GEOGRAPHY (ALL DISCIPLINES)- NOTES FOR SENIOR SECONDARY

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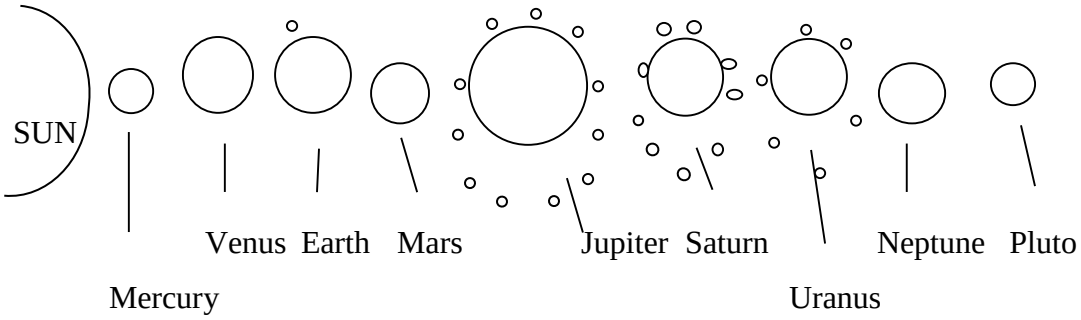
THE SOLAR SYSTEM

- The solar system is made up of the sun and everything that orbits around it, including planets, moons, asteroids, comets and meteoroids.
- The planets include eight planets: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune and Pluto.

The Solar System



ORDER OF PLANETS

1. **MERCURY**

- The smallest and nearest planet to the sun.
- It is about 579 000 000 km away.
- Its revolution around the sun is 88 days, which is the length of a year in mercury.
- The planet has a dense atmosphere of heavy inner gases
- It has no satellite or moon.

2. **VENUS**

- It is twice the distance of mercury away from the sun, it is the next closest planet.
- Venus is often considered as Earth's twine because of their close proximity in size, mass (weight) and density.
- It is a hot planet and has a dense atmosphere of carbon dioxide.
- It's the earth twin planet because it is almost similar to the earth.
- Its takes 243 earth days to take its rotation

- It suffers from extreme greenhouse effect.

3. **EARTH**

- It has an atmosphere consisting of a mixture of gases.
- Its surface temperature ranges from -50^{o} to $+50^{o}$.
- Life is possible on this planet.
- The Earth has 1 natural moon or satellite that revolves eastwards around the Earth once in every 28 days.
- The Earth takes $365^{1}/_{4}$ days to revolve around the sun.

4. **MARS**

- It has a reddish appearance and therefore called **Red planet**.
- It is smaller than Earth but it is believed by most professional astronomers to be the next planet after Earth to have the possibility of some plant life.
- It has 2 moons.

5. **JUPITER**

- It is the largest planet in the solar system.
- It is 773 million km away from the sun
- Its surface is made of many gases like hydrogen, helium and methane.
- It has 63 moons or satellites.
- It is very cold due to its distance away from the sun.

6. **SATURN**

- It is the second largest planet.
- It is 1,429 million km away from the sun.
- It has three rings and 61 satellites around it.
- It is so far from the sun that it takes $29^{1}/_{2}$ years to complete its orbit.

7. **URANUS**

- It was discovered in late 18^{th} century.
- It is another giant planet 50 times larger than Earth and 15 times as heavy.
- Uranus has twenty-seven known satellites, the largest ones being Titania, Oberon, Umbriel, Ariel and Miranda.
- It has a greenish- bluish appearance.

- It is tilted at an angle of 88^{o} hence it rotates in a retrograde or backward manner.
- Unlike other planets, Uranus orbits around the sun in a clockwise direction from east to west with five satellites revolving round it.
- It has a faint equatorial ring discovered in 1979.

8. **NEPTUNE**
   - Neptune is the eighth and farthest known planet from the Sun in the Solar System**.**
   - The planet is named after the Roman god of thesea**.**
   - Neptune's atmosphere is primarily composed of hydrogen and helium.
   - Neptune has thirteen known satellites.
   - It closely resembles Uranus .
   - Itis very cold and it has blue appearance.
9. **PLUTO**
   - Newly discovered.
   - It takes 248 years to complete its orbit due to distance from the sun.
   - It takes 6.4 days for its rotation
   - When it is near the sun (perihelion) and when it is farthest from the sun (aphelion) the distance is 2766 million miles.

OTHER MEMBERS OF THE SOLAR SYSTEM

ASTEROID

- Minor member of the solar system
- An asteroid is a small irregular shaped rocky body that revolves around the sun.
- There are about 50,000 asteroids in the solar system.

METEOR

- A meteor is also a minor member of the solar system
- It's a bright trail of light that appears in the night sky.
- It is also a shooting star
- Meteors are caused by rocky objects from space called meteoroids.
- Most Meteoroids burn up far above the earth and also land on the ground and are then called **Meteorites.**

COMET

- These are spheres covered with ice and dust that leave trails of water vapour as they race through space.

THE SHAPE OF THE EARTH

- The earth has a spherical shape.
- It is a little flattened at both ends like an egg and so can be called a geoid (earth shaped).
- It is bulged along the equator and flattened at the poles.

EVIDENCE TO PROVE THAT THE EARTH'S IS SPHERICAL IN SHAPE

Aerial photographs:

- Pictures taken from high altitudes by rockets and satellites show clearly the curved edge of the earth.

Circumnavigation of the Earth:

- Modern air routes and ocean navigation are based on the assumption that the earth is round.

Ship's visibility:

- When the ship leaves harbour, it disappears over the curved surface.
- If the earth were flat, the entire ship would be seen or obscured all at once.

The lunar eclipse:

- The cast by the Earth on the moon during a lunar eclipse is always circular.

Sunrise and sunset:

- 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.

Planetary bodies are spherical:

- All observations from telescopes reveal the planetary bodies, the Sun, Moon, satellites and stars have circular outlines.

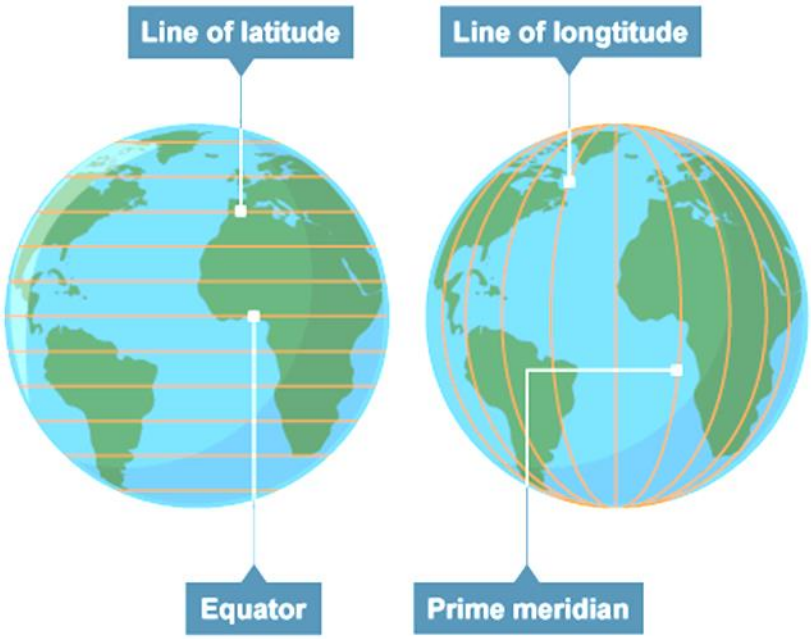
LATITUDE AND LONGITUDE

LINES OF LATITUDE:

- Imaginary lines around the Earth running parallel to the equator.
- These are measured in degrees north or south of the equator

LONGITUDE:

- Imaginary lines around the Earth running from the north to the south pole.
- These are measured in degrees east or west of the Greenwich or Prime Meridian.

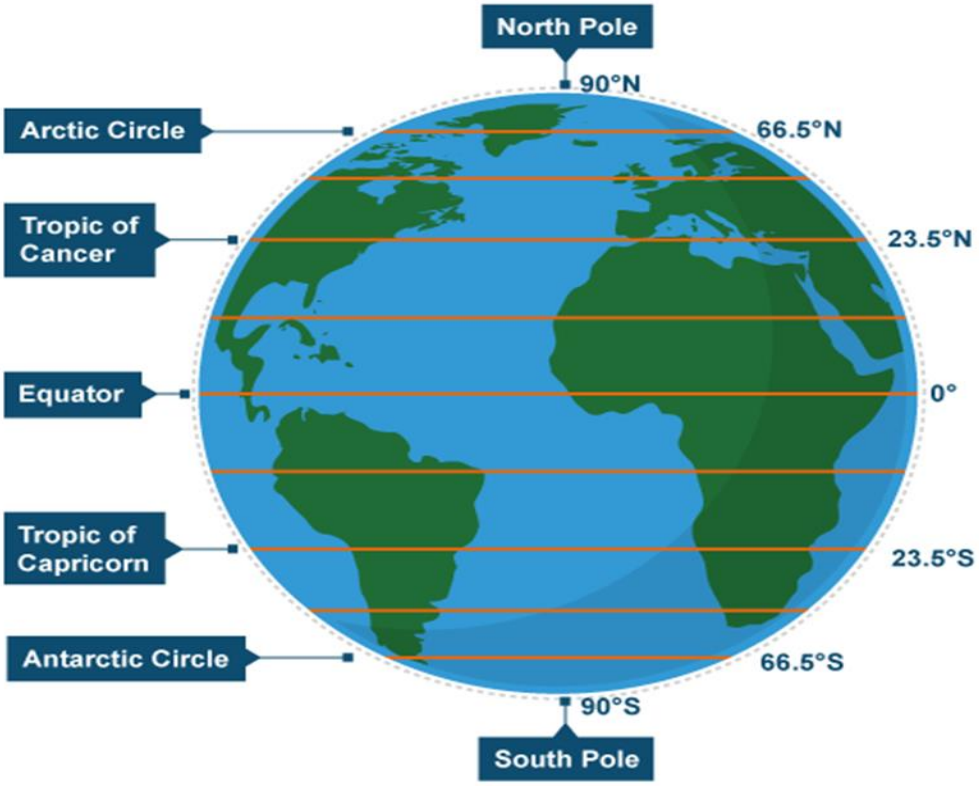


Lines of latitude circle the Earth in an east-west direction. They are parallel.

IMPORTANT LINES OF LATITUDE:

- the equator (0°)
- the Tropic of Cancer (23.5° north)
- the Tropic of Capricorn (23.5° south)
- the Arctic circle (66.5° north)

- the Antarctic circle (66.5° south)
- the North Pole (90° north)
- the South Pole (90° south)

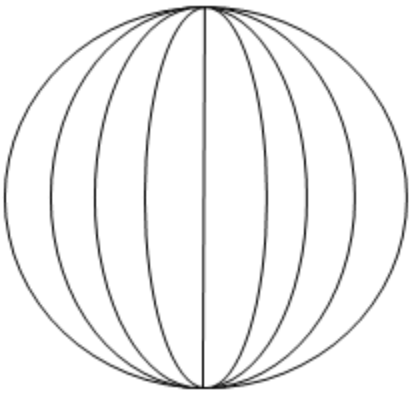


IMPORTANCE OF LINES OF LATITUDES

- Location of places on the globe
- Calculating of distances of places from the equator
- Delineation or demarcation of climatic zones.

LINES OF LONGTUDES

- Longitude is the measurement east or west of the prime meridian.
- Longitude is measured by imaginary lines that run around the Earth vertically (up and down) and meet at the North and South Poles. These lines are known as meridians.



Meridians or longitudes

Uses of Longitude

- To locate and fix places on the maps
- To find distance between meridian in km/miles
- To calculate time east or west of any given meridian.

LONGITUDE AND TIME

- Local time at Greenwich Meridian is called Greenwich MeanTime **(GMT)**
- Local time-since the earth makes one complete rotation of 360^0 in one day or 24 hours, it passes through 15^0 in one hour or 1^0 in 4 minutes.
- The earth rotates from west to east, so every 15^0 we go eastwards, local time is advanced by 1 hour.
- Conversely, if we go westwards, local time is retarded by 1 hour.
- Places east of Greenwich see the sun earlier and again time, whereas places west of Greenwich see the sun later and lose time.

CALCULATION OF WORLD TIME ZONES

- Every point on the earth surface rotates through 360^0 every 24 hours.

  $\frac{24^1}{}$hours $\frac{360^{o15}}{}$

  $\frac{24}{1}$ $\frac{24}{1}$

1 hour = 15^0

Further we know that 1 hour =60 minutes hence

$\cancel{60}^4$ minutes $\cancel{15}^{o1}$

$\cancel{15}_1$ $\cancel{15}_1$

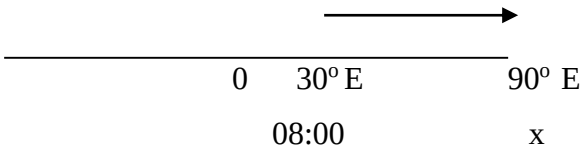
4 minutes= 1^o

- The earth is divided into 25 equal time zones of 15^o each Longitudes the lines that run east and west of the prime meridian are used to calculate time.
- The longitudes meet at the line 180^o E and W, also known as the international dateline.
- As we move towards the west we lose time.

