Content

Credits

The latest Indian Edition of Certificate Physical and Human Geography has been referred while preparing this PDF notes. All the facts, information and data has been taken from the textbook itself. The facts, information and data has been organised in a reading friendly manner for students so that they can understand it easily.

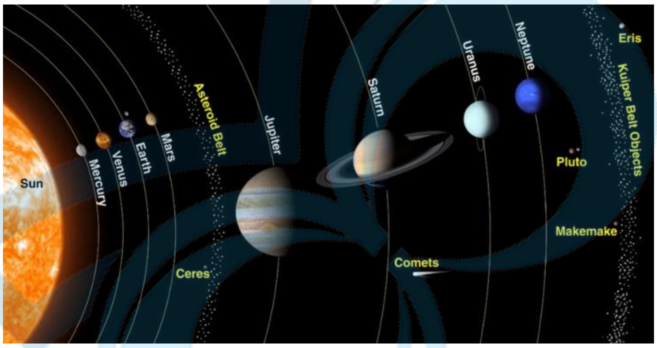
Chapter 1: The Earth and the Universe

Exploring the Universe

- Stars are far bigger than the earth on which we live. Some of the larger ones have been estimated to be many millions of times the size of the earth.
- They occur in cluster as galaxies or nebulas. Each galaxy may contain as many as 100 million stars.
- Earth's own galaxy (the Milky Way) alone contains as many as 100,000 million stars.
- The light from the nearest star travelling at the speed of light (i.e., 186,000 miles per second) takes something like four years to reach us.
- A ray of light from the sun takes about eight minutes to reach the earth. Light takes only a second to reach us from the moon.

The Solar System

- The solar system comprises the Sun and its nine planets which are believed to have been developed from the condensation of gases and other lesser bodies.
- All the planets revolve round the Sun in elliptical orbits. Like the earth, they shine only by the reflected light of the sun.



- **Mercury**
  - Amongst the Eight planets, it is the smallest and closest to the sun, only 36 million miles away.
  - A year in Mercury is only 88 days.

- **Venus:**
  - It is the next closest planet, twice the distance away from the sun.
  - It is often considered as 'Earth's twin' because of their close proximity in size, mass (weight) and density.

- **Earth**
  - It has a natural satellite, the Moon, 238,900 miles away, that revolves eastward around the Earth once in every 27 days.

- **Mars**
  - It has dark patches on its surface and is believed by most professional astronomers to be the next planet after Earth to have the possibility of, some plant life.

- **Jupiter**
  - The largest planet in the solar system.
  - Its surface is made up of many gases like hydrogen, helium, and methane
  - It is distinguished from other planets by its circular light and dark bands, and the twelve satellites that circle round it.
  - It is more than 485 million miles from the Sun, its surface is very cold, probably about -200°F. (-130°C.).

- **Saturn**
  - It has three rings and nine satellites around it.
  - It is the second largest after Jupiter. It is so far from the Sun that it takes 29+ years to complete its orbit.

- **Uranus**
  - It is another giant planet, 50 times larger than Earth and 15 times as heavy.
  - Unlike other planets, Uranus orbits around the sun in a **clockwise direction** from **east to west** with five satellites revolving round it.

- **Neptune**
  - It is the outermost planets in the solar system.
  - It has only two known satellites and is probably much colder.

__Note__: Till recently (August 2006), Pluto was also considered a planet. However, in a meeting of the International Astronomical Union, a decision was *taken that Pluto like other celestial objects (2003 UB313) discovered in recent past may be called 'dwarf planet'.*

The most recent definition of a planet was adopted by the International Astronomical Union in 2006. It says a planet must do three things:

1. It must orbit a star (in our cosmic neighbourhood, the Sun).

2. It must be big enough to have enough gravity to force it into a spherical shape.

3. It must be big enough that its gravity cleared away any other objects of a similar size near its orbit around the Sun.

Pluto did not fulfil the last criterion; hence it was excluded from being a planet.

The Shape of the Earth

- The earth is round, it is not a perfect sphere.
- It is a little flattened at both ends like an orange. It can, in fact, be called a geoid ('earth-shaped').
- The **spherical shape** of the earth is also masked by the intervening highlands and oceans on its surface.

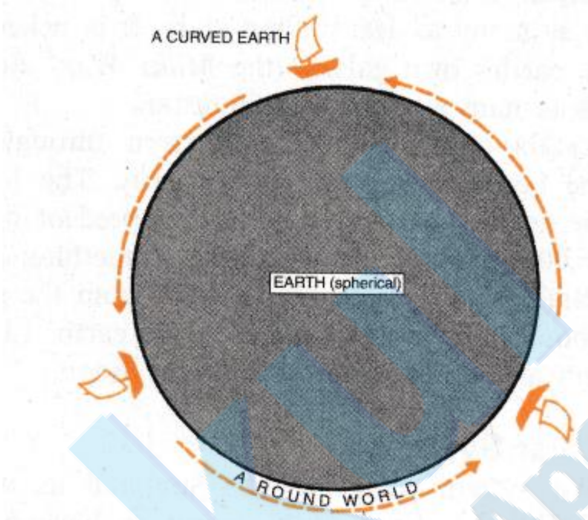
Evidence of the Earth's Sphericity

There are many ways to prove that the earth is spherical. The following are some of them:

- **Circumnavigation of the earth**: The first voyage around the world by Ferdinand Magellan and his crew, from 1519 to 1522 proved beyond doubt that the earth is spherical.

  No traveller going round the world by land or sea has ever encountered an abrupt edge, over which he would fall.

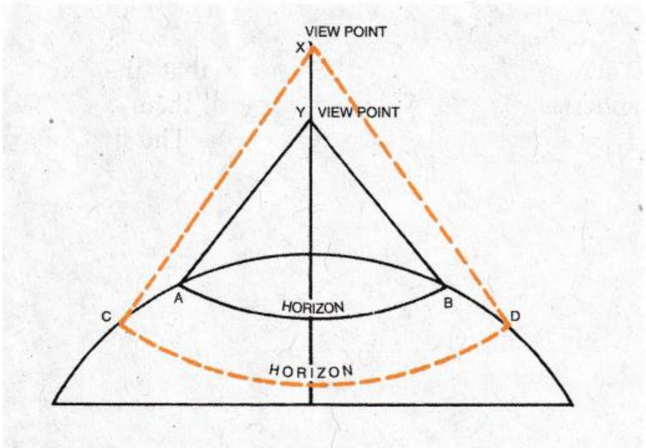
  Modern of routes and ocean navigation are based on the assumption that the earth is round



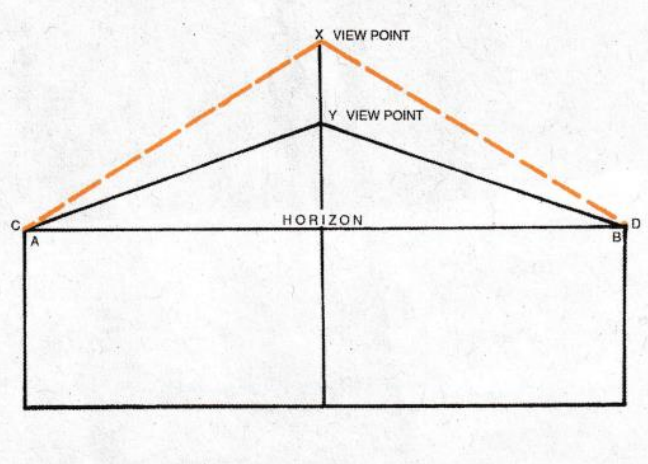
Circumnavigation of the earth

(b) **Abrupt drop at the edge of a table-like earth**

- **The circular horizon:** The distant horizon viewed from the deck of a ship at sea, or from a cliff on land is always and everywhere circular in shape. This circular horizon widens with increasing altitude and could only be seen on a spherical body.

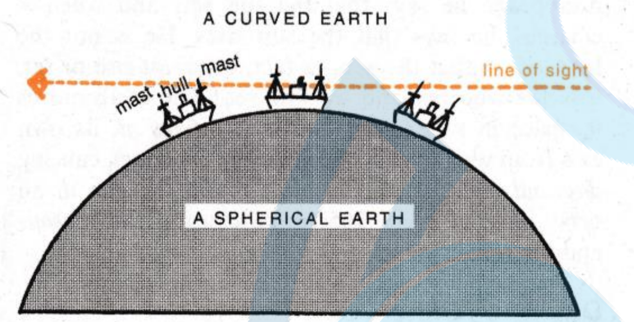


(a) Increasing altitude widens the circular horizon. Viewed from Y the horizon would be AB but from a higher viewpoint (X) a wider horizon (C, D) would be seen



(b) Visible horizon remains the same regardless of altitude. If the earth were flat the horizon seen from either Y or X would be the same

- **Ship's visibility:** When a ship appears over the distant horizon, the top of the mast is seen first before the hull. In the same way when it leaves harbour, its disappearance over the curved surface is equally gradual. If the earth were flat, the entire ship would be seen or obscured all at once.



