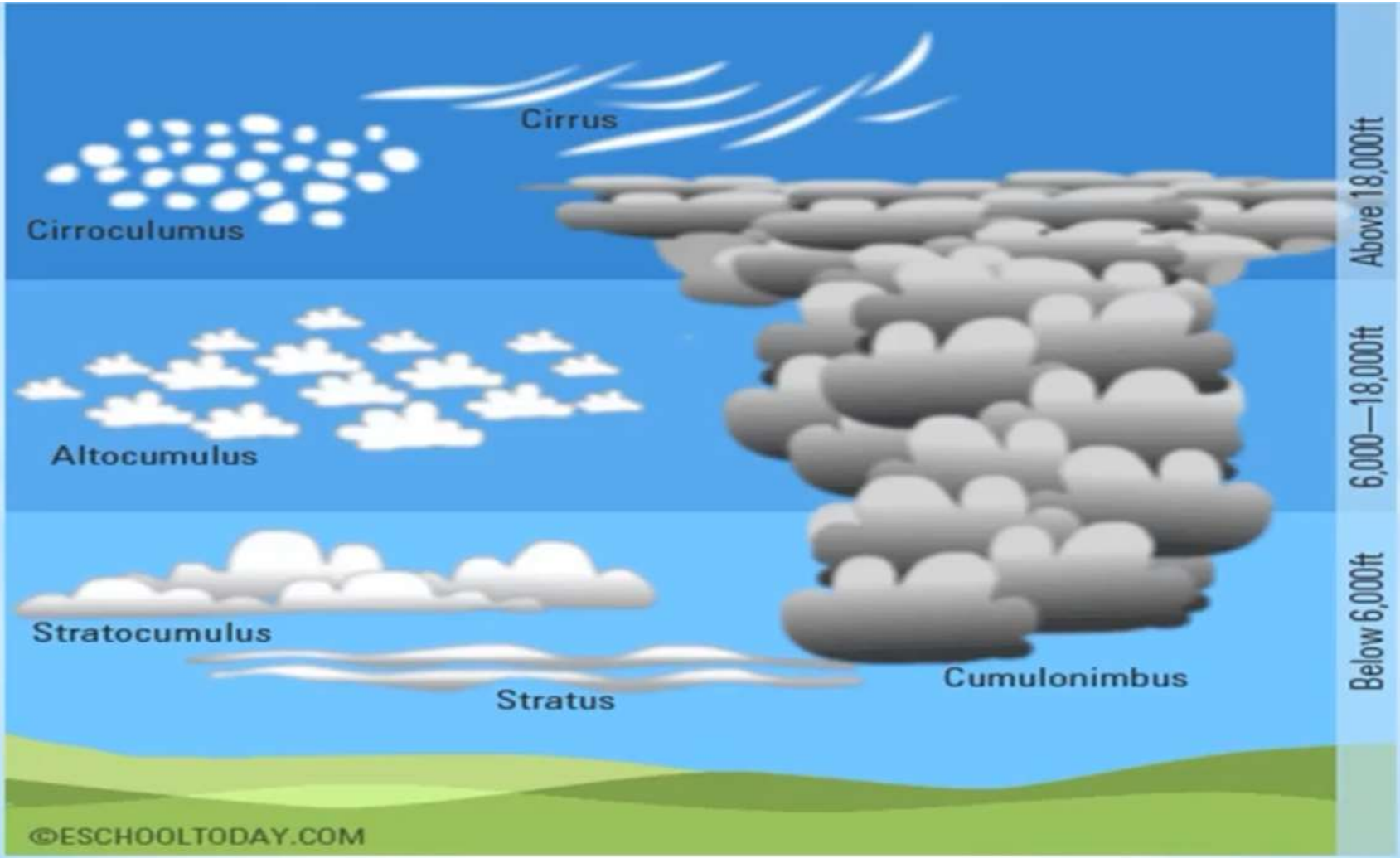
(i) cirrus; (ii) cumulus; (iii) stratus; (iv) nimbus.

- *Cirrus:* Cirrus clouds are formed at high altitudes (8,000 - 12, 000 m). They are thin and detached clouds having a feathery appearance. They are always white in colour.

- *Cumulus:* Cumulus clouds look like cotton wool. They are generally formed at a height of 4,000 -7,000 m. They exist in patches and can be seen scattered here and there. They have a flat base.

- ***Stratus:*** As their name implies, these are layered clouds covering large portions of the sky. These clouds are generally formed either due to loss of heat or the mixing of air masses with different temperatures.

- ***Nimbus:*** Nimbus clouds are black or dark grey. They form at middle levels or very near to the surface of the earth. These are extremely dense and opaque to the rays of the sun. Nimbus clouds are shapeless masses of thick vapour.


Cirrus
Cirroculumus
Altocumulus
Stratocumulus
Stratus
Cumulonimbus
Above 18,000ft
6,000—18,000ft
Below 6,000ft
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# CHAPTER -11 WATER IN THE ATMOSPHERE

This chapter deals with Humidity, types of humidity, relative humidity, absolute humidity, specific humidity, dew point, condensation, saturated air, types of precipitation -dew, frost, fog, mist, clouds cirrus, cumulus, stratus, nimbus, precipitation, types-(rainfall, sleet, snowfall, hailstones,)rainfall types convectional type, orographic rainfall, cyclonic rainfall, world distribution of rainfall.

Air contains water vapour. It varies from zero to four per cent by volume of the atmosphere and plays an important role in the weather phenomena. Water is present in the atmosphere in three forms namely - gaseous, liquid and solid.
The moisture in the atmosphere is derived from water bodies through evaporation and from plants through transpiration. Thus, there is a continuous exchange of water between the atmosphere, the oceans and the continents through the processes of evaporation, transpiration, condensation and precipitation.

Water vapour present in the air is known as humidity. It is expressed quantitatively in different ways.
The actual amount of the water vapour present in the atmosphere is known as
the ***absolute humidity***.
It is the weight of water vapour per unit volume of air and is expressed in terms of grams per cubic metre.
The ability of the air to hold water vapour depends entirely on its temperature. The absolute humidity differs from place to place on the surface of the earth.
The percentage of moisture present in the atmosphere as compared to its full capacityat a given temperature is known as the ***relative humidity***.
The air containing moisture to its full capacity at a given temperature is said to be
***saturated***.
The temperature at which saturation occurs in a given sample of air is known as ***dew point***.

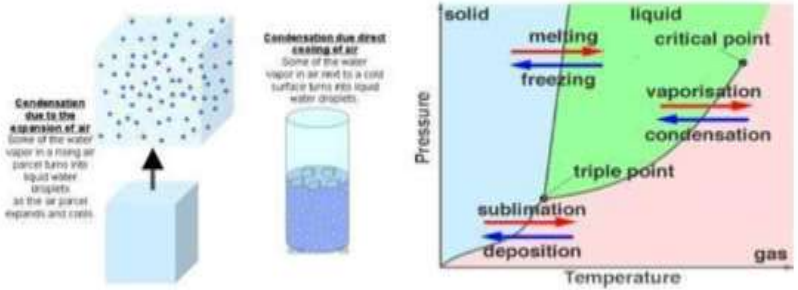
## WATER IN THE ATMOSPHERE EVAPORATION AND CONDENSATION

The amount of water vapour in the atmosphere is added or withdrawn due to evaporation and condensation respectively.
Evaporation is a process by which water is transformed from liquid to gaseous state. Heat is the main cause for evaporation.
The temperature at which the water starts evaporating is referred to as the ***latent heat of vaporization***.
Hence, the greater the movement of air, the greater is the evaporation.
The transformation of water vapour into water is called ***condensation***. Condensation is caused by the loss of heat. When moist air is cooled, it may reach a level when its capacity to hold water vapour ceases. Then, the excess water vapour condenses into liquid form. If it directly condenses into solid form, it is known as ***sublimation***.
In free air, condensation results from cooling around very small particles
termed as hygroscopic condensation nuclei. Particles of dust, smoke and salt from the ocean are particularly good nuclei because they absorb water.
Condensation also takes place when the moist air comes in contact with some colder object and it may also take place when the temperature is close to the dew point.
Condensation, therefore, depends upon the amount of cooling and the relative humidity of the air. Condensation is influenced by the volume of air, temperature, pressure and humidity. Condensation takes place:

(i) When the temperature of the air is reduced to dew point with its volume remaining constant;
(ii)when both the volume and the temperature are reduced;
(iii) when moisture is added to the air through evaporation. However, the most
favourable condition for condensation is the decrease in air temperature.
After condensation the water vapour or the moisture in the atmosphere takes one of the following forms — dew, frost, fog and clouds.
Forms of condensation can be classified on the basis of temperature and location.

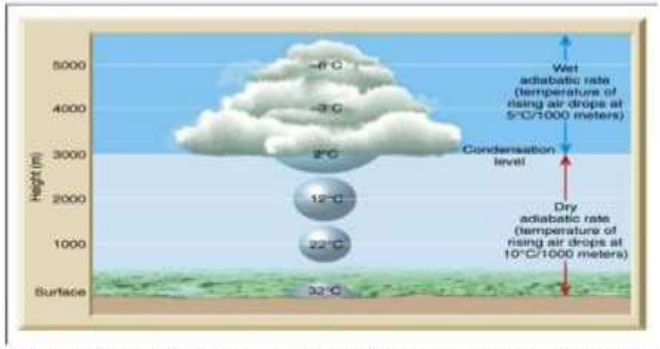


Condensation takes place when the dew point is lower than the freezing point as well as higher than the freezing point.




**Dew**

- When the moisture is deposited in the form of water droplets on cooler surfaces of solid objects (rather than nuclei in air above the surface) such as stones, grass blades and plant leaves, it is known as ***dew***.




The ideal conditions for its formation are 1. clear sky, 2. calm air, 3. high relative humidity, 4. cold and long nights.
For the formation of dew, it is necessary that the dew point is above the freezing point.

**Frost**

Frost forms on cold surfaces when condensation takes place below freezing point (0C), i.e. the dew point is at or below the freezing point. The excess moisture is deposited in the form of minute ice

crystals instead of water droplets. The ideal conditions for the formation of white frost are the same as those for the formation of dew, except that the air temperature must be at or below the freezing point. 0

**Fog and Mist**

When the temperature of an air mass containing a large quantity of water vapour falls all of a sudden, condensation takes place within itself on fine dust particles. So, the ***fog*** is a cloud with its base at or very near to the ground. Because of the fog and mist, the visibility becomes poor to zero. In urban and industrial centres smoke provides plenty of nuclei which help the formation of fog and mist. Such a condition when fog is mixed with smoke, is described as ***smog***.

The only difference between the mist and fog is that mist contains more moisture than the fog. In mist each nuclei contains a thicker layer of moisture. Mists are frequent over mountains as the rising warm air up the slopes meets a cold surface. Fogs are drier than mist and they are prevalent where warm currents of air come in contact with cold currents. Fogs are mini clouds in which condensation takes place around nuclei provided by the dust, smoke, and the salt particles.

**Clouds**

Cloud is a mass of


minute water droplets or tiny crystals of ice formed by the condensation of the water vapour in free air at considerable elevations. As the clouds are formed at some height over the surface of the earth, they take

various shapes. According to their height, expanse, density and transparency or opaqueness clouds are grouped under four types :

(i) cirrus; (ii) cumulus; (iii) stratus; (iv) nimbus.

***Cirrus***

Cirrus clouds are formed at high altitudes(8,000 - 12, 000 m). They are thin and detached clouds having a feathery appearance. They are always white in colour.

***Cumulus***

Cumulus clouds look like cotton wool. They are generally formed at a height of 4,000 -7,000 m. They exist in patches and can be seen scattered here and there. They have a flat base.

***Stratus***

As their name implies, these are layered clouds covering large portions of the sky. These clouds are generally formed either due to loss of heat or the mixing of air masses with different temperatures.

***Nimbus***

Nimbus clouds are black or dark gray. They form at middle levels or very near to the surface of the earth. These are extremely dense and opaque to the rays of the sun. Sometimes, the clouds are so low that they seem to touch the ground. Nimbus clouds are shapeless masses of thick vapour.

A combination of these four basic types can give rise to the following types of clouds: ***high clouds*** - cirrus, cirrostratus, cirrocumulus;

***middle clouds*** - altostratus and altocumulus;



***low clouds***- stratocumulus and nimbostratus

and ***clouds with extensive vertical development*** - cumulus and cumulonimbus.

**Precipitation**

The process of continuous condensation in free air helps the condensed particles to grow in size. When the resistance of the air fails to hold them against the force of gravity, they fall on to the earth's surface. So after the condensation of water vapour, the release of moisture is known as ***precipitation***. This may take place in liquid or solid form.

The precipitation in the form of water is called ***rainfall***, when the temperature is lower than the 0 C, precipitation takes place in the form of fine flakes of snow and is called ***snowfall***.

Moisture is released in the form of hexagonal crystals. These crystals form flakes of snow. Besides rain and snow, other forms of precipitation are ***sleet*** and ***hail***, though the latter are limited in occurrence and are sporadic in both time and space.

***Sleet*** is frozen raindrops and refrozen melted snow-water. When a layer of air with the temperature above freezing point overlies a subfreezing layer near the ground, precipitation takes place in the form of sleet. Raindrops, which leave the warmer air, encounter the colder air below. As a result, they solidify and reach the ground as small pellets of ice not bigger than the raindrops from which they are formed.

Sometimes, drops of rain after being released by the clouds become solidified in to small rounded solid pieces of ice and which reach the surface of the earth are called ***hailstones***.

These are formed by the rainwater passing through the colder layers. Hailstones have several concentric layers of ice one over the other.

**Types of Rainfall**

On the basis of origin, rainfall may be classified into three main types -

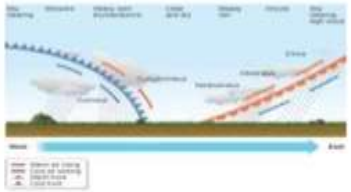
**1. the convectional, 2. orographic or relief and 3. the cyclonic or frontal.**

***Convectional Rain***

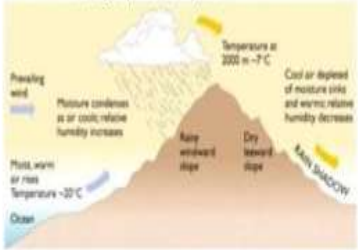
The, air on being heated, becomes light and rises up in convection currents. As it rises, it expands and loses heat and consequently, condensation takes place and cumulous clouds are formed. With thunder and lightening, heavy rainfall takes place but this does not last long. Such rain is common in the summer or

in the hotter part of the day. It is very common in the equatorial regions and interior parts of the continents, particularly in the northern hemisphere.

***cyclonic Rainfall***

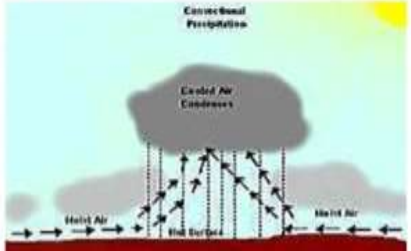


***Orographic rainfall***



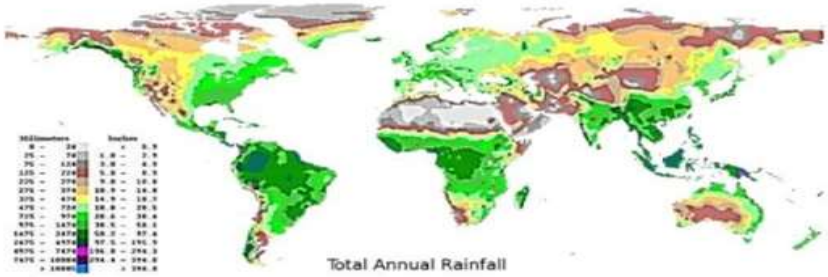

CONVECTIONAL RAIN FALL

When the saturated air mass comes across a mountain, it is forced to ascend and as it rises ,it expands; the temperature falls, and the moisture is condensed. The chief characteristic of this sort of rain is that the windward slopes receive greater rainfall. After giving rain on the windward side, when these winds reach the other slope, they



descend, and their temperature rises. Then their capacity to take in moisture increases and hence, these leeward slopes remain rainless and dry. The area situated on the leeward side, which gets less rainfall is known as the ***rain-shadow area.*** It is also known as the ***relief rain. Cyclonic Rain***

**World Distribution of Rainfall**



Total Annual Rainfall

Different places on the earth's surface receive different amounts of rainfall in a year and that too in different seasons.

1. In general, as we proceed from the equator towards the poles, rainfall goes on decreasing steadily.
2. The coastal areas of the world receive greater amounts of rainfall than the interior of the continents.
3. The rainfall is more over the oceans than on the landmasses of the world because of being great sources of water.
4. Between the latitudes 35 and 40 N and S of the equator,
5. the rain is heavier on the eastern coasts and goes on decreasing towards the west.
6. But, between 45 and 65 N and S of equator, due to the westerlies, the rainfall is first received on the western margins of the continents and it goes on decreasing towards the east.
7. Wherever mountains run parallel to the coast, the rain is greater on the coastal plain, on the windward side and it decreases towards the leeward side.

**ON THE BASIS OF THE TOTAL AMOUNT OF ANNUALPRECIPITATION, MAJOR PRECIPITATION REGIMES OF THEWORLD ARE IDENTIFIED AS FOLLOWS.**

1. The equatorial belt, the windward slopes of the mountains along the western coasts in the cool temperate zone and the coastal areas of the monsoon land receive heavy rainfall of over 200 cm per annum.
2. Interior continental areas receive moderate rainfall varying from 100 - 200 cm per annum.
3. The coastal areas of the continents receive moderate amount of rainfall.
4. The central parts of the tropical land and the eastern and interior parts of the temperate lands receive rainfall varying between 50 - 100 cm per annum.
5. Areas lying in the rain shadow zone of the interior of the continents and high latitudes receive very low rainfall-less than 50 cm per annum.
6. Seasonal distribution of rainfall provides an important aspect to judge its effectiveness.
7. In some regions rainfall is distributed evenly throughout the year such as in the equatorial belt and in the western parts of cool temperate regions.

**II. TOPICS –**

**Each topic has been converted into a concept map. It is a visual organization and representation of knowledge.**

**There are 10 concepts maps in all.**

**III. FURTHER REFERENCE –**

**Kindly watch the following videos for a better understanding.**

https://youtu.be/BIHyQD4S--A

https://youtu.be/4KWF1Vfjf2g

https://youtu.be/YV06KcP-poA

# Assignment

**Q.1 Name three types of Precipitation.**

**Q.2 Explain relative humidity .**

**Q.3 Why does the amount of water vapour decreases rapidly with altitude?**

**Q.4 How are clouds formed ? Classify them .**

**Q.5 Discuss the salient features of the world distribution of precipitation.**

**Q.6 What are forms of condensation ?**

**Q.7 Describe the Process of Dew & Frost formation.**

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# Movement of Ocean Water

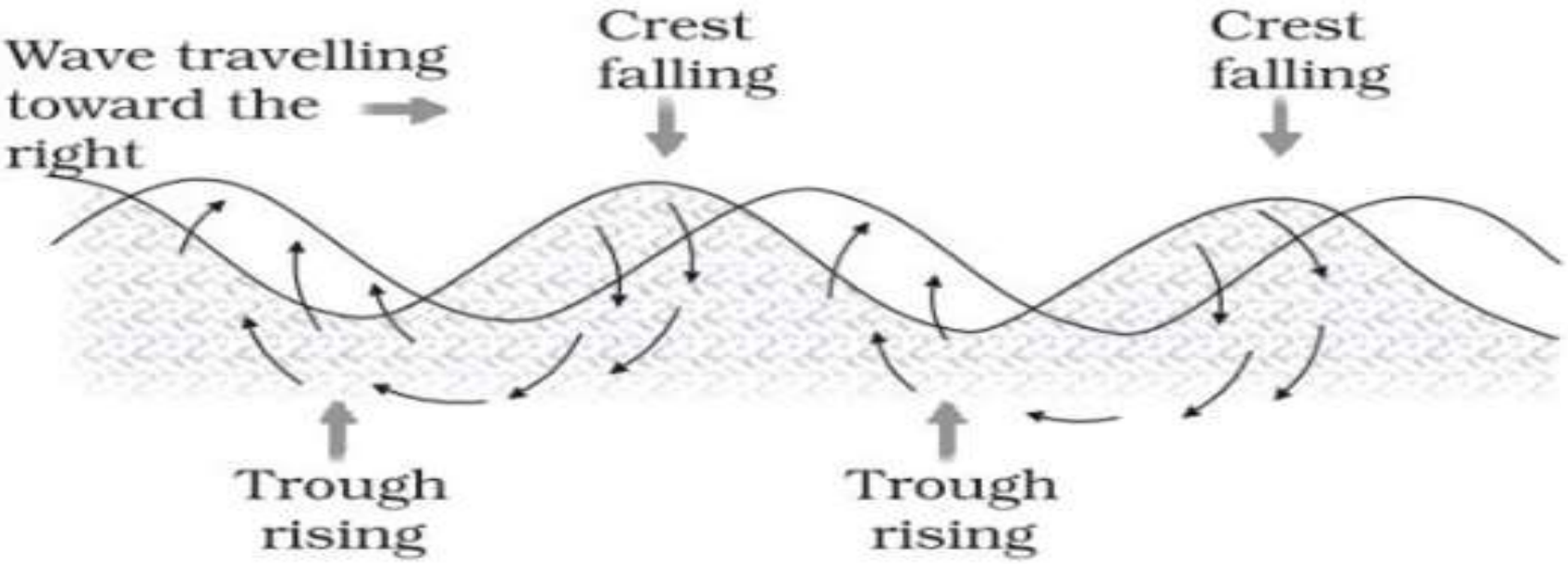


**Figure14.1 : Motion of waves and water molecules**

### Characteristics of Waves

*Wave crest and trough* : The highest and lowest points of a wave are called the crest and trough respectively.

*Wave height* : It is the vertical distance from the bottom of a trough to the top of a crest of a wave.

*Wave amplitude* : It is one-half of the wave height.

*Wave period* : It is merely the time interval between two successive wave crests or troughs as they pass a fixed point.

*Wavelength* : It is the horizontal distance between two successive crests.

*Wave speed* : It is the rate at which the wave moves through the water, and is measured in knots.

*Wave frequency* : It is the number of waves passing a given point during a one-second time interval.

### Tides of Bay of Fundy, Canada

The highest tides in the world occur in the Bay of Fundy in Nova Scotia, Canada. The tidal bulge is 15 - 16 m. Because there are two high tides and two low tides every day (roughly a 24 hour period); then a tide must come in within about a six hour period. As a rough estimate, the tide rises about 240 cm an hour (1,440 cm divided by 6 hours). If you have walked down a beach with a steep cliff alongside (which is common there), make sure you watch the tides. If you walk for about an hour and then notice that the tide is coming in, the water will be over your head before you get back to where you started!