WORKED EXAMPLES

1. When Time in Zambia 30^oE is 08:00hours. Find the time at point P which is 90^oE

Solution



Difference in longitude = $>90^o - 30^o = 60^o$

= 1 hour → 15^o

= X 60^o

$\cancel{15}^1$ X $\cancel{60}^4$

$\cancel{15}_1\cancel{15}_1$

X = 4

Time at P = 08:00 + 4 hours = 12:00 hours

EXAMPLE: 2

2. Town X is situated at longitude 30° West and Town Y is located on Longitude 60° E. When local time at X is 08: 00 hrs, what is the local time at Y?

08: 00 hrs X

$30^o + 60^o = 90^o$

1 h = 15^o

X 90^o

$\frac{90}{15} = \frac{15X}{15}$

X = 6

08: 00

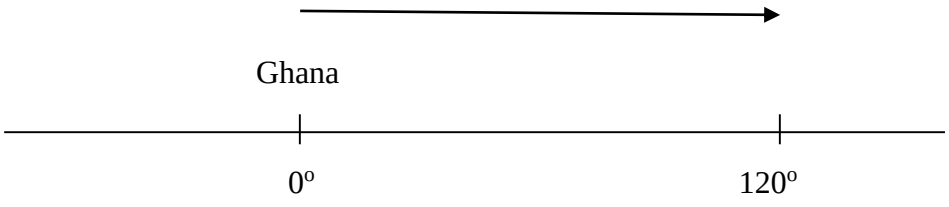
+ 06: 00

14: 00

Therefore, time at Town X is 14: 00 hrs.

EXAMPLE: 3

A jet destined for place X, 120^{o} E, leaves Ghana (0^{0}) at 14: 00hrs GMT, and takes one hour to fly every 30 degrees. At this speed, what would be the local time at place X when the jet arrives their?



0^{o} + 120^{o} = 120^{o}

1hr = 15^{o}

X 120^{o}

4

~~15~~X/~~15~~ =~~120~~/~~15~~

X = 8

14: 00

+ 08: 00

22: 00

EXAMPLE 4

4. The Local time of a station X is 16:00hrs, when time in London is 19:00 hrs. What is the longitude of the station X?

19:00 hrs

-16:00 hrs

3:00 hrs

3 X 15 =45°

Longitude for Station X is 45^{0}W

ANGLE OF ELEVATION

- It is an angle at which the sun strikes the earth at a particular time and season.
- The changing altitude of the midday sun would also be expressed as angle of elevation
- Elevation is height at a given datum line changes in the altitude is caused due to the apparent movement of the sun.
- To find the angle of elevation of the midday sun of a given place at the given part of the year, it is vital to know the position of the sun at different times of the year as may be summarized as follows.
- On 21st March and 23rd September the sun overhead at the equator and it is called equinox. During this time, day and nights are equal in all parts of the world.
- On 23rd June, the sun overhead the tropical of cancer (23½°N) and it also known as summer solstice.
- On 22nd December the sun overhead at the tropical of Capricorn (23½°S). This is also called winter solstice

How to Calculate the Angle of elevation of the Midday Sun.

- The following procedure will be used to calculate the angle ofelevation :

1. When both the overhead sun and the place are in the same hemisphere, subtract the overhead sun angle from the place and the difference subtracted it from 90^o

   e.g. Milan is 46^oN find the angle of elevation on 21st June $90 – (46\text{-}23^1/_2)$

   $90 – 22^1/_2$

   $\underline{67^1/_2}^o$

2. Whenthe sun overhead at the equator use the formula 90 – n. where n is the latitude angle of the place. For example what is the angle of elevation in Lusaka 25^o on 21st march? 90-25=65.

3. When the overhead sun and the place are in difference hemispheres add the overhead sun angle and the angle of the place then subtract from 90. Cairo is 30^oN, what is the angle of elevation of the midday sun on 22nd December.

   <e = 90 – Latitude

   $30^o + 23^1/_2 = 53^1/_2$ $= 90 - 53^1/_2 = \underline{36^1/_2}$

Examples

1. On 22nd December the sun is overhead at the tropic of Capricorn. What will be sun's angle of elevation of 60°N? <e = (90 – latitude)

$23^1/_2$ $= 90 - 83^1/_2$

$\underline{+ 60}$ $= \underline{6^1/_2}$

$\underline{83^1/_2}$

2. On 21st June, the sun is overhead at the tropic of Cancer. What will be the angle of elevation at 10°S

$23^1/_2$°N <c= (90 - latitude)

$\underline{-10°S}$ $= 90 - 13^1/_2$

$\underline{13^1/_2}$ $= \underline{76^1/_2}$

3. Calculate the angle of elevation for latitude 20°S when the sun is overhead at the tropic of cancer.

20°S <e = (90 - latitude)

$\underline{+ 23^1/_2°N}$ $= 90 - 43^1/_2$

$\underline{43^1/_2}$ $= \underline{46^1/_2}$

4. On 21st September the sun overhead at the equator. What is the angle of elevation at latitude 90°N?

90°N <e = (90 - latitude)

$\underline{+ 0}$ $= 90 - 90$

$\underline{90}$ $= \underline{0°}$

5. On 21 June the sun is overhead at the tropic of cancer. What is the angle of elevation for latitude 10°S?

90 <e = (90 - latitude)

$23^1/_2$N $= 90 - 33^1/_2$

$\underline{+10S}$ $= \underline{56^1/_2}$

$\underline{33^1/_2}$

6. What will be the angle of elevation for latitude 20ºN when the sun is overhead at latitude 20ºN?

20ºN <e = (90 - latitude)

-20ºN = 90 - 0

0 = 90º

HOW TO FIND LINEAR DISTANCE

- Latitudes are also used to find linear distance. For example 1º (1 degree) is equal to 111km from the line of latitude.

Example 1

What is the approximate straight line distance between Cairo (30ºN) and Bulawayo (20ºS)?

D= 30ºN + 20ºSNB. N+S= +

D= 50º N+N= -

D= 50º× 111Km S+S= -

D= 5 550Km. S+N= +

Therefore the distance is 5 550Km

- **Example 2**

Town A lies at 10ºs and Town B lies at 65ºs. What is the distance between these two towns.

D=65ºs-10º s

D= 55º × 111Km

D= 6105Km

Example 3

Find the distance between Lusaka 16ºs and Kampala 8ºN?

D= 16ºs- 8ºN

D= 8º × 111Km

D= 888Km

EXERCISE

1. Find the distance between:

(a) Lusaka 14ºs and Dar-es-salam 3ºs.

(b) Harare 16ºs and Nairobi 5ºN.

(c) Kampala 30ºN and Cairo 30ºN.

(d) Darban 30ºs and 51ºN.

THE INTERNATIONAL DATE LINE

- This is longitude 180°E and W where time changes by exactly 24 hours.
- The International Date Line sits on the 180º line of longitude in the middle of the Pacific Ocean, and is the imaginary line that separates two consecutive calendar days.
- A traveller going eastwards **gain time** until he reaches longitude 180°E, when he will be 12:00 hours ahead of Greenwich Mean Time. A traveller going westwards **loses time** when he reaches 180°W.
- Longitude 180°E and W is the International Day Line where time changes by one day when crossed.
- A traveller travelling east **gains a day** upon crossing from west to east.
- And a traveller travelling west **loses a day** upon crossing from east to west.
- The International date line in the mid-pacific curves from 180° meridian at the Bering strait, Tonga and other Islands to prevent confusion of day and date in some of the Island groups that are cut through by the Meridian.

THE MOVEMENT OF THE EARTH

- The Earth like all planets has two distinct movements.
- These are rotation and revolution.

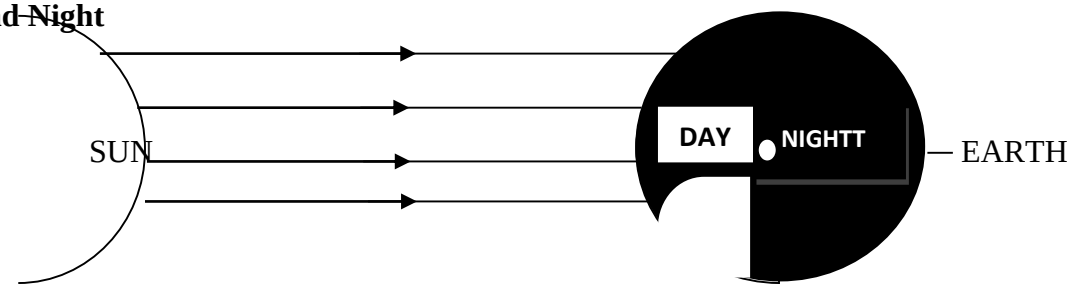
ROTATION

- The rotation of the earth is the movement of the earth on its axis each day in 24 hours.
- It rotates in anticlockwise direction from the west to east.

EFFECTS OF EARTH ROTATION

- A difference of 1 hour between two meridians 15^0 apart.
- The deflection of winds and ocean currents
- The daily rising and falling of tides
- Day and night: One part of the Earth emerges from darkness into daylight at sunrise.

Day and Night



- It brings about Sunrise and Sunset.

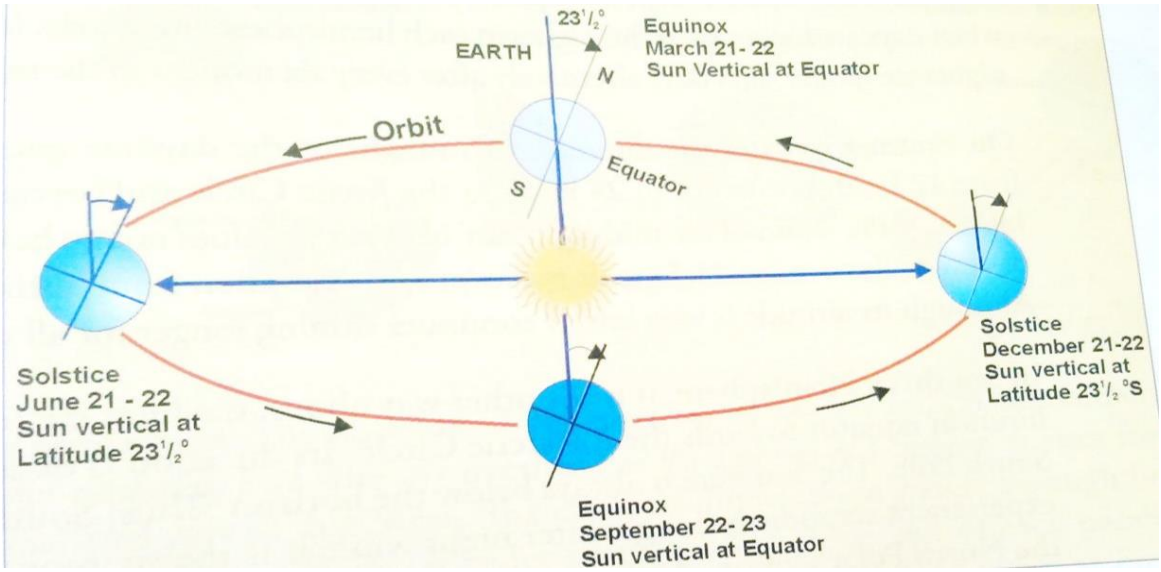
REVOLUTION

- Revolution is the movement of the earth around the sun from West to East following the path called orbit.
- It takes 365and quarter days for the earth to complete its budget.

EFFECTS OF REVOLUTION

- ***CHANGES IN ALTITUDE OF THE MID DAY SUN:*** The revolution of the earth on an axis inclined at an angle $66^1/_20$ and it will always point to the same direction.
- The northern hemisphere will be tilted towards the sun and the southern hemisphere in the other half**.**
- This brings changes in the altitude of the midday sun at different latitudes at different times of the year such as:
    - ❖ On 21st March and 23rd September the sun overhead at the equator and it is called equinox. During this time, day and nights are equal in all parts of the world.
    - ❖ On 23rd June, the sun overhead the tropical of cancer (23½°N) and it also known as summer solstice.
    - ❖ On 22nd December the sun overhead at the tropical of Capricorn (23½°S). This is also called winter solstice
- **CHANGES IN SEASONS:** Revolution causes seasons like summer, winter, autumn and spring depending on the apparent movement of the sun**.**
- **EQUINOXES:**

- Equinox means equal days and equal night.
- At equator the sun overhead and the position of the earth will be on 21st March and 23rd September shows the mid-day sun at $90^{0.}$
- 21st March indicates spring season before the start of summer in the Northern Hemisphere and it is called **VERTICAL EQUINOX**
- 23rd September in the southern hemisphere is called the **AUTUMNAL EQUINOX** before the start of the winter season.



VARIATION IN LENGTH OF DAY AND NIGHT TIME:

- The revolution of the earth around the sun causes variations in length of day and night time over different latitude.
- The sun overhead at the Tropic of cancer and Capricorn at various times.
- When the sun overhead in the southern hemisphere at the tropic of Capricorn, the northern hemisphere will receive less hours of daytime but more night time hours.
- When the sun overhead in the Northern hemisphere at the tropic of Cancer, the southern hemisphere will receive less hours of daytime but more night time hours.

EXERCICE

1. On which of the following days will places along latitude $23^{1/2N}$ have 12 hours of daylight and 12 hours of darkness?