The mast of a ship is seen before the hull on curved horizon

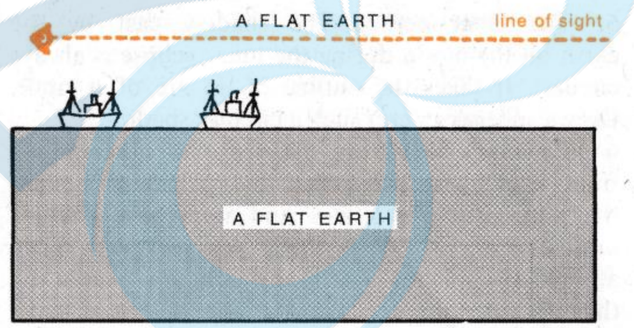
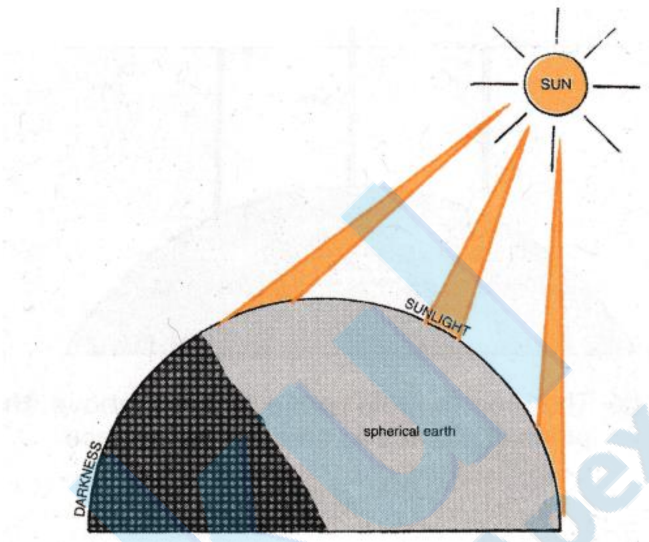
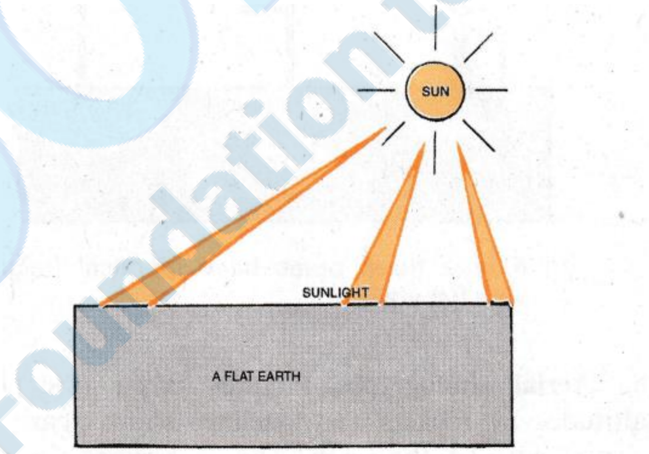


Fig. 4 (b) A flat earth, the entire ship is seen at once on a flat surface

- **Sunrise and sunset:** The sun rises and sets at different times in different places. As the earth rotates from west to east, places in the east see the sun earlier than those in the west. If the earth were flat, the whole world would have sunrise and sunset at the same time. But we know this is not so



(a) Sun rises and sun sets at different times for different places

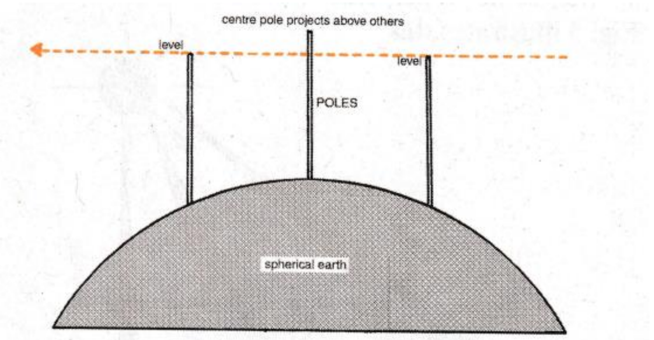


(b) The whole world will have sun rise or sun set at the same time

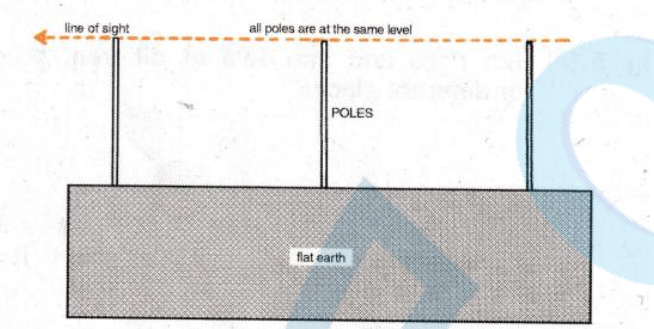
- **The lunar eclipse:** The shadow cast by the earth on the moon during the lunar eclipse is always circular. It takes the outline of an arc of a circle. only a sphere can cast such a circular shadow.

- **Planetary bodies are spherical**: All observations from telescopes reveal that the planetary bodies, the Sun, Moon, satellites and stars have circular outlines from whichever angle you see them. They are strictly spheres. Earth, by analogy, cannot be the only exception.

- **Driving poles on level ground on a curved earth:** Engineers when driving poles of equal length at regular intervals on the ground have found that they do not give a perfect horizontal level. The centre pole normally projects slightly above the poles at either end because of the curvature of the earth. Surveyors and field engineers therefore have to make certain corrections for this inevitable curvature, i.e., 8 inches to the mile.



(a) The centre pole projects well above the poles at either end on a curved surface



(b) All the three poles have identical heights on a flat surface

- **Aerial photographs:** Pictures taken from high altitudes by rockets and satellites show clearly the curved edge of the earth. This is perhaps the most convincing and the most up-to-date proof of the earth's sphericity.

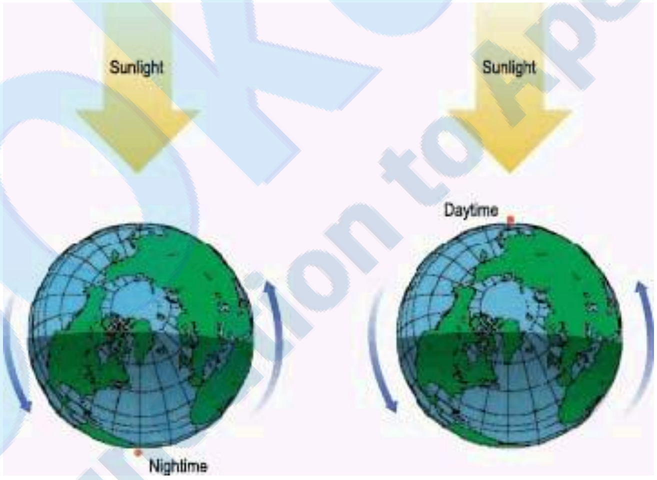
The Earth's Movement

The earth moves in space in two distinct ways:

- It **rotates** on its own axis from west to east once in every **24 hours**, causing day and night.
- It also **revolves** round the sun in an orbit once in every $\mathbf{365\frac{1}{4}}$ **days** causing the seasons and the year.

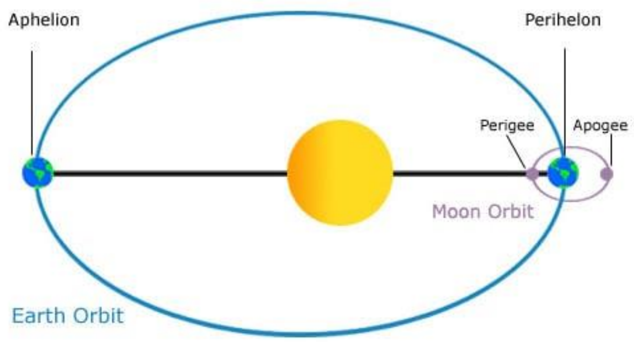
Day and Night

- When the earth rotates on its own axis, only one portion of the earth's surface comes into the rays of the sun and experiences **Daylight.**
- The other portion which is away from the sun's rays will be in **Darkness.**
- As the earth rotates from west to east, every part of the earth's surface will be brought under the sun at sometimes or the other.
- A part of the earth's surface that emerges from darkness into the sun's ray experience **sunrise.**
- Later, when it is gradually obscured from the sun's beams it experiences **sunset.**
- **The sun is, in fact stationary and it is the earth which rotates.**



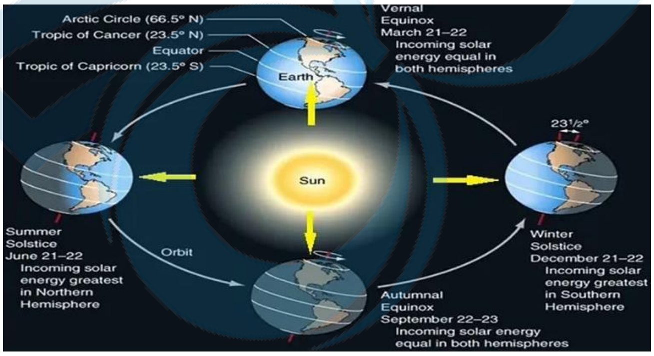
The Earth's Revolution

- When the earth revolves round the sun, it spins on an **elliptical orbit** at a speed of 18.5 miles per second or 6,600 Milles per hour.
- One complete revolution takes $\mathbf{365\frac{1}{4}}$ days or a year. A normal year is taken to be 365 days, and an extra day is added every four years as a Leap year.



Varying Lengths of Day and Night

- The axis of the earth is inclined to the plane of the **Ecliptic** (the plane in which the earth orbits round the sun) at an angle of $\mathbf{66\frac{1}{2}}$°, giving rise to different seasons and varying lengths of day and night.
- If the axis were perpendicular to this plane, all parts of the globe would have equal days and nights at all times of the year, but we know this is not so.
- In the **northern hemisphere in winter** (December) as we go northwards, the hours of darkness steadily increase.
- At the Arctic Circle ($66\frac{1}{2}$° N), the sun never 'rises' and there is darkness for the whole day in mid-winter on 22 December.
- Beyond the Arctic Circle the number of days with complete darkness increases, until we reach the North Pole (90°N.) when half the year will have darkness.
- In the **summer** (June) conditions are exactly reversed. Daylight increases as we go poleward.
- At the Arctic Circle, the sun never 'sets' at mid-summer (21 June) and there is a complete 24-hour period of continuous daylight.
- In summer the region north of the Arctic Circle is popularly referred to as 'Land of the Mid night Sun'.
- At the North Pole, there will be six months of continuous daylight.