**Movements of Ocean Water**

**The ocean water is dynamic. The horizontal and vertical motions are common in ocean water bodies.**

**The horizontal motion refers to the ocean currents and waves. The vertical motion refers to tides. Ocean currents are the continuous flow of huge amount of water in a definite direction while the waves are the horizontal motion of water.**

**Water moves ahead from one place to another through ocean currents while the water in the waves does not move, but the wave trains move ahead.**

**Water particles only travel in a small circle as a wave passes. Wind provides energy to the waves. Wind causes waves to travel in the ocean and the energy is released on shorelines.**

**The largest waves are found in the open oceans. Waves continue to grow larger as they move and absorb energy from the wind.**

**Most of the waves are caused by the wind driving against water. When a breeze of two knots or less blows over calm water, small ripples form and grow as the wind speed increases until white caps appear in the breaking waves. Waves may travel thousands of kilometers before rolling ashore, breaking and dissolving as surf. A wave's size and shape reveal its origin.**

**The moon’s gravitational pull to a great extent and to a lesser extent the sun’s gravitational pull, are the major causes for the occurrence of tides. Another factor is centrifugal force, which is the force that acts to counter balance the gravity.**

**Together, the gravitational pull and the centrifugal force are responsible for creating the two major tidal bulges on the earth.**

**On the side of the earth facing the moon, a tidal bulge occurs while on the opposite side though the gravitational attraction of the moon is less as it is farther away, the centrifugal force causes tidal bulge on the other side.**

**The highest tides in the world occur in the Bay of Fundy in Nova Scotia, Canada. The tidal bulge is 15 – 16 m. Because there are two high tides and two low tides every day (roughly a 24 hour period); then a tide must come in within about a six hour period. As a rough estimate, the tide rises about 240 cm an hour (1,440 cm divided by 6 hours).**

**The most common tidal pattern is semi-diurnal tide, featuring two high tides and two low tides each day. The successive high or low tides are approximately of the same height.**

**The height of rising water (high tide) varies appreciably depending upon the position of sun and moon with respect to the earth. When the sun, the moon and the earth are in a straight line, the height of the tide will be higher. These are called spring tides and they occur twice a month, one on full moon period and another during new moon period.**

**Normally, there is a seven day interval between the spring tides and neap tides. At this time the sun and moon are at right angles to each other and the forces of the sun and moon tend to counteract one another.**

**Once in a month, when the moon's orbit is closest to the earth (perigee), unusually high and low tides occur. During this time the tidal range is greater than normal.**

**When the earth is closest to the sun (perihelion), around 3rd January each year, tidal ranges are also much greater, with unusually high and unusually low tides. When the earth is farthest from the sun (aphelion), around 4th July each year, tidal ranges are much less than average.**

**Usually, the currents are strongest near the surface and may**

**Usually, the currents are strongest near the surface and may attain speeds over five knots. At depths, currents are generally slow with speeds less than 0.5 knots. We refer to the speed of a current as its "drift." Drift is measured in terms of knots. The strength of a current refers to the speed of the current. A fast current is considered strong. A current is usually strongest at the surface and decreases in strength (speed) with depth. Most currents have speeds less than or equal to 5 knots.**

**Surface currents constitute about 10 per cent of all the water in the ocean, these waters are the upper 400 m of the ocean and deep water currents make up the other 90 per cent of the ocean water. These waters move around the ocean basins due to variations in the density and gravity.**

**Heating by solar energy causes the water to expand. That is**

**Heating by solar energy causes the water to expand. That is why, near the equator the ocean water is about 8 cm higher in level than in the middle latitudes. This causes a very slight gradient and water tends to flow down the slope. Wind blowring on the surface of the ocean pushes the water to move.**

**Ocean currents are classified into cold currents and warm currents on the basis of temperature. Cold-water ocean currents occur when the cold water at the poles sinks and slowly moves towards the equator. Warm-water currents travel out from the equator along the surface, flowing towards the poles to replace the sinking cold water.**

**The mixing of warm and cold currents help to replenish the oxygen and favour the growth of planktons, the primary food for fish population. The best fishing grounds of the world exist mainly in these mixing zones.**

**Class 11 Geography Notes Chapter 14 Important Terms:**

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https://youtu.be/0ZbLJSVwOPA

https://youtu.be/JXvuEoW_rOE

https://youtu.be/HnAntnLFs7M

## Assignment

**Q.1 What are waves?**

**Q.2 What are Tides?**

**Q.3 How are Tides caused?**

**Q.4 How are Tides related to Navigation .**

**Q.5 Define Gravitational Force.**

**Q.6 What are the causes of currents?**

**Q.7 Where do waves in the ocean get their energy from?**

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# Life on the Earth

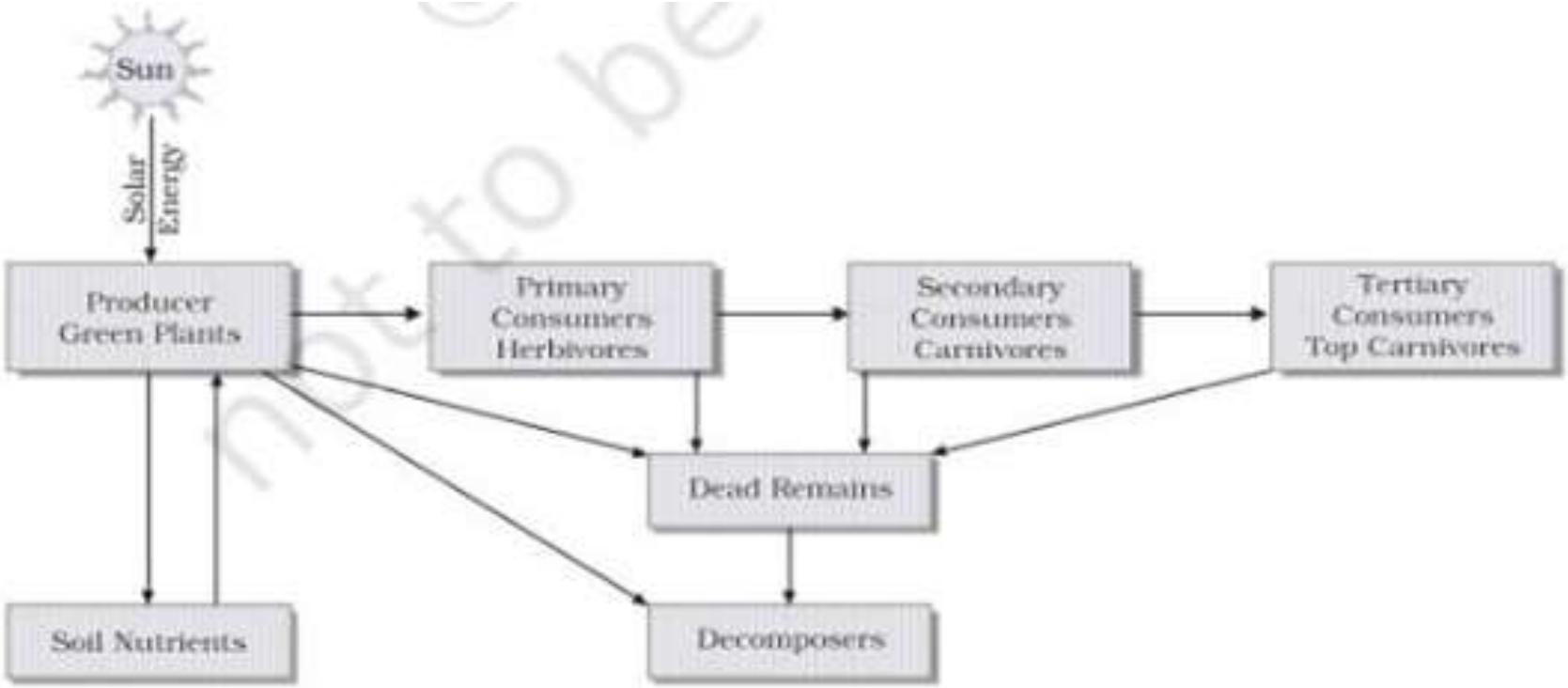


**Figure 15.1 : Structure and functions of ecosystems**

**Table 15.1 : World Biomes**

| *Biomes* | *Subtypes* | *Regions* | *Climatic Characteristics* | *Soil* | *Flora and Fauna* |
|---|---|---|---|---|---|
| Forest | A. Tropical<br>1. Equatorial<br>2. Deciduous<br>B. Temperate<br>C. Boreal | A1. 10° N-S<br>A2. 10° - 25° N-S<br>B. Eastern North America, N.E. Asia, Western and Central Europe<br>C. Broad belt of Eurasia and North America (parts of Siberia, Alaska, Canada and Scandinavia) | A1. Temp. 20-25°C, evenly distributed<br>A2. Temp. 25-30°C, Rainfall, ave. ann. 1,000mm, seasonal<br>B. Temp. 20-30° C, Rainfall evenly distributed 750-1,500mm, Well-defined seasons and distinct winter.<br>C. Short moist moderately warm summers and long cold dry winter; very low temperatures. Precipitation mostly snowfall 400 -1,000mm | A1. Acidic, poor in nutrients<br>A2. Rich in nutrients<br>B. Fertile, en-riched with decaying litter<br>C. Acidic and poor in nutrients, thin soil cover | A1. Multi-layered canopy tall and large trees<br>A2. Less dense, trees of medium height; many varieties co-exist. Insects, bats, birds and mammals are common species in both<br>B. Moderately dense broad leaved trees. With less diversity of plant species. Oak, Beach, Maple etc. are some common species. Squirrels, rabbits, skunks, birds, black bears, mountain lions etc.<br>C. Evergreen conifers like pine, fur and spruce etc. Wood peckers, hawks, bears, wolves, deer, hares and bats are common animals |
| Desert | A. Hot and Dry | A. Sahara | A. Temp. 20 - 45°C | Rich in | A-C. Scanty vege- |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | animals |
| Desert | A. Hot and Dry desert<br>B. Semi arid desert<br>C. Coastal desert<br>D. Cold desert | A. Sahara, Kalahari, Marusthali, Rub-el-Khali<br>B. Marginal areas of hot deserts<br>C. Atacama<br>D. Tundra climatic regions | A. Temp. 20 - 45°C.<br>B. 21 - 38°C.<br>C. 15 - 35°C.<br>D. 2 - 25°C<br>A-D Rainfall is less than 50 mm | Rich in nutrients with little or no organic matter | A-C. Scanty vegetation; few large mammals, insects, reptiles and birds<br>D. Rabbits, rats, antelopes and ground squirrels |
| Grassland | A. Tropical Savannah<br>B. Temperate Steppe | A. Large areas of Africa, Australia, South America and India<br>B. Parts of Eurasia and North America | A. Warm hot climates, Rainfall 500-1,250 mm<br>B. Hot summers and cold winter. Rainfall 500 - 900 mm | A. Porous with thin layer of humus.<br>B. Thin flocculated soil, rich in bases | A. Grasses; trees and large shrubs absent; giraffes zebras, buffalos, leopards, hyenas, elephants, mice, moles, snakes and worms etc., are common animals<br>B. Grasses; occasional trees such as cottonwoods, oaks and willows; gazelles, zebras, rhin- |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | oceros, wild horses, lions, varieties of birds, worms, snakes etc., are common animals |
| Aquatic | A. Freshwater<br>B. Marine | A. Lakes, streams, rivers and wetlands<br>B. Oceans, coral reefs, lagoons and estuaries | A-B Temperatures vary widely with cooler air temperatures and high humidity | A. Water, swamps and marshes<br>B. Water, tidal swamps and marshes | Algal and other aquatic and marine plant communities with varieties of water dwelling animals |
| Altitudinal | —— | Slopes of high mountain ranges like the Himalayas, the Andes and the Rockies | Temperature and precipitation vary depending upon latitudinal zone | Regolith over slopes | Deciduous to tundra vegetation varying according to altitude |

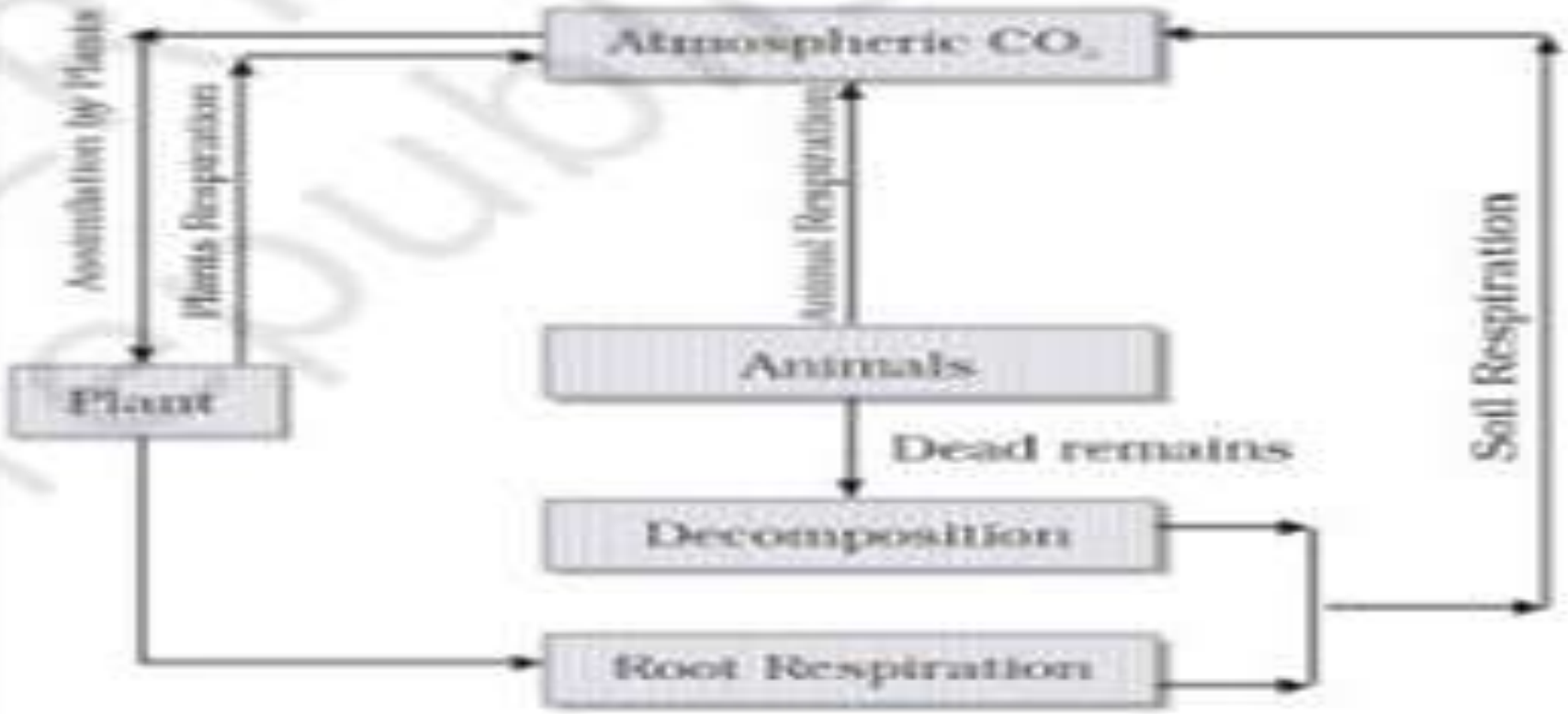


**Figure 15.2 : Carbon Cycle**

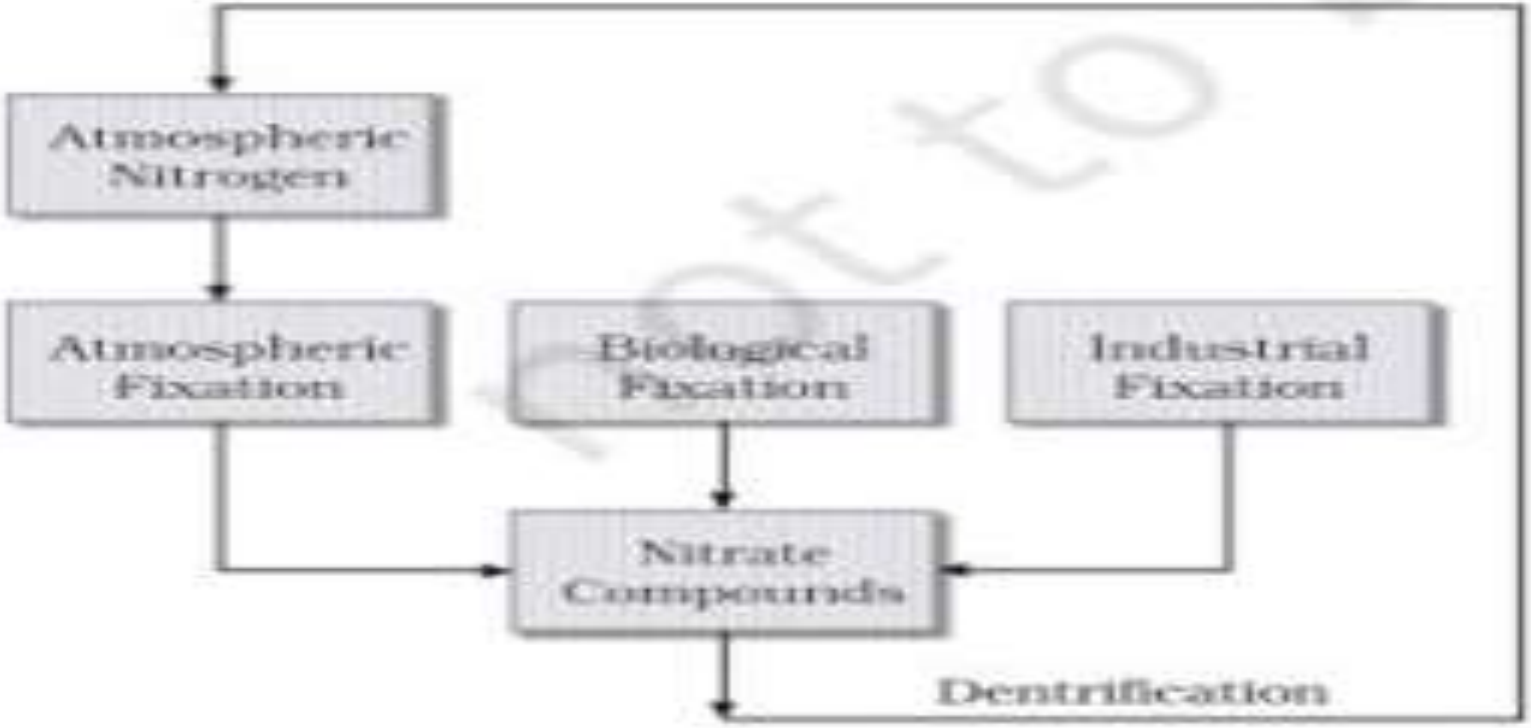


**Figure 15.3 : Nitrogen Cycle**

**Life on the Earth**

**Life on the earth is found almost everywhere. Living organisms are found from the poles to the equator, from the bottom of the sea to several km in the air, from freezing waters to dry valleys, from under the sea to underground water lying below the earth's surface.**

**The biosphere includes all the living components of the earth. It consists of all plants and animals, including all the micro-organisms that live on the planet earth and their interactions with the surrounding environment.**

**The biosphere and its components are very significant elements of the environment. These elements interact with other components of the natural landscape such as land, water and soil.**

**as land, water and soil.**

**They are also influenced by the atmospheric elements such as the temperature, rainfall, moisture and sunlight. The interactions of biosphere with land, air and water are important to the growth, development and evolution of the organism.**

**The term ecology is derived from the Greek word 'oikos' meaning 'house', combined with the word 'logy' meaning the 'science of or 'the study of. Literally, ecology is the study of the earth as a 'household', of plants, human beings, animals and micro-organisms.**

**A German zoologist Ernst Haeckel, who used the term**

**A German zoologist Ernst Haeckel, who used the term as 'oekologie' in 1869, became the first person to use the term 'ecology'. The study of interactions between life forms (biotic) and the physical environment (abiotic) is the science of ecology. Hence, ecology can be defined as a scientific study of the interactions of organisms with their physical environment and with each other.**

**Ecosystems are of two major types: terrestrial and aquatic. Terrestrial ecosystem can be further be classified into 'biomes'.**

**A biome is a plant and animal community that**

**classified into biomes ?**

**A biome is a plant and animal community that covers a large geographical area. The boundaries of different biomes on land are determined mainly by climate.**

**From a structural point of view, all ecosystems consist of abiotic and biotic factors. Abiotic factors include rainfall, temperature, sunlight, atmospheric humidity, soil conditions, inorganic substances (carbon dioxide, water, nitrogen, calcium, phosphorus, potassium, etc.).**

**Biotic factors include the producers, the consumers (primary, secondary, tertiary) and the decomposers. The producers include all the green plants, which manufacture their own food through photosynthesis.**

**manufacture their own food through photosynthesis.**

**The primary consumers include herbivorous animals like deer, goats, mice and all plant-eating animals.**

**The carnivores include all the flesh-eating animals like snakes, tigers and lions. Certain carnivores that feed also on carnivores are known as top carnivores like hawks and mongooses.**

**Decomposers are those that feed on dead organisms (for example, scavengers like vultures and crows), and further breaking down of the dead matter by other decomposing agents like bacteria and various micro-organisms.**

**Generally, two types of food-chains are recognised: grazing food-chain and detritus food- chain. In a grazing food-chain, the first level starts with plants as producers and ends with carnivores as consumers at the last level, with the herbivores being at the intermediate level.**

**There are five major biomes — forest, desert, grassland, aquatic and altitudinal biomes.**

**The sun is the basic source of energy on which ail life depends. This energy' initiates life processes in the biosphere through photosynthesis, the main source of food and energy for green plants.**

**During photosynthesis, carbon dioxide is converted**

**The sun is the basic source of energy on which ail life depends. This energy' initiates life processes in the biosphere through photosynthesis, the main source of food and energy for green plants.**

**During photosynthesis, carbon dioxide is converted into organic compounds and oxygen. Out of the total solar insolation that reaches the earth's surface, only a very small fraction (0.1 per cent) is fixed in photosynthesis. More than half is used for plant respiration and the remaining part is temporarily stored or is shifted to other portions of the plant.**