   A. 22nd December and 21st June. B. 21ST June and 23rd September.

   C. 21st March and 21st June. D. 21st March and 23rdSeptember.

2. Define equinox……

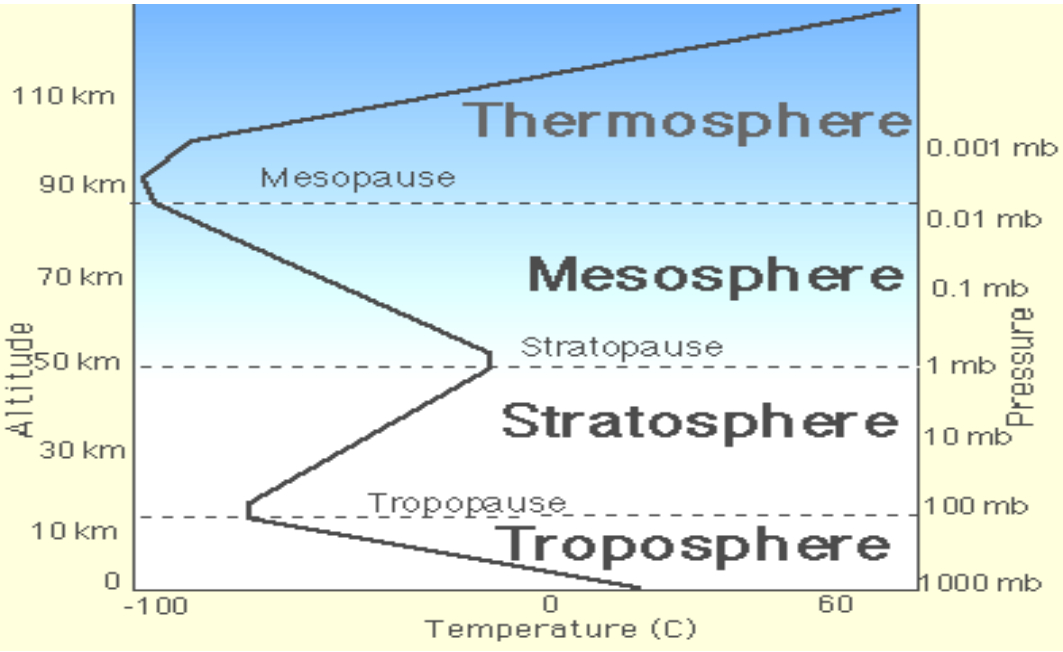
3. Explain two effects of earth rotation

EARTH'S ATMOSPHERE

- The atmosphere is a mixture of nitrogen (78%), oxygen (21%), and other gases (1%) that surrounds Earth.
- All of these gases combine to absorb ultraviolet radiation from the Sun and warm the planet's surface through heat retention.
- Oxygen is the most important of the gases in our atmosphere in relation to animal life

STRUCTUREOF THE ATMOSPHERE

The atmosphere has 4 layers:



The atmosphere is divided into 4 major layers. These are:

1. THE TROPOSPHERE

- The troposphere begins at the surface and extends to between 7 km at the poles and 17 km at the equator, with some variation due to weather.
- This is the layer where we live and where weather happens.
- Troposphere starts from 0 to 12 km and Contains 75% of the gases in the atmosphere.
- As height increases, temperature decreases, the troposphere that we live in near the surface of the earth;
- The troposphere is the lowest layer of the atmosphere.
- The troposphere contains 99 % of the water vapor in the atmosphere.
- Temperature in this layer generally decreases with height.
- The boundary between the stratosphere and the troposphere is called the **tropopause**

2. STRATOSPHERE

- Above the tropopause lies the stratosphere.
- Stratosphere -12 to 50 km. In this layer the temperature increases with height.
- This is because the stratosphere houses the ozone layer.
- The ozone layer is warm because it absorbs ultraviolet (UV) rays from the sun. The stratosphere extends to about 51 km.
- The majority of the ozone (about 97%) found in the atmosphere is concentrated in the stratosphere at an altitude of 15 to 55 kilometers above the Earth's surface.
- This stratospheric ozone provides an important service to life on the Earth as it absorbs harmful ultraviolet radiation

3. THE MESOSPHERE

- The mesosphere is the layer above the stratosphere.
- Mesosphere - 50 to 80 km.
- The temperature decreases with height here just like it does in the troposphere.
- This layer also contains ratios of nitrogen and oxygen similar to the troposphere, except the concentrations are 1000 times less and there is little water vapor there, so the air is too thin for weather to occur.

- The mesosphere extends to about 85 km. Most meteors burn up in this zone of the atmosphere.

4. THE THERMOSPHERE

- The thermosphere is the uppermost layer of the atmosphere.
- Thermosphere - 80 km and up.
- In this layer the temperature increases with height because it is being directly heated by the sun.
- The thermosphere extends up to between 320 and 380 km.
- This is where the International Space Station orbits.
- The top layer, where the air is hot but very thin.
- The temperature here can rise to 1,500 °C. This layer contains:

Ionosphere: This is the lower part of the thermosphere. It extends from about 80 to 550 km.

Exosphere: The upper part of the thermosphere. It extends from about 550 km for thousands of kilometers.

EXERCISE

1. What is the boundary between the stratosphere and the troposphere is called…….
2. Mention the four layers of the atmosphere.
3. Explain briefly the role played by the stratosphere in supporting human life.
4. Show how the troposphere is able to support life

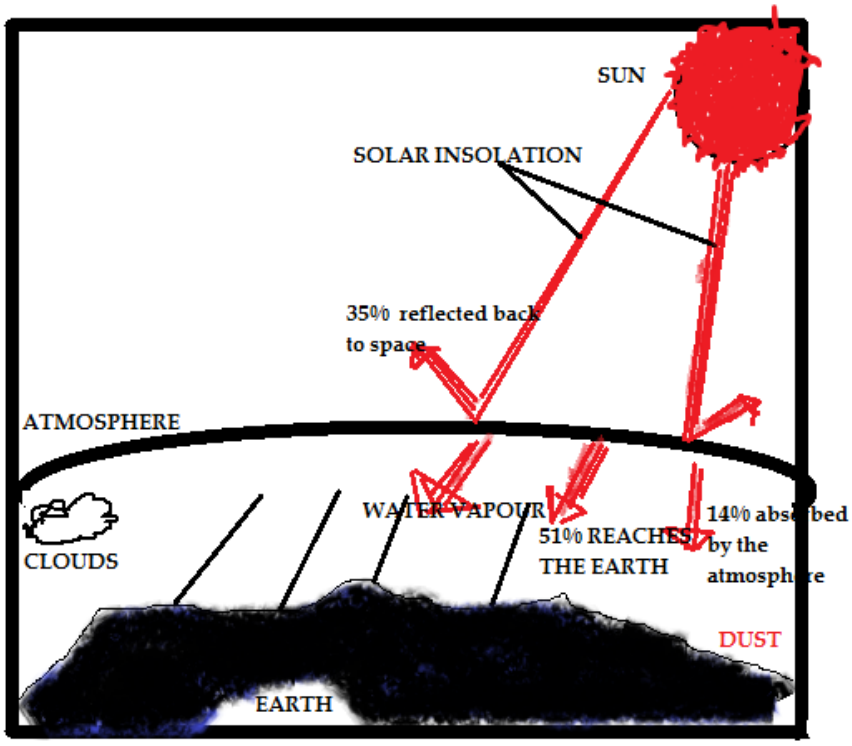
INSOLATION

- Insolation is the amount of solar radiation received per unit at the earth surface.
- This energy travels through space for a distance of 150 million KM
- This radiation from the sun is made up of three parts namely:

1. WHITE VISIBLE LIGHT -This is what we see when the sun shines. The white visible light is the most intense and has great influence on our climate.

2. THE LESS VISIBLE ULTRA VIOLET -This is very harmful and it affect our skin and can cause sun-burn when our bare body is exposed to for a long time.

3. THE INFRA-RED RAYS - This can penetrate even dust and fogs and is widely used in photographs.



- It is estimated that 35% of the solar radiation that reach the atmosphere is reflected back to the space by dust, clouds and air molecules and it has no part in heating the earth atmosphere.
- It is also estimated that the incoming solar radiation or insolation, about 14% is absorbed by water vapour, carbon dioxide and other gases.
- Its interception by the air causes it to be scattered and diffused so that the visible rays of the spectrum between the ultra-violet and infra-red give rise to the blue sky that we see.
- It is also estimated that the remaining 51% reaches the earth and warms the surface and in turn the layers of air above by conduction and through the transmission of heat by upward movement through convection.
- The radiation of heat by the earth continues during the night.
- The rate of insolation differs between land and water surfaces.
- Land get heated much more quickly than water because :

- ❖ Water is Transparent
- ❖ Heat is absorbed more slowly in water
- ❖ Water is in motion
- ❖ The absorbed heat is distributed over a greater depth and area in water.

EXERCISE

1. What is the percentage of solar energy which:

(a) Reaches the atmosphere……..

(b) Reflected back to space……

© Is absorbed by the atmosphere……

2. Mention the four layers of the earth atmosphere

EARTH MOVEMENTS

FAULTING AND FOLDING

1.1 Introduction: Forces Leading to Faulting and Folding

- Earth movements are movements caused by internal and external forces.

- These movements can be lateral or vertical in nature.

(i) **Internal forces** are forces that operate within the earth surface leading to earthquakes, Vulcanicity, folding and faulting.

- They are also called **endogenic forces.**

(ii) **External forces** are forces that operate on the earth's surface leading to denudation, glaciations, river action and wave action.

- They are also called**exogenic forces.**
- Earth movements are also called tectonic movements as they help in building the relief features on the earth's surface.

1.2 Classification of Earth movements

- Earth movements are classified on various bases.
- On the basis of time taken by such movement, there are **slow movements** and **sudden movements**.

1.2.1 Slow movements

- These are movements which bring about changes on the earth's surface gradually (slowly).
- Slow movements may take hundreds or thousands of years.
- They act on the earth's crust either vertically or horizontally.
- Slow movements can result in any of the following; **uplift, submergence** or **subsidence** of earth's crust.

1.2.2 Sudden movements

- Unlike slow movements, sudden movements bring about abrupt changes in the crust.
- Examples of sudden movements are **volcanic eruption**, **landslide** and **earthquakes**

1.3 Vertical and Horizontal movements

- Slow movements can further be divided into vertical and lateral movements depending on whether the earth's surface has gone up or from one side to another horizontally.

1.3.1 Vertical movements

- These are up and down movements which cause the crustal rocks to fault.
- They originate from the centre of the earth and affect its surface.
- Vertical movements are also called **epeirogenic**movements.
- Vertical movements

i. are slow and wide spread
ii. do not bring changes in horizontal rock strata
iii. Create continents, plateaus and oceans if large scale uplift or subsidence occurs. Other features produced include Block Mountains, basins and some type of escarpments.

1.3.2 Horizontal movements

- Horizontal movements are geographically called orogenesis.
- They are forces which act on the earth's crust from side to side horizontally and cause the crustal rocks to fold.
- They cause lot of disruption in the horizontal layer strata.
- Horizontal movements produce landforms such as Fold Mountains, rift valleys and Block Mountains.

1.4 Forces of Tension and Compression

- Both horizontal and vertical movements exert great forces of tension and compression, which produce impressive landforms.

DIFFERENT BETWEEN COMPRESSION AND TENSION FORCES

COMPRESSION FORCE	**TENSION FORCE**
Compression force exerts pressure from both sides that is forces push towards the centres	Tension forces exert pressure from opposite directions that is forces pull the rocks apart.

The pressure applied causes rock layers or surface to crack or develop faults	The pressure applied causes the rock layers or surface to crack or develop faults.

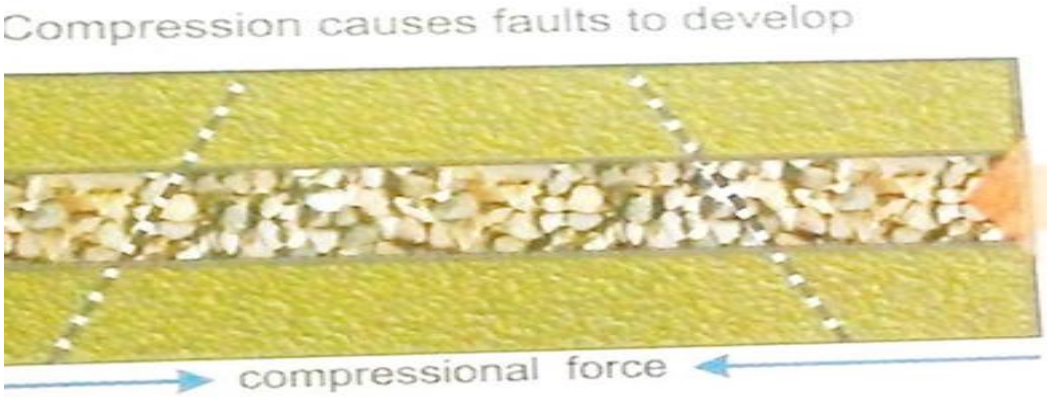
1.4.1 Forces of Tension

- Tension is produced when forces are working in opposite directions i.e. away from a given point or plane.
- Tensional forces lengthen the earth's crust.
- Under the influence of extreme tensional forces, the rock strata are broken or fractured.
- Forces of tension produce **faults** and the plane alone which displacement of fractured rock strata takes place is called the **fault plane** (a line of fracture is called fault line).
- Landforms produced by tensional forces include **rift valleys**, **Block Mountains** and **fault scarps.**

1.4.2 Forces of Compression

- Compression occurs when rock strata are pushed against a hard plane from one side or from both sides towards a given point or plane.
- Compression forces shorten the earth's crust and leads to the bending (warping) of rock layers.