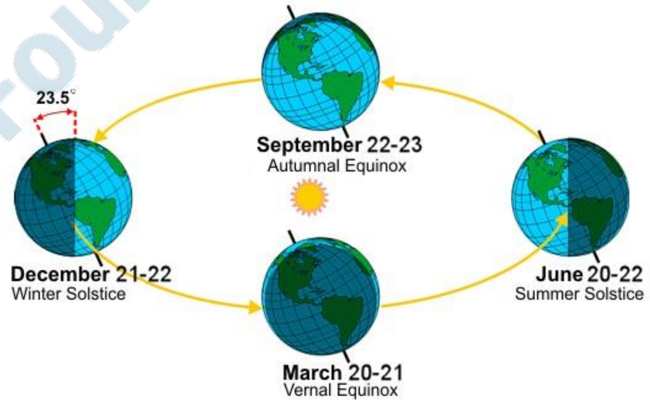


Above figure illustrates the revolution of the earth and its inclination to the plane of the ecliptic which causes the variation in the length of day and night at different times of the year.

- In the **South Hemisphere**, the same process takes place, except that the conditions are reversed.
- When it is summer in the northern hemisphere, the southern continents will experience winter. Mid-summer at the North Pole will be mid-winter at the South Pole.

The Altitude of the Midday Sun

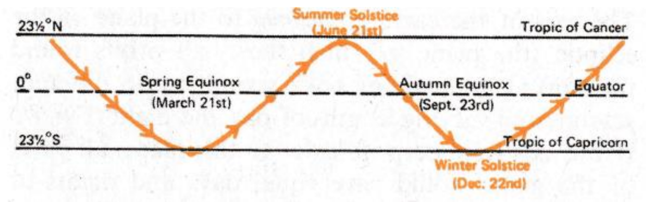
- In the course of a year the earth's revolution round the sun with its axis inclined at $66\frac{1}{2}$° to the plane of the ecliptic changes the apparent altitude of the midday sun.
- The sun is **vertically overhead** at the equator on two days each year. These are usually 21 March and 21 September though the date changes because a year is not exactly 365 days.
- These two days are termed **Equinoxes** meaning 'equal nights' because on these two days all parts of the world have equal days and nights.
- After the March equinox the sun appears to move north and is vertically overhead at the Tropic of Cancer ($23\frac{1}{2}$°N.)



- On about 21 June. This is known as **the June or summer solstice**, when the northern hemisphere will have its longest day and shortest night.
- By about 22 December, the sun will be overhead at the Tropic of Capricorn ($23\frac{1}{2}$°S). This is the **Winter Solstice** when the southern hemisphere will have its longest day and shortest night.
- The Tropics thus mark the limits of the overhead sun, beyond these the sun is **never overhead** at any time of the year. Such

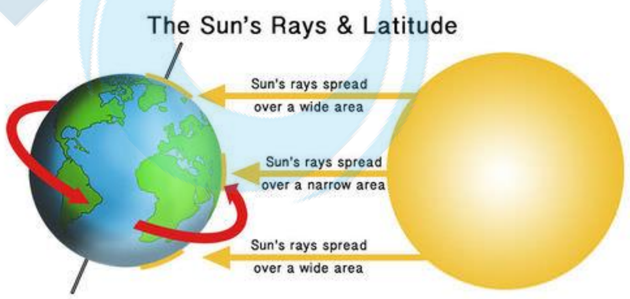
regions are marked by distinct seasonal change spring, summer, autumn and winter

- Beyond the Arctic Circle ($66\frac{1}{2}$°N) and the Antarctic Circle ($66\frac{1}{2}$°S) where darkness lasts for 6 months and daylight is continuous for the remaining half of the year, it is always cold, for even during the short summer the sun is never high in the sky.
- Within the tropics, as the midday sun varies very little from its vertical position at noon daily, the four seasons are almost indistinguishable. Days and nights are almost equal all the year round.



Seasonal Changes and their Effects on temperature

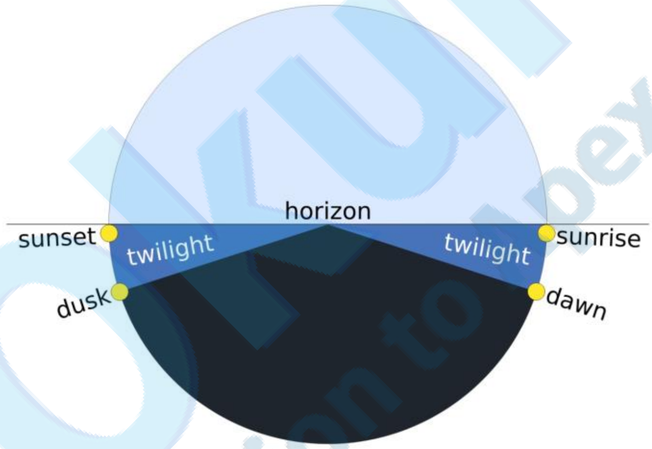
- Summer is usually associated with much heat and brightness whereas winter with cold and darkness. In summer, the sun is **higher in the sky** than in winter.
- When the sun is overhead, its rays fall almost vertically on the earth, **concentrating** its heat, on a small area, temperature therefore rises and summers are always warm.
- In winter, the **oblique rays** of the sun, come through the atmosphere less directly and have much of their heat absorbed by atmospheric impurities and water vapour. The sun's rays fall **faintly** and spread over a great arca. There is thus little heat, and temperatures remain low.



- In addition, days are longer than nights in summer and more heat is received over the longer daylight duration. Nights are shorter and less heat is lost.
- There is a **Net gain** in total heat received and temperature rises in summer. Shorter days and longer nights in winter account for the reverse effects.

Dawn and Twilight

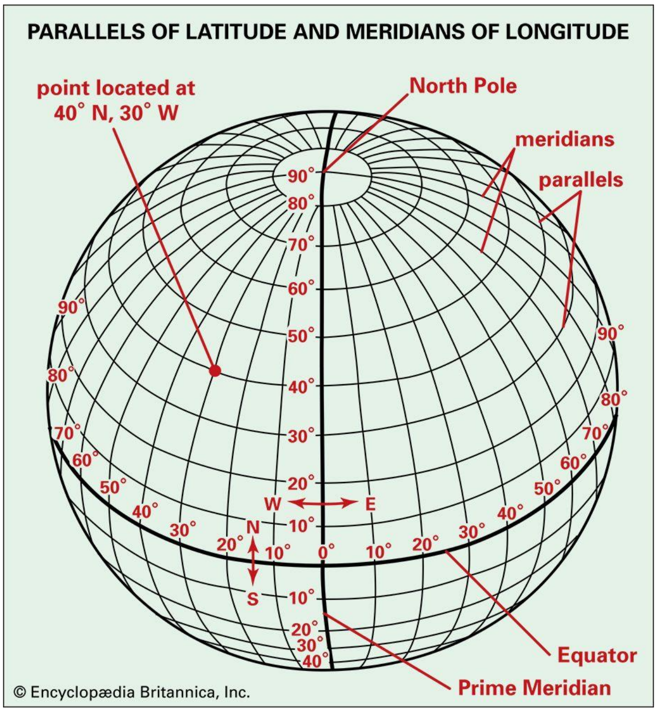
- The brief period between sunrise and full daylight is called **Dawn** and that between sunset and complete darkness is termed **Twilight.**



- This is caused by the fact that during the periods of dawn and twilight the earth receives **diffused or refracted light** from the sun whereas it is still below the horizon.
- Since the sun rises and sets in a vertical path at the equator the period during which refracted light is received is short.
- But in temperate latitudes, the sun rises and sets in an oblique path and the period of refracted light is longer.
- It is much longer still at the poles, so that the winter darkness is really only twilight most of the time.

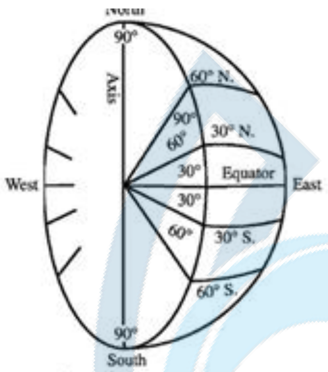
Mathematical Location of Places on the Globe

- The earth's surface is so vast, it is impossible to locate any place on it. For this reason, imaginary and longitude pin-points any place on the earth's surface.
- For example, Delhi is **28°37'** N. and **77°10'E**; London is **51°30'N** and **0°5'W** and Sydney is **33°55' S** and **151°12' E**.



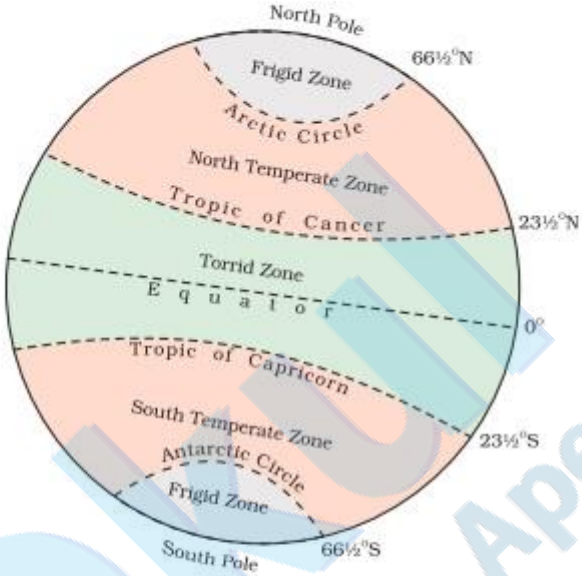
Latitude

- Latitude is the **Angular distance** of a point on the earth's surface, measured in degrees from the centre of the earth.