**Oxygen is the main by-product of photosynthesis. Oxygen occurs in a number of chemical forms and combinations. It combines with nitrogen to form nitrates and with many other minerals and elements to form various oxides such as the iron oxide, aluminium oxide and others. Much of oxygen is produced from the decomposition of water molecules by sunlight during photosynthesis and is released in the atmosphere through transpiration and respiration processes of plants.**

**Other than carbon, oxygen, nitrogen and hydrogen being the principal geochemical components of the biosphere, many other minerals also occur as critical nutrients for plant and animal life. These mineral elements required by living organisms are obtained initially from inorganic sources such as phosphorus, sulphur, calcium and potassium.**

**Class 11 Geography Notes Chapter 15 Important Terms:**

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**III. FURTHER REFERENCE –**

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https://youtu.be/DYo2O_eQK9U

https://youtu.be/P8OCPfv0P_I

https://youtu.be/pn8_IiHxqug

# Assignment

**Q.1 What do you understand by the term ‘ Ecology’?**

**Q.2 What is Ecological system?**

**Q.3 What is Food chain?**

**Q.4 What do you understand by the Term ‘Food Web’?**

**Q.5 What is Biome?**

**Q.6 What are Biogeochemical Cycles?**

**Q.7 What is an Ecological balance?**

**Q.8 Identify the major types of ecosystem in the World .**

**Q.9 Explain how Nitrogen is fixed in the Atmosphere.**

**Q.10 Discuss the Important measures needed to prevent ecological imbalances .**

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# Biodiversity & Conservation

Figure 16.2 : Red Panda — an endangered species

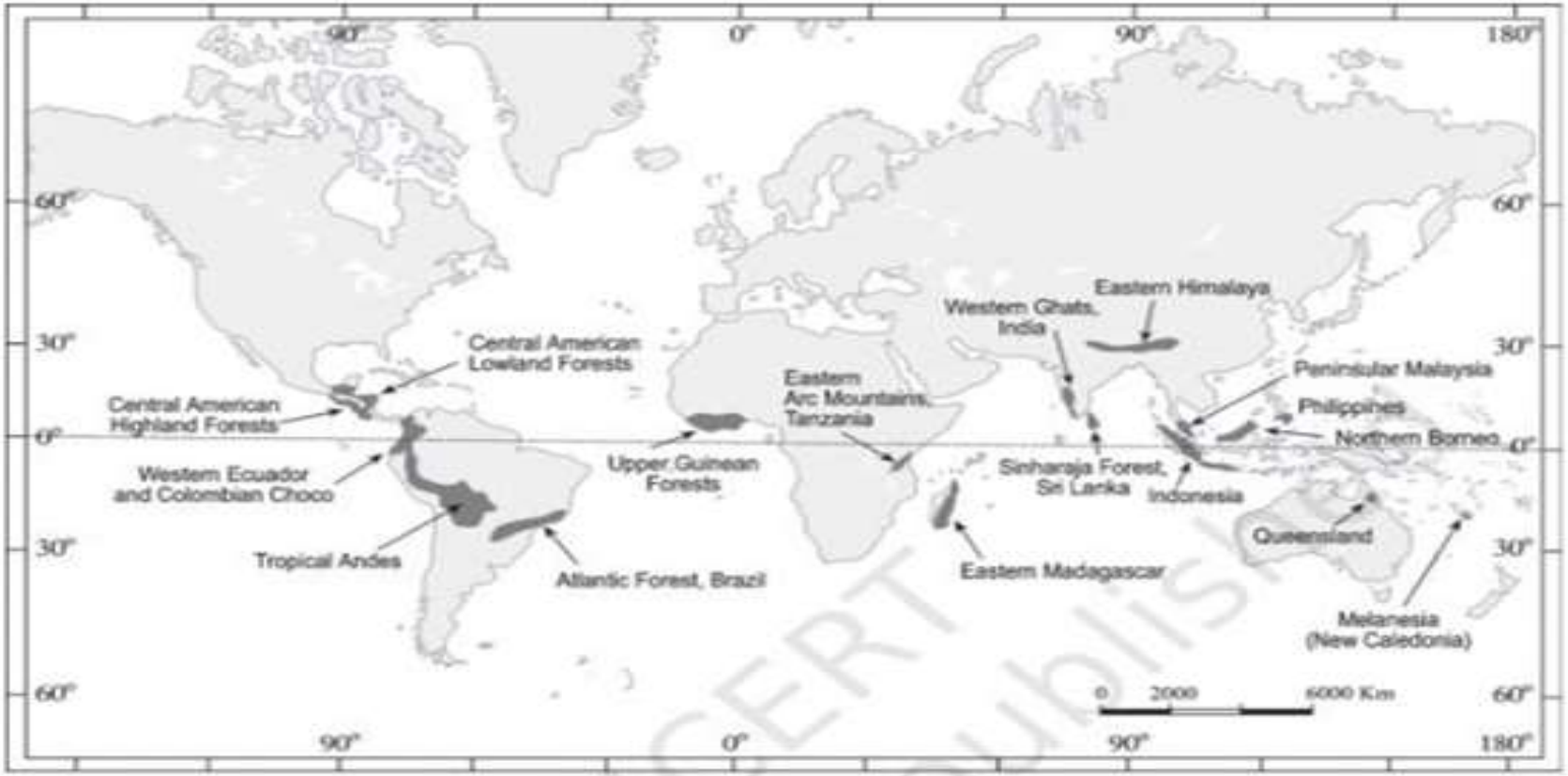


**Figure 16.5 : Some ecological 'hotspots' in the world**

**Biodiversity and Conversation**

**The average half-life of a species is estimated at between one and four million years, and 99 per cent of the species that have ever lived on the earth are today extinct.**

**Biodiversity is not found evenly on the earth. It is consistently richer in the tropics. As one approaches the polar regions, one finds larger and larger populations of fewer and fewer species.**

**biodiversity.**

**Human beings genetically belong to the homo sapiens group and also differ in their characteristics such as height, colour, physical appearance, etc., considerably. This is due to genetic diversity. This genetic diversity is essential for a healthy breeding of population of species.**

**Genetic diversity has given a great contribution in development of human culture. In a similar way human species has also contributed in maintaining natural diversity at genetic, species and ecosystem level.**

**Different species of ecosystem are busy in one activity or the other. Without activities they can neither survive nor develop.**

**Different species of ecosystem are busy in one activity or the other. Without activities they can neither survive nor develop.**

**Ecosystem evolves and sustains without any reason. That means, every organism, besides extracting its needs, also contributes something of useful to other organisms.**

**Ecological functions are important for ecosystem function and human survival. The more diverse an ecosystem, better are the chances for the species to survive through adversities and**

**an ecosystem, better are the chances for the species to survive through adversities and attacks, and consequently, is more productive. Just like a species with a high genetic diversity, an ecosystem with high biodiversity may have a greater chance of adapting to environmental change. In other words, the more the variety of species in an ecosystem, the more stable the ecosystem is likely to be.**

**Biodiversity as we have today is the result of 2.5-3.5 billion years of evolution. Before the advent of humans, our earth supported more biodiversity than in any other period.**

**Since, the emergence of humans, however, biodiversity has begun a rapid decline, with one species after another bearing the brunt of extinction due to overuse. The number of species globally vary from 2 million to 100 million, with 10 million being the best estimate.**

**For all humans, biodiversity is an important resource in their day-to-day life. One important part of biodiversity is 'crop diversity', which is also called agro-biodiversity. Biodiversity is seen as a reservoir of resources to be drawn upon for the manufacture of food, pharmaceutical, and cosmetic products.**

**Since the last few decades, growth in human population has increased the rate of consumption of natural resources. It has accelerated the loss of species and habitation in different parts of the world.**

**Tropical regions which occupy only about one-fourth of the total area of the world, contain about three- fourth of the world human population. Over-exploitation of resources and deforestation have become rampant to fulfil the needs of large population. As these tropical rain forests contain 50 per cent of the species on the earth, destruction of natural habitats have proved disastrous for the entire biosphere.**

**cause damage to the flora and fauna of the earth, bringing change to the biodiversity of respective affected regions. Pesticides and other pollutants such as hydrocarbons and toxic heavy metals destroy the weak and sensitive species.**

**The International Union of Conservation of Nature and Natural Resources (IUCN) has classified the threatened species of plants and animals into three categories for the purpose of their conservation: (a) Endangered species (b) Vulnerable species and (c) Rare species.**

**The International Union of Conservation of Nature and Natural Resources (IUCN) has classified the threatened species of plants and animals into three categories for the purpose of their conservation: (a) Endangered species (b) Vulnerable species and (c) Rare species.**

**Biodiversity is important for human existence. All forms of life are so closely interlinked that disturbance in one gives rise to imbalance in the others. If species of plants and animals become endangered, they cause degradation in the environment, which may threaten human being's own existence.**

**Janeiro, Brazil in June 1992.**

**Government of India passed the Wild Life (Protection) Act, 1972, under which national parks and sanctuaries were established and biosphere reserves declared.**

**There are some countries which are situated in the tropical region; they possess a large number of the world's species diversity. They are called mega diversity centers. There are 12 such countries, namely Mexico, Columbia, Ecuador, Peru, Brazil, Democratic Republic of Congo, Madagascar, China, India, Malaysia, Indonesia and Australia in which these centers are located.**

**Hotpots are defined according to their vegetation. Plants are important because these determine the primary productivity of an ecosystem. Most, but not all, of the hotpots rely on species-rich ecosystems for food, firewood, cropland, and income from timber. In Madagascar, for example, about 85 per cent of the plants and animals are found nowhere else in the world. Other hotspots in wealthy countries are facing different types of dangers.**

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https://youtu.be/gUDDT4vFT_g

https://youtu.be/4y1EXPx6Pjg

https://youtu.be/0F-9ZrT5Zxc

# Assignment

**Q.1 What is Biodiversity ?**

**Q.2 What are different levels of Biodiversity ?**

**Q.3 What do you understand by ‘Hotspots'?**

**Q.4 Discuss briefly the importance of animals to human kind .**

**Q.5 What do you understand by ‘Exotic Species’?**

**Q.6 What are the roles played by Biodiversity in the shaping of nature. ?**

**Q.7 What are the major factors that are responsible for the loss of Biodiversity ?**

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UNIT I

# CHAPTER.1 GEOGRAPHY AS ADISCIPLINE

*This unit deals with*

*1• Geography as an integrating discipline; as a science of spatial attributes*
*2• Branches of geography; importance of physical geography*

3. What is geography?
4. Relation between man and nature?
5. Development of geography
6. Relation between geography and other subjects
7. Geography answers the questions where? What? & Why?
8. Relation between Physical Geography and Natural Science'
9. Geography and social science relation.
10. Branches of Geography Based on Systematic Approach and Regional Approach
11. Physical geography and its importance.

**WHY SHOULD WE STUDY GEOGRAPHY?**

1. We live on the earth's surface
2. Our lives are affected many ways by our surroundings
3. We depend on the resources available from the earth surface
4. Primitive societies substituted on the plants and animals
5. Food , shelter, and dress are depending on the climate
6. Cropping pattern is based on climate of the place
7. To know the changes taken place throughout the geological time
8. To know the lands and people
9. Develop skills to convert globe to map
10. To have visual sense of the earth surface

**2. What are the recent techniques that helped the geographer to understand the earth's surface better?**

1. GIS& GPS
2. COMPUTER CARTOGRAPHY

**3. WHAT IS GEOGRAPHY?**

The earth consists of physical and cultural features. They are different from one place to another. This difference helped to understand the relation between physical and cultural features. Physical features provided the stage and human societies enacted the drama to develop their skills. With the use of skills and tools ,he modified the nature

1 ERATOSTHENES

"GEOGRAPHY IS THE DESCRIPTION OF THE EARTH".

**Who coined the term 'Geography' first?**

ERATOSTHENES, A GREEK SCHOLAR (276-194 BC)

**What is the origin of the word 'Geography'?**

**The word derived from Greek language geo- earth , graphos=description.**

Some scholars defined geography as the description of the earth as the abode of human beings.

**How can we say that the earth is 'multidimensional'?**

Many Sciences developed to describe the physical features of the earth such as Geology, Pedology, Oceanography Botany Zoology and Meteorology & Cultural features of the earth such as Economics, History, Sociology Political Science, Anthropology,

**How does Geography differ from other subjects?**

Geography differs from other subjects in terms of matter and methodology. Geography derives its data from Social Sciences and Natural Sciences.



**What do you mean by 'areal differentiation'?**

When there is similarity and dissimilarity among the physical and cultural features on the earth surface, it is called aerial differentiation.

**What do Geographers study?**

They study the variations and association of the features on the earth surface

e.g. Cropping pattern differs from place to place and it is due to difference in the climate, soil, demand, transport facility, capacity of the farmer.

A geographer also studies the cause and effect relationships.

The interaction between man and nature is highly dynamic and not static; so it is also called as the study of the relation between unstable earth and untrusting man.

**What is the relation between man and nature?**

Human is an integral part of nature and nature has imprints of man.

**What is the effect of nature on man?**

Food clothing, shelter and occupation of man are decided by the nature

**How does technology help man?**

--to loosen the shackles of the physical conditions.
--to develop resources and utilize them.
--to reach the higher needs of the life. It increased the production of the crops& mobility of labor.

**Describe the dialogue between nature and man.**

*You created the soil, I created the cup,*
*You created night, I created the lamp.*
*You created wilderness, hilly terrains and deserts;*
*I created flower beds and gardens.*

**Explain the changes occurred in the civilization of man in course of time?**

1. Man moved from stage of necessity to stage of freedom.
2. Created new possibilities from the nature
3. We find now humanized nature and naturalized man
4. Space got organized with the help of transport and communication.

**What does Geography study?**

Geography studies spatial organization and spatial integration.

**Which are the three questions concerned with Geography?**

What are the natural and cultural features found on the earth surface?
Where are these features found?
Why are these features found there?

**How can we say that Geography is an integrated discipline?**

It is a discipline of synthesis; it includes spatial and temporal synthesis.

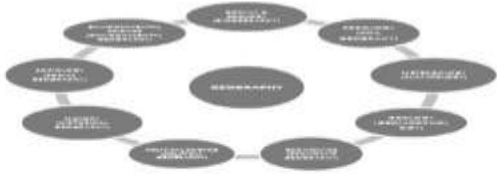
Its approach is holistic in nature. It recognizes the fact that the world is a system of interdependence. The present world is a global village. The efficient transport and communication helped the world to become unified village. The audiovisual media helped the data to be enriched. Technology provided better chances of monitoring natural phenomena as well as the economic and social parameters.

**What is the basic objective of Sciences & Social Sciences?**

The basic aim of Science and Social Science is to understand the reality of the nature.

**Explain the relationship of Geography with other subjects?**

2 RELATION WITH OTHER SUBJECTS



How do other subjects help Geography as an integrated subject?

History helps in knowing the man-made activities; Physics helps to calculate the effect of climate on man. Economics helps to understand the effect of human activities on the development of the country. The geographical factors modified the course of history. The change in the climate has influence on the occupation.

## PHYSICAL GEOGRAPHY AND NATURAL SCIENCE

Define the relation of geography with Natural Science

All branches of physical Geography have close relation with Natural Sciences. Biogeography has close link with Zoology and Botany.

3ALEXANDER VAN HUMBOLDT

Mathematics and Arts also have contributed to the development of Geography to measure the area and dimensions of the earth. Cartography and projections are based on mathematics.

Explain the contribution of social science to the Human geography.

History of geographical thought is the mother of all branches of geography. Sociology, political science, economics provide the aspects of social reality. Population geography has close link with demography.

BRANCHES OF GEOGRAPHY

BASED ON SYSTEMATIC APPROACH INTRODUCED BY *Alexander Von Humboldt*, a German geographer (1769-1859

ALEXANDER VAN HUMBOLDT

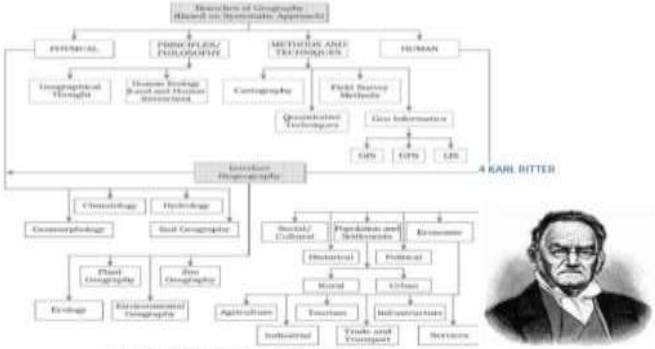



Figure 1.4 : Branches of geography based on systematic approach



KARL RITTER (1779-1859)

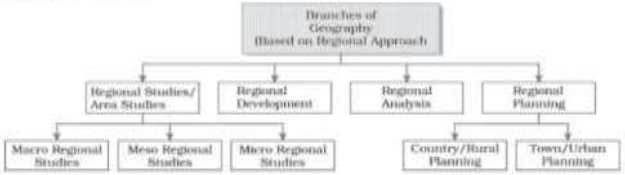



**Figure 1.3 : Branches of geography based on regional approach**

What is the importance of PHYSICAL GEOGRAPHY?

Physical geography includes study of Lithosphere, Atmosphere, Hydrosphere & Biosphere: each element is very important for human beings.

Landforms provide base for agriculture, industries, transport and communication, and settlements. Mountains provide water to rivers, forests center for tourist spots.

Climate influences on the cropping pattern, livestock, food and clothes of the people.

Sinate and precipitation influence the type of forests. Oceans provide food, water transport, and influence the climate; they are the source of hydrological cycle

5 RICHARD HARTSHORNE

**What is Geography?**

Geography is concerned with the description and explanation of the areal differentiation of the earth's surface

*Richard Hartshorne*

Geography studies the differences of phenomena usually related in different parts of the earth's surface

*Hettner*

6 HETTNER

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https://youtu.be/_zr3Hzpr0JE

https://youtu.be/kj1m3Ema9Pc

**Q.1 Why should we study Geography?**

**Q.2 What is Geography?**

**Q.3 Who coined the term Geography first?**

**Q.4 How can we say that Earth is multidimensional?**

**Q.5 What do you mean by Areal differentiation?**

**Q.6 How can we say that Earth is an Integrated Discipline?**

**Q.7 What is the importance of Physical Geography?**

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# CHAPTER -3 INTERIOR OF THE EARTH

This chapter deals with

1. Sources of information of about the earth interior 2. direct sources 3. Indirect sources 4. earth quake 5. Earth quake waves 6. Propagation of earthquake waves 7. emergence of shadow zone 8. types of earthquakes 9. effects of earthquakes 10. structure of the earth 11. the crust 12. The mantle 13. the core 14. volcanoes and volcanic landforms 15. types of volcanoes 16. shield volcano 17. composite volcanoes 18. caldera 19. flood basalt provinces 20. mid ocean ridge volcanoes 21. volcanic landforms intrusive forms, plutonic rocks ,batholiths, laccoliths, lapolith, phacolith ,sills & dykes

## Sources of Information about the Earth's Interior

- There are two sources for information about interior of the earth - a) Direct Sources and b) Indirect Sources:
- Direct Sources: Mining, drilling and volcanic eruption are examples of direct sources. During the process of mining and drilling rocks and minerals are extracted which gives information that there are layer system in the crust. Crust is made of many kinds of rocks and minerals. Volcanic eruption suggests that there is some zone inside the earth which is very hot and in liquid condition. Direct sources are not very reliable because mining and drilling can be done only up to some depth only.
- Indirect Sources: Seismic waves, gravitational field, magnetic field, falling meteors etc are example of indirect sources. They are very important for know about earth's interior. Movement of seismic wave suggests that there are three layers in the earth and each layer has different density. Density increases toward the center of the earth.

Movement of seismic wave suggests two things: a) There are three layers in the earth and b) Each layer has different density which increases toward the center of the earth.

EARTH QUAKE

It is the shaking of the earth, natural event. It is caused due to release of energy which generates waves that travel to all directions.

WHY DOES EARTH SHAKE?

The release of energy occurs along the fault line

Rocks along the fault tend to move in opposite directions as the overlying strata press them the friction locks them together.

However, the tendency of movement overcome the friction

As a result, blocks get deformed

They slide over another: as a result energy releases.

Energy waves travel in all directions.

The point where energy releases is called focus/hypocenter

Above the focus point on the surface it is called epicenter

EARTH QUAKE WAVES

All earth quakes take place in the lithosphere ( 200 km depth)

An instrument called *Seismograph* records the waves.

## Earthquake and Seismic Waves

Meaning of Earthquake: Sudden movement or vibration on the earth surface is called earthquake. In other words, sudden release of energy due to tectonic activity is called earthquake. An earthquake may be produced due to: a) movement of plates, b) rising of magma, c) folding and faulting, d) violent volcanic eruption etc. When earthquake occurs, three types of wave are produced called as seismic waves. These are: a) P or Primary Wave, b) S or Secondary Wave, and c) L or Long or Surface Wave.

- P and S waves are combinely called as 'Body Wave' as they move inside the body of the earth.



- P wave is the fastest wave. It is also called as longitudinal wave. These waves move forth and back. In other words, P waves move parallel to the direction of wave. These waves can move in both solid and liquid.
- S wave is slower than P wave. It is also called as transverse wave. It moves perpendicular to the direction of the wave. These waves move only in solid and disappear in liquid.
- L wave is the slowest wave. It moves on the earth surface. It causes maximum destruction on the earth surface.


- Focus: It is point inside the earth surface from where an earthquake starts. It is always hidden inside the earth. Focus of an earthquake may be found at the depth of 100-200 km.
- Epicenter: It is a point on the earth surface which records the seismic waves for the first time. Maximum destruction from an earthquake is caused on the epicenter. Epicenter is located just perpendicular to the focus.
- P and S waves are called as Body Wave.
- P wave can pass through both solid and liquid. But S wave can pass only through solid.
- Seismograph: It is an instrument which record seismic waves on a paper.
- Richter Scale: It is an scale which measures the magnitude of an earthquake. In other words, energy released by an earthquake is measured on Richter Scale. Generally, it is from 0 to 10. An earthquake measuring 6 on Richter Scale is 10 times more stronger than 5 and 100 times more stronger than 4.
- Crust and upper part of the mantle is called 'lithosphere'.
- The opening through with magma comes out from a volcano is called as 'mouth' or 'crater'. When crater is collapsed due to a violent explosion it is called as 'caldera'.
- Mid-Oceanic Ridge: When plates move away from each other under the water of the ocean and magma rises up, it form a long hill like landform called as mid-oceanic ridge. Mid-oceanic ridge of Atlantic Ocean is the best example.
- Mercalli Scale: It was developed by an Italian seismologist. It measures the destruction caused by an earthquake. It ranges from 1 to 12.