- Compression force produces **Fold Mountains.**



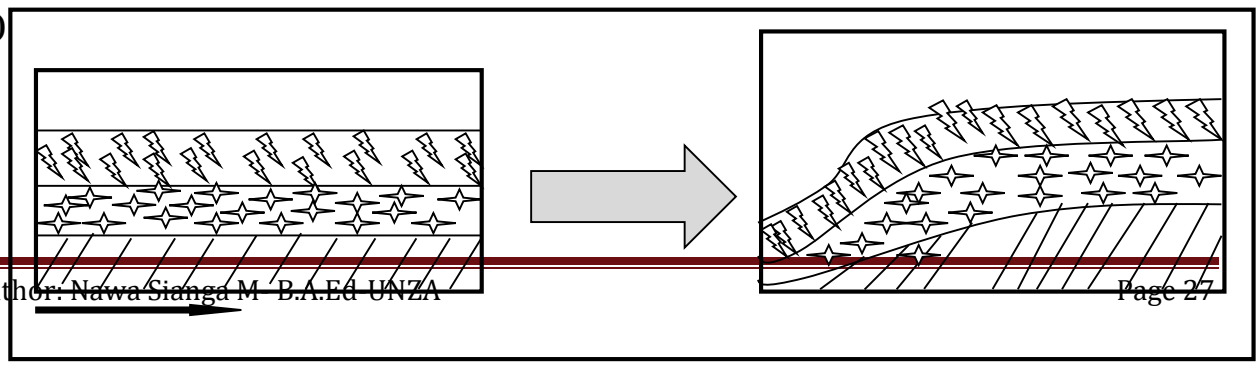
FOLDING

- Folding is the process which involves slow bending of crustal rocks over long periods of time as a result of compression forces acting on young rocks.
- A **fold** isa bend in the rock as a response to compression forces.
- Therefore, **folding** is the bending of rock strata due to forces of compression.
- This means that folding is caused by compression force.
- The compressed rocks bend upwards to form complex folds called fold mountains or simple folds called **anticlines and synclines**

TYPES OF FOLDS

(a) Monocline Fold is formed when rock strata are pushed by compression forces against a hard plane from one side. Figure 1.3 shows the formation of monocline fold.

(b)



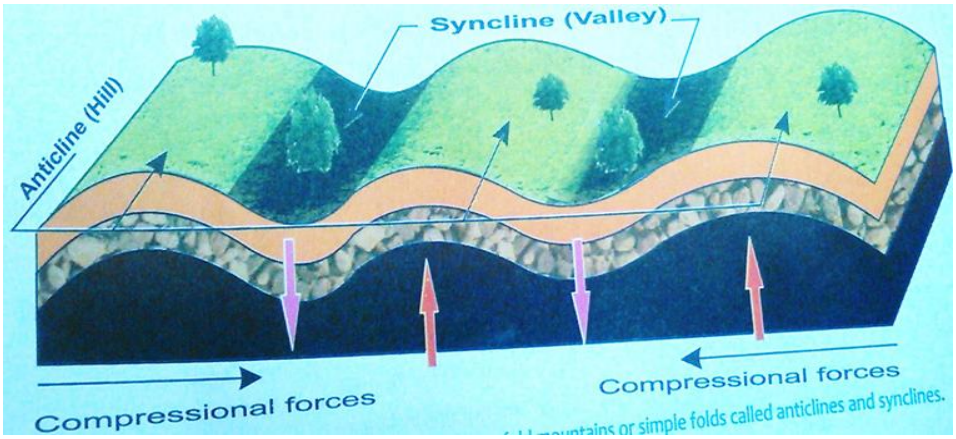
Compression hard side Monocline fold

(c) Anticline Fold: is formed when layers of rock bend (warp) up.

- It resembles an arch like structure with limbs dipping away from the fold centre.
- The sides of a fold are called **limbs**.
- An anticline fold is also called an **up fold**

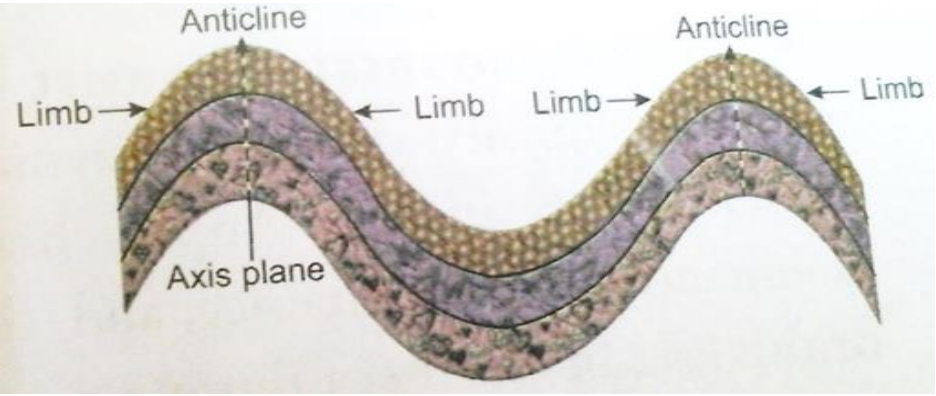
(d) Syncline Fold is formed when rock layers bend or warp downward. It is also called a **down fold.**

- The centre line of the uphold (anticline) or downfold (syncline) is called the crest/axis. In simple folds, rock layers dip away or towards the centre of the fold are roughly symmetrical.
- The process of folding produce mountains and valleys.
- Anticlines become mountains while synclines become valleys.



(D) SIMPLE FOLD

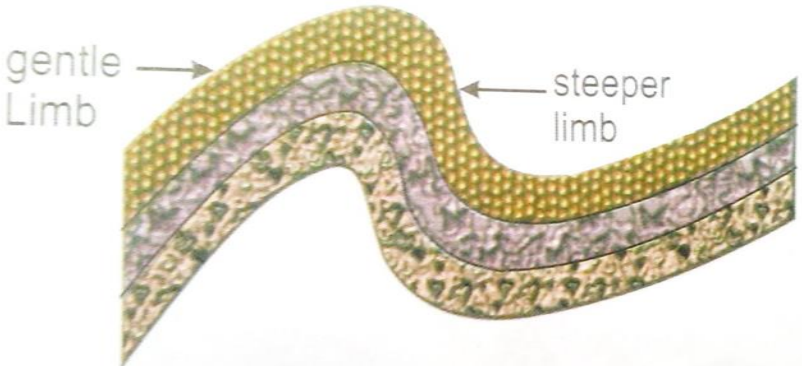
- A simple fold is also called symmetrical fold
- These are fold produced with both limbs inclined at the limbs inclined at the same angle of declination that is the limbs are the same.



(E) ASYMMETRICAL FOLD

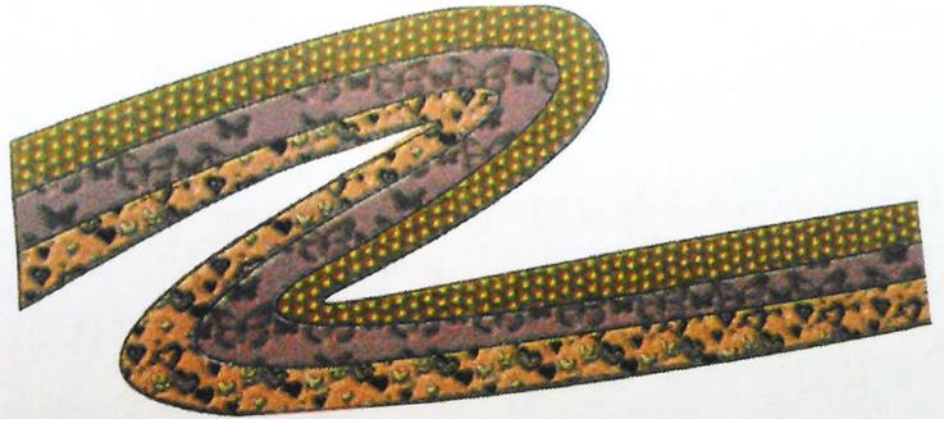
- Asymmetrical fold is produced when compression forces continue to act on a simple fold.
- Thus asymmetrical fold is formed from a simple fold due to continued compression.
- In the asymmetrical fold, one limb is steeper than the other.

Asymmetric Ford



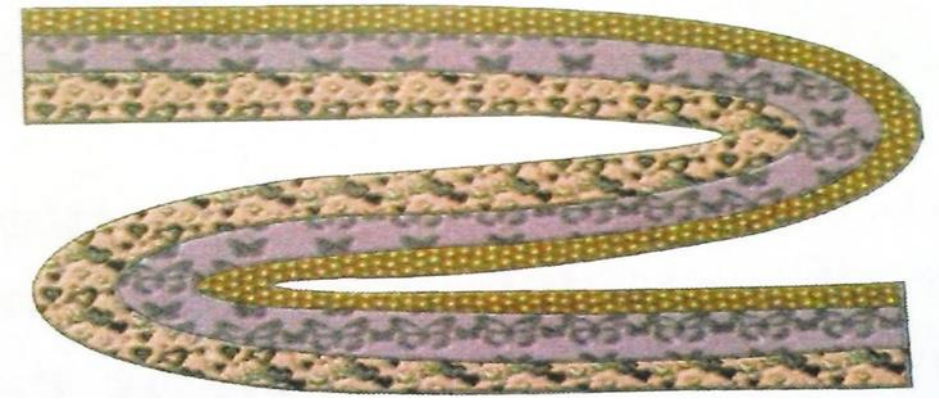
(F) OVERFOLD

- An overfold is formed when one limb of an asymmetrical fold is pushed over the other limb.
- This process occurs when the compression forces from one side is greater than that from the other side. This pushes the crest of a fold too far.



RECUMBENT FOLD

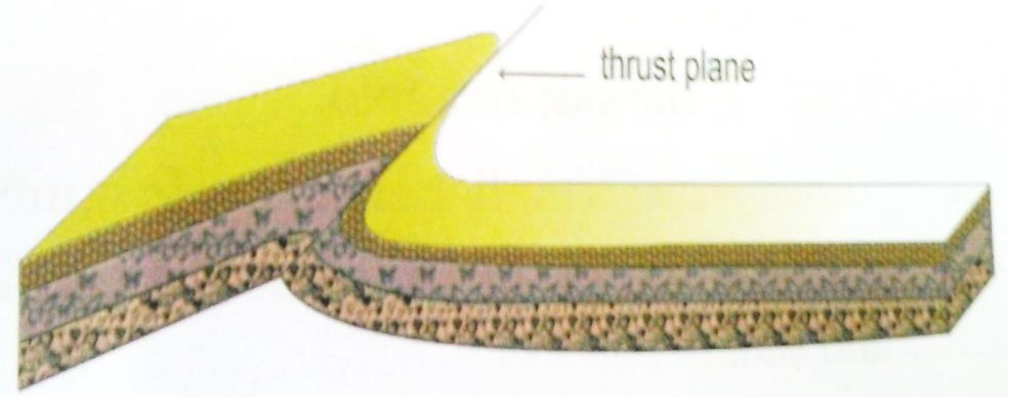
- This is the type of fold when where one limb in an Overfold under great compressional force is pushed to a greater distance.



(f) AN OVERTHRUST FOLD

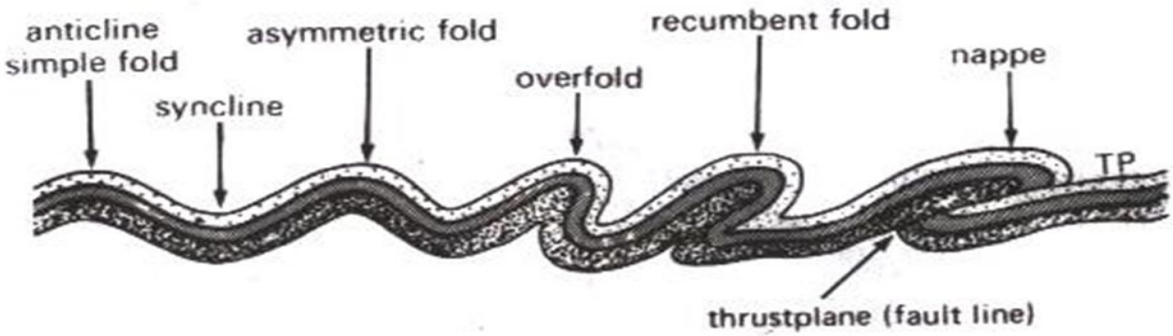
- An overthrust fold is also called the **napple fold.**
- The fold is formed due to overfolding
- One limb is pushed further along the fault line or fracture inclined at the angle from the ground.
- An overthrust fold is formed when pressure is very great.
- Extreme compression force causes a fracture in the crust and the upper part of the recumbent fold (overfold) to slide forward over the lower part.

- The overriding portion of the thrust is known as a **nappe.**



SUMMARY

Fig. 2.5 Types of folding



- Folding on a large scale results in mountain building, the process called **orogeny (orogenesis).**
- Mountains formed by the process of folding are called **Fold Mountains.**
- Examples of Fold Mountains include: Himalayas mountains, Andes Mt, Rocky Mt, Alps Mt, Appalachians Mt, Atlas Mt (North west Africa) and Cape Ranges (South Africa).