Angular distance from equator

- It is **Parallel** to a line, the equator, which lies midway between the poles.
- These lines are therefore called parallels of latitude, and on a globe are actually circles, becoming smaller pole-wards.
- The equator represents 0° and the North and South Poles are 90°N. and 90°S. Between these points lines of latitude are drawn at intervals of 1°. Each degree is sub divided into 60 minutes and each minute into 60 seconds.
- The most important lines of latitude are the equator, the Tropic of Cancer ($23\frac{1}{2}$°N), the Tropic of Capricorn ($23\frac{1}{2}$°S), the Arctic Circle ($66\frac{1}{2}$°N) and the Antarctic Circle ($66\frac{1}{2}$°S).



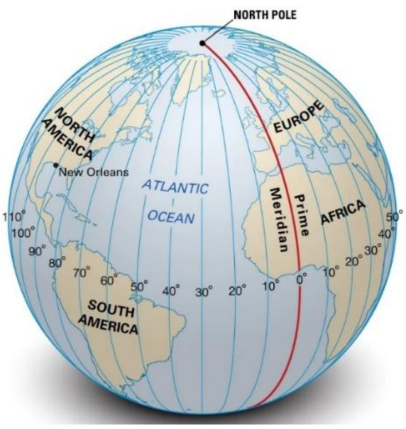
- As the earth is slightly flattened at the poles, the linear distance of a degree of latitude at the pole is a little longer than that at the equator.
- For example, at the equator (0°) it is 68.704 miles, at 45° it is 69.054 miles and at the poles it is 69.401 miles. The average is taken as 69 miles.

Longitude

- Longitude is an **Angular distance**, measured in degrees along the equator east or west of the prime (or First) Meridian.
- on the globe longitude is shown as a series of semi-circles that run from pole to pole passing through the equator. Such lines are also called **Meridians.**
- In 1884, by international agreement choose the zero meridian which passes through the Royal Astronomical observatory at Greenwich, near London.
- This is the **Prime Meridian** (0°) from which all other meridians radiate eastwards and westwards up to 180°.
- As the parallels of latitude become shorter pole-wards, so the meridians of longitude, which **converge at the poles**, enclose a narrower space. The degree of longitude therefore decreases in length.
- It is longest at the equator where it measures 69.172 miles. At 25° it is 62.73 miles, at 45°

it is 49 miles, at 75° 18 miles and at the poles 0 mile.

- There is so much difference in the length of degrees of longitude outside the tropics, that they are not used for calculating distances as in the case of latitude.
- But they have one very important function, they determine in relation to G.M.T. or Greenwich Mean Time, which is sometimes referred to as World Time.



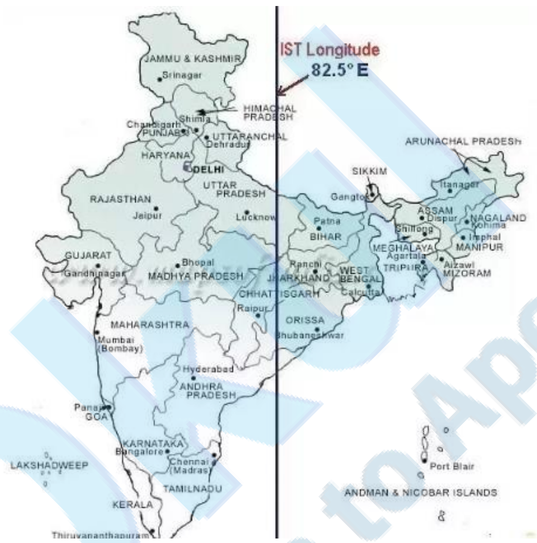
Longitude and Time

Local Time

- Since the earth makes one complete revolution of 360° in one day or 24 hours, it passes through 15° in one hour or 1° in 4 minutes.
- The earth rotates from west to east, so every 15° we go eastwards, local time is **Advanced** by 1 hour.
- conversely, if we go west wards, local time is **retarded** by 1 hour. Thus, places east of Greenwich see the sun earlier and gain time, whereas places west of Greenwich see the sun later and lose time.
- Hence when it is noon, in London (Longitude 0°5'W), the local time for Madras (80°E) will be 5 hours 20 minutes ahead of London. But the local time for New York (74°W) will be 4 hours 56 minutes behind London or 7.04 a.m.

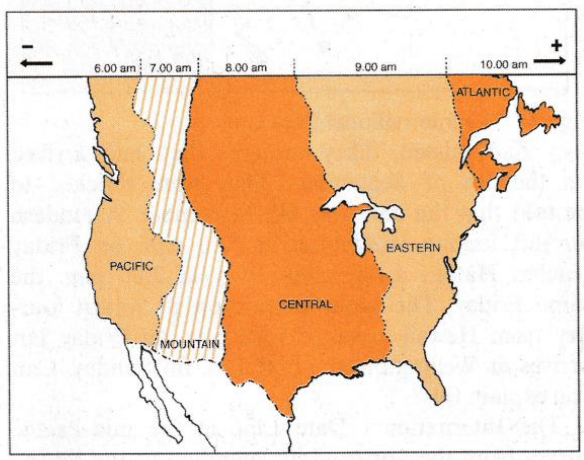
Standard Time and Time Zones

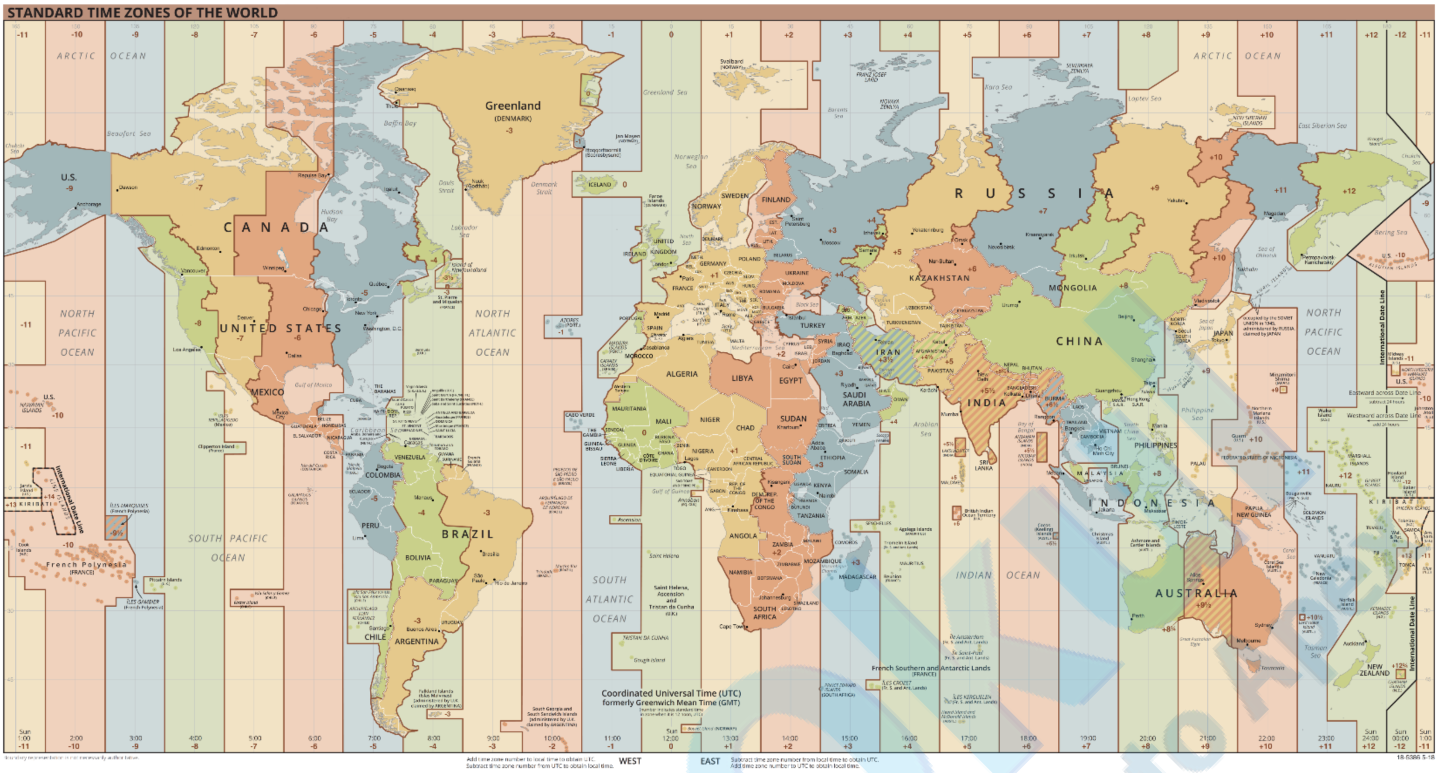
- If each town were to keep the time of its own meridian, there would be much difference in local time between one town and the other.
- To avoid these difficulties, a system of **Standard time** is observed by all countries. Most countries adopt their standard time from the central meridian of their countries.
- The Indian Government has accepted the meridian of 82.5° east for the standard time which is 5 hrs 30 mins ahead of Greenwich Mean Time.



- The whole world has in fact been divided into 24 Standard Time Zones, each of which differs from the next by 15° in longitude or one hour in time.
- Larger countries like U.S.A., Canada and U.S.S.R. which have a great east-west stretch have to adopt several time zones for practical purposes.
- U.S.S.R. the largest country, which extends through almost 165° of longitude is divided into eleven time zones.
- Both Canada and U.S.A. have five time zones- the Atlantic, Eastern, Central, Mountain and Pacific Time Zones. The difference between the local time of the Atlantic and Pacific coasts is nearly five hours.