## Effects of Earthquake

a) Ground shaking
b) Destruction to houses and buildings
c) Land slide and tsunami
d) Soil liquefaction [solid soil becomes liquid]
e) Damage to dams and reservoirs
f) Fire accidents
g) Destruction to transport and communication lines.

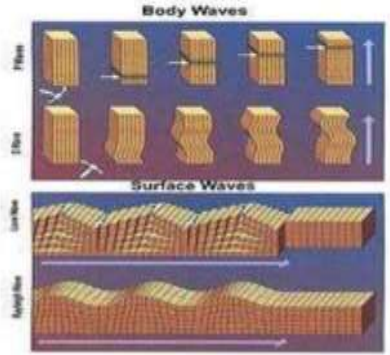
## Shadow Zones and Their Formation

Meaning of Shadow Zone: When earthquake takes place, all the places on the earth surface do not record the seismic waves. There are some zones where seismic waves [P and S waves] do not reach during an earthquake. It is called as shadow zone. Shadow zones are formed due to two reasons:

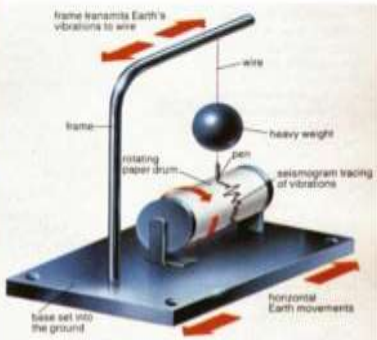
a) Three layers in the earth
b) Varying density of each layer
c) Liquid condition of the mantle

- P Wave Shadow Zone: Ideally seismic waves should move in straight line but due to varying density of layer P wave moves in a curved path. Due to this an area around the earth does not record P wave. This zone is from $105^0$ to $145^0$ from the focus.

- S Wave Shadow Zone: It is larger zone than P wave shadow zone. It developed because S wave does not pass through liquid mantle of the earth. Therefore, the zone from $105^0$ all around the earth from the focus is called as S wave shadow zone.




SEISMOGRAPH




TYPES OF EARTH QUAKE WAVES

- BODY WAVES
  - P' WAVES
  - S' WAVES
- SURFACE WAVES
  - LOVE WAVES
  - RELEIGH WAVES

BODY WAVES GENERATED DUE TO ENERGY GENERATED IN THE EARTH'S INTERIOR
They interact with the surface rocks and generate other waves called surface waves
The velocity of the waves changes along with the density of material, denser the material higher the velocity
Their direction also changes according to the density of the material

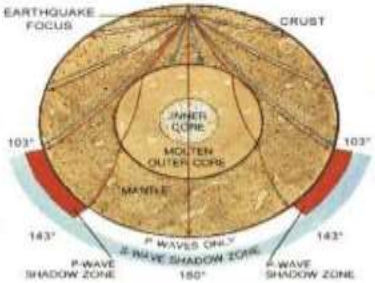
PROPAGATION OF EARTHQUAKE WAVES
When they travel in the body they vibrate the bodies of the rocks
P waves vibrate parallel to their direction of the movement



It led to the density difference in the material due to stretching and squeezing
Other three waves vibrate perpendicular to their direction

They create troughs and crests over the surface

EMERGENCE OF SHADOW ZONE




Where earthquake waves are not reported, such zones are called earthquake shadow zones.
It is observed that seismographs located beyond 103° from the epicenter do not record the earthquakes.

Seismographs located beyond 142° again record 'p' waves only .
The entire zone beyond 142° do not receive 's' waves

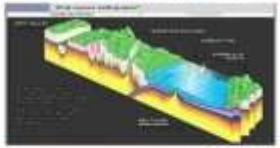
The shadow zone of 's' waves is much larger than the 'p' waves it is equal to 40% of the earth surface

TYPES OF EARTHQUAKES

INDONE


MINING EARTH QUAKE - SOUTH AFRI

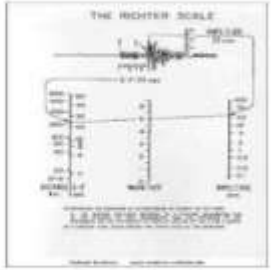
TECTONIC EARTH QUAKE GUJARAT



NUCLEAR EXPLOSION EARTH QUAKE JAPAN

RESERVOIR IMPOUND EARTHQUAKE TEHRI DAM

HOW IS EARTH QUAKE MEASURED-RICHTER SCALE







The magnitude of most earthquakes is measured on the **Richter scale**, invented by Charles F. Richter in 1934. The Richter magnitude is calculated from the amplitude of the largest seismic wave recorded for the earthquake, no matter what type of wave was the strongest.

The Richter magnitudes are based on a logarithmic scale (base 10). What this means is that for each whole number you go up on the Richter scale, the amplitude of the ground motion recorded by a seismograph goes up ten times. Using this scale, a magnitude 5 earthquake would result in ten times the level of ground shaking as a magnitude 4 earthquake (and 32 times as much energy would be released). To give you an idea how these numbers can add up, think of it in terms of the energy released by explosives: a magnitude 1 seismic wave releases as much energy as blowing up 6 ounces of TNT. A magnitude 8 earthquake releases as much energy as detonating **6 million tons of TNT**. Pretty impressive, huh? Fortunately, most of the earthquakes that occur each year are magnitude 2.5 or less, too small to be felt by most people.

The Richter magnitude scale can be used to describe earthquakes so small that they are expressed in negative numbers. The scale also has no upper limit, so it can describe earthquakes of unimaginable and (so far) inexperienced intensity, such as magnitude 10.0 and beyond.

Although Richter originally proposed this way of measuring an earthquake's "size," he only used a certain type of seismograph and measured shallow earthquakes in Southern California. Scientists have now made other "magnitude" scales, all calibrated to Richter's original method, to use a variety of seismographs and measure the depths of earthquakes of all sizes.

**The Mercalli Scale**

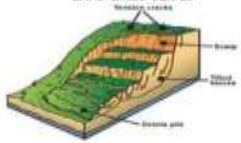
Here's a table describing the magnitudes of earthquakes, their effects, and the estimated number of those earthquakes that occur each year.

| | Modified Mercalli Scale | Richter Magnitude Scale |
|---|---|---|
| I | Only felt by sensitive instruments | 1.5 |
| II | Felt by few persons at rest, especially on upper floors, delicate suspended objects may swing | 2.0 |
| III | Felt indoors, but may not be recognized as earthquake, vibrations like large passing truck | 2.5 |
| IV | Felt indoors by many, some outdoors, may awaken some sleeping persons; dishes, windows, doors may move, cars rock. | 3.0 |
| V | Felt by most; some windows, dishes break; tall objects may fall. | 3.5 |
| VI | Felt by by all, falling plaster and chimneys, light damage but some fear. | 4.0 |
| VII | Very noticeable, damage to weaker buildings or fill; driving automobiles notice. | 4.5 |
| VIII | Walls, monuments, chimneys, bookcases fall; liquifaction; driving is difficult | 5.0 |
| IX | Buildings shifted off foundations, cracked and twisted; ground is cracked and underground pipes are broken. | 5.5 |
| X | Most structures severely damaged to destroyed; ground is cracked, rails are bent, landslides on steep slopes | 6.0 |
| XI | Few structures standing; bridges and roads severely damaged or destroyed, large fissures in ground | 6.5 |
| XII | Total damage; can see the earthquake wave move through the ground, gravity overcome and objects thrown into the air | 7.0 |
| | | 7.5 |
| | | 8.0 |

EFFECTS OF EARTH QUAKE

GROUND SHAKING

LAND &MUD SLIDES



AVALANCHES

GROUND LURCHING

SOIL LIQUEFACTION

GROUND DISPLACEMENT

FLOODS FROM DAM

FIRES

STRUCTURAL COLLAPSE

TSUNAMI



First six listed above have some bearings upon landforms while others may be considered the effects causing immediate concern to the life and properties of people in the region.

Tsunami occurs when the epicenter is below the ocean floor with sufficient magnitude. Tsunamis are waves generated by the termers not by the earthquake. The magnitude should be more than 5 in Richter scale.

The earthquakes of magnitude 8+ are rare occurs once in 1-2 years .tiny types occur every minute.

**The structure of the Earth**

Imagine a Scotch egg.....

1. The outer shell of the Earth is called the **CRUST** (breadcrumbs)
2. The next layer is called the **MANTLE** (sausage meat)
3. The next layer is the liquid **OUTER CORE** (egg white)
4. The middle bit is called the solid **INNER CORE** (egg yolk)

The deepest anyone has drilled into the earth is around 12 kilometers, we've only scratched the surface. How do we know what's going on **deep** underground?

**There are lots of clues:**

- 1.The overall density of the Earth is much higher than the density of the rocks we find in the crust. This tells us that the inside must be made of something much denser than rock.
- 2. Meteorites (created at the same time as the Earth, 4.6 billion years ago) have been analyzed. The commonest type is called a contrite and they contain iron, silicon, magnesium and oxygen (Others contain iron and nickel). A meteorite has roughly the same density as the whole earth. A meteorite minus its iron has a density roughly the same as Mantle rock (e.g. the mineral called olivine).
- 3. Iron and Nickel are both dense and magnetic.
- 4. Scientists can follow the path of seismic waves from earthquakes as they travel through the Earth. The inner core of the Earth appears to be solid whilst the outer core is liquid (s waves do not travel through liquids). The mantle is mainly solid as it is under extreme pressure (see below). We know that the mantle rocks are under extreme pressure, diamond is made from carbon deposits and is created in rocks that come from depths of 150-300 kilometers that have been squeezed under massive pressures.

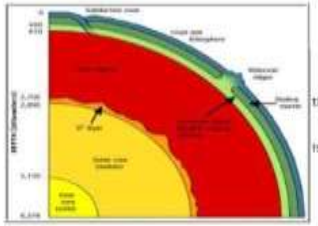
5. The Earth is sphere (as is the scotch egg!) with a diameter of about 12,700 Kilometers. As we go deeper and deeper into the earth the temperature and pressure rises. The core temperature is believed to be an incredible 5000-6000°c.

6. The crust is very thin (average 20Km). This does not sound very thin but if you were to imagine the Earth as a football, the crust would be about ½ millimeter thick. The thinnest parts are under the oceans (OCEANIC CRUST) and go to a depth of roughly 10 kilometers. The thickest parts are the continents (CONTINENTAL CRUST) which extend down to 35 kilometers on average. The continental crust in the Himalayas is some 75 kilometers deep.

7. The mantle is the layer beneath the crust which extends about half way to the centre. It's made of solid rock and behaves like an extremely viscous liquid - (This is the tricky bit... the mantle is a solid which flows????) The convection of heat from the center of the Earth is what ultimately drives the movement of the tectonic plates and cause mountains to rise. Click here for more details

The outer core is the layer beneath the mantle. It is made of **liquid** iron and nickel. Complex convection currents give rise to a dynamo effect which is responsible for the Earth's magnetic field.

8. The inner core is the bit in the middle!. It is made of **solid** iron and nickel. Temperatures in the core are thought to be in the region of 5000- 6000° c and it's solid due to the massive pressure.



## EARTH STRUCTURE

### The crust - the Outer most solid part

1. Brittle in nature
2. Thickness is 5 km. thin under the oceans and thick under the continents
3. 10 km under oceans and 70 km under mountains

Density in the ocean floor is $3g/cm^3$( basalt) mean density is $2.7g/cm^3$

### The mantle

1. Second layer from the top of the earth
2. 2. it extends from Moho-discontinuity to a depth of 2900 km.
3. 3.the upper portion of the mantle is called ASTHENOSPHERE ( Astheno= weak it extends up to 400 km)
4. 4. It is the source of magma
5. average density is $3.4g/cm^3$
6. 6. crust and upper most part of the mantle is called Lithosphere. Its thickness is 10 -200km
7. 7. Lower mantle is in solid state

### The core

1. It extends from 2900 km to 6300 km depth
2. 2. Outer core is liquid while inner core is solid
3. 3. outer core density is $5\ g/cm^3$ inner core is $13\ g/cm^3$
4. made of heavy metals such as Nickel and Iron
5. It is also called as **Nife**

## VOLCANOES AND VOLCANIC LANDFORMS

**A volcano is place where gases, ashes and or molten rock material lava escape to the ground.**

Active volcano Mount Pinatubo, Philippines in 1991.

**Lava from Mt. Kilauea pouring into the ocean during the sunset**

**The Differences between Active, Dormant and Extinct volcanoes**

**Active Volcano:** Is a volcano that is currently erupting or shows signs of unrest activities, like earthquake activity or significant amounts of gas discharged. It is a volcano that is not presently erupting, but has erupted in the past is considered likely to do erupt in the future again.

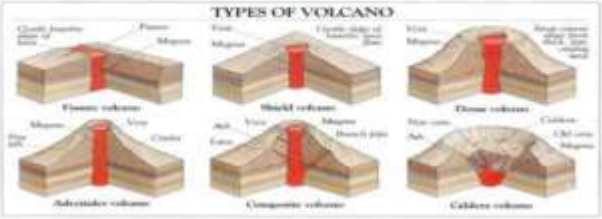
**One of the dormant volcanoes in the Cascades in the "Three Sister Area."**

**Dormant:** These volcanoes are also called "Sleeping" volcanoes because it is presently inactive, but could erupt again. For example, the majority of the Cascade volcanoes arebelieved to be dormant rather than extinct.



**This is an Aerial view of Crater Lake in Oregon.**

**Extinct:** Is a volcano that is presently not erupting, that is unlikely to do so for a very long time in the future.




Classification of volcanoes based on nature of eruption and land forms developed on the surface.

### SHIELD VOLCANO

1. Largest of volcanoes
2. Hawaiian Islands are best examples
3. Basalt lava flow
4. Lava is very fluid
5. They are not steep
6. They become explosive when water is held in tower
7. Develops in to cinder cone

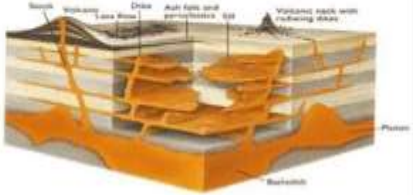
### COMPOSITE VOLCANOES

1.Cool and more viscous lava
2.Explosive eruptions
3.They erupt pyroclastic and ashes along with lava
4.Layers are formed

### CALDERA

1.These are the most explosive type of volcanoes

2. They collapse themselves and form into lakes
3. The magma chamber is huge and found nearby




FLOOD BASALT PROVINCES

1. Consists of highly fluid lava
2. Some parts of the world are covered by thousands of sq.km of basalt
3. there can be series of flows
4. Average thickness is more than 50 km
5. Individual flow is 100 of sq.k.m
6. Ex. Deccan plateau

MID OCEANIC RIDGES VOLCANOES

1. Found in oceanic surfaces
2. More than 70,000 km length
3. Frequent volcanic eruptions
4. Ex. Mid Atlantic ridge

INTRUSIVE VOLCANIC LANDFORMS

1. when volcanic eruption takes place some lava comes out and some settle down in the lithosphere.
2. when lava comes out forms volcanic rocks, some part cools down in the lower portion forms plutonic rocks

INTRUSIVE FORMS OCCUR INSIDE THE CRUST.

BATHOLITH:

A large part of the magma material that cools in the deeper depthof the crust. They are dome shaped, cover large areas,

They come out when erosion takes place.they are granite bodies.

LACOLITHS: large dome shaped intrusive bodies. Consists of level bodies

Connected through pipe like conduit from below it resembles composite volcanoes found deeper depthsthey are localised source of lava

Ex. Karnataka plateau

LAPOLITHS:concave shaped lava formation phacoliths: wave typed lava formation

SILL: horizontal sheet of lava

DYKES: vertical lava formation

## Chapter-4 DISTRIBUTION OF OCEANS AND CONTINENTS

GIST OF THE LESSON: CONTINENTAL DRIFT, EVIDENCES TO SUPPORT CONTINENTAL DRIFT, FORCES OF DRIFTING, POST DRIFT STUDIES, OCEAN FLOOR CONFIGURATION, DISTRIBUTION OF VOLCANOES AND EARTHQUAKES, CONCEPT OF SEA FLOOR SPREADING, PLATE TECTONICS, MAJOR AND MINOR PLATES, TYPES OF PATE BOUNDARIES RATES OF PLATE MOVEMENT, FORCES OF PLATE MOVEMENTS MOVEMENT OF THE INDIAN PLATE.

CONTINENTAL DRIFT: ABRAHAM ORTELIUS a Duchy map maker 1596 first proposed the possibility of joining the continents such as America with Europe and Africa
ANTONIO PELLEGRINI drew the map showing the three continents together.
ALFRED WEGENER a German meteorologist put forth THE CONTINENTAL DRIFT THEORY.
According to him,
All continents formed a single continental mass called PANGAEA
All oceans formed a single universal ocean called PANTHALASSA
AROUND 200 mya THE PANGAEA BEGAN TO SPLIT INTO TWO LARGE MASSES CALLED LAURASIA and GONDWANA LAND
By further splitting Laurasia formed northern continents and Gondwana land formed southern continents.

EVIDENCES TO SUPPORT THE CONTINENTAL DRIFT

1. The matching of continents (jig-saw fit)

A. the shorelines of S. America and Africa have remarkable match

B. a map was produced by Bullard in 1964 to show the jigsaw fit of these two continents.

C. it was fit around 1000 fathom line of the shoreline

2. ROCKS OF SAME AGE ACROSS THE OCEANS

A. the belt of ancient rocks of 2000 my from Brazil coast matches with those of Western Africa
B. Marine deposits of South America and Africa belong to Jurassic age.

3. TILLITE

A. sedimentary rock formed out of glacial deposits
B. sediments from India have similar counter parts at different continents of south.
C. tillite indicates prolonged glaciations
D. The same glaciations is found in Africa, Falklands, Madagascar, Antarctica and Australia
E. the glacial tillite indicates that unambiguous evidence of palaeo climates and drifting of continents.

4. PLACER DEPOSITS
a. Formation of placer deposits of gold in Ghana coast has no source rock.
a. The gold bearing veins of rocks are found in Brazil

5. DISTRIBUTION OF FOSSILS
- Identical species of animals and plants are found along the coastal regions of the different continents.
- lemurs occurs in India , Madagascar and Africa.
- The contiguous land mass was called LEMURIA
- the fossils of mesosaurus were found in only South Africa and Brazil.

LEMURIA

MESOSAURUS

DISTRIBUTION OF FOSSILS

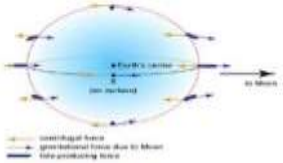



FORCES FOR DRIFTING THE CONTINENTS
1. Wegner suggested that the movement responsible for the drifting of the continents was caused by

A. POLAR FLEEING FORCE B. TIDAL FORCE

Possible driving forces for plate tectonics:

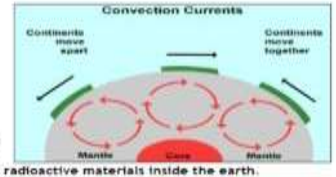
2. bottom lithosphere tractions by convection currents.
3. trench pull (covered earlier).
4. ridge push (sliding off a high, crust in compression).
5. trench suck (rollback).
6. global expanding or contracting forces.
7. membrane forces on spinning ellipsoid (e.g. variants of polar fleeing forces).



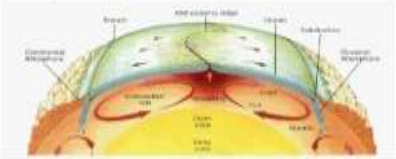
TIDAL FORCE

Wegener suggested that these two forces are responsible for the movement of plates.

Most of the scholars consider that these forces are not sufficient to move the plates.