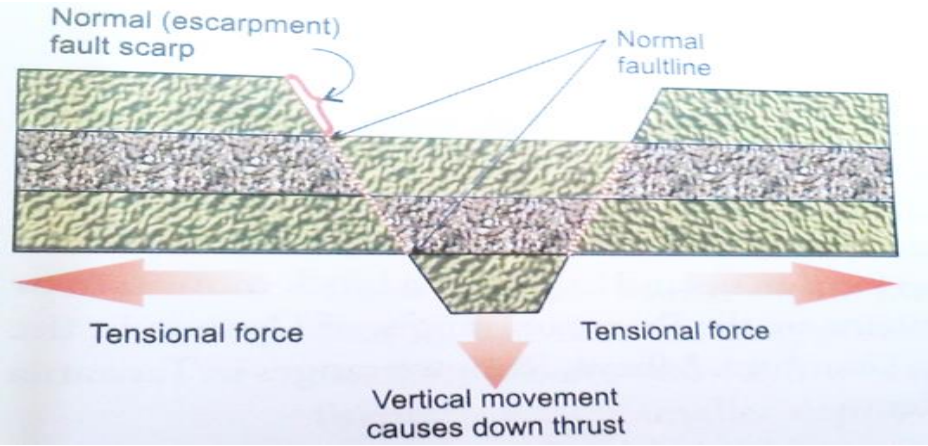
1.6.2 FAULTING

- A **fault** is a fracture (break/crack) produced by vertical and lateral movements within the Earth's crust.
- **Faulting** is the tearing or breaking or cracking or fracturing of the earth's crust due to compression and tension forces resulting in the displacement of earth blocks on either sides of the fault.
- **Faulting** is the displacement of rocks upward or downward from their original position along such a fracture. The line along which displacement of the fractured rock strata takes place is called the **fault line.**
- **Faulting** is caused by earth movements which creates forces of tension and compression that are either lateral or vertical forces.
- Tension forces cause a **normal fault**, compression force causes **reverse fault** and lateral movements produce a **tear fault.**
- **Escarpments** also called **fault scarps** develop when faulting is accompanied by upward or downward movements of adjoining parts of the crust.

Types of faults

There are several different kinds of faults, which are named according to the type of stress that acts on the rocks.

(a) Normal faults are produced by forces of tension. Rocks under tensional forces will develop faults and the block in the center may sink down leaving those on either sides in their position.



(b) Reverse Fault

- These are also known as **thrust faults** and are caused by forces of compression.
- In a reverse fault, one block is pushed up and over the other block.
- The block which is pushed up may override another to form **a block mountain** or **horst**. Reverse faults are produced by compression forces.

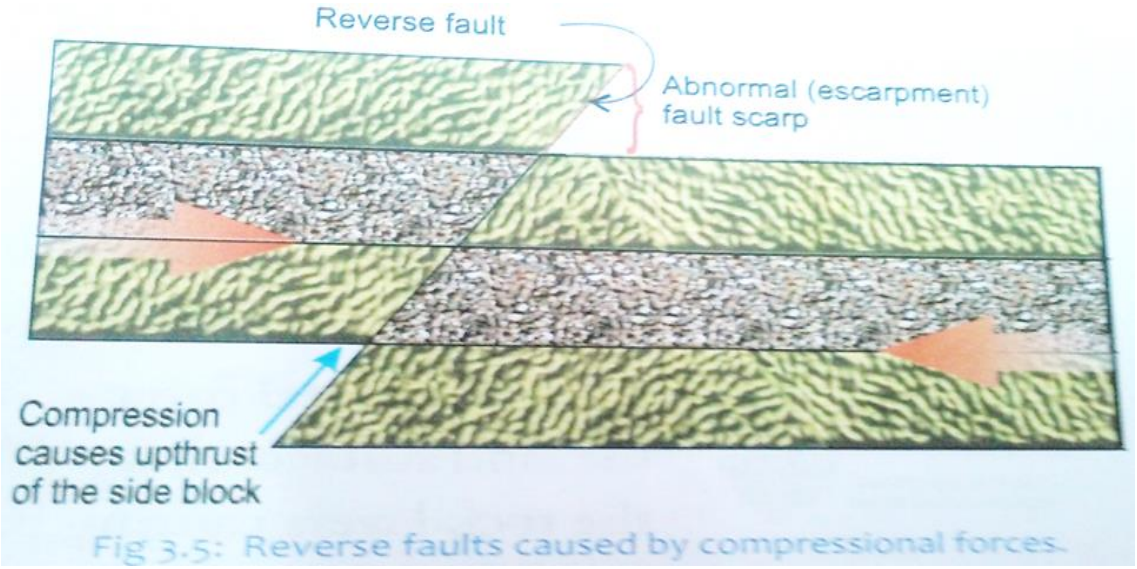
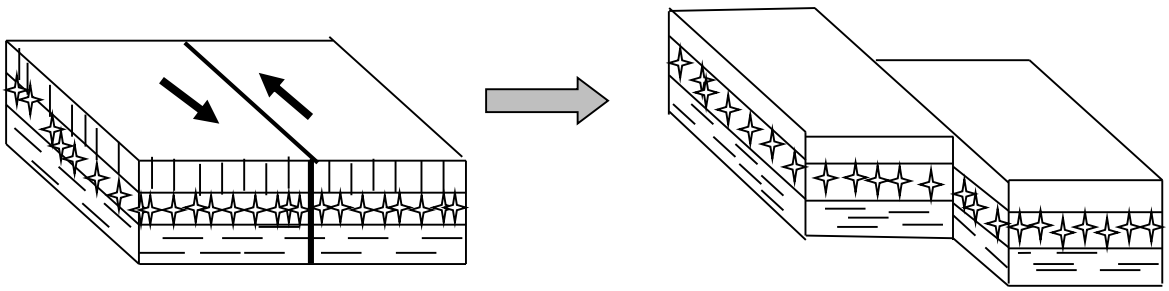


Fig 3.5: Reverse faults caused by compressional forces.

(c) Tear Fault

- Tear faults are also known as **wrench** or **transform fault.**
- Tear faults are caused by lateral tensional forces.

Fig showing a tear fault



1.6.3 Features formed/produced by Faulting

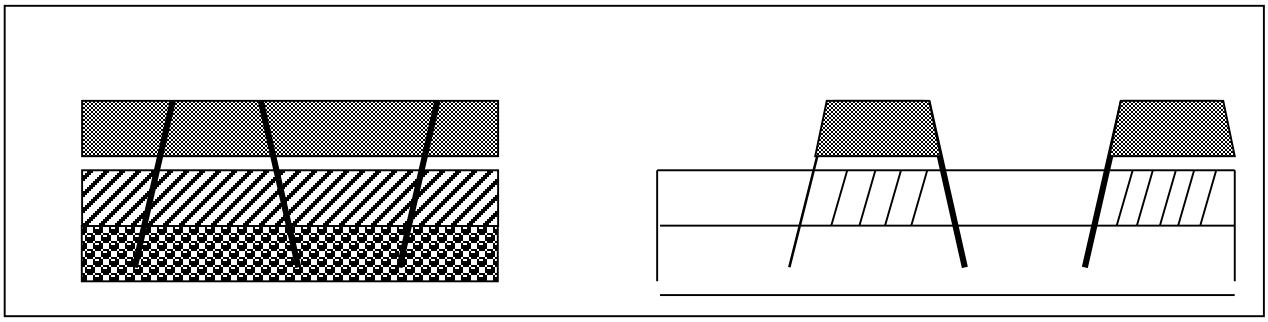
Faulting leads to the formation of **rift valleys**, **horsts** (or **Block Mountains**) and **escarpments** (or **fault scraps**).

(a) Block mountain

- A block mountain is also called a **Horst**.
- Block Mountain is formed when the middle block of land bounded by faults is uplifted by the compression forces.
- Examples of Block Mountains include Mt. Rwenzori in East Africa and Hunsruck mountains.

(b) Rift Valleys (Grabens)

- A valley is a long, narrow depression in between two high lands.
- Therefore, a rift valley is an elongated trough bound by two in – facing escarpments.
- A rift valley is also called a **Graben**
- A rift valley is formed by sinking of rock strata lying between two almost parallel faults.



(c) Escarpments (fault Scrapes)

- Escarpments are also known as fault scarps.
- An escarpment is a very steep slope in a continuous line along a fault.
- Escarpments are the characteristic features of rift valleys and horsts.
- Some escarpments are steep and may extend several hundred kilometers.

Definition of Rift Valley

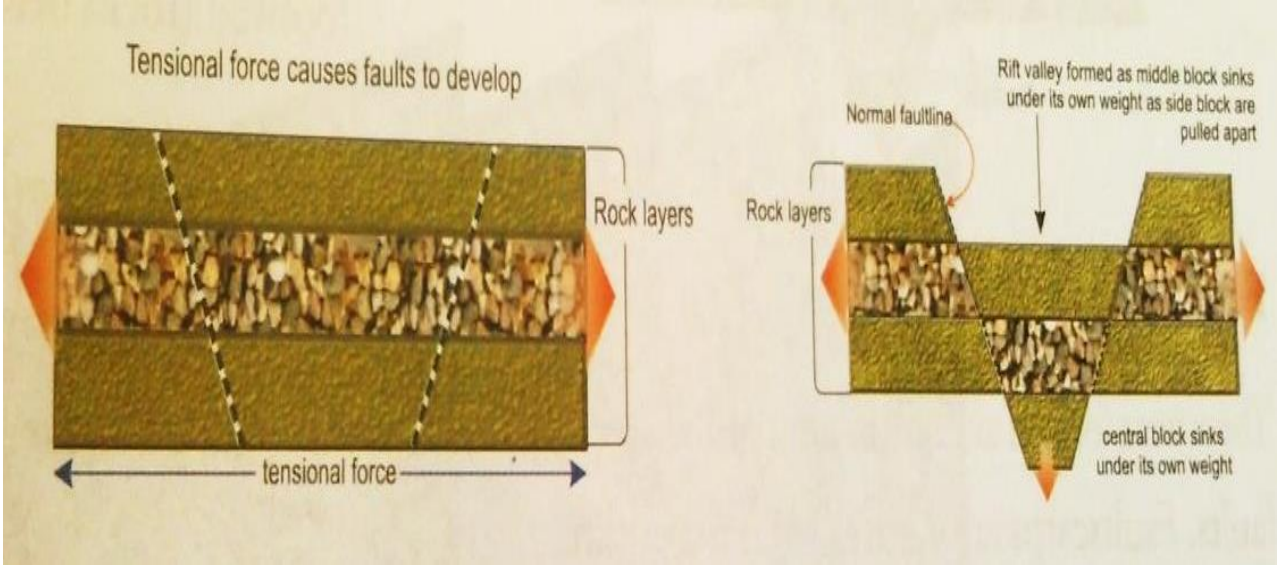
- Rift valley is a long narrow trough between more or less parallel faults with steep fault scarps on either side**.**

THEORIES ON THE FORMATION OF A RIFT VALLEY

- The formation of a rift valley is explained using a number of theories.
- Two most prominent theories are tension theory and compression theory.
- Each of these two theories depends on upward swells, along fault lines.
- A rift valley can be formed by either Tension or Compression force.

(a) FORMATION OF RIFT VALLEY BY TENSION FORCE

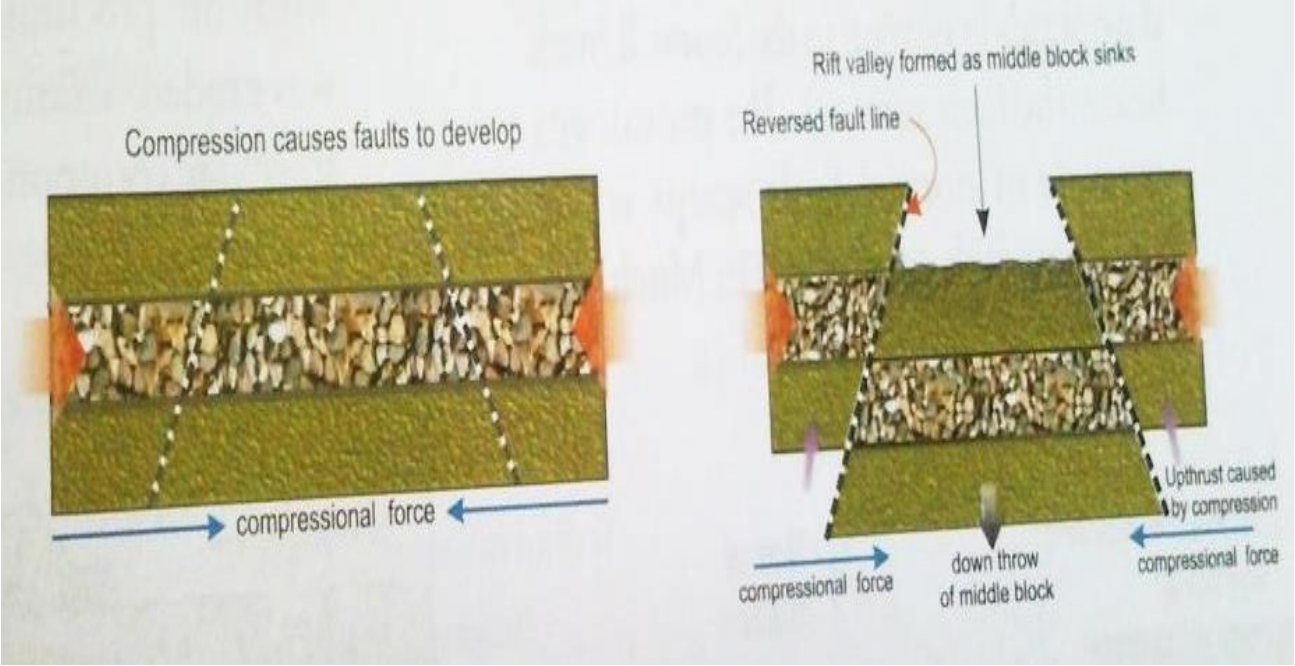
- Lines of weakness form when layers of rocks are subjected to tension forces.
- These lead to the development of adjacent normal faults.
- The central block sinks as the side blocks are pulled apart.
- The central part that sinks or slips down between the faults forms a rift valley.