The five time zones of North America





Standard Time Zones of the World

The International Date Line

- A traveller going eastwards gains time from Greenwich until he reaches the meridian 180°E. when he will be 12 hours ahead of G.M.T. Similarly, in going westwards, he loses 12 hours when he reaches 180°W.
- There is thus a total difference of 24 hours or a **Whole day** between the two sides of the 180° meridian.
- This is the International Date Line where the date changes by exactly one day when it is crossed.
- A traveller crossing the date line from east to west **loses** a day (because of the loss in time he has made) and while crossing the dateline from west to east he **Gains** a day (because of the gain in time he encountered).
- Thus, when it is midnight, Friday on the Asiatic side, by crossing the line eastwards, he gains a day, it will be midnight Thursday on the American side, i.e., he experiences the same calendar date twice.

International date line

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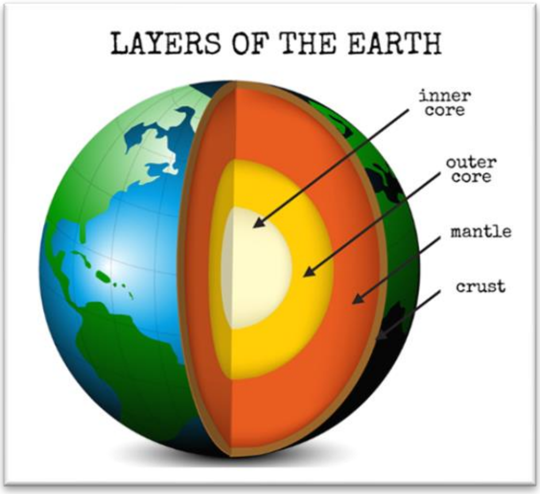
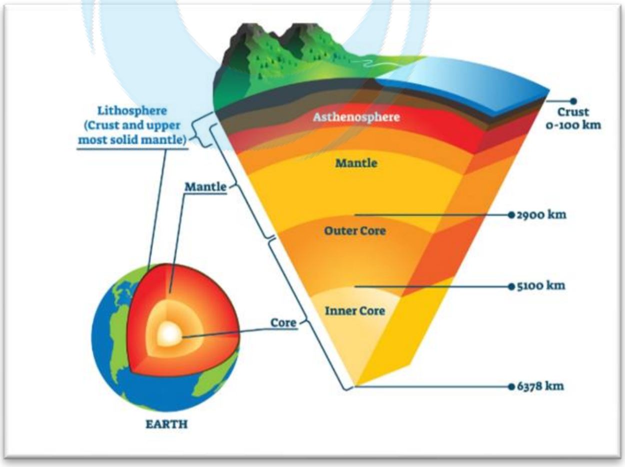
Chapter 2 The Earth's Crust

The Structure of the Earth:

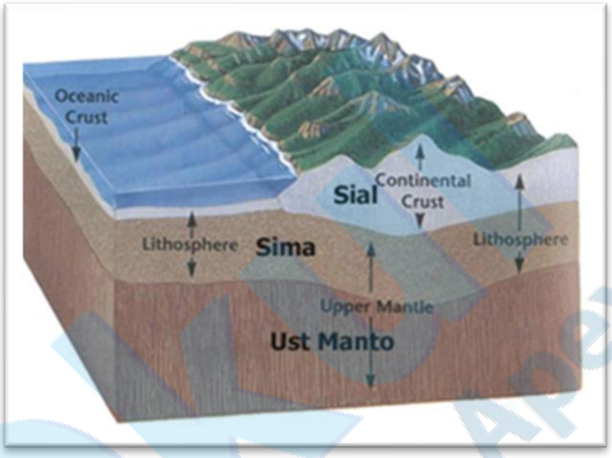
- The earth is made up of several concentric layers.



- The outer layer is the earth's crust-the **Lithosphere**-which comprises two distinct parts.
- The upper part consists of Granitic rocks and forms the continents. Its main mineral constituents are silica and alumina so it is collectively referred to as the **sial.** It has an average density of 2.7.
- The lower part is a continuous zone of denser **Basaltic rocks** forming the ocean floors, comprising mainly silica, iron and magnesium. It is therefore called sima and has an average density of 3.0.
- The sial and the sima together form the earth's crust which varies in thickness from only 3-4 miles beneath the oceans to as much as 30 miles under some parts of the continents.



- Since the sial is lighter than the sima, the continents can be said to be 'floating' on a sea of denser sima.



- Immediately beneath the crust or lithosphere is the **mantle** (or mesosphere) about 1,800 miles thick, composed mainly of very dense rocks rich in **olivine.**
- The interior layer is the core, (or barysphere) 2160 miles in radius, and is made up mainly of iron (Fe) with some nickel and is called **nife.**
- The temperature here is estimated to be as high as 3,500°F., and the core is subject to extremely high pressure.
- Under such conditions, the core could be expected to be in a liquid state. But recent studies through earthquake waves have suggested that the innermost part of the core is probably a crystalline or solid mass.
- Parts of the earth's crust are immersed by oceans and seas. These forms the **Hydrosphere.**
- Extending skywards for over fifteen miles, the earth is enveloped by a mass of gases which make up the **atmosphere.**

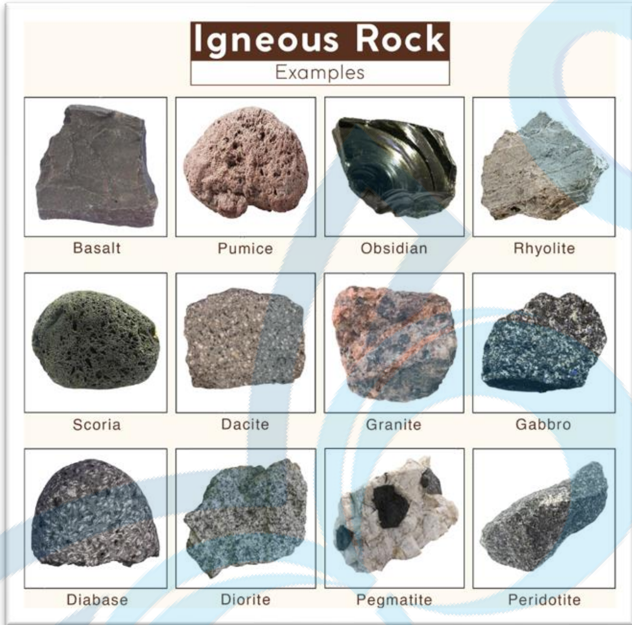
The Classification of Rocks

- The earth's crust is made up of various types of rocks, differing from one another in texture, structure, colour permeability, mode of occurrence and degree of resistance to denudation.
- All rocks may be classified into three major groups igneous, sedimentary and

metamorphic, according to their origin and appearance.

Igneous Rocks

- Igneous rocks are formed by the cooling and solidification of molten rock (**Magma**) from beneath the earth's crust. They are normally **Crystalline** in structure.
- They do not occur in strata (layers) nor do they contain fossils.
- Igneous rocks may be sub-divided on the basis of **mineral composition.** When they contain a high proportion of silica, they are said to be **acid.**
- Acid igneous rocks, such as granite, are less dense and are lighter in colour than **basic** rocks. These contain a greater proportion of basic oxides, e.g., of iron, aluminium or magnesium, and are thus denser and darker in colour.



In terms of origin there are two main classes of igneous rocks.

1. **Plutonic rocks:**

- These are igneous rocks, formed at some depth in the earth's crust.
- They have cooled and solidified slowly so that large, easily-recognized crystals have been able to form.
- These intrusive rocks, such as granite, diorite and gabbro, are exposed at the surface by the processes of denudation and erosion.

2. **Volcanic rocks:**

- These ate molten rocks poured out of Volcanoes as **Lavas**. They solidify rapidly on the earth's surface and the **Crystals** are small.
- Basalt is a common volcanic or **Extrusive** rock and forms lava flows, lava sheets and lava plateaux, e.g., those of Antrim in Northern Ireland, the Deccan Plateau in India and the Columbia-Snake Plateau in U.S.A.
- Some kinds of basalt solidify in a very peculiar manner to form **long polygonal columns.**
- A well-known example is the columnar basalt of the Giant's Causeway in Antrim.

- Some of the molten lava may push its way to the surface through clefts and passages, solidifying as **vertical dykes or horizontal sills.**
- Most igneous rocks are extremely hard and resistant. For this reason. they are quarried for road-making and polished as monuments and gravestones.

Sedimentary Rocks

- Sedimentary rocks are formed from **sediment** accumulated over long periods, usually under water.
- They are distinguished from the other rock types in their characteristic **Layer** formation and are termed **Stratified Rocks.**

- The strata may vary in thickness from a few inches to many feet. The rocks may be coarse or fine-grained, soft or hard.
- The materials that form sedimentary rocks may be brought by streams, glaciers, winds or even animals. They are non-crystalline and often contain **fossils** of animals, plants and other micro-organisms.

- Sedimentary rocks are thus the most varied in their formation of all rocks.
- Sedimentary rocks are classified according to their **age** and different kinds of rocks formed during the same period are grouped together. It is more useful to know the **characteristics** of the various kinds of rocks.

Sedimentary rocks may be classified under three major categories in accordance with their origin and composition.