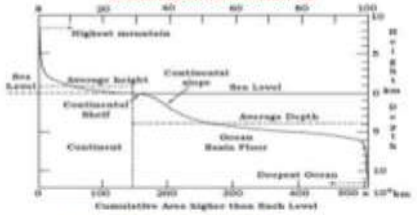

POST DRIFT STUDIES
Information collected from the ocean mapping is more useful to study the continental drift
Convectional current theory
It was proposed by ARTHUR HOLMES IN 1930
Due to difference in the temperature currents are formed due to disintegration of radioactive materials inside the earth.
These currents are found entire mantle portion



## MAPPING OCEAN FLOOR

1. Existence of ridges and deep trenches nearby continental margins
2. Mid oceanic ridge is the most active for volcanic eruptions
3. The ocean floor is much younger than the continents
4. Rocks of equal distance of the ridge have similar chemical composition and age

### OCEAN FLOOR CONFIGURATION



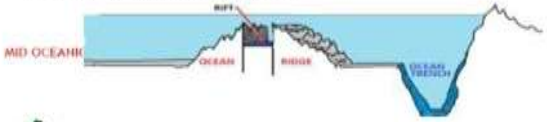

### OCEAN FLOOR CONFIGURATION

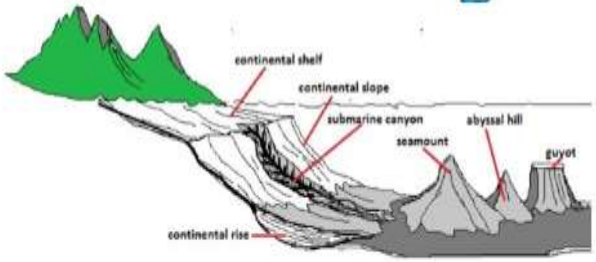
The ocean floor is segmented into three major divisions
Based on depth and configuration

1. **Continental margins**
   - **a.Form transitional zone between continental shore and deep sea basins**
   - **b.They include continental slope , shelf, continental rise and deep oceanic trenches**

ABYSSAL PLAINS

1. EXTENSIVE PLAINS
2. FOUND BETWEEN CONTINENTAL MARIGN AND MID OCEANIC RIDGE
3. CONTINENTAL SEDIMENTS GET DEPOSITED






### DISTRIBUTION OF VOLCANOES AND EARTHQUAKES

1.all volcanoes and earthquakes are paralle to the coast
2.this line also coinsides with mid- atalantic ridge
3.alpine hymalayan system
4.around the pacific ocean it is called **ring of fire**

Mid oceanic ridges

1. Interconnected mountain system within the ocean
2. Longest mountain chain in the ocean floor
3. Consist of central rift system at the crust
4. Intense volcanic activity is found

### CONCEPT OF SEA FLOOR SPREADING

1.It was proposed by Hess in 1961
2.he believed that new lava pushes out the plates from the mid oceanic ridge
3.palaeo magnetic studies of the ocean floor reveals that
A.along the mid oceanic ridge there is intense volcanic eruption
B.huge amount of lava comes out along the mid atlantic ridges
C.the equidistant rock formations have similar age and chemical compositions & magnetic properties
7.rocks closer to the mid oceanic ridges are young and normal polarity
8. The age of rocks increases as the distance increases from the mid oceanic ridge
9. Oceanic crust is much younger( 200my) than continental crust (1200my)
10. The sediments of ocean floor is very thin
11.earth quakes are common along the deep sea trenches
Positions of continents through geological past

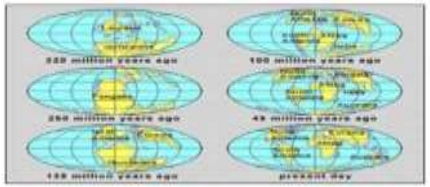
### PLATE TECTONICS

1. **The theory of plate tectonics was introduced by McKenzie, parker and Morgan in 1967**
2. **A tectonic plate is also called as lithosphere plate**
3. **It is a massive irregularly shaped slab of solid rock**
4. **Consists of oceanic and continental sphere**
5. **Plates move horizontally over the Asthenosphere**
6. **Average thickness is 100 km of oceanic part and 200 km continental part**
7. **It may be oceanic or continental**
8. **Pacific plate is largest oceanic plate where as Eurasian plate is the largest continental plate**

**MAJOR PLATES OF THE EARTH CRUST**

**MAJOR PLATES**

## MAJOR PLATES




1.Antarctica And Surrounding Oceanic Plate 2. North American Plate
3. South American Plate Pacific Plate
India-Australia-New Zealand PLATE
6.African Plate Eurasian Plate


## MINOR PLATES

1. Cocos
Plate 2. Nazca Plate 3. Arabian Plate 4. Philippine Plate 5. Caroline Plate 6 .Fuji Plate

These plates are moving constantly throughout geological time not the continent believed by Wegener
Pangaea was the convergent of all the plates
Position of Indian subcontinent is traced with the help of rocks analyzed from Nagpur area

## TYPES OF PLATE BOUNDARIES

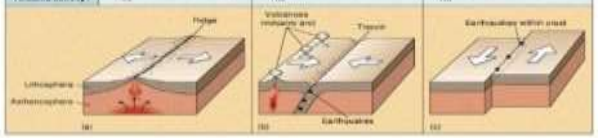
### I. DIVERGENT BOUNDARIES

1. New crust is generated 2. plates move away from each other
2. These are called spreading sites 3. Ex. Mid Atlantic ridge

### II.CONVERGENT BOUNDARY

1. Crust is destroyed 2. sinking of plate is called 'subduction zone'
3. There are three ways in which subduction occurs
   I. Ocean and continent II. Ocean and ocean III. continent and continent plates

| Type of Margin | Divergent | Convergent | Transform |
|---|---|---|---|
| Motion | Spreading | Subduction | Lateral sliding |
| Effect | Constructive (Oceanic lithosphere created) | Destructive (Oceanic lithosphere destroyed) | Conservative (lithosphere neither created or destroyed) |
| Topography | Ridge/Rift | Trench | No major effect |
| Volcanic activity? | Yes | Yes | No |






## III TRANSFORM BOUNDARIES

1. Crust is neither produced nor destroyed
2. Plates slide horizontally
3. Perpendicular to the mid oceanic ridges
4. Differential movement of a plate at the same time
5. Rotation of the earth has its effect on this movement

## RATES OF PLATE MOVEMENT

1. The strips of normal and reverse magnetic field helped the scientists to study the rate of plate movement
2. Arctic ridge has the slowest rate less than 2.5 cm /year east pacific rise has more than
3. 15 cm/year

## FORCES OF THE PLATE MOVEMENT

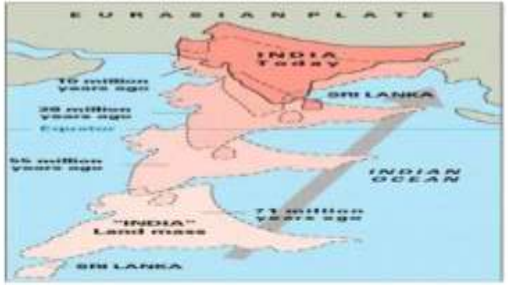
1. Surface of the earth is dynamic
2. Interior is always mobile
3. Beneath the lithosphere there is always movement of magma horizontally
4. Heated material rises to the top and cooled material sinks down
5. This cycle is repeated over the time and form convection cells

## SOURCES OF HEAT

A. Residual heat b. Radioactive decay
6. It was first considered by Arthur Holmes in 1930
7. Later it also influenced Harry Hess

## MOVEMENT OF INDIAN PLATE

1. Indian plate includes India and Australia
2. Northern boundary is along the Himalayas
3. It is the place of continental convergence
4. In the east it extends up to Rakinyoma mountains of Myanmar
5. Eastern margin is spreading site
6. Western margin extends along Kirthar mountains, Makran coast red sea rift .
7. The boundary between India and Antarctica is called divergent boundary
8. Till 225 m y a India was separated by Tethys sea
9. About 200 m y a India started its journey towards north
10. India collided with Asia about 40-50 m y a and caused the upliftment of Himalayas
11. About 140 m y a the position of Indian plate is at 50°s latitude
12. During the movement of Indian plate two events occurred in India
13. A. out pouring of lava and formation of Deccan plateau
    B. Subsidence of west coast
    14. The Himalayas started rising about 40 m y a




STAGES OF MOVEMENT OF INDIAN PLATE TO WARDS ASIAN PLATE AT DIFFERENT AGES

**II. TOPICS –**

**Each topic has been converted into a concept map. It is a visual organization and representation of knowledge.**

**There are 10 concepts maps in all.**

**III. FURTHER REFERENCE –**

**Kindly watch the following videos for a better understanding.**

https://youtu.be/ZymhmV-X-T4

https://youtu.be/KFkzjILgRQI

https://youtu.be/sXtmvKYYTwU

https://youtu.be/ZiI6IrS4nes

**Q.1 What are Bodywaves ?**

**Q.2 Name the Direct source of information about the Interior of the Earth .**

**Q.3 Why do earthquake wave develop shadow zone?**

**Q.4 What do you understand by Intrusive forms?**

**Q.5 Explain the distribution of earthquake & volcanic plate on the Earth .**

**Q.6 What are the evidence in the support of Continental drift theory?**

**Q.7 What are Mid Oceanic ridges?**

**Q.8 Bring about the basic difference between the drift theory & plate tectonic .**

**Dear Students**
**Welcome to the New Academic session 2020-21**

**Before you go through this e-lesson,ensure that you have read the lesson. Mark the technical words ,Find out their meaning and note them in your register. The Various You tube links provide in the lesson will help in comprehending the concepts & make it easier for you .**

**Happy learning**

UNIT III LAND FORMS

# CHAPTER-5 MINERALS AND ROCKS

This unit deals with

Minerals, elem ents, characteristics of minerals such as crystal form cleavage, fracture,lustre, colour,streak, transparency ,structure, hardness specific grvity, important minerals such as feldspar,quartz,pyroxene,amphibole,mica,olivine and their characteristics classificationof minerals, rocks,igneous,sedimentary ,metamorphic rocks rock cycle

**Minerals found in the crust are in solid form where as in intrior they are in liquid form98% of the crust consist of eight elements**

**1.oxygen 2. Silicon 3. Aluminium 4. Iron. 5. Calcium 6. Sodium 7. Potassium 8. Magnes**

**the rest is constituted by titanium, hydrogen, phosphorous, manganese, sulphur carbon, nickel & other elements**

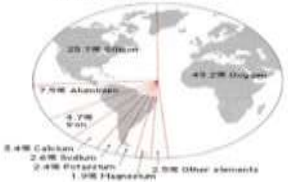



**Table 5.1 : The Major Elements of the Earth's Crust**

| Sl. No. | Elements | By Weight(%) |
|---|---|---|
| 1. | Oxygen | 46.60 |
| 2. | Silicon | 27.72 |
| 3. | Aluminium | 8.13 |
| 4. | Iron | 5.00 |
| 5. | Calcium | 3.63 |
| 6. | Sodium | 2.83 |
| 7. | Potassium | 2.59 |
| 8. | Magnesium | 2.09 |
| 9. | Others | 1.41 |

Many elements found in combination with other elements. These substances are called minerals

Mineral: naturally occuring inorganic substance having an orderly atomic structure and a definite chemical composition and physical properties.

It is composed of two or three minerals /single element ex. S,Cu, Ag,Au, Graphite.

There are at least 2000 minerals in the crust. There are at least six mineral groups which form rocks in the crust.

The basic source of all minerals is the hot magma in the interior of the earth. Coal, petroleum and natural gas are organic minerals

## PHYSICAL CHARACTERISTICS OF MINERALS

(I) EXTERNAL CRYSTAL FORM:Internal arrangement of molecules-cube, octahedrom,hexagonal, prisms.

Figure 8 CUBE

Figure 9 HEXAGONAL

Figure OCTAHEDRONS

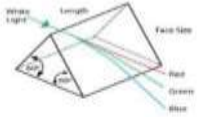



Figure 7 PRISM

(II) CLEAVAGE:




Tendency to break in given direcations producing relatively plane surfaces, it may any direction

**FRACTURE: Conchoidal fracture**

Obsidian

**Conchoidal fracture** is a curved breakage that resembles the concentric ripples of a mussel shell. It often occurs in amorphous or fine-grained minerals such as flint, opal or obsidian, but may also occur in crystalline minerals such as quartz. **Sub conchoidal fracture** is similar to conchoidal fracture, but not as curved. (Note that obsidian is an igneous rock, not a mineral, but it does illustrate conchoidal fracture well.)

**Earthy fracture**

Limonite

**Earthy fracture** is reminiscent of freshly broken soil. It is frequently seen in relatively soft, loosely bound minerals, such as limonite, kaolinite and aluminite.

**Hackly fracture**

Native copper

**Hackly fracture** (also known as **jagged fracture**) is jagged, sharp and uneven. It occurs when metals are torn, and so is often encountered in native metals such as copper and silver.

**Splintery fracture**

Chrysotile

**Splintery fracture** comprises sharp elongated points. It is particularly seen in fibrous minerals such as chrysotile, but may also occur in non-fibrous minerals such as kyanite.

**Uneven fracture**

Magnetite

**Uneven fracture** is self descriptive. It occurs in a wide range of minerals including arsenopyrite, pyrite and magnetite.The crystal breaks inan irregular manner not along the planes

LUSTURE : **Adamantine lustre**

Cut diamonds

**Adamantine** minerals possess a superlative lustre, which is most notably seen in diamond.[1] Such minerals are transparent or translucent, and have a high refractive index (of 1.9 or more).[2] Minerals with a true adamantine lustre are uncommon, with examples being cerussite and zircon.[3]

Minerals with a lesser (but still relatively high) degree of luster are referred to as **subadamantine**, with some examples being garnet and corundum

**Dull lustre**

Kaolinite

**Dull** (or **earthy**) minerals exhibit little to no luster, due to coarse granulations which scatter light in all directions, approximating a Lambertian reflector. An example is kaolinite.[4] A distinction is sometimes drawn between dull minerals and earthy minerals,[5] with the latter being coarser, and having even less lustre.

**Greasy lustre**

Moss opal

**Greasy** minerals resemble fat or grease. A greasy lustre often occurs in minerals containing a great abundance of microscopic inclusions, with examples including opal and cordierite.[1] Many minerals with a greasy lustre also feel greasy to the touch.[2]

**Metallic lustre**

Pyrite

**Metallic** (or **splendant**) minerals have the lustre of polished metal, and with ideal surfaces will work as a reflective surface. Examples include galena,[1] pyrite[2] and magnetite.[3]

**Pearly lustre**

Muscovite

**Pearly** minerals consist of thin transparent co-planar sheets. Light reflecting from these layers give them a lustre reminiscent of pearls.[1] Such minerals possess perfect cleavage, with examples including muscovite and stibite.[2]



**Resinous lustre**

Amber

**Resinous** minerals have the appearance of resin, chewing gum or (smooth surfaced) plastic. A principal example is amber, which is a form of fossilized resin.[1][2]

**Silky lustre**

Satin spar variety of gypsum

**Silky** minerals have a parallel arrangement of extremely fine fibres,[1] giving them a lustre reminiscent of silk. Examples include asbestos, ulexite and the satin spar variety of gypsum. A **fibrous** lustre is similar, but has a coarser texture.

**Submetallic lustre**

Sphalerite**Submetallic** minerals have similar lustre to metal, but are duller and less reflective. A submetallic lustre often occurs in near-opaque minerals with very high refractive indices,[1] such as sphalerite, cinnabar and cuprite.

**Vitreous lustre**

Quartz

**Vitreous** minerals have the lustre of glass. (The term is derived from the Latin for glass, *vitrum*.) This type of lustre is one of the most commonly seen,[1] and occurs in transparent or translucent minerals with relatively low refractive indices.[2] Common examples include calcite, quartz, topaz, beryl, tourmaline and fluorite, among others.

**Waxy lustre**

Jade

**Waxy** minerals have a lustre resembling wax. Examples include jade[7] and chalcedony.[10]

**Optical phenomena**

**Asterism**

Sapphire cabochon

**Asterism** is the display of a star-shaped luminous area. It is seen in some sapphires and rubies, where it is caused by impurities of rutile.[1][2][3] It can also occur in garnet, diopside and spinel.

**Aventurescence**

Aventurine **Aventurescence** (or **aventurization**) is a reflectance effect like that of glitter. It arises from minute, preferentially oriented mineral platelets within the material. These platelets are so numerous that they also influence the material's body colour. In aventurine quartz, chrome-bearing fuchsite makes for a green stone and various iron oxides make for a red stone.[10]

**Chatoyancy**

Tiger's eye

**Chatoyant** minerals display luminous bands, which appear to move as the specimen is rotated. Such minerals are composed of parallel fibers (or contain fibrous voids or inclusions), which reflect light into a direction perpendicular to their orientation, thus forming narrow bands of light. The most famous examples are tiger's eye and cymophane, but the effect may also occur in other minerals such as aquamarine, moonstone and tourmaline.



**Colour change**

Alexandrite

**Color change** is most commonly found in Alexandrite, a variety of chrysoberyl gemstones. Other gems also occur in color-change varieties, including (but not limited to) sapphire, garnet, spinel. Alexandrite displays a color change dependent upon light, along with strong pleochroism. The gem results from small scale replacement of aluminum by chromium oxide, which is responsible for alexandrite's characteristic green to red color change. Alexandrite from the Ural Mountains in Russia is green by daylight and red by incandescent light. Other varieties of alexandrite may be yellowish or pink in daylight and a columbine or raspberry red by incandescent light. The optimum or "ideal" color change would be fine emerald green to fine purplish red, but this is exceedingly rare.

**Schiller**Labradorite

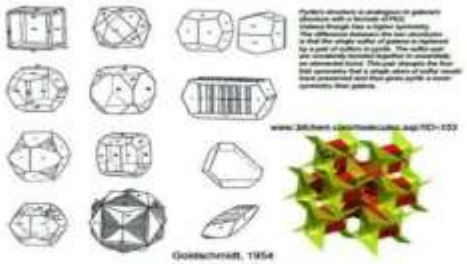
**Schiller**, from German for "twinkle", is a term used to describe the metallic iridescence originating from below the surface of a stone, that occurs when light is reflected between layers of minerals. It is seen in moonstone and labradorite and is very similar to adularescence and aventurescence.[10]

appearance of material without regard to clolour-metallic silky glossy

COLOUR :some colours determined by molecular structure ex.malachite, azurite, chalcopyrite some because of impurities found the crystal.
STREAK : colour of the ground powder of any mineral Ex. Malachit -green, fluorite - purple/white

TRANSPARENCY: Transparency **Definition:** Transparency refers to the degree to which light can pass through a mineral.
**Terminology**: *Opaque* - no light can pass through the mineral;
*Translucent* - light can pass through the mineral but is diffused so that images cannot be seen clearly;
*Transparent*- light can pass through the mineral and images can be seen clearly.

1. Transparency -light rays pass through 2.translucent-light pass through but diffused 3.opaque-light doesnot pass through.




Magnetite
(III) STRUCTURE :particular arrangement of the individual crystals - fine medium,or coarse, coarse grained fibrous, separable divergent rdiating

HARDNESS: as corundum. The table below shows comparison with absolute hardness measured by a sclerometer, with pictorial examples.[(III)]

| Mohs hardness | Mineral | Chemical formula | Absolute hardness | Image |
|---|---|---|---|---|
| 1 | Talc | $Mg_3Si_4O_{10}(OH)_2$ | 1 |  |
| 2 | Gypsum | $CaSO_4 \cdot 2H_2O$ | 3 |  |
| 3 | Calcite | $CaCO_3$ | 9 |  |
| 4 | Fluorite | $CaF_2$ | 21 |  |
| 5 | Apatite | $Ca_5(PO_4)_3(OH^-,Cl^-,F^-)$ | 48 |  |



| Mohs hardness | Mineral | Chemical formula | Absolute hardness | Image |
|---|---|---|---|---|
| 6 | Orthoclase Feldspar | $KAlSi_3O_8$ | 72 |  |
| 7 | Quartz | $SiO_2$ | 100 |  |
| 8 | Topaz | $Al_2SiO_4(OH^-,F^-)_2$ | 200 |  |
| 9 | Corundum | $Al_2O_3$ | 400 |  |
| 10 | Diamond | C | 1600 |  |

(IV) Relative resistance being scratched ten minerals are selected to measure the degree of hardness from 1to 10

1. Talc 2.gypsum 3.calcite 4.fluorite 5.apatite 6.feldspar 7.quartz 8.topaz 9.corundum 10.diamond. ex.fingre nail has 2.5 hardness knife has 5.5 hardness

(V) SPECIFIC GRAVITY :The ratio between the weight of a given object and the weight of an equal volume of water ; object weighed in air and then weighed in water and divide weight in air by the difference of th elwo weights.

IMPORTANT MINERALS OF THE EARTH CRUST

FELDSPAR: Silicon & Oxygen Are Common Elements ,Sodium, Potassium Calcium Aluminium Are Found In Specific Variety. ½ The Earth Crust Consists Of Feldspar.Light Cream To Salmon Pink Colour Used In Ceramics And Glass Making.

QUARTZ:important component of sand granite.consists of silica, hard mineral, insoluble in water it is white ore coloruless used INRADO OR RADOR

YROXENE :consists of calcium aluminum magnesium iron silica, it forms 10% of earth crust, found in meteorites,green or black in colour

OLIVINE:Magnesium,Iron, Silica are major elements,used in jewellary, greenish crystal, found inbasaltic rocdk

AMPHIBOLE:
major elements.
, used in asbestos

**aluminium, calcium silica, iron magnesium are They form 7% of earth crust, green or black colour industry, hornblende is a;nother formof amphibole**

MICA:consists of potassium, aluminium, magnesium iron silica . Form 4%

Of the earth crust. Found in basaltic rock

IGNEOUS ROCKS: 1. They are primary rocks 2.formed due to cooling of lava 3. They are two types intrusive & extrusive rocks

Extrusive rocks have small grains because of sudden cooling Intrusive rocks have bigger grains due to slow cooling4.they are hard 5. Do not contain fossils 6. Do not allow water to percolate through them 7. No layers

SEDIMENTARY ROCKS:1. Formed Due To Sedimentation 2. Consists Of Layers 3. Contain Fossils 4.The Process Of Sedimentary Rock Formation Is Called Lithification 5. They Are Three Types . A. Mechanically Formed B.Chemically Formed 3. Organically Formed.

METAMORPHIC ROCKS: 1.Formed Due To Recrystalization 2.Formed Due To Pressure And Temperature 3. Very Smooth

4. Consists of layers sime times very precelous stones

**Type of rock**

Igneous rock Sedimentary rockMetamorphic rock



Granite Sandstone Slate

CLASSIFICATIONOF MINERALS

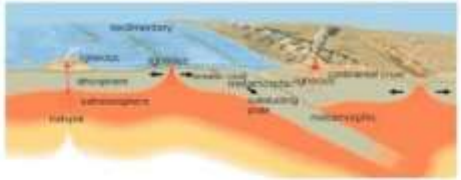
METALLIC MINERALS — NON METALLIC MINERALS

FERROUS — NON FERROUS — PRECIOUS — ORGANIC — INORGANIC

IRON — COPPER — GOLD — COAL — SULPHAR ROCKS

Rocks are aggregate of one or more minerals,they may be hard or soft in varied colours, they do not have definite chemical compositon.

Petrology is the science of rocks. Petrologist who studies the scientific methods of rocks.



ROCK CYCLE

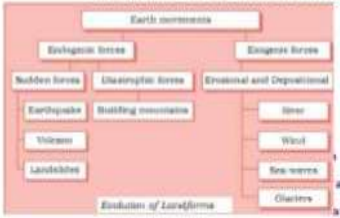
A diagram of the rock cycle. Legend: 1 = magma; 2 = crystallization (freezing of rock); 3 = igneous rocks; 4 = erosion; 5 = sedimentation; 6 = sediments/sedimentary rocks; 7 = tectonic burial and metamorphism; 8 = metamorphic rocks; 9 = melting.

Rock cycle is a continuous process through which old rocks are converted into new rocks. Igneous rocks are changed into metamorphicor sedimentary rocks. Metamorphic rocks afurther change into magma

# CHAPTER -6 GEOMORPHIC PROCESSES

This chapter deals with Geomorphic process,exogenic,endogenic processes,diastrophism,volcanism,weathering,types of weathering mechnical(unloading ,expansion,temperature change expansion freezing thawing frost wedging salt weathering ), chemical (solution, carnonation,hydration oxidation and reduction),biological (plants, animals man).biological activity and weathering, special effects of weathering, significance of weathering, mass movement,slow movement, rapid movementland slide, erosion , deposition, soilformition, process of soil formation soil forming factors, parent material, topography, climate, biological activity, time.