(b) FORMATION OF RIFT VALLEY BY COMPRESSION FORCE

- Lines of weakness form when rock layers are subjected to compression forces.
- Adjacent reverse faults will then develop.
- The outer blocks are pushed over the centre which caused them to rise over the centre block.
- The centre block remained down and led to the development of a trough known as the Rift Valley.

- The overhanging sides are caused due to reverse faults which eventually collapse or worn away by weathering and erosion.



Importance of faulting

- Formation of high mountains
- Usually, highlands have abundant and reliable rainfall.
- Formations of Rift Valley lakes Faulted areas are usually rich in mineral deposits. Example is Lake Magadi in Kenya which has vast deposits of soda ash.
- May result into impressive scenery which can be used for tourism attraction.
- Formation of waterfalls.

Problems associated with Faulting

- The development of transport facilities is hindered
- Rift valleys are very hot and experience little or no rainfall since they lie in the rain shadow.
- Faulted areas experience severe soil erosion and mass wasting which result in destruction of soil surface, crops and sometimes people's property.

INFLUENCE OF FOLD MOUNTAINS ON HUMAN ACTIVITIES

- Fold Mountains often receive heavy rain or snow falls which give rise to important rivers, for example Alps mountains in Europe.

BENEFITS OF RIFT VALLEYS

- Lakes in the Rift valleys provide water for domestic and industrial purposes such as for irrigation in agriculture.
- Modification of climate due to existence of mountains.
- Production of geothermal electricity from the underground.
- Rain shadow areas with low rainfall provide pasture for grazing
- Salt-water lakes are used for mining.
- Tourist attraction – beautiful scenery provided by lakes, mountains and escarpments
- Wild conservation

CHALLENGES/PROBLEMS FACED BY PEOPLE LIVING IN THE RIFT VALLEY

- Earthquakes (tremors)
- Flooding
- High temperatures
- Little rainfall/drought in the rain shadow areas.
- Poor means of transport and communication
- Poor soils.
- Salty lakes because of high temperatures/high evaporation.
- Shortage of water
- Soil erosion
- Unreliable rainfall
- Volcanic eruption, which destroy property and lives

Revision Questions

1. Which of the following is not a Rift valley lake?
   A. Lake Tanganyika B. Lake Bangweulu C. Lake Turkana D. Lake Rukwa

2. _____ is a feature produce when a block of the earth's crust is depressed between parallel faults.

   A. Tilt block B. Hanging valley C. Rift Valley D. Block Mountain

3. An up thrust block between two faults is known as _____.

   A. An escarpment B. A Horst C. A Rift Valley D. A volcano

4. Explain how the Rift Valley is formed using the tensional theory
5. Explain the meaning of the following terms in relation to the study of landforms

   (a) Syncline

   (b) Anticline

   (c) Orogenesis

   (d) Epeirogenesis

   (e) Horst

   (f) Recumbent fold

   (b) Explain how a fault is formed.

   (c) Describe how a Rift valley is formed.

6. Draw diagrams to show the following features

   (a) Normal fault

   (b) Tear fault

   (c) Reverse fault

7. Draw diagrams to illustrate the following features

   (a) Simple fold

   (b) An Over fold

   (c) A symmetrical fold

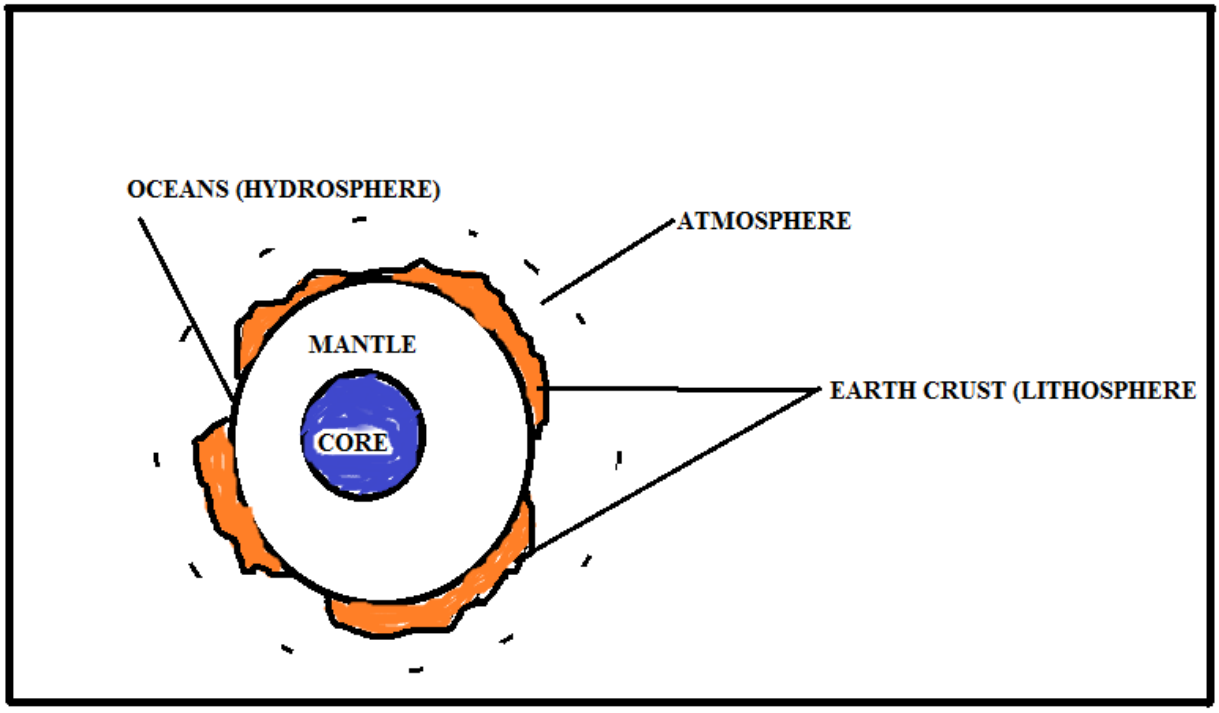
8. Describe one of the processes responsible for the formation of Rift valley.

9. Give four benefits of the rift valley.

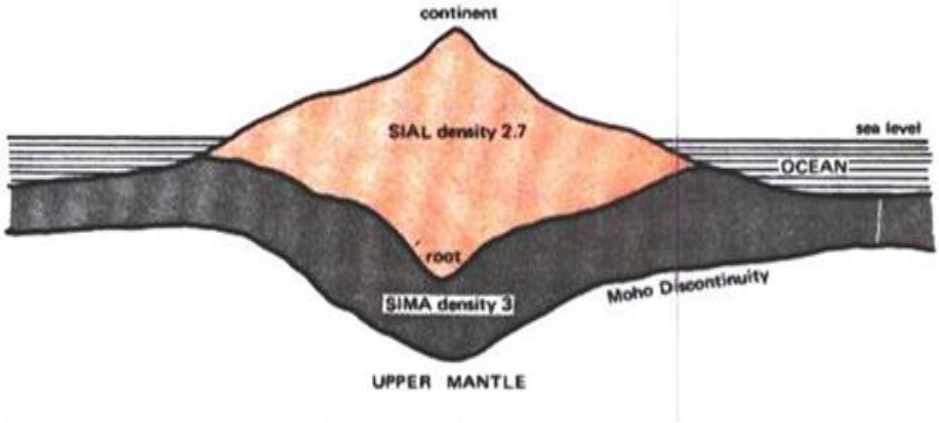
10. Identify four problems faced by people living in a Rift Valley.

PHYSICAL PARTS OF THE EARTH

1. The earth is made up of several concentric layers.
2. The outer layer is called the **earth's crust or lithosphere** which also has two parts **(continental and oceanic crust).**



- The upper part consists of granitic rocks and forms the continent, its mineral constituents are silica and alumina.
- It is referred to as Sial.
- It has the density of 2.7
- The lower part is the basaltic rocks forming the ocean floors, it is made up of Silica, Iron and Magnesium(**SIAL**).
- It is therefore called sima and has the density of 3.0.



- The sial and sima together form the earth's crust (lithosphere).

3. Below is the earth's crust is the **mantle or mesosphere** which is 2900km thick and is made up of dense rocks rich in olivine.
4. The interial layer is the **core** or **barysphere** which is about 3476 km in radius

- The core is made up of some iron and some nickel and is called **NIFE**

5. The core has very high temperature about 1927 C and very high pressure
6. Part of the earth's crust is immersed (covered) by oceans and seas and these form the hydrosphere.

THE TYPES OF ROCKS

- The earth is made up of different rocks
- These differ from one another in **texture, structure, colour and permeability**.
- All the rocks are divided into three major groups and these are igneous, sedimentary and metamorphic rocks.

IGNEOUS ROCKS

- These are formed due to cooling and solidification of the molten magma form underground.

- The rock are crystalline in structure
- They do not occur in layers or stratas and do not contain fossils
- When the igneous rocks contain a lot high proportion of silica they are said to be acid and these are less dense and light in colour.
- There are two types of igneous

a) Plutonic Rocks

- These are formed within the earth's crust
- They cool and solidify within the earth's crust
- These might be exposed to the surface by denudation

b) volcanic rocks

- These are rocks formed when molten lava is poured out of the volcanoes
- They solidify rapidly on the earth's surface and the crystals are small.
- Basalt is common volcanic rock and forms lava flows, lava sheets and lava plateaus.

SEDIMENTARY ROCKS

- They are formed from sediments accumulated over a long period
- They are different from other rocks because there are layers or strata
- The materials that form these rocks may come from a stream, winds, ice and animals.
- The rocks are non-crystalline and mainly contain fossils of animals, plants and other micro-organism.
- These rocks are classified according under three categories and these are

a) **Mechanically formed sedimentaryrocks**

- These are formed from the accumulation of materials derived from other rocks which have been cemented together
- The best example of this type of rocks is sand stone.

b) Organically formed sedimentary rocks

- These are rocks formed from the remains of living organisms like the corals or shellfish who's freshly parts decompose, leaving behind the hard shells
- The best examples are lime stone, coal and chalk.

c) Chemically formed sedimentary

- Such kinds of rocks are precipitated chemically from solution of one kind or another.

- The best example are gypsum , potash and nitrates.

METAMORPHIC ROCKS

- All rocks weather igneous or sedimentary may become sedimentary or changed rocks due to great heat and pressure.
- Heat and pressure may change into slate, lime stone into marble, sand stone into quartzite, granite into gneiss, shale into schist and; coal into graphite.

EXERCISE

1. State the two mineral constituent of SIAL

i…….. ii…….

2. ……are rocks formed by cooling and solidification of molten rock (magma) from beneath the Earth's crust

3. Mention any two characteristics of sedimentary rocks

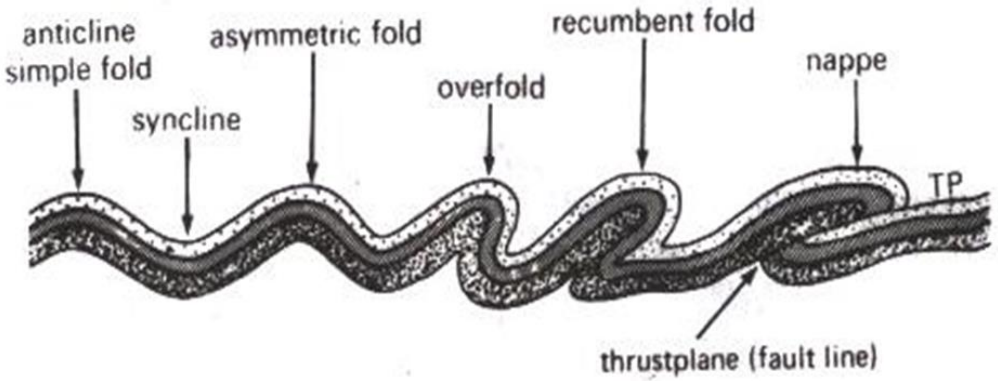
TYPES OF MOUNTAINS

a) Fold mountains

- These are the most wide spread and most important.
- They are formed by large scale earth's movement when stresses are set up in the earth's crust.
- These stresses may be due to increased load of over laying rocks, flow movement of mantle or contraction and expansion of some parts of the earth.
- This makes the rocks to be subjected to compressive forces that produce wrinkling or folding along the lines of weaknesses.
- The up folded waves are called anticlines and down folds are called the troughs or synclines
- Some examples of Fold Mountains are Himalayas, rookies, Andes, and alpps mountains.