1. **Mechanically formed sedimentary rocks:**

- These rocks have been formed from the accumulation of materials derived from other rocks which have been cemented together.
- **Sandstones** are probably the most familiar sedimentary rocks. They are made from sand grains, often quartz fragments derived from granites. Their texture, composition and colour vary tremendously.
- A coarser type of sandstone is known as **grit.**

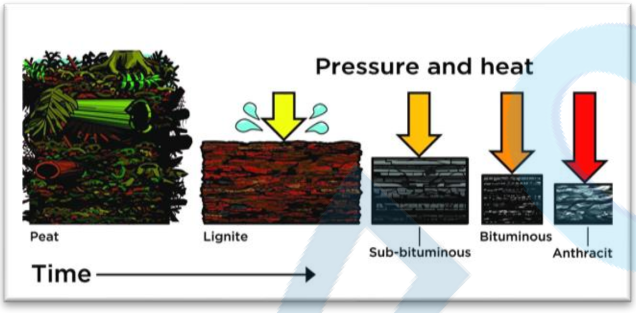
- When larger pebbles are firmly cemented to form a rock, it is called **Conglomerate.**

- When the pebbles are rounded, or **Breccia** when the fragments are angular.
- The finer sedimentary materials form clay, widely used for brick-making, shale or mudstone. Sand and gravel may occur in uncemented form.

2. **Organically formed sedimentary rocks:**

- These rocks are formed from the remains of living organisms such as corals or shellfish, whose fleshy parts have been decomposed, leaving behind the hard shells.
- The most common rocks formed in this way are of the **Calcareous** type. They include **limestones and Chalk.**

- The **Carbonaceous** rocks are also organically formed but from vegetative matter-swamps and forests.
- The pressure of overlying sediments has compressed the plant remains into compact masses of carbon which eventually become **Peat, Lignite or coal,** all of which bear great economic value.



3. **Chemically formed sedimentary rocks:**

- Such rocks are precipitated chemically from solutions of one kind or another.
- **Rocks salts** are derived from strata which once formed the beds of seas or lakes.
- Gypsum or calcium sulphate is obtained from the evaporation of salt lakes, such as the Dead Sea, which have a very high salinity. In similar ways, potash and nitrates may be formed.

Metamorphic Rocks

- All rocks whether igneous or sedimentary may become **metamorphic or changed rocks** under great heat and pressure.
- Their original character and appearance may be greatly altered by such forces, particularly during intense earth movements.
- In this manner, **clay may be metamorphosed into Slate, limestone into marble, sandstone into Quartzite, granite into Gneiss, shale into Schist and coal into Graphite**.

The influence of Rock types on Landscape:

- The appearance and characteristic features of landforms are greatly influenced by the underlying rock type.
- Softer rocks like clay and shale are worn down much faster than harder rocks like granite.

Earth Movements and the Major Landforms:

- The earth is constantly being reshaped by the agents of **Denudation-**running water, rain, frost, sun, wind, glaciers and waves, so that our present landforms are very varied and diverse.
- But these agents only modify the pattern of mountains, plateaux and plains which have been modelled by movements of the earth's crust.

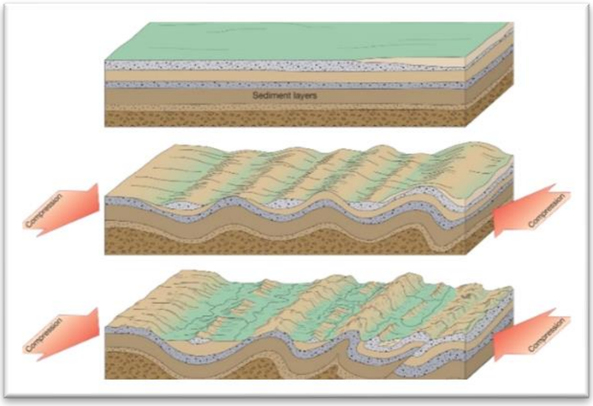
Types of Mountains:

Based on their mode of formation, four main types of mountains can be distinguished:

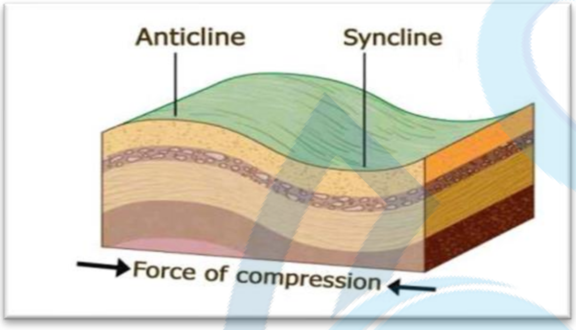
1. **Fold mountains:**

- They are caused by large-scale **earth movements**, when **stresses** are set up in the earth's crust.
- Such stresses may be due to the increased load of the overlying rocks, flow movements in the mantle, magmatic intrusions into the crust, or the expansion or contraction of some part of the earth.

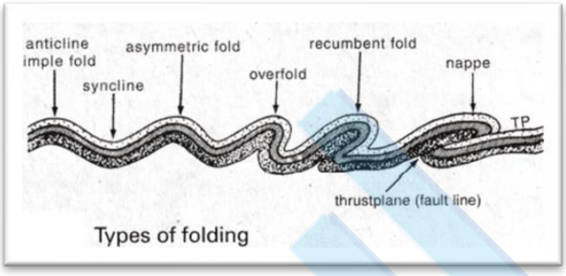
- When such stresses are initiated, the rocks are subjected to compressive forces that produce wrinkling or **folding** along the **lines of weakness.**
- Folding effectively shortens the earth's crust, creating from the original level surface a series of 'waves'.



- The upfolded waves are called **anticlines** and the troughs or downfolds are **Synclines.**



- The formation of up- and downfolds closely resembles that of the wrinkles of a table-cloth when it is pushed from either one or both sides of the table.
- In the great fold mountains of the world such as the Himalayas, Rockies, Andes and Alps due to the complexity of the compressional forces, the folds developed much more complicated forms.
- When the crest of a fold is pushed too far, an **overfold** is formed. If it is pushed still further, it becomes a **recumbent fold.**
- In extreme cases, fractures may occur in the crust, so that the upper part of the recumbent fold slides forward over the lower part along a **thrust plane**, forming an **overthrust fold.** The over-riding portion of the thrust fold is termed a **Nappe.**
- Since the rock strata have been elevated to great heights, sometimes measurable in miles, fold mountains may be called **mountains of elevation.**



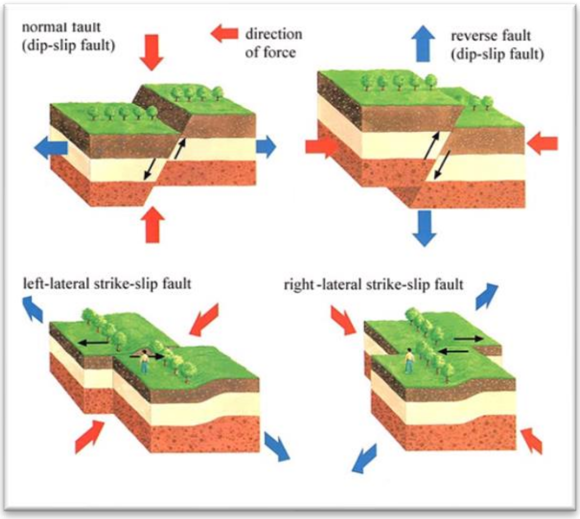
Types of folding

- The fold mountains are also closely associated with volcanic activity. They contain many active volcanoes, especially in the Circum-Pacific fold mountain system.
- They also contain rich mineral resources such as tin, copper, gold and petroleum.

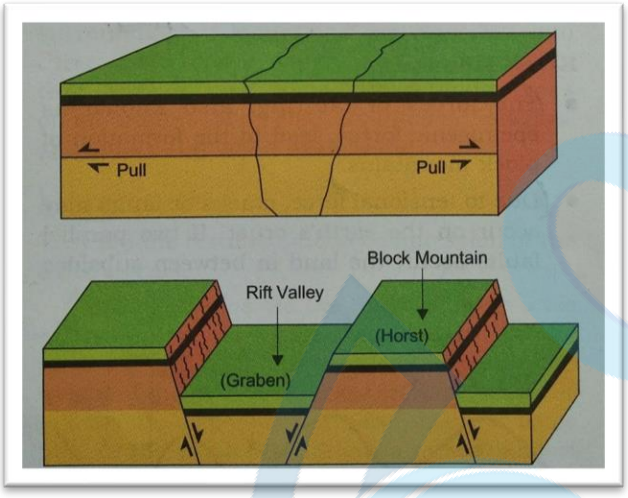
Distribution of fold mountains in the world:

2. Blocks Mountains:

- When the earth's crust bends folding occurs, but when it cracks, **faulting** takes place.
- Faulting may be caused by tension or compression, forces which lengthen or shorten the earth's crust, causing a section of it to subside or to rise above the surrounding level.



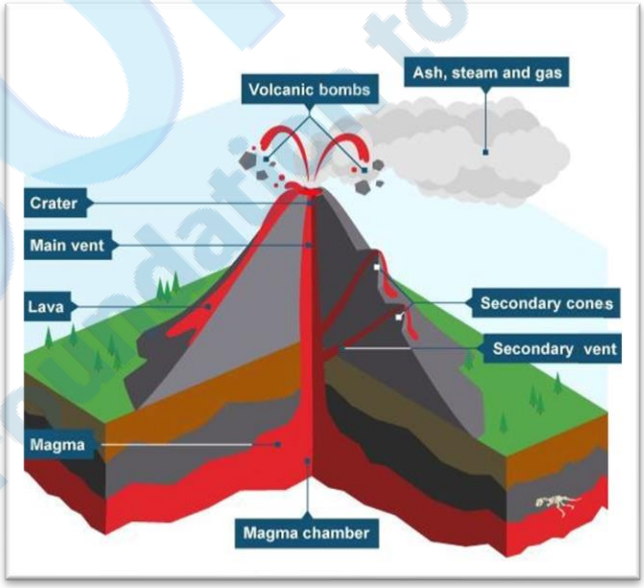
- Faulting causes **horsts** or **block mountains** and their counterparts **graben** or **rift valley.**



- Earth movements generate **tensional forces** that tend to pull the crust apart, and faults are developed.
- If the block enclosed by the faults remains as it is or rises and the land on either side subsides, the upstanding block becomes the horst or block mountain.
- The faulted edges are very steep, with scarp slopes and the summit is almost level, eg. The Hunsruck mountains, the Vosges and Black Forest of the Rhineland.
- Tension may also cause the central portion to be let down between two adjacent fault blocks forming a graben or rift valley, which will have steep walls.
- **Compressional forces** setup by earth movements may produce **a thrust or reverse fault** and shorten the crust. A block may be raised or lowered in relation. to surrounding areas.
- In general, large scale block mountains and rift valleys are due to tension rather than compression.
- The faults may occur in series and be further complicated by tilting and other irregularities. Denudation through the ages modifies faulted landforms.