1. Why earth is uneven?
   Due to internal and external forces earth is changing its surface conditions.
   The earth crust is always dynamic
   It moves vertically and horizontally
   The differences in the internal forces making the surface uneven Wearing down of relief features Is called gradation.
   The endogenic forces always elevate parrts of the earth's surface and hence the exogenic processes fail to even out the relief variations of the surface of the earth.
   Variations remain as long as there is difference between endogenic and exogenic forces.
   The surface of the earth is sensitive. Human being is using the surface intensively and extensively.
   GEOMORPHIC PROCESSES
   The endogenic and exogenic forces cause physical stress and chemical actions on the earth material and bring the changes in the configuration of the earth surface is called
   GEOMORPHIC PROCESSES
   **Diastrophism and volcanism are endogenic processes**




**Weathering, Masswasting,Erosion & Deposition Are Exogenic Processes**
**Any Exogenic Element Of Nature Capable Of Acquiring And Transporting Earth Materials Can Be Called A Geomorphic Agent.**
**They Become Mobile When There Is Gradient**
**The Erosional Agents Are**
**1.Running Water ,2. Moving Ice, 3.Wind, 4.Underground Water ,5.Waves**
A process is a force applied on earth materials affecting the same
agent is a mobile medium which removes transports and deposits earth materials.
avity also causes directional forces activating downslope movements of matter
aves and tides are inderect movements of the earth caused by gravitation
With out gravity and gradient there is no mobility for erosional agents as a result there is no erosion transportation, and deposition on the earth surface.
All the movements on/in the earth are due to gravitation and gradient.from higher level to lower level and high pressure to low pressure areas
**ENDOGENIC PROCESS: the energy generating from with in the earth is the main force behind the endogenic geomorphic processes.**

**The energy genarated due to**
**1. Radioactivity 2.Rotational Force 3.Tidal Friction 4.Primordial Heat From The Origin Of The Earth.**
**Diastrophism And Volvanism Are Due To Geothermal Grdients And Heat Flow From Within The Earth.**
**Crustal Thickness,Strength, Action Of Endogenic Forces Are Due To Variations In Geothermal Gradients And Heat Flow Are Uneven.**
**DIASTROPHISM : All process that move elevate or duild up portions of the erth's crust come under DIASTROPHISM**
**THEY ARE TWO TYPES**



**1.OROGENIC PROCESSES : mountain building through folding**
**2.EPEROGENIC PROCESS: uplifting large part of earth crust**
**3.EARTH QUAKES**
**4.PLATE TECTONICS: involve horizontal movements**

**DIFFERENCE BETWEEN OROGENY AND EPEROGENY**

| OROGENY | EPEROGENY |
|---|---|
| Crust is severely damaged | simple deformation |
| Mountain building process | continental formation |
| Folding and faulting | upliftment of landmass |
| Cause tension and compression | vertical force |

VOLCANISM: Movement of molten rock towards the earth's surface and also formation of many intrusive and extrusive volcanic forms.
Volcanism: It is the process in which volcanoes takes place
Volcanoes are the land forms formed due to volcanic process
EXOGENIC PROCESSES: They derive their energy from atmosphere determined by the prime source The sun and also gradients created by the tectonic factors.
Gravitational force create gradient towards down slope direction.
Force applied per unit area is called
STRESS. Stress can be produced in a said body pushing or pulling
This includes deformation. Forces acting along the faces of earth materials are shear stresses .(seperating forces). It is this stress that breaks rocks and other earth materials.the shear stress result in angular displacement/slippage. Besides gravitational stress there is molecular stress which is caused by temperature change, crustallisation and melting ,chemical processes normally lead to loosening of bonds between grains , dissolving of soluble minerals or cementing materials.
The basic reason for weathering, mass movement erosion and deposition is the development of stress in the earth materials.
Since there are different climatic regions there is variation in the exogenic process from region to region. Temperature and precipitation are the two major elements that control various processes.
All the exogenic process are covered under general term DENUDATION.
The word denude means uncover. Weathering , masswasting erosion and transportation are included in denudation.

DENUDATIONAL PROCESSES AND THEIR Driving Forces

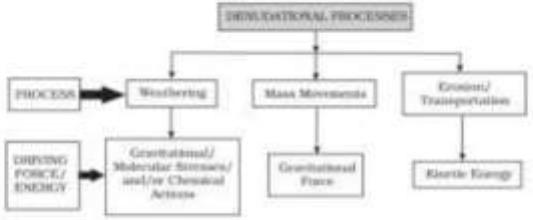



**Figure 6.1 : Denudational processes and their driving forces**

This Chart We Observe That For Each Process There Is Driving Force Called Energy On The Earth Surface Thermal Gradient Is Caused By

1. Latitude 2.Seasons 3.Land And Water Distribution 4. Angle Of Earh's Inclination

The Densityof Natural Vegetation Is Greatly Influenced By The Temperature And Precipitation Helps Indirectly The Exogenic Processes.

THE OTHER FACTORS OF CLIMATIC VARIATIONS ARE1.Altitude 2. Angle Of Slope 3. Ocean Currents 4.Amount Of Insolation Received By The Region 5. Wind Velocity And Direction 6. Direcion Of The Slope 7. Amount And Kind Of Precipitation 8.Relation Between Precipitaion And Evaportion 9. Daily Rang Of Temperature 10.Freezing And Thawing Frequency 11. Depth Of Frost Penetration

The Sole Driving Force Behind All The Exogenic Process Is The Sun

When Climatic Factors Are Common The Intensity Of Action Depend On Type And Structure Of Rocks

STRUCTURE INCLUDES folds,faults, orientation inclination of beds, presence or absence of joints ,bedding planes hareness, softness of constituent minerals, chemical susceptibility of mineral constituents , the permeability or impermeability.

Different types of rocks offer varying resistances to various geomorphic processes .

Particular rock may be resistant to one process and non resistant to other process

As a result there is varied relief over the earth surface

The effects of exogenic forces may be small and slow but inlong run they have greater effects

Finally the surface of the earth is operated by different geomorphic processes and at varying rates

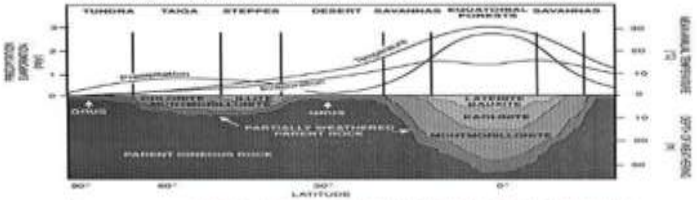
WEATHERING: It is the action of elements of weather on earth materials

Weathering is defined as mechanical disintegration and chemical deconposition of rocks through the actions of various element so fweather and climate

In weathering there is no motion of materials takes place so it si in-situ or on site process

FACTORS INFLUENCING THE WEATHERINGS DEPTH OF WEATHERING

1.GEOLOGICAL STRUCTURE 2.CLIMATE 3.TOPOGRAPHY 4. NATURAL VEGETATION




(I) CHEMICAL (II) PHYSICAL/MECHANICAL (III)BIOLOGICAL WEATHERING

CHEMICAL WEATHERING PROCESSES

Agroup of weathering processes viz; solution , carnonation, hydration , oxidation and reduction asc on the roks to decompose, dissolve orreduce them to a fine clastic state through chemical reactions by oxygen ,surface /soil water and other acids. Water and air along with heat must be present to speed up all chemical reactions.

Over and above the carbon dioxide present in the air, decomposition of plants and animals increases the quanitity of carbon dioxide underground . these chemical reactions on various minerals are very much reactions on various minerals are very much similar to the chemical reactions in a laberatory.



SOLUTION: the water /acid with dissolved content is called solution. This process involves removal of solids in solution and depends upon solubility of amineral in water or weak acids.when water reacts with any solid many solids may become solution. Ex. Sulphates, nitrates, potassium .

When rain comes these solids dissolve into solution with out leaving any residue.

Calcium carbonate , magnesium bicorbanate present in the lime stone are dissolved in and form carbonic acid,$CO^2$ produced by decaying organic matter along with soil water greatly aids inthis reaction . Common salt is also suceptible to this process.

CARBONATION: It is the reaction of carbonate and bicarbonate with minerals such as feldspar, & carboinate minerals $CO^2$ from atmosphere and soil air is absorbed by water to form carbonic acid.Ca$CO^3$& Mg$CO^3$are dissolved in carbonic acid and washed away to form the caves in lime stone region.

Clay minerals are easily eroded due to the presence of minerals which can exchange the ions with the water .

HYDRATION: it is the chemical addition of water , minerals take up water and expand , this expansion increases the volume of material.ex. calcium sulphate takes water and convert into gypsum.it is unstabel than calcium sulphate.it is reversible reaction and when this process continuous for longer time the materials diintegrates.

Many clayminerals swell and contract during wetting and drying and a repetition of this process results in cracking of overlying materials.salts inpore spaces undergo rapid and repeated hydration and help in physical weathering through exfoliation and granular disintegration

OXIDATION AND REDUCTION

Oxidation means combination of minerals with oxygen to form oxides and hydroxides.

Oxidation occurs when there is sufficient water and atmosphere. EX. Iron, manganes, sulphur, In the process of oxidation breakdown occurs due the addition of oxygen.red colour of iron becomes into yellow colour.when oxidised minerals re kept in the places where there is no oxygen reduction takes place.ex. such conditions occurs below water table waterlogged areas. Red colour of iron becomes greenish or bluish grey.

PHYSICAL WEATHERING PROCESSES

Factors Influencing The Physical Weathering

1.Gravitational Force Overburden Pressure, Load And Shearing Stress

2. Expansion Forces Due To Temperature Changes, Crystal Growth Or Animal Activity

3.Water Pressures Controlled By Wetting And Drying Cycles.

They are mostly due to thermal expansion, and pressure release. The repeated action of these processes cause damage to the rocks

UNLOADING AND EXPANSION: Removal of overlying rock load because of continued erosion causes vertical pressure release with the result that the upper layers of the rock expand producing disintegration of rock masses.fractures will develop parallel to the ground surface. In areas of curved ground surface aarched fracaatures tend to produce massivce sheets or exfoliation slabs of rock.exfoliation sheets resultinf from expansion due to unloadinf and pressure release my measure hundreds or even thousands of metres in horizontal extent.large smooth rounded domes called exfoliation domes result due to this process

TEMPERATURE CHANGES AND EXPANSION: Various minerals found in the rocks expand at different rates when temperature increases. Each one pushes others. When temperature falls contraction takes place.because of diurnal changes in temperature the effects is mostly on superficial layers of the rocks.the effects of this process is significant in hot deserts and cold deserts.though it is small the continuous process for longer time and larger area the effect is greater. The effect is greater at the depth of the rocks.fractures occurs parallel to the surface.due continuous expansion and contraction the rock layers become lose and exfoliation takes place.a large dome shaped structures are formed due to this process. Tores which are large boulders also form due this process.exfoliated domes are big insize where as exfoliated tores are varied sizes.

FREEZING THAWING AND FROST WEDGING:due to repeated freezing and melting frost weathering occurs in the pores and cracks of rocks.it is most effective in higher elevations of the midlatitudes.

Glacial areas are suhjected to frost wedging daily . In this process the rate of freezing is more important. Rapid freezing causes sudden expansion an dhigh pressure. Finally this process makes the rock to break into pieces

SALT WEATHERING; salts in the rocks expand due to thermal action hydration and crystallisation.ex. Calcium sodium magnesium potassium and barium .high temperature between 30°C to 50°C of surface temperature indesertrs favour such salt expansion.

Salt crystals in near surface poresceause splitting of individual grains within rocks,.which eventually fall off. This process of falling off of individual grains may result in granuair disingetrationor granular foliation.

Salt crystallisationis most effective of all salt weathering processes, in areas with alternating wetting and drying conditions salt crystal growth is favoured and the neighbouring grains are pushed aside.sodium chloride and gypsum crystals in desert areas heave up overlying layers of materials and with the result polygonal cracks develop all over the heaved surface. With swalt crystal growth, chalk breaks down most readily followed byLimstone ,Sandstone ,Chalk ,Gneiss And Granite .

BIOLOGICAL WEATHERING: Removal or contribution of ions to the environment due to biological activity is called biological weathering.burrowing and wedging by organism like earthworks tremites, rodents help in exposing the new surfaces to chemical attack and assists in the pentration of moinsture and air..

SOME SPECIAL EFFECTS OF WEATHERING: Exfoliation is a is a result but not a process . Removal of layers from curved surfaces result into rounded surfaces.it occurs due to expansion and contraction dnduced by temperature changes.exfoliation domes occur due to unloading where as tors occurs due to thermal expansion .

SIGNIFICANCE OF WEATHERING:Responsible for the formation of soils and erosion and deposition. biodiversity is basically depending on depth of weathering .erosion may not be significant when there is no weathering.weathering aids mass wasting , erosion and reduction of relief and changes in landforms .weathering of rocks and depostion helps in the enrichment and concentrations of certain valuable ores of iron manganaese , aluminium copper.it is an important process of soil formation.

ENRICHMENT:when rocks undergo weathering some materials are removed through chemical or physical leaching by ground water and thereby the concentrationof remaining materials increases. Without such a weathering taking place , the concentration of the same valuable material may not be sufficient and economically viable to exploit , process and refine, this is what is called enrichment.

MASS MOVEMENT: these movements transfer the mass of rock debris down the slopes under the direct influence of gravity.air water ice donot carry debris ,but debris carry them.the movements of mass may range from slow to rapid.

TYPES OF MASS MOVEMENTS:creep,flow , slide and fall; mass movements are active over weathered slopes than unweathered slopes. mass movements are aided by gravity not any erosional agent. mass movements do not come under erosion though there is shift of material.

When force is greater than resistance mass movement occurs. Ex. Weak unconsolidated material, thinly bedded rocks, faults, steeply diffing beds, vertical cliffs ,steep slopes , abundant prefiptitation and torrential rains and scarcity of vegetation.

Activating causes precede mass movements:
(i) removal of support from below to materials above through natural or artificial means

(ii)increase in gradient and height of slpes

(iii)overloading through additionof materials naturally or by artificial filling



(iv) overloading due to heavy rainfall saturation and lubrication of slope materials

(v)removel of material or load from over the original slope surfaces.

(vi) occurrence of earthquakes, explosions or macunery

(vii)excessive natural seepage

(viii)heavy draw down of water from lakes, reservoirs and rivers

(ix)indiscriminate removal of natural vegetation

CLASSIFICATION OF MASS MOVEMENTS

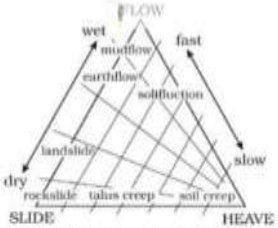
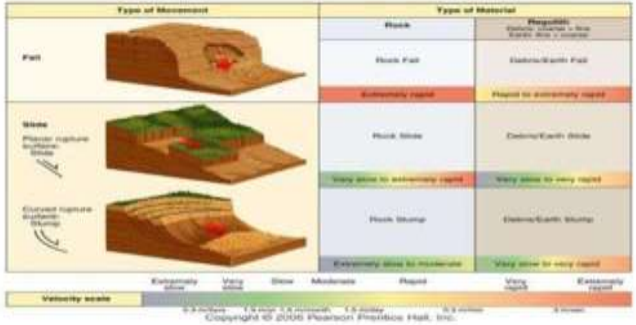



Figure 6.5 : Relationships among different types of mass movements, their relative rates of movement and moisture limits (after Whitehead, 2001)




Heave ,flow and slide are the three forms of movements the relationship is shown in the figure no.

The mass movements can be grouped into three types

1.slow movements 2. Rapid movements 3. Land slide

SLOW MOVEMENTS

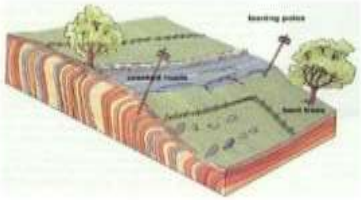

Soil creep causes distinctive curved form of tree trunks over time.

Illustration 5
Indications of Soil Creep

CREEP: It generally occurs on moderately steep, soil covered slopes.

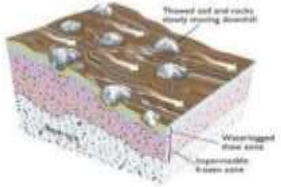
Movement of material is extremely slow. Material may be rockdebris or soil

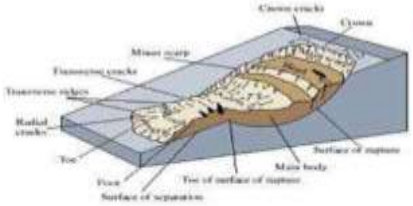
Ex. Bending of telephone pole,and fence poles.



Types of creep : soil creep, talus creep rock creep rock glacier creep

Solifluction:slow down slope flowing soil mass or fine grained rock debris saturated or lubricated with water. It is common in moist temperate areas where surface melting of deeply frozen ground and long continued rain respectively occur frequently.






MUD FLOW

RAPID MOVEMENTS

CONDITIONS: 1.humid climatic regions 2.gentle to steep slopes 3. Heavy rain 4. Loose soils



EARTH FLOW: movements of water saturated clayey or silty erth materials down low angle terraces or hillsides .

EARTHFLOW

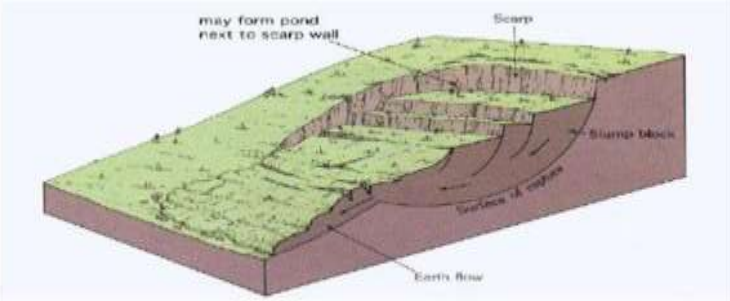
In the absence of vegetation cover and with heavy rainfall,thick layers of weathered materials get saturated with water and either slowly or rapidly flow down along definite channels.It looks like a channels of mud.when they overflow the channels they engulf the roads and rail bridges.

They generally occur due to volcanic eruptions. Volcanic ash dust and other fragments turn intomud due to heavy rains and flow down as tongues or streams ofmud causing great destruction to the human settlements.


DEBRIS AVALANCHES: Found in humid regions with or without vegetationin narrow tracks of steep slopes. It is much faster than mud flow, it is similar to snow avalanches.

LANDSLIDES: these are rapid and perceptible movements.dry materials are found the size and shape of the materials are depending on the nature of the rock,degree of weathering,steepness of slope.

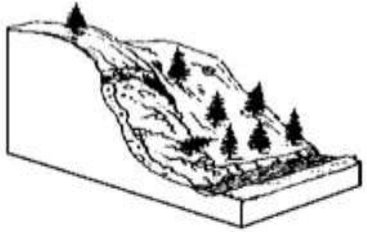
SLUMP:




slipping of one or several units of rock debris with a backward rotationwith respect to the slope over which the movement takes place

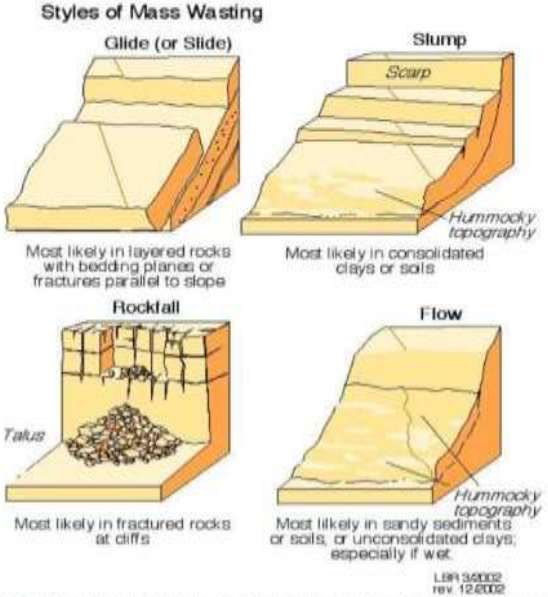
DEBRIS SLIDE:rapid rolling or sliding of earth debris without backward rotation of mass is known as debris slide.

Debris slide

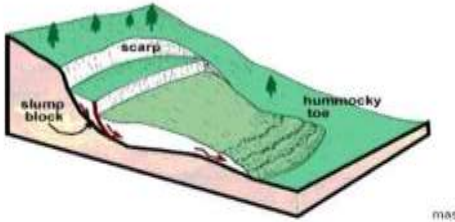


ROCK FALL






Rockslide sliding of individual rock masses down bedding joint or fault surfaces , it generally occurs at the steep slopes. Superficial layers of the rock generally fall.




mass movement

Reasons for land slides along the Himalayas

1. Tectonically active
2. Made of sedimentary rocks
3. Steep slopes
4. Heavy rains
5. Unconsolidated material is found

EROSION AND DEPOSITION

Erosion involves acquisition and transportation of rock debris

Abration by rock debris carried by geomorphic agents also aids erosion

By erosion relief degrades , the landscape is work down. Weatherin may not be pre condition for erosion.

Weathering , mass wasting, and erosion are degradational processes. It is the erosion largly responsible for continuous changes that the earth surface is undergoing.

Erosion and transportation are controlled by kinetic energy.wind running water and glaciers are controlled by climate.

Comparison of wind runing water and glacier

| wind | Running water | glacier |
|---|---|---|
| Predominent in hot deserts | Found most parts of the earth | Found only in high latitude and altitude |
| Sand dunes are common features | Valleys and deltas are common features | U shaped valleys and morians are common |
| Ex. Sahara, atacama kalahari | Amazon.Nile, Bramhaputra | Greenland, Antarctica |
| Air is gas | Water is liquid | Glacier is solid |
| Limited land forms | Extensive land forms | Limited land forms |
| High speed | Normal speed | Very slow movement |

EROSION:"application of kinetic energy associated with the agent to the surface of the land along which it moves". It is computed as KE =½ $mv^2$

M=mass V= velocity KE= kinetic energy

SOIL FORMATION: Soil is the collection natural bodies on the earth's surface containing living matter and supporting or cpable or suporting plants.

Soil is a dynamic matelal in which many chemical , biolligical , and physical activities go on constantly. It is the result of decay, it is also a medium of growth. It is changing and developing body. Characteristics are changing from season to season.

Too cold ,too hot , and dry areas biological activity stops.organic matter increases when leaves fall and decompose.

PROCESS OF SOIL FORMATION: weathering is basic process for soil formation. The weathered material is transported and decomposed due to bacteria lichens and moss. The dead remains increases the humus of the soil.minor grasses and ferns can grow. Bushes , trees also grow ,plants roots and burrowing animals help the soil formation.

PEDOLOGY:is Sceince of soil formation

PEDOLOGIST:is the scientist of soil formation



SOIL FORMING FACTORS:1. Parent material 2. Topography 3. Climate 4. Biological activity. 5.time

PARENT MATERIAL:passive control factor ,it is insitu, onsite, or transported.it depends on texture, structure, chemical compositon of the soil. Nature and depth of weathering is an important factor.chemical composition ,texture are the characteristics derived from patent material

TOPOGRAPHY:passive control factor,amount of exposer to the sun light,drainage system,steep slopes have less deposition,gentle slopes have thick soils. Plains have thick and dark coloured soils . In mid latitude southern slopes expose to the sun light and get decomposed more .