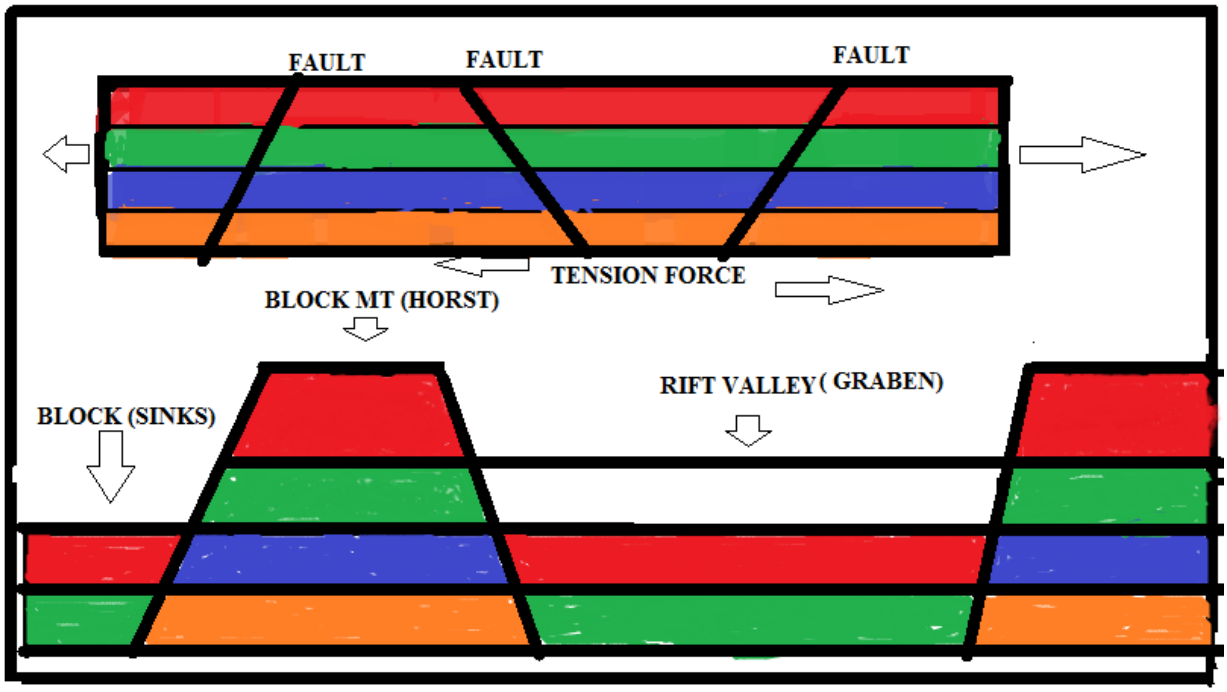
The diagram shows the types of folds that are formed when the ford is pushed so far.

Fig. 2.5 Types of folding



b) Block mountains

- When the earth's crusts 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 rise above the surrounding level.
- The earth movement generates the tension forces which pulls the crust and faults are created
- When the land in between the faults raises it form a block or horst mountain, but when it sinks it forms a rift valley.



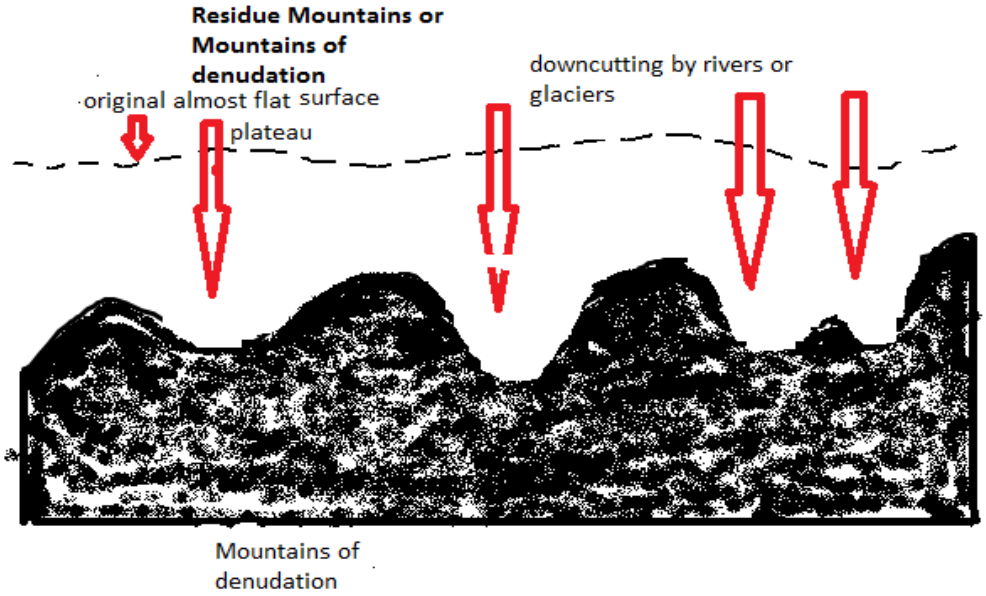
c) Volcanic mountains

- They are formed due to the eruption of the volcano.
- When lava is coming out of the volcano they cool and solidify forming a volcanic mountain.
- The extremely hot materials that comes out includes molten lava, volcanic bombs, ciders, ashes, dust and liquid mud
- They fall in successive layers around the vent.

d) Residual mountains

- They are mountains that are formed due to denudation.
- It is a mountain formed due to accumulation of materials or residues.
- Residual Mountains are also known as mountains of denudation.
- These are mountains evolved by denudation where the general level of the land has been lowered by the agents of denudation in which some very resistant areas may remain and these form residual mountains.

- Residual mountains may also evolve from plateaus which have been dissected by rivers into hills and valleys where the down- cutting streams have eroded the uplands into mountains of denudation.



TYPE OF **PLATEAUS**

- Plateaus are elevated uplands with extensive level surfaces.
- plateaus may be grouped into the following types

a) Tectonic plateaus

- These are formed by the movement which up lift and they are of the considerable size.
- When such plateaus are enclosed by Fold Mountains, they are called intermonten plateaus.

b) Volcanic plateaus

- They are formed when molten lava comes out and spreads out of the earth's crust and spreads over its surface and solidifying forms a lava plateau.

c) **Dissected plateau**

- They are formed due to continue process of weathering and erosion by running water, ice and wind.
- This make high and extensive plateaus to be won down and their surfaces made irregular

TYPES OF PLAINS

- A plain is an area of low land and can either be level or undulating
- Plains may be grouped into three major types

a) Structural plain

- These are the structurally depressed areas of the world that make up some of the most extensive natural lowland on the earth's surface.
- They are formed by horizontally bedded (layered) rocks which are not disturbed by crustal movement of the earth.

b) Depositional plains

- There are plains formed by the decomposition of materials brought by various agents of transportation.
- Some of the largest decomposition plains are due to deposition by rivers.

c) Erosional plains

- These are plains that are formed due to the agent of erosion
- They are formed due to erosion done by rain, rivers ,ice and wind
- Such plains of denudation are called pene-plains which means almost plains

VOLCANISM ANDVULCANICITY

Vulcanicity: This is the processes by which molten materials from the mantle (magma) are intruded into the Earth's crust but also extruded from the Crust.

Volcanicity: Refers to the ways by which magma is intruded into the earth's crust

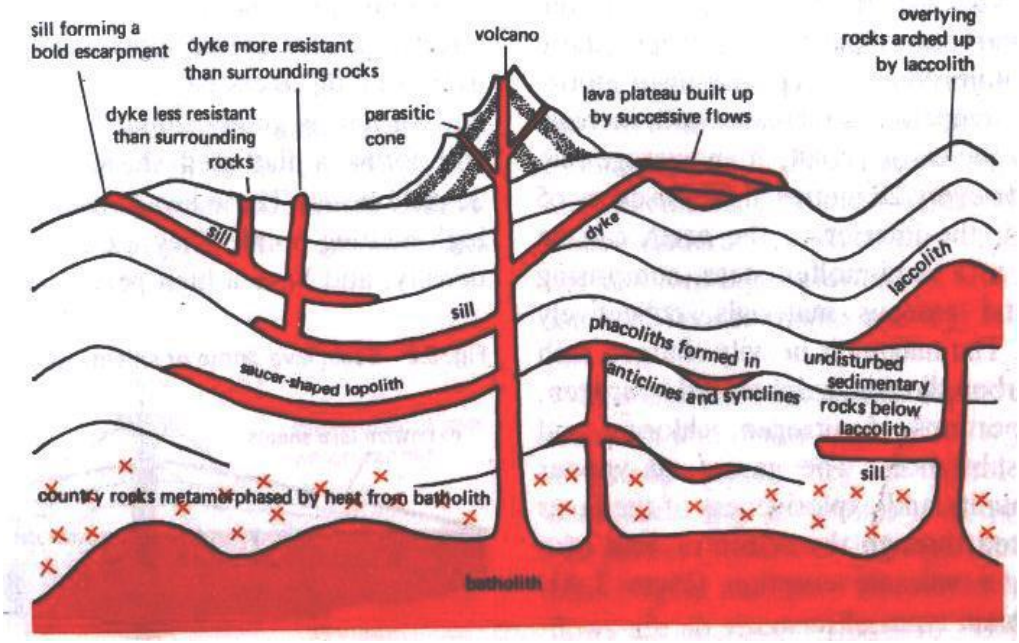
- Volcanic activities have an influence on the earth's land forms.
- Solid, liquid, or gaseous materials may find their way to the surface from the underground.
- When these materials are within the earth's crust they are called magma
- When they reach the surface they are called lava.
- Due to low pressure the magma may fail to reach the earth surface, this makes it to cool and solidify within the earth's crust forming intrusive landforms.

CAUSES OF VOLCANICITY AND VOLCANIC ERUPTION

They include:

- Increased quantity of magma in the mantle leading to increase to pressure pushing this magma out wards.
- Presence of fissure and cracks allowing magma to move towards the crust.
- Increase in the temperature of magma inside making the magma very light to move along a crack.
- Increase in the vent allowing a big quantity of magma to move in at once.

INTRUSIVE LAND FORMS



a) Sill

- It is an intrusion of magma which is horizontal along the bedding plane of sedimentary
- Sometimes denudation exposes the sill and it resembles a lava flow.

b) Dyke (Dike)

- It is similar to a sill but a dyke is vertically ejected
- It is an intrusion of magma which is vertically ejected.

c) Laccolith

- It is a large blister igneous of mound with a domed shaped upper surface and a level base.

d) Lopolith

- It is an igneous intrusion which has a saucer shape

e) Phagolith

- It is an intrusion which has a lens shaped mass

f) Batholith

- Is a huge mass of igneous rocks which forms a massive and resistant upland region after removal of over laying rocks?

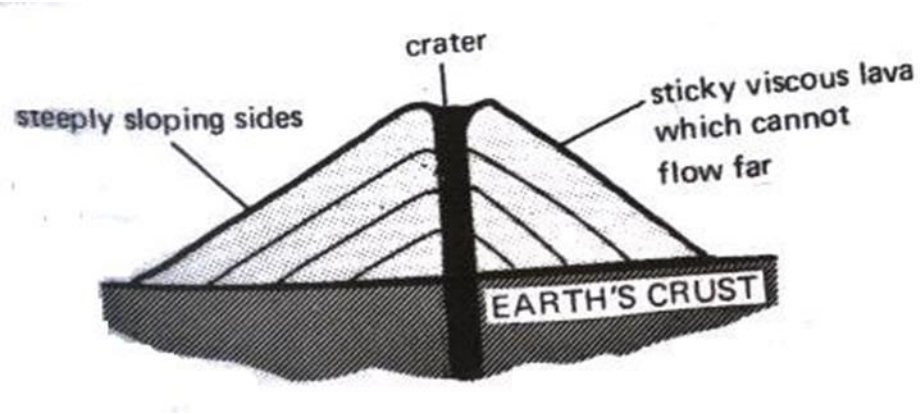
ORIGIN OF VOLCANOES

- It is connected to crustal disturbances(movement of tectonic plate), especially where there are zones of weakness due to deep faulting or folding
- As the temperature increases with increased depth below the earth's crust at the rate of 1^0C for every 20 meters ,the (centre) of the earth expected to be in a semi-molten state comprising(made of solid, liquid and gas material) called magma.
- Magma is charged with gases like carbon dioxide, nitrogen, chlorine and other volatile substances.
- These gases increase the mobility and explosiveness of lava which comes out through the vents of the volcano during a volcanic eruption.

TYPES OF VOLCANIC LAVA

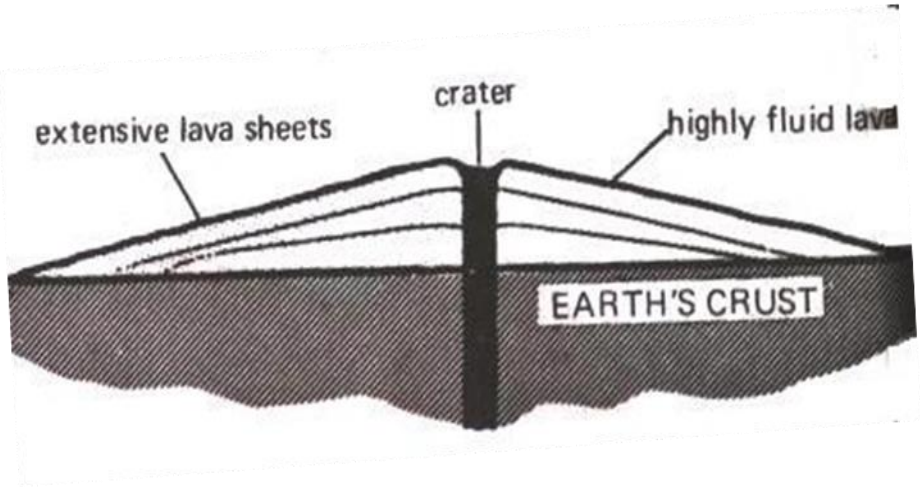
a) Acid lavas

- These are highly viscous with a high melting point
- They are light colored , of low density and have a high percentage of silica
- They flow slowly and do not travel far before they solidify
- The cone formed is therefore steep sided.
- They usually make more noise and explosion when erupting.