3. **Volcanic mountains:**

- Volcanoes which are built up from material ejected from fissures in the earth's crust. The material includes molten lava, volcanic bombs, cinders, ashes, dust and liquid mud.
- They fall around the **Vent** in successive layers, building up a characteristic volcanic cone.
- Volcanic mountains are often called **Mountains of accumulation.**

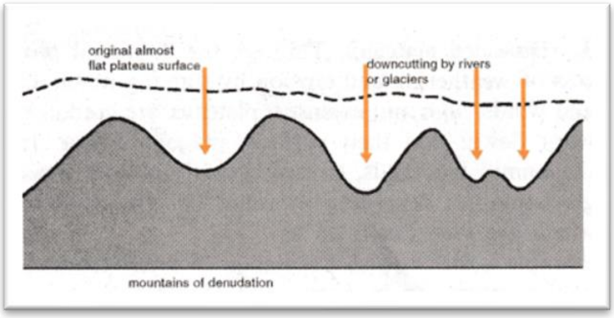


- They are common in the Circum-Pacific belt and include such volcanic peaks as Mt. Fuji (Japan) Mt. Mayon (Philippine), Mt. Merapi (Sumatra), Mt. Agung (Bali) and Mt. Catopaxi (Ecuador).

4. **Residual mountains:**

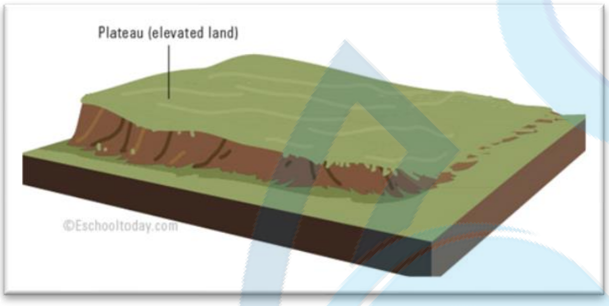
- These are mountains evolved by **Denudation.** Where the general level of the land has been lowered by the agents of denudation some very resistant areas may remain and these form **residual mountains.**
- Example: Mt. Manodnock in U.S.A. Residual mountains may also evolve from plateaux which have been **dissected** by rivers into hills and valleys.

- Here the ridges and peaks are all very similar in height. Examples of dissected plateaux, where the down-cutting streams have eroded the uplands into **mountains of denudations** are the Highlands of Scotland, Scandinavia and the Deccan Plateau.



Types of Plateaux:

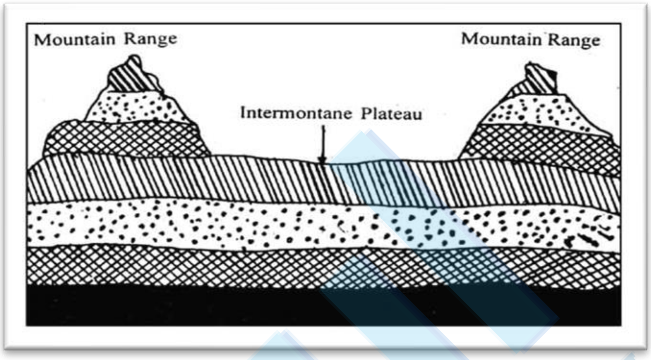
- Plateaux are elevated uplands with extensive level surfaces, and usually descend steeply to the surrounding lowland. They are sometimes referred to as **tablelands.**



- Like all highlands, plateaux are subjected to erosional processes. As a result, their original characteristics may be greatly altered.
- According to their mode of formation and their physical appearance, plateaux may be grouped into the following types:

1. Tectonic plateaux:

- These are formed by **earth movements,** which cause uplift, and are normally of a considerable size, and fairly uniform altitude.
- They include **continental blocks** like the Deccan Plateau in India.
- Some of the tectonic plateaux may be tilted like the Meseta of central lberia, or faulted like the Harz of Germany.
- When plateaux are enclosed by fold mountains, they are known as **intermont plateaux.**



- Examples are the Tibetan Plateau between the Himalayas and the Kunlun, and the Bolivian Plateau between two ranges of the Andes.
- Intermont plateaux are some of the highest and the most extensive plateaux in the world.

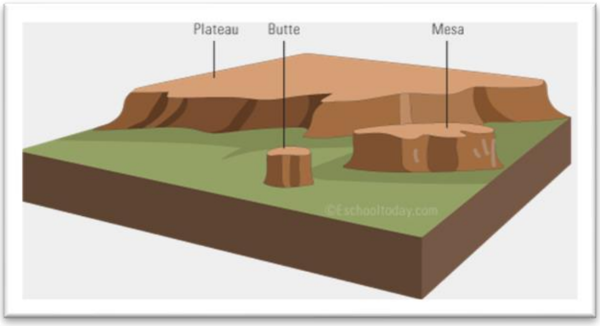
2. Volcanic plateaux:

- Molten lava may issue from the earth's crust and spread over its surface to form successive sheets of **basaltic lava.** These solidify to form a **lava plateau.**
- Some of the better-known volcanic plateaux are the Antrim Plateau of Northern Ireland and the north-western part of the Deccan Plateau.
- The most remarkable plateau built by lava is the Columbia-Snake Plateau which covers an area almost twice as big as Malaysia.
- Each layer of the lava flow is over 100 feet thick and the entire depth of successive lava layers is estimated to be almost a mile.

3. Dissected plateaux:

- Through the continual process of **weathering and erosion** by running water, ice and winds, high and extensive plateaux are gradually worn down, and their surfaces made irregular.
- In the humid highlands, stream action and sometimes glaciation cut deep, narrow valleys in the plateaux, which are then described as **Dissected plateaux.** An example is the Scottish Highlands.

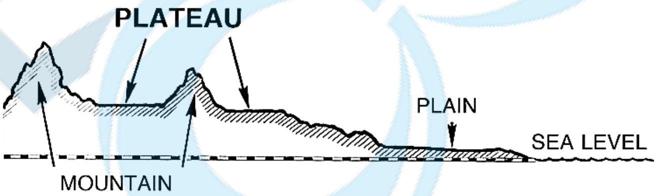
- In drier countries, vertical corrasion by rivers and abrasion by winds will dissect the plateau into steep-sided tabular masses termed **mesas and buttes,** intersected by deep canyons. This is a common feature of arid and semi-arid areas, e.g. in the south-western U.S.A.



- Many of the world's plateaux have rich mineral resources and have been actively mined. The African Plateau yields gold, diamonds, copper, manganese and chromium.
- In the Brazilian Plateau, there are huge resources of iron and manganese, particularly in the Minas Gerais area.
- The Deccan Plateau has deposits of manganese, coal and iron and the plateau of Western Australia is rich in gold and iron.

Types of Plains:

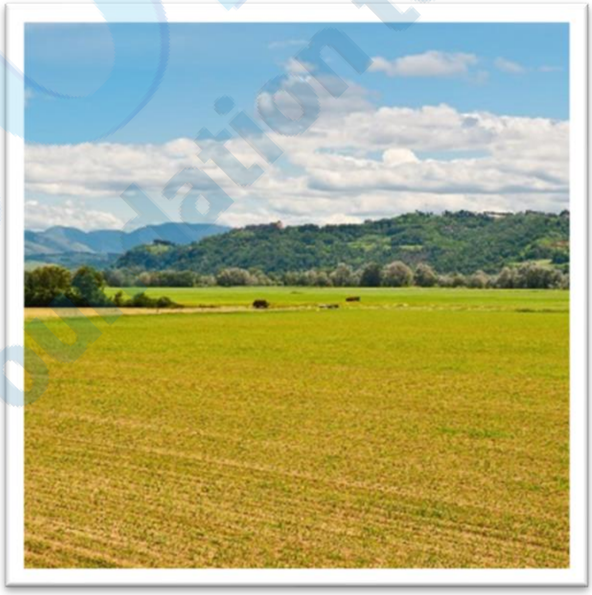
- A plain is an **area of lowland**, either level or undulating. It seldom rises more than a feet hundred feet above sea level. There may be low hills which will give a typical **rolling topography**.