CLIMATE:it is an active factor in soil formation. Climatic elements are (i) moisture( interms of its intensity, frequency and durationof precipitation -evaporation and humidity

(II) Temperature in terms of seasonal and diurnal variation.

Precipitation increases the biological activity.

Excess of water helps to transport the dissolved particles to downward

(eluviation)

Deposition of these particles is called 'Illuviation'

Heavy rainfall removes the calcium , magnesium, sodium ,potasium along with silica.

Removal of silica is called desilication

In dry areas excess of evaporation leads to deposition of salts on the surface of the soil

These salt layers are called 'hard pans' in the hot deserts

In tropical climates, under moderate rainfall conditions calcium carbonate nodules are formed.

Biological activity :plants and animals add organic matter to the soil.also helps in moisture retention. Dead plants add humus to the soil In humid areas, the bacterial activity is higher than cold areas

As a result undecomposed material is found in cold areas

In hot areas bacteria fix the nitrogen in the soil which is used by the plants

Rhizobium is the bacteria fix the nitrogen in the soil and live in the roots of legumenace plantsants, temites,rodents, earthworms change the chemical composition of th soil.

Time: Important controlling factor of soil formatioon.Longer the time,thicker the soil layers. No time limit for the formation of the soil layers.

**II. TOPICS –**

**Each topic has been converted into a concept map. It is a visual organization and representation of knowledge.**

**There are 10 concepts maps in all.**

**III. FURTHER REFERENCE –**

**Kindly watch the following videos for a better understanding.**

https://youtu.be/NBkw-zz5P7U

https://youtu.be/TzyH37ep-PQ

https://youtu.be/k2fPa45mLbM

https://youtu.be/YQiGZJTaPgI

https://youtu.be/DjN_2U_kLSQ

**Q.1 What are Metamorphic rocks?**

**Q.2 What is an Igneous Rocks?**

**Q.3 What is meant by sedimentary rocks?**

**Q.4 What are Geomorphic Process?**

**Q.5 What is Soil erosion?**

**Q.6 Define Gradation?**

**Q.7 What do you mean by Rocks? Name the three major classes of minerals with their Physical characteristics.**

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**Happy learning**

**Fundamental of Physical Geography**

**Chapter-8 Composition and Structure of Atmosphere**

**This unit deals with :**

- Atmosphere — compositions and structure; elements of weather and climate
- Insolation — angle of incidence and distribution; heat budget of the earth — heating and cooling of the atmosphere (conduction, convection, terrestrial radiation, advection); temperature — factors controlling temperature; distribution of temperature — horizontal and vertical; inversion of temperature• Pressure — pressure belts; winds-planetary seasonal and local, air masses and fronts; tropical and extra tropical cyclones
- Precipitation — evaporation; condensation — dew, frost, fog, mist and cloud; rainfall — types and world distribution
- World climates — classification (Koeppen), greenhouse effect, global warming and climatic changes

**CHAPTER EIGHT**

What is the importance of atmosphere?

Air is essential to the survival of all organisms. Some organisms like humans may survive for some time without food and water but can't survive even a few minutes without breathing air. That shows the reason why we should understand the atmosphere in greater detail. The air is an integral part of the earth's mass and 99 per cent of the total mass of the atmosphere is confined to the height of 32 km from the earth's surface

**Define the Atmosphere**

Atmosphere is a mixture of different gases and it envelopes the earth all round. It contains life- giving gases like oxygen for humans and animals and carbon dioxide for plants.

**What is the average height of the Atmosphere?**

The air is an integral part of the earth's mass and 99 per cent of the total mass of the atmosphere is confined to the height of 32 km from the earth's surface. The air is colourless and odourless and can be felt only when it blows as wind.

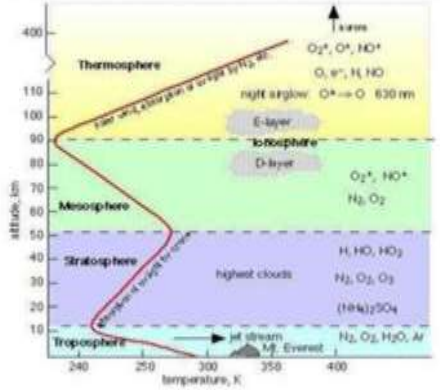
**Can you imagine what will happen to us in the absence of ozone in the atmosphere?**

In the absence of Ozone life is not possible on the earth surface. Ozone layer protects us from harmful UV rays.

**COMPOSITION OF THE ATMOSPHERE**

The atmosphere is composed of gases, water vapour and dust particles. The proportion of gases changes in the higher layers of the atmosphere in such a way that oxygen will be almost in negligible quantity at the height of 120 km. Similarly, carbon dioxide and water vapour are found only up to 90 km from the surface of the earth.

**COMPOSITION AND STRUCTURE OF ATMOSPHERE**




| Constituent | Formula | Percentage by Volume |
|---|---|---|
| Nitrogen | $N_2$ | 78.08 |
| Oxygen | $O_2$ | 20.95 |
| Argon | Ar | 0.93 |
| Carbon dioxide | $CO_2$ | 0.036 |

| | | |
|---|---|---|
| Neon | Ne | 0.002 |
| Helium | He | 0.0005 |
| Krypto | Kr | 0.001 |
| Xenon | Xe | 0.00009 |
| Hydrogen | $H_2$ | 0.00005 |

Study the above table showing the composition of the atmosphere and answer the following questions.

1. Which gas constitutes the highest % of atmosphere?
2. Name the gas which constitutes least % of atmosphere

**Gases**

Carbon dioxide is meteorologically a very important gas as it is transparent to the Incoming solar radiation but opaque to the outgoing terrestrial radiation. It is largely responsible for the green house effect.The volume of carbon dioxide has been rising in the past few decades mainly because of the burning of fossil fuels. This has increased the air temperature . Ozone is another important component of the atmosphere found between 10 and 50 km above the earth's surface. and its filter and absorbs the ultra-violet rays radiating from the sun and prevents them from reaching the surface of the earth.

**Water Vapour**

Water vapour is also a variable gas in the atmosphere. In the warm and wet tropics, it may account for four per cent of the air by volume, while in the dry and cold areas of desert and polar regions, it may be less than one per cent of the air. Water vapour also decreases from the equator towards the poles. It also absorbs parts of the insolation from the sun and preserves the earth's radiated heat.

**Dust Particles**

Dust particles are generally concentrated in the lower layers of the atmosphere; yet, convectional air currents may transport them to great heights. The higher concentration of dust particles is found in subtropical and temperate regions due to dry winds in comparison to equatorial and polar regions. Dust and salt particles act as hygroscopic nuclei around which water vapour condenses to produce clouds.

**STRUCTURE OF THE ATMOSPHERE**

1. The atmosphere consists of different layers with varying density and temperature.
2. Density is highest near the surface of the earth and decreases with increasing altitude.
3. The column of atmosphere is divided into five different layers depending upon the temperature condition.

**Name the layers of atmosphere**

**They are:** troposphere, stratosphere, mesosphere, thermosphere and exosphere.

The troposphere

1. It is the lowermost layer of the atmosphere.
2. Thickness of the troposphere is greatest at the equator because heat is transported to great heights by strong convectional currents.
3. Extends roughly to a height of 8 km near the poles and about 18 km at the equator.
4. This layer contains dust particles and water vapour.
5. All changes in climate and weather take place in this layer.
6. Its average height is 13 km
7. The temperature in this layer decreases at the rate of 1 °C for every 165 m of height.
8. The zone separating the troposphere from stratosphere is known as the tropopause.
9. This is the most important layer for all biological activity.

**The stratosphere**

1. It is found above the tropopause and extends up to a height of 50 km.
2. One important feature of the stratosphere is that it contains the ozone layer.
3. This layer absorbs ultra-violet radiation and shields life on the earth from intense, harmful form of energy.

**The mesosphere**

1. It lies above the stratosphere,
2. which extends up to a height of 80 km.
3. The upper limit of mesosphere is known as the mesopause.
4. In this layer, once again, temperature starts decreasing with the increase in altitude and Up to minus 100°C at the height of 80 km.

**The ionosphere**

1. It is located between 80 and 400 km above the mesopause.
2. It contains electrically charged particles known as ions, and hence, it is known as ionosphere.
3. Radio waves transmitted from the earth are reflected back to the earth by this layer.
4. Temperature here starts increasing with height.
5. The uppermost layer of the atmosphere above reaches up to minus 100

**Exosphere**

1. the thermosphere is known as the exosphere.
2. This is the highest layer but very little is known about it.
3. Whatever contents are there, these are extremely rarefied in this layer, and it gradually merges with the outer space.

**Elements of Weather and Climate temperature,**

The main elements of atmosphere which are subject to change and which influence human life on earth are temperature, pressure, winds, humidity, clouds and precipitation.

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https://youtu.be/yIlF8DjXH88

https://youtu.be/1qMK6V8kz14

**Q.1 Define Atmosphere .**

**Q.2 What is the importance of Atmosphere?**

**Q.3 Ozone is an Important constituent of Atmosphere . How?**

**Q.4 Name the gases found in Atmosphere .**

**Q.5 Write a short note on Dust particles & Water vapour .**

**Q.6 Explain the composition & structure of Atmosphere.**

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## UNIT -1 INTRODUCTION - INDIA

*This unit deals with*

- *Location – space relations and India's place in the world*


Facts of India

| India Facts | |
|---|---|
| Territorial Sea | 12 nm (nautical miles) |
| Contiguous Zone | 24 nm |
| Exclusive economic Zone | 200 nm |
| Continental Shelf | 200 nm or to the edge of the continental margin |
| Longest River | Ganga |
| Largest Lake | Lake Chilka |
| Highest Point | Mt. $K^2$ (8611 m) |
| Highest Point of Himalaya | Kanchan Junga (8,598 m) |
| Lowest Point | Kuttanad (-2.2 m) |
| Northernmost Point | Siachen Glacier near Karakoram |
| Southernmost Point | Indira Point, Great Nicobar, Andaman & Nicobar Islands |
| Southernmost Point of India (Mainland) | Cape Comorin (Kanya Kumari) |
| Westernmost Point | West of Ghuar Mota, Gujarat |
| Easternmost Point | Kibithu, Arunachal Pradesh |
| Highest Altitude | Kanchenjunga, Sikkim |
| Lowest Altitude | Kuttanad (Kerala) |

Mark the southernmost and northern most latitudes and the easternmost and westernmost longitudes.

The mainland of India, extends from Kashmir in the north to Kanyakumari in the south and Arunachal Pradesh in the east to Gujarat in the west.

India's territorial limit further extends towards the sea up to 12 nautical miles (about 21.9 km) from the coast.

Our southern boundary extends up to 6°45' N latitude in the Bay of Bengal.

Let us work out implications of having such a vast longitudinal and latitudinal extent.

The latitudinal and longitudinal extent of India are roughly about 30 degrees, whereas the actual distance measured from north to south extremity is 3,214 km, and that from east to west is only 2,933 km.

What is the reason for this difference?

This difference is based on the fact that the distance between two longitudes decreases towards the poles whereas the distance between two latitudes remains the same everywhere.

Find out the distance between two latitudes?



From the values of latitude, it is understood that the southern part of the country lies within the tropics and the northern part lies in the sub-tropical zone or the warm temperate zone. This location is responsible for large variations in land forms, climate, soil types and natural vegetation in the country. Now, let us observe the longitudinal extent and its implications on the Indian people. From the values of longitude, it is quite discernible that there is a variation of nearly 30 degrees, which causes a time difference of nearly two hours between the easternmost and the westernmost parts of our country. You are familiar with the concept of Indian Standard Time (IST). What is the use of the standard meridian? While the sun rises in the northeastern states about two hours earlier as compared to Jaisalmer, the watches in Dibrugarh, Imphal in the east and Jaisalmer, Bhopal or Chennai in the other parts of India show the same time.

Why does this happen?

There is a general understanding among the countries of the world to select the standard meridian in multiples of 7° 30' of longitude. That is why 82° 30' E has been selected as the 'standard meridian' of India. Indian Standard Time is ahead of Greenwich Mean Time by 5 hours and 30 minutes.

There are some countries where there are more than one standard meridian due to their vast east-to-west extent. For example, the USA has seven time zones.

Name a few places in India through which the standard meridian passes.

1. ALLAHABAD 2. KAKINADA

India with its area of 3.28 million sq. km accounts for 2.4 per cent of the world's land surface area and stands as the seventh largest country in the world. Find out the names of the countries which are larger than India.

**SIZE**

*Total area of India is 32. lakh sq. km 7th largest country with 2.4 % of total land area of the world Indian subcontinent.*

It includes the countries Pakistan, Nepal, Bhutan, Bangladesh and India.

Coastline length is 7516.5 km land frontier area is 15200 km.

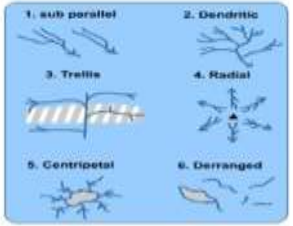
**INDIA AND ITS NEIGHBORS**

1. Pakistan 2. China 3. Nepal 4. Bhutan 5. Myanmar 6. Bangladesh 7. Sri Lanka 8 Maldivies..

Sri Lanka is separated from India by the Gulf of Mannar and Palk Strait

## CHAPTER -3 DRAINAGE SYSTEM

The flow of water through well-defined channels is known as 'drainage'
The network of such channels is called a 'drainage system'.
The drainage pattern of an area is the outcome of the geological time period, nature and structure of rocks, topography, slope, amount of water flowing and the periodicity of the flow.




**Drainage system** **Important Drainage Patterns**

(i) The drainage pattern resembling the branches of a tree is known as "dendritic" the examples of which are the rivers of northern plain.
(ii) When the rivers originate from a hill and flow in all directions, the drainage pattern is Known as 'radial'. The rivers originating from the Amarkantak range present a good example of it.
(iii) When the primary tributaries of rivers flow parallel to each other and secondary tributaries join them at right angles, the pattern is known as 'trellis'.
(iv) When the rivers discharge their waters from all directions in a lake or depression, the pattern is know as 'centripetal'.
The boundary line separating one drainage basin from the other is known as the watershed.
The catchments of large rivers are called river basins while those of small rivulets and rills are often referred to as watersheds.

There is, however, a slight difference between a river basin and a watershed. Watersheds are small in area while the basins cover larger areas.
They are accepted as the most appropriate micro, meso or macro planning regions.
Indian drainage system may be divided on various bases.
On the basis of discharge of water
(orientations to the sea), it may be grouped into:
(i) the Arabian Sea drainage; and
(ii) the Bay of Bengal drainage.
They are separated from eachother through the Delhi ridge, the Aravalis and the Sahyadris (water divide is shown by a line in Figure 3.1). river basin
77 per cent of the drainage area consisting of the Ganga, the Brahmaputra, the Mahanadi, the Krishna, etc. is oriented towards the Bay of Bengal
23 percent comprising the Indus, the Narmada, the Tapi,the Mahi and the Periyar systems discharge their waters in the Arabian Sea.
On the basis of the size of the watershed,
the drainage basins of India are grouped into three categories:
(i) Major river basins with more than 20,000 sq. km of catchment area. It includes 14 drainage basins such as the Ganga, the Brahmaputra, the Krishna, the Tapi, the Narmada, the Mahi, the Pennar, the Sabarmati, the Barak, etc.



(ii) Medium river basins with catchment area between 2,000-20,000 sq. km incorporating 44 river basins such as the Kalindi, the Periyar, the Meghna, etc.
(iii) Minor river basins with catchment area of less than 2,000 sq. km include fairly good number of rivers flowing in the area of low rainfall.
North Indian rivers are originating from Himalayas peninsular rivers are originating from Western ghats
The Narmada and Tapi are two large rivers which are exceptions originating form central highlands.
the Indian drainage may also be classified into the Himalayan drainage and the Peninsular drainage.

### THE HIMALAYAN DRAINAGE

1. The Himalayan drainage system has a long geological history.
2. the important rivers are Ganga, the Indus and the Brahmaputra rivers.
3. Since these are fed both by melting of snow and precipitation, rivers of this system are perennial.
4 .rivers form giant gorges V-shaped valleys, rapids and waterfalls in their mountainous course.
5. While entering the plains, they form depositional features like flat valleys, ox-bow lakes, flood plains.

### EVOLUTION OF THE HIMALAYAN DRAINAGE

1.Geologists believe that a mighty river called Shiwalik or Indo-Brahma traversed the entire longitudinal extent of the Himalaya from Assam to Punjab and onwards to Sind, and finally discharged into the Gulf of Sind near lower Punjab during the Miocene period some 5-24 million years ago
2. The remarkable continuity of the Shiwalik and its lacustrine origin and alluvial deposits consisting of sands, silt, clay, boulders and conglomerates support this viewpoint.
In due course of time Indo- Brahma river was dismembered into three main drainage systems:
(i) the Indus and its five tributaries in the western part;
(ii) the Ganga and its Himalayan tributaries in the central part; and
(iii) the stretch of the Brahmaputra in Assam and its Himalayan tributaries in the eastern part.
The dismemberment was probably due to the Pleistocene upheaval in the western Himalayas, including the uplift of the Potwar Plateau (Delhi Ridge), which acted as the water divide between the Indus and Ganga drainage systems.
Likewise, the down thrusting of the Malda gap area between the Rajmahal hills and the Meghalaya plateau during the mid-pleistocene period, diverted the Ganga and the Brahmaputra systems to flow Towards the Bay of Bengal.

### THE RIVER SYSTEMSOFTHEHIMALAYAN DRAINAGE

#### The Indus System

1.It is one of the largest river basins of the world, covering an area of 11,65,000 sq. km (in India it is 321, 289 sq. km and a total length of 2,880 km (in India 1,114 km).
2. The Indus also known as the Sindhu, is the westernmost of the Himalayan rivers in India.
3. It originates from a glacier near Bokhar Chu (31°15' N latitude and 81°40' E longitude) in the Tibetan region at an altitude of 4,164 m in the Kailash Mountain range.
4. In Tibet, it is known as '*Singi Khamban*; or Lion's mouth. After flowing in the northwest direction between the Ladakh and Zaskar ranges, it passes through Ladakh and Baltistan.
5.It cuts across the Ladakh range, forming a spectacular gorge near Gilgit in Jammu and Kashmir.
6. It enters into Pakistan near Chillar in the Dardistan region. Find out the area known as Dardistan.
7. tributaries such as the Shyok, the Gilgit, theZaskar, the Hunza, the Nubra, the Shigar, the Gasting and the Dras.
9. It finally emerges out ofthe hills near Attock where it receives the Kabul river on its right bank.
10.The other important tributaries joining the right bank of the Indus are the Khurram, the Tochi, the Gomal, the Viboa and the Sangar. They all originate in the Sulatman ranges.
11. The river flows southward and receives 'Panjnad' a little above Mithankot. The Panjnad is the name given to the five rivers of Punjab, namely the Satluj, the Beas, the Ravi, the Chenab and the Jhelum.It finally discharges into the Arabian Sea, east of Karachi. The Indus flows in India only through the Leh district in Jammu and Kashmir.

#### The Ganga System

1. The Ganga is the most important river of India both from the point of view of its basin and cultural significance.
2. It rises in the Gangotri glacier near Gaumukh (3,900 m) in the Uttarkashi district of Uttarakhand.

3. Here, it is known as the Bhagirathi.
4. It cuts through the Central and the Lesser Himalayas in narrow gorges. At Devprayag, the Bhagirathi
5. meets the Alaknanda; hereafter, it is known as the Ganga.
6. The Alaknanda has its source in the Satopanth glacier above Badrinath. The Alaknanda consists of the Dhauli and the Vishnu Ganga which meet at Joshimath or Vishnu Prayag.
7. The other tributaries of Alaknanda such as the Pindar joins it at Karna Prayag while Mandakini or Kali Ganga meets it at Rudra Prayag.
8. The Ganga enters the plains at Haridwar. From here, it flows first to the south, then to the south-east and east before splitting into two distributaries, namely the Bhagirathi and the Hugli. The river has a length of 2,525 km. It is shared by Uttarakhand (110 km) and Uttar Pradesh(1,450 km), Bihar (445 km) and West Bengal (520 km).
9. The Ganga basin covers about 8.6 lakh sq. km area in India alone.
10. The Ganga river system is the largest in India having a number of perennial and non-perennial rivers originating in the Himalayas in the north and the Peninsula in the south, respectively.
11. The Son is its major right bank tributary.
12. The important left bank tributaries are the Ramganga, the Gomati, the Ghaghara, the Gandak, the Kosi and the Mahananda.
13. The river finally discharges itself into the Bay of Bengal near the Sagar Island.

### The Brahmaputra System

1.The Brahmaputra, one of the largest riversof the world, has its origin in the Chemayungdung glacier of the Kailash range near the Mansarovar lake.
2.From here, it traverses eastward longitudinally for a distance of nearly 1,200 km in a dry and flat region of southern Tibet, where it is known as the Tsangpo, which means 'the purifier.'
3.The Rango Tsangpo is the major right bank tributary of this river in Tibet.
4. It emerges as a turbulent and dynamic river after carving out a deep gorge in the Central Himalayas near Namcha Barwa (7,755 m).
5.The river emerges from the foothills under the name of Siang or Dihang. It enters India west of Sadiya town in Arunachal Pradesh.
6. Flowing southwest, it receives its main left bank tributaries, viz., Dibang or Sikang and Lohit; thereafter, it is known as the Brahmaputra.
7. The Brahmaputra receives numerous tributaries in its 750 km long journey through the Assam valley.
8.Its major left bank tributaries are the Burhi Dihing and Dhansari (South) whereas the important right bank tributaries are the Subansiri, Kameng, Manas and Sankosh.
9. The Brahmaputra enters into Bangladesh near Dhubri and flows southward. In Bangladesh, the Tista joins it on its right bank from where the river is known as the Yamuna.
10. It finally merges with the river Padma, which falls in the Bay of Bengal. The Brahmaputra is well-known for floods, channel shifting and bank erosion.
11.This is due to the fact that most of its tributaries are large, and bring large quantity of sediments owing to heavy rainfall in its catchment area.

### THE PENINSULAR DRAINAGE SYSTEM

1.The Peninsular drainage system is older than the Himalayan one.
2. This is evident from the broad, largely-graded shallow valleys, and the maturity of the rivers.
3.The Western Ghats running close to the western coast act as the water divide between the major Peninsular rivers, discharging their water in the Bay of Bengal and as small rivulets joining the Arabian Sea.
4.Most of the major Peninsular rivers except Narmada and Tapi flow from west to east.
5.The Chambal, the Sind, the Betwa, the Ken, the Son, originating in the northern part of the Peninsula belong to the Ganga river system. The other major river systems of the Peninsular drainage are - the Mahanadi the Godavari, the Krishna and the Kaveri.
6.Peninsular rivers are characterised by fixed course, absence of meanders and non -perennial flow of water.
7.The Narmada and the Tapi which flow through the rift valley are, however, exceptions.

### The Evolution of Peninsular Drainage System

Three major geological events in the distant past have shaped the present drainage systems of Peninsular India:



(i) Subsidence of the western flank of the Peninsula leading to its submergence below the sea during the early tertiary period. Generally, it has disturbed the symmetrical plan of the river on either side of the original watershed.
(ii) Upheaval of the Himalayas when the northern flank of the Peninsular block was subjected to subsidence and the consequent trough faulting. The Narmada and The Tapi flow in trough faults and fill the original cracks with their detritus materials. Hence, there is a lack of alluvial and deltaic deposits in these rivers.
(iii) Slight tilting of the Peninsular block from northwest to the southeastern direction gave orientation to the entire drainage system towards the Bay of Bengal during the same period.

**Table 3.1 : Comparison between the Himalayan and the Peninsular River**

**Table 3.1 : Comparison between the Himalayan and the Peninsular River**

| Sl. No. | Aspects | Himalayan River | Peninsular River |
|---|---|---|---|
| 1. | Place of origin | Himalayan mountain covered with glaciers | Peninsular plateau and central highland |
| 2. | Nature of flow | Perennial: receive water from glacier and rainfall | Seasonal: dependent on monsoon rainfall |
| 3. | Type of drainage | Antecedent and consequent leading to dendritic pattern in plains | Super imposed, rejuvenated resulting in trellis, radial and rectangular patterns |
| 4. | Nature of river | Long course, flowing through the rugged mountains experiencing headward erosion and river capturing. In plains meandering and shifting of course | Smaller, fixed course with well adjusted valleys |
| 5. | Catchment area | Very large basins | Relatively smaller basin |
| 6. | Age of the river | Young and youthful, active and deepening in the valleys | Old rivers with graded profile, and have almost reached their base levels |

### *The River Regime*

1.The pattern of flow of water in a river channel over a year is known as its regime.
2. The north Indian rivers originating from the Himalayas are perennial as they are fed by glaciers through snow melt and also receive rainfall water during rainy season.
3.The rivers of South India do not originate from glaciers and their flow pattern witnesses fluctuations. 4. The flow increases considerably during monsoon rains. Thus, the regime of the rivers of South India is controlled by rainfall which also varies from one part of the Peninsular plateau to the other.
5.The discharge is the volume of water flowing in a river measured over time. It is measured either in cusecs (cubic feet per second) or cumecs (cubic metres per second).
6.The Ganga has its minimum flow during the January-June period. The maximum flow is attained either in August or in September. After September, there is a steady fall in the flow. The river, thus, has a monsoon regime during the rainy season.
7.There are striking differences in the river regimes in the eastern and the western parts of the Ganga Basin.
8.The Ganga maintains a sizeable flow in the early part of summer due to snow melt before the monsoon rains begin. The mean maximum discharge of the Ganga at Farakka is about 55,000 cusecs while the mean minimum is only 1,300 cusecs.

**What are the factors responsible for such a large difference?**

### EXTENT OF USABILITY OF RIVER WATER

**River Water can be used in the following way**

1. Construction of dams
2. Interlinking of rivers
3. Construction of check dams
4. Construction of canals parallel to the river
5. Lift Irrigation

## PROBLEMS OF RIVER WATER USABILITY

(i) No availability in sufficient quantity
(ii) River water pollution
(iii) Load of silt in the river water
(iv) Uneven seasonal flow of water
(v) River water disputes between states
(vi) Shrinking of channels due to the extension of settlements towards the thalweg

**Why are the rivers polluted?**
**Have you seen the dirty waters of cities entering into the rivers?**
**Where do the industrial affluent and wastes get disposed of ?**
Most of the cremation grounds are on the banks of rivers and the dead bodies are sometimes thrown in the rivers. On the occasion of some festivals, the flowers and statues are immersed in the rivers. Large scale bathing and washing of clothes also pollute river waters.
**How can the rivers be made pollution free?**
**Have you read about Ganga Action Plan, or about a campaign for cleaning the Yamuna at Delhi? Collect materials on schemes for making rivers pollution free and organise the materials into a write up.**

**II. TOPICS –**

**Each topic has been converted into a concept map. It is a visual organization and representation of knowledge.**

**There are 10 concepts maps in all.**

**III. FURTHER REFERENCE –**

**Kindly watch the following videos for a better understanding.**

https://youtu.be/OokK8gtPtX8

https://youtu.be/Y-wy060NYoM

https://youtu.be/7XOtAYvLuTY

https://youtu.be/H3_EkGLHrZ8

https://youtu.be/RiIZSYx41dk

**Q.1 What is the percent share of India's total area to World area?**

**Q.2 What is the length of India from north to south?**

**Q.3 What is the length of India from East to West?**

**Q.4 What separates India from Sri Lanka?**

**Q.5 Name the two southern most neighbours of India .**

**Q.6 Which countries are included in Indian subcontinent?**

**Q.7 What do you mean by Indian subcontinent?**

**Q.8 Which river is known as the ‘Sorrow of Bengal’?**

**Q.9 Which river has the largest basin in India ?**

**Q.10 Write three characteristics of the Peninsular Rivers .**

**Q.11 Define Drainage system .**

**Q.12 Explain important features of Kaveri Basin .**

**Dear Students**
**Welcome to the New Academic session 2020-21**

**Before you go through this e-lesson,ensure that you have read the lesson. Mark the technical words ,Find out their meaning and note them in your register. The Various You tube links provide in the lesson will help in comprehending the concepts & make it easier for you .**

**Happy learning**

# CHAPTER -5 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 and soil conditions as fully as possible.**

Himalayan heights are marked with temperate vegetation;
the Western Ghats and the Andaman Nicobar Islands have tropical rain forests,
the deltaic regions have tropical forests and mangroves;
the desert and semi desert areas of Rajasthan are known for cacti, a wide variety of bushes and thorny vegetation.
Depending upon the variations in the climate and the soil, the vegetation of India changes from one region to another.
On the basis of certain common features such as predominant vegetation type and climatic regions, Indian forests can be divided into the following groups:

**TYPES OF FORESTS**

(i) Tropical Evergreen and Semi Evergreen forests
(ii) Tropical Deciduous forests
(iii) Tropical Thorn forests
(iv) Montane forests
(v) Littoral and Swamp forests.

**Tropical Evergreen and Semi Evergreen Forests**

1.These forests are found in the western slope of the Western Ghats, hills of the northeastern region and the Andaman and Nicobar Islands.
2.They are found in warm and humid areas with an annual precipitation of over 200 cm and mean

3.Tropical evergreen forests are well stratified, with layers closer to the ground and are covered with shrubs and creepers, with short structured trees followed by tall variety of trees.
4. trees reach great heights up to 60 m or above.
5. There is no definite time for trees to shed their leaves, flowering and fruition.
As such these forests appear green all the year round.
6.Species found in these forests include rosewood, mahogony, aini, ebony, etc.

SEMI EVERGREEN FOREST

1.The semi evergreen forests are found in the less rainy parts of these regions.
2.Such forests have a mixture of evergreen and moist deciduous trees.
3.The under growing climbers provide an evergreen character to these forests.
4.Main species are white cedar, hollock and kail.
5.The oak forests in Garhwal and Kumaon were replaced by pine (chirs) which was needed to lay railway lines.
6. Forests were also cleared for introducing plantations of tea, rubber and coffee.



**Tropical Deciduous Forests**

1.These are the most widespread forests in India.
2.They are also called the monsoon forests.
3.They spread over regions which receive rainfall between 70-200 cm.
4.On the basis of the availability of water, these forests are further divided into moist and dry deciduous.

*The Moist deciduous forests*

*1.They are mostly found in* the regions which record rainfall between 100-200 cm.
2.These forests are found in the northeastern states along the foothills of Himalayas, eastern slopes of the Western Ghats and Odisha.
3. Teak, *sal, shisham, hurra,mahua, amla, semul, kusum*, and sandalwood

etc. are the main species of these forests.

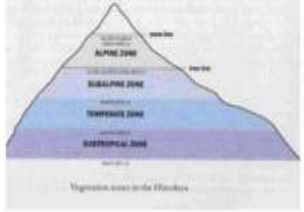
*Dry deciduous forest*

1.covers vast areas of the country,
2. rainfall ranges between 70 -100 cm.
3.On the wetter margins, it has a transition to the moist deciduous, while on the drier margins to thorn forests.
4.These forests are found in rainier areas of the Peninsula and the plains of Uttar Pradesh and Bihar.
5.park lands are found in the higher rainfall regions of the Peninsular plateau and the northern Indian plain.
6.As the dry season begins, the trees shed their leaves completely and the forest appears like a vast grassland with naked trees all around. *Tendu, palas, amaltas, bel, khair*, axlewood, etc. are the common trees of these forests.
In the western and southern part of Rajasthan, vegetation cover is very scanty due to low rainfall and overgrazing.

**Tropical Thorn Forests**

1.Tropical thorn forests occur in the areas which receive rainfall less than 50 cm.
2.These consist of a variety of grasses and shrubs.
3.It includes semi-arid areas of south west Punjab,Haryana, Rajasthan, Gujarat, Madhya Pradesh and Uttar Pradesh.
4.In these forests, plants remain leafless for most part of the year and give an expression of scrub vegetation.
5.Important species found are *babool, ber*, and wild date palm, *khair, neem, khejri, palas*, etc. 6.Tussocky grass grows upto a height of 2 m as the under growth.

**Montane Forests**




1.In mountainous areas, the decrease in temperature with increasing altitude leads to a corresponding change in natural vegetation.
2.Mountain forests can be classified into two types, the northern mountain forests and the southern mountain forests.
3.The Himalayan ranges show a succession of vegetation from the tropical to the tundra, which change in with the altitude.

**5.** Deciduous forests are found in the foothills of the Himalayas.

1. It is succeeded by the wet temperate type of forests between an altitude of 1,000-2,000 m.

# CHAPTER- 6 SOILS

## IMPORTANCE OF SOILS

1.provide support & nutrients to the plants
2.plants provide food and clothes are grown over the soils
3.Provide shelter to microorganisms
4.Supply nutrients to plants

The major factors affecting the formation of soil are 1.relief, 2.parent material, 3.climate, 4.vegetation 5.life-forms and 6.time. 7. human activities

Components of the soil
1.mineral particles, 2.humus, 3.water 4. air.

Structure of the soil
If we dig a pit on land and look at the soil, we find that it consists of three layers which are called horizons.
'Horizon A' is the topmost zone, where organic materials have got incorporated with the mineral matter, nutrients and water, which are necessary for the growth of plants.
'Horizon B' is a transition zone between the 'horizon A' and 'horizon C', and contains matter derived from below as well as from above. It has some organic matter in it, although the mineral matter is noticeably weathered.
'Horizon C' is composed of the loose parent material.
This layer is the first stage in the soil formation process and eventually forms the above two layers.
This arrangement of layers is known as the soil profile.
Underneath these three horizons is the rock which is also known as the parent rock or the bedrock.
Soil, which is a complex and varied entity has always drawn the attention of the scientists.

## CLASSIFICATIONOF SOILS

In ancient times, soils used to be classified into two main groups - Urvara and Usara, which were fertile and sterile, respectively. In the 16th century A.D., soils were classified on the basis of their inherent characteristics and external features such as
1. texture, 2. colour, 3. slope of land and 4. moisture content in the soil.
Based on texture, main soil types were identified as 1.sands, 2.clayey, 3.silty and 4.loam, etc.
On the basis of colour, they were 1.red, 2.yellow, 3.black, etc.
the ICAR has classified the Indian soils on the basis of their nature and character as per the United States Department of Agriculture (USDA) Soil Taxonomy.
(i)Inceptisols (ii) Entisols (iii) Alfisols (iv) Vertisols (v) Aridisols (vi) Ultisols (viii) Others
On the basis of genesis, colour, composition and location, the soils of India have been classified into:
(i) Alluvial soils(ii) Black soils(iii) Red and Yellow soils(iv) Laterite soils(v) Arid soils
(vi) Saline soils(vii) Peaty soils(viii) Forest soils.

### Alluvial Soils

1.Alluvial soils are widespread in the northern plains and the river valleys.
2.These soils cover about 40 per cent of the total area of the country.
3.They are depositional soils, transported and deposited by rivers and streams.
4.Through a narrow corridor in Rajasthan, they extend into the plains of Gujarat.
5.In the Peninsular region, they are found in deltas of the east coast and in the river valleys.
6.They are generally rich in potash but poor in phosphorous.
7.In the Upper and Middle Ganga plain, two different types of alluvial soils have developed, viz. Khadar and Bhangar. Khadar is the new alluvium and is deposited by floods annually, which enriches the soil by depositing fine silts.
8.Bhangar represents a system of older alluvium, deposited away from the flood plains.
9.Both the Khadar and Bhangar soils contain calcareous concretions (Kankars).
These soils are more loamy and clayey in the lower and middle Ganga plain and the Brahmaputra valley.
10.The sand content decreases from the west to east.
11.The colour of the alluvial soils varies from the light grey to ash grey. Its shades depend on the depth of the deposition, the texture of the materials, and the time taken for attaining maturity.



### Black Soil

1.Black soil covers most of the Deccan Plateau which includes parts of Maharashtra, Madhya Pradesh,
Gujarat, Andhra Pradesh and some parts of Tamil Nadu.
2. In the upper reaches of the Godavari and the Krishna, and the northwestern part of the Deccan Plateau, the black soil is very deep.
4.These soils are also known as the 'Regur Soil' or the 'Black Cotton Soil'.
5.The black soils are generally clayey, deep and impermeable.
6.They swell and become sticky when wet and shrink when dried. So, during the dry season, these soil develop wide cracks.
7.Chemically, the black soils are rich in lime, iron, magnesia and alumina.
8.They also contain potash. But they lack in phosphorous, nitrogen and organic matter.
9.The colour of the soil ranges from deep black to grey.

### Red and Yellow Soil

1.Red soil develops on crystalline igneous rocks in areas of low rainfall in the eastern and southern part of the Deccan Plateau.
2.Along the piedmont zone of the Western Ghat, long stretch of area is occupied by red loamy soil. Yellow and red soils are also found in parts of Odisha and Chattisgarh and in the southern parts of the middle Ganga plain.
3.The soil develops a reddish colour due to a wide diffusion of iron in crystalline and metamorphic rocks.
4.It looks yellow when it occurs in a hydrated form.
5.The fine-grained red and yellow soils are normally fertile,
6.whereas coarse-grained soils found in dry upland areas are poor in fertility.
7.They are generally poor in nitrogen, phosphorous and humus.

### Laterite Soil

1.Laterite has been derived from the Latin word 'Later' which means brick.
2.The laterite soils develop in areas with high temperature and high rainfall.
3.These are the result of intense leaching due to tropical rains.
4.With rain, lime and silica are leached away, and soils rich in iron oxide and aluminum compound are left behind.
5.Humus content of the soil is removed fast by bacteria that thrives well in high temperature.
6.These soils are poor in organic matter, nitrogen, phosphate and calcium, while iron oxide and potash are in excess.
7.Hence, laterites are not suitable for cultivation; however, application of manures and fertilizers are required for making the soils fertile for cultivation.
8.Red laterite soils in Tamil Nadu, Andhra Pradesh and Kerala are more suitable for tree crops like cashewnut.
9.Laterite soils are widely cut as bricks for use in house construction. These soils have mainly developed in the higher areas of the Peninsular plateau.
10 The laterite soils are commonly found in Karnataka, Kerala, Tamil Nadu, Madhya Pradesh and the hilly areas of Odisha and Assam.

### Arid Soils

1.Arid soils range from red to brown in colour.
2.They are generally sandy in structure and saline in nature. In some areas, the salt content is so high that common salt is obtained by evaporating the saline water.
3.Due to the dry climate, high temperature and accelerated evaporation, they lack moisture and humus.
4.Nitrogen is insufficient and the phosphate content is normal.
5. Lower horizons of the soil are occupied by 'kankar' layers because of the increasing calcium content downwards.
6. The 'Kankar' layer formation in the bottom horizons restricts the infiltration of water, and as such when irrigation is made available, the soil moisture is readily available for a sustainable plant growth.
7.Arid soils are characteristically developed in western Rajasthan, which exhibit characteristic arid topography.
8.These soils are poor and contain little humus and organic matter.

**Saline Soils**

1.They are also known as *Usara* soils.
2.Saline soils contain a larger proportion of sodium, potassium and magnesium, and thus, they are infertile, and do not support any vegetative growth.
3.They have more salts, largely because of dry climate and poor drainage. They occur in arid and semi-arid regions, and in waterlogged and swampy areas.
4. Their structure ranges from sandy to loamy.
5.They lack in nitrogen and calcium. Saline soils are more widespread in western Gujarat, deltas of the eastern coast and in Sunderban areas of West Bengal.
6. In the Rann of Kuchchh, the Southwest Monsoon brings salt particles and deposits there as a crust. Seawater intrusions in the deltas promote the occurrence of saline soils. In the areas of intensive cultivation with excessive use of irrigation, especially in areas of green revolution, the fertile alluvial soils are becoming saline.
7.Excessive irrigation with dry climatic conditions promotes capillary action, which results in the deposition of salt on the top layer of the soil. In such areas, especially in Punjab and Haryana, farmers are advised to add gypsum to solve the problem of salinity in the soil.

**Peaty Soils**

1.They are found in the areas of heavy rainfall and high humidity, where there is a good growth of vegetation.
2.Thus, large quantity of dead organic matter accumulates in these areas, and this gives a rich humus and organic content to the soil.
3.Organic matter in these soils may go even up to 40-50 per cent. These soils are normally heavy and black in colour.
4.At many places, they are alkaline also.
5.It occurs widely in the northern part of Bihar, southern part of Uttaranchal and the coastal areas of West Bengal, Orissa and Tamil Nadu.

**Forest Soils**

1.Forest soils are formed in the forest areas where sufficient rainfall is available.
2.The soils vary in structure and texture depending on the mountain environment where they are formed.
3.They are loamy and silty on valley sides and coarse-grained in the upper slopes.
4.In the snow-bound areas of the Himalayas, they experience denudation, and are acidic with low humus content.
5.The soils found in the lower valleys are fertile.

**SOIL DEGRADATION**

1. Soil degradation can be defined as the decline in soil fertility, when the nutritional status declines and depth of the soil goes down due to erosion and misuse.
2.Soil degradation is the main factor leading to the depleting soil resource base in India.
3.The degree of soil degradation varies from place to place according to the topography, wind velocity and amount of the rainfall.

**SOIL EROSION**

1.The destruction of the soil cover is described as soil erosion. The soil forming processes and the erosional processes of running water and wind go on simultaneously.
2. There is a balance between these two processes.
3.The rate of removal of fine particles from the surface is the same as the rate of addition of particles to the soil layer. Human activities too are responsible for soil erosion to a great extent.
4.The human population increases, the demand on the land also increases.
5.Forest and other natural vegetation is removed for human settlement, for cultivation, for grazing animals and for various other needs.
6.Wind and water are powerful agents of soil erosion because of their ability to remove soil and transport it.
7.Wind erosion is significant in arid and semi-arid regions.



8 In regions with heavy rainfall and steep slopes, erosion by running water is more significant.
9.Water erosion which is more serious and occurs extensively in different parts of India, takes place mainly in the form of sheet and gully erosion.
10 Sheet erosion takes place on level lands after a heavy shower and the soil removal is not easily noticeable.
11.But it is harmful since it removes the finer and more fertile top soil. Gully erosion is common on steep slopes.
12.Gullies deepen with rainfall, cut the agricultural lands into small fragments and make them unfit for cultivation.
12.A region with a large number of deep gullies or ravines is called a badland topography. Ravines are widespread, in the Chambal basin.
13.Besidesthis, they are also found in Tamil Nadu and West Bengal.
14The country is losing about 8,000 hectares of land to ravines every year.
15.Deforestation is one of the major causes of soil erosion.
16.Plants keep soils bound in locks of roots, and thus, prevent erosion. They also add humus to the soil by shedding leaves and twigs.

Forests have been denuded practically in most parts of India but their effect on soil erosion are more in hilly parts of the country.

A fairly large area of arable land in the irrigated zones of India is becoming saline because of over irrigation.
The salt lodged in the lower profiles of the soil comes up to the surface and destroys its fertility. Chemical fertilizers in the absence of organic manures are also harmful to the soil. Unless the soil gets enough humus, chemicals harden it and reduce its fertility in the long run. This problem is common in all the command areas of the river valley projects, which were the First beneficiaries of the Green Revolution. According to estimates, about half of the total land of India is under some degree of degradation. Every year, India loses millions of tons of soil and its nutrients to the agents of its degradation, which adversely affects our national productivity. So, it is imperative to initiate immediate steps to reclaim and conserve soils.

**Soil Conservation**

| NEED FOR SOIL CONSERVATION | METHODS TO CONSERVE SOILS |
|---|---|
| 1. Large scale soil erosion | 1.controlled grazing |
| 2. Excessive use of fertilizers | 2.terraced farming |
| 3. Faulty methods of cultivation | 3. ban on shifting cultivation |
| 4. Deforestation | 4. contour bunding |
| 5. Over use of land for cultivation. | 5.Regulated forestry |
| 6. Overgrazing | 6.cover cropping |
| 7. Shifting cultivation | 7. mixed forming |
| | 8. crop rotation |

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**There are 10 concepts maps in all.**

**III. FURTHER REFERENCE –**

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https://youtu.be/VIT_7FhO-yM

https://youtu.be/vTACbFxysi4

https://youtu.be/B-aq-PKAC-Y

https://youtu.be/izv6svG2Jnk

https://youtu.be/_MTGMI6ay18

**Q.1 Sandalwood is an example of ……. forest ?**

**Q.2 Regur soil is another name for the ……..soil?**

**Q.3 What was the purpose of Project Tiger?**

**Q.4 What is Natural vegetation?**

**Q.5 Define Biosphere reserves .**

**Q.6 What is soil?**

**Q.7 What are the main factors responsible for! The formation of soil?**

**Q.8 What percent of India is covered with Alluvial Soil?**

**Q.9 What is soil Degradation?**

**Q.10 What is soil conservation?**