- The plains usually form the best land of a country and are often intensively cultivated.
- Population and settlements are normally concentrated here, and when plains are traversed by rivers, as most of them are, their economic importance may be even greater, e.g., the Indo-Gangetic plain, the Mississippi plain and the Yang--tze plain.
- Some of the most extensive temperate plains are grasslands like the Russian Steppes, the North American Prairies, and the Argentinian Pampas.
- Plains may be grouped into three major types based on their mode of formation:

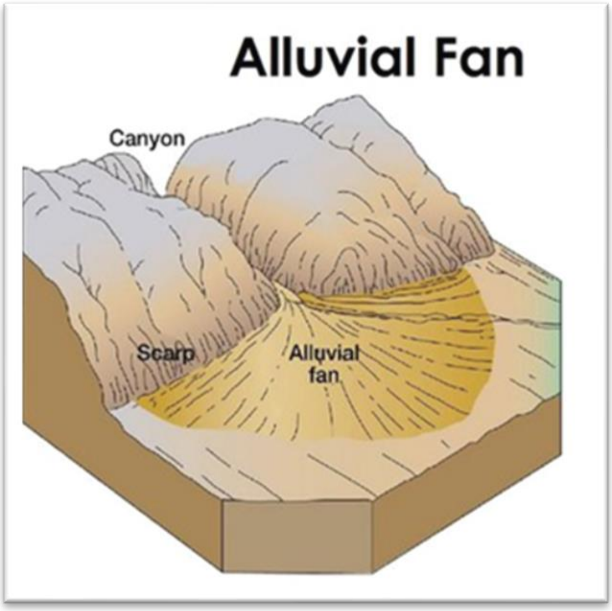
1. **Structural plains:**

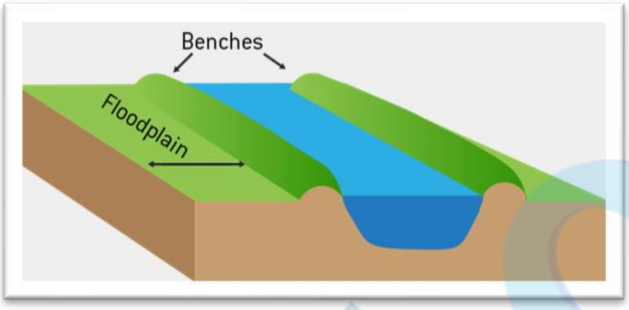
- These are the **structurally depressed** areas of the world, that make up some of the most extensive natural lowlands on the earth's surface.
- They are formed by horizontally bedded rocks, relatively undisturbed by the crustal movements of the earth.
- They include such great plains as the Russian Platform, the Great Plains of U.S.A. and the central lowlands of Australia.

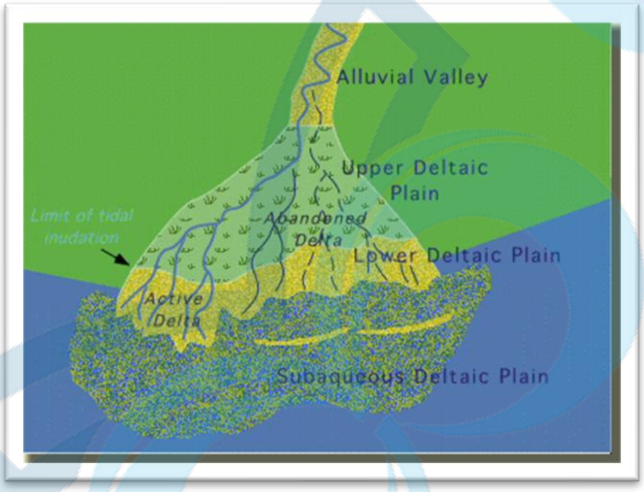


2. **Depositional plains:**

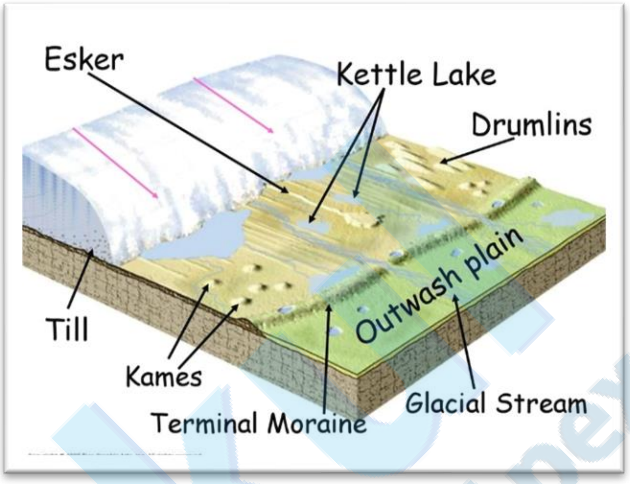
- These are plains formed by the **deposition** of materials brought by various agents of transportation.
- They are comparatively level but rise gently towards adjacent highlands. Their fertility and economic development depend greatly on the types of sediments that are laid down.
- Some of the largest depositional plains are due to deposition by **large rivers.**
- Active erosion in the upper course results in large quantities of alluvium being brought down to the lower course and deposited to form extensive **alluvial plains, flood plains and deltaic plains.**



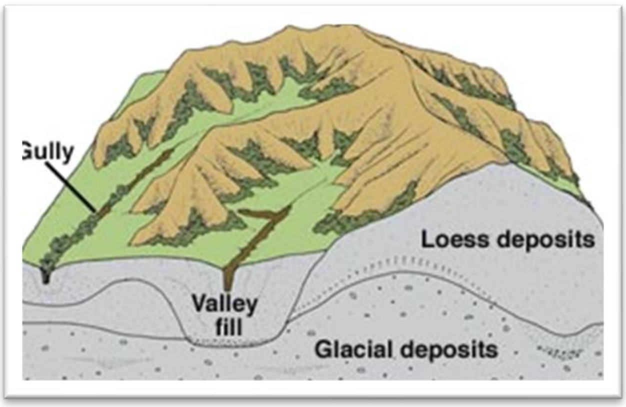




- They form the most productive agricultural plains of the world, intensively tilled and very densely populated.
- The Nile delta of Egypt is noted for rice and cotton cultivation, the Ganges delta for rice and jute growing, while the plain of North China, where the Hwang Ho has spread out a thick mantle of alluvium, supports a wide range of crops.
- Glaciers and ice-sheets may deposit a widespread mantle of unsorted fluvio-glacial sands and gravels in the **outwash plain** or may drop boulder clay, a mixture of various sizes of boulders and clay, to form a **till plain or drift plain.**



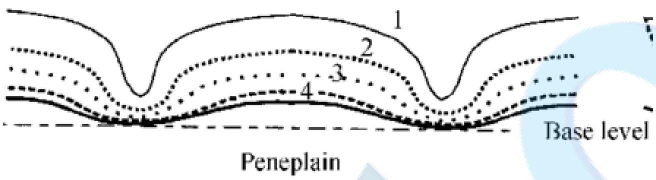
- Outwash plains are usually barren lands, e.g., some parts of Holland and northern Germany, but boulder clay may be very valuable farming land e.g., the Mid-West of the U.S.A. and East Anglia in England.
- In coastal regions, waves and winds often drive beach materials, mud, sand or shingle, landwards and deposit them on the **coastal plain** to form marine swamps, mud-flats, tidal and estuarine lowlands.
- Uplift may raise the coastal lowlands slightly and they then form an emergent coastal plain e.g., the coastal margins from Florida to Texas.
- Winds may blow aeolian deposits- very fine particles known as **loess**- from interior deserts or barren surfaces and deposit them upon hills, valley or plains forming a loess plateau, as in north-west China, or a loess plain, as in the Pampas of Argentina.

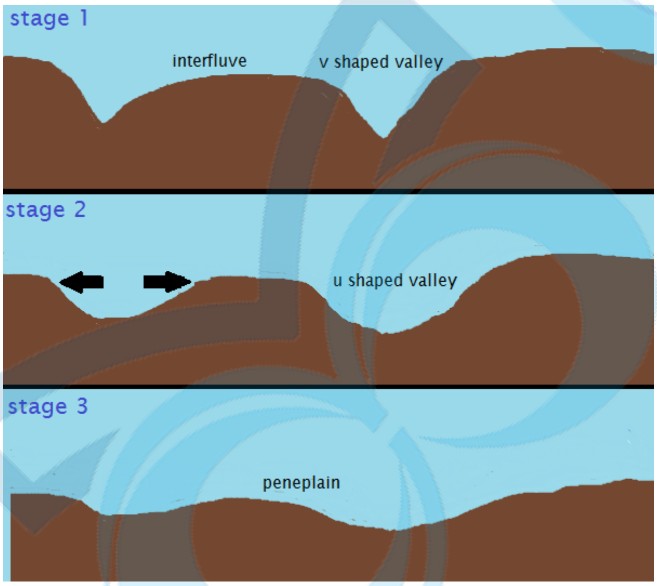


- The loess helps to level an undulating plain by filling up grooves and depressions. Many of the loess covered plains in the world are fertile agricultural regions.

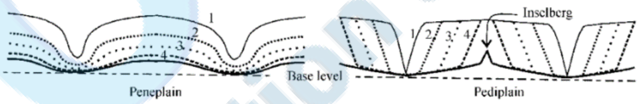
3. **Erosional plains:**

- These plains are carved by the agents of erosion
- Rain, rivers, ice and wind help to smooth out the irregularities of the earth's surface, and in terms of millions of years, even high mountains can be reduced to low undulating plains.
- Such plains of denudation are described as **peneplains** a word meaning 'almost-plains'.
- Rivers, in their course from source to sea, deepen their valleys and widen their banks.
- The projecting spurs are cut back so that the level ground bordering the river is constantly widened. At the same time the higher land between the rivers is gradually lowered.





- In glaciated regions, glaciers and ice-sheets scoured and levelled the land forming **ice sourced plains.** Hollows scooped out by the ice ate now filled by lakes.
- There are extensive ice-scoured plains in northern Europe and northern Canada. Finland is estimated to have 35,000 lakes, occupying I0% of the total land surface of the country.
- In arid and semi-arid regions, wind **deflation** sweeps away much of the eroded desert materials, lowering the level of land and forming extensive plains, e.g. the gravelly or stony desert plains called **reg** in Africa.
- Mechanical weathering in arid and semi-arid areas wears back the mountain slopes to leave a gently sloping **Pediments or Pediplains.**



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