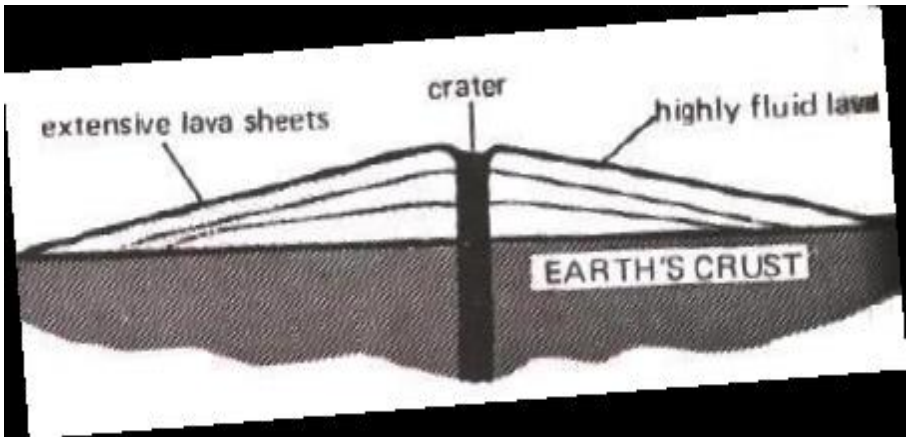


b) Basic lavas

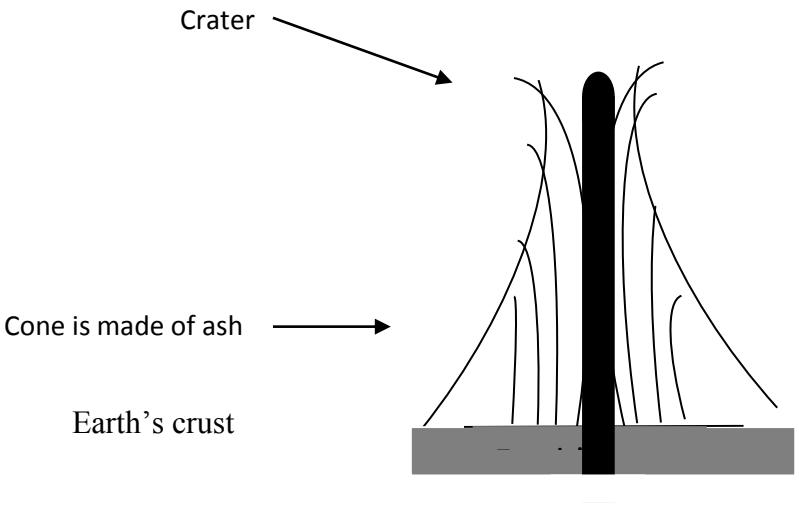
- These are very hot lavas about 1000^0 C and are highly fluid.
- They are dark colored like basalt, rich in iron and magnesium.
- When poured out of the volcano, they flow quietly and are not explosive
- They flow with the speed of 16 to 48 km per hour and spreads out as thin sheets over a great distance before they solidify.
- They form a volcano which is gentry sloping and forms a flattened shield.
- Extrusive landforms are determined by the nature and composition of the lava and other ejected materials that reach the surface of the earth.



- 1. **Lava planes** and **basalt plateaux**: formed from the fluid basic lava, flowing for long distances. The basalt plateaux is formed in many continents.
- 2. **Lava domes orshied volcanoes**: they are formed by highly fluid lava. They have gently rising slopes and broad, flattened tops.

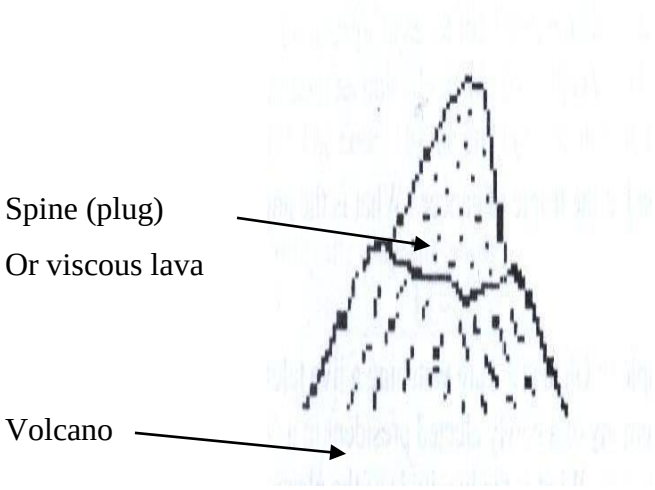


1. **Ash and Cinder Cones -** Formed by less fluid lava that explode more violently form. Ash and cinder cones have large central craters, and steep slopes and seldom exceeding 300 meters, such as mountain Nuovo, near Naples and mountain Paricutin in Mexico.



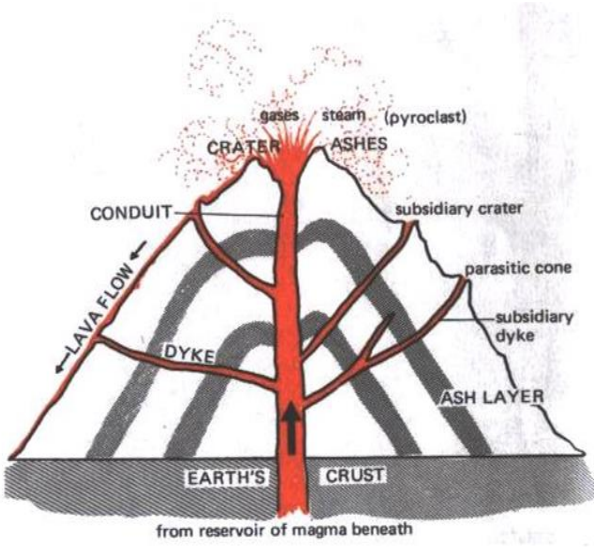
2. **Spine or plug**- viscous lava gives rise to steeply sloping cones sometimes the lava are so viscous.

- That when they are forced out of the volcano they form a spine or plug.
- Spines are rare because they often rapidly break up on cooling e.g. Mount Peele.



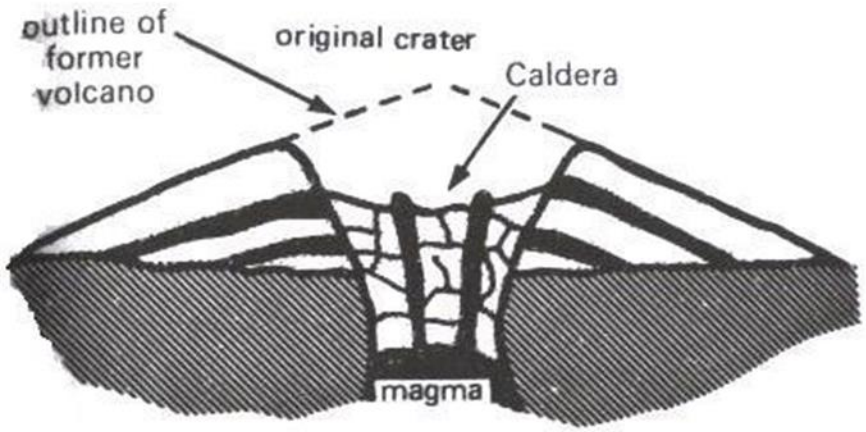
3. **Composite cone** – these are highest and most common volcanoes.

- They are called **strata – volcanoes.**
- The cones are built up by several eruptions of lava, ashes and other volcanic materials from the main **conduit** which leads down to a reservoir of magma



4. **A caldera** – during an eruption, materials from the top of the cone is blown off or collapses into the vent widening the orifice into a large crater.

- Some volcanoes may have greatly enlarged depressions called calderas which may be several kilometers across.



The Distribution of Volcanoes in the World

- Volcanoes are located in a fairly clearly defined pattern around the world, closely related to regions that have been intensely folded or faulted.
- There are well over 500 active volcanoes and thousands of dormant and extinct ones.
- They occur along coastal mountain ranges as offshore islands and in the midst of oceans, but there are few in the interiors of continents.
- The greatest concentration is probably that in the **circum – pacific region,** popularly termed the **'pacific ring of fire'** which has been estimated to include two thirds of the world's volcanoes.

Types of volcanoes

a) Active volcanoes

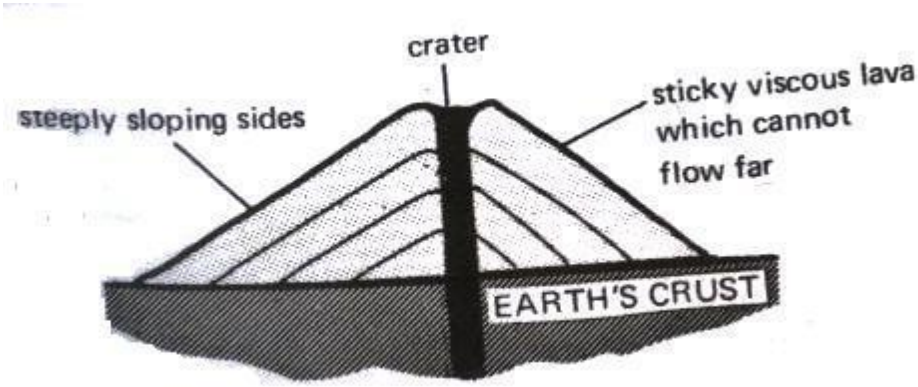
- Volcanoes are said to be active when they erupt frequently and at least when they erupted within recent time.

b) Dormant volcanoes

- These are volcanoes that have been known to erupt and shows signs of possible eruption in future

c) Extinct volcanoes

- These are volcanoes that have not erupted at all in history times but still retain the features of volcanoes.
- All volcanoes pass through active, dormant ant extinct stages



EXTRUSIVE LAND FORMS

- They are determined by the nature and composition of lava and other ejected materials that reach the surface of the earth.
- Volcanic cones are most typical of the extensive features.
- The highly fluid lavas that explode more violently form ash and cinder cones with large central centers and steep slopes
- The highest and most common volcanoes have composite cones. They are often called strato volcanoes.
- A composite volcano is made up by several eruptions of lava, ash and other volcanoes materials.

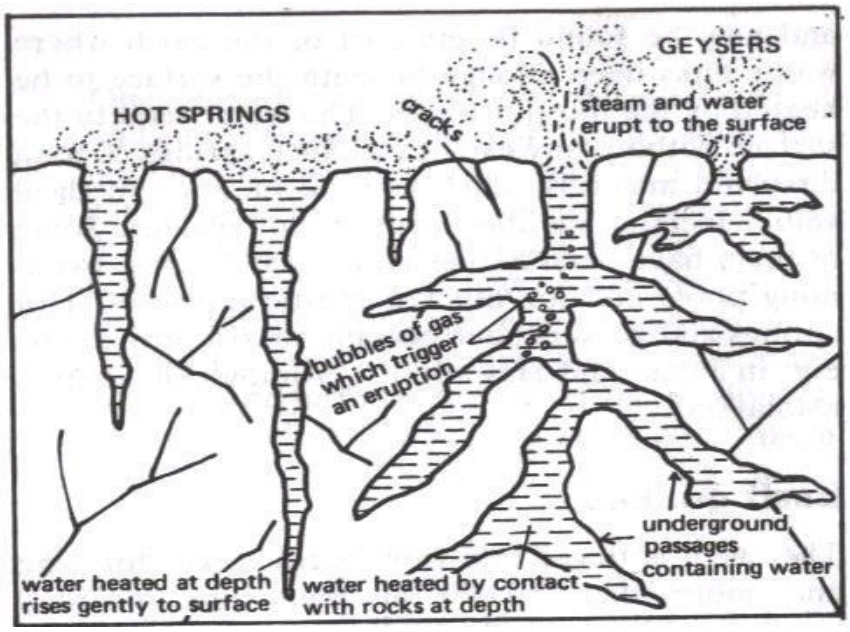
EFFECTS OF VOLCANOES

Positive effects

- Volcanic rocks after weathering result into formation of very fertile soils hence encourage agriculture
- Vulcanicity helps in formation of valuable minerals like diamond, gold, silver.
- Vulcanicity leads to formation of geysers which are sources of geothermal electricity which help in domestic and industrial use.
- Vulcanicity result into formation of many features acting as tourist attraction hence foreign exchange: crater lakes, volcanic mountains, geysers.

- Volcanic mountains facilitate moderation of climate and receive high rainfall than flat areas.
- Fishing is likely to be found in crater lakes

GEYSERS AND HOT SPRINGS



- **Geysers** are fountain of super-heated hot steam that may spout up to the height of 45 meters from the earth's crust.
- Water is usually emitted with an explosion.
- **Hot springs** are more common and may be found in any part of the earth where water sinks deep enough to be heated by interior forces.
- Water from a hot spring rises to the surface without explosion.
- Hot springs contain dissolved minerals which may be of some medical value.

EARTHQUAKES

Definition

- An earthquake is a sudden earth movement or vibration in the earth's crust.
- It is also defined as a motion of the ground surface, ranging from faint tremor to a wild motion or it is the sudden shaking of the earth crust.

CAUSES OF EARTHQUAKES

Earthquakes are caused by:

i. Movement of tectonic plates. Along the plate's boundaries movements can
   - Pull plates away from each other
   - Push plates against each other
   - Cause plates to slide sideways relative to each other.

ii. Volcanic eruptions – violent volcanic eruptions put solid rock under great stress and cause vibrations in the earth's crust.

NATURE OF EARTHQUAKES

- Earthquakes are not of the same intensity.
- Some of them are very severe while others are very mild and others still are not even noticed.

(a) **Focus** is the point within the earth's crust where the earthquake originates.

- It is also called a **hypocenter** or **seismic focus**.
- Waves move away from the focus in a cyclic manner.

(b) **Epicenter** is the point on the earth's surface directly above the focus.

- This is the point where shock waves first hit the surface.
- Before an earthquake takes place, there is slow build-up of tectonic strain that progressively deforms the crustal rocks, producing stored elastic energy.
- When the stress exceeds the strength of the fault, the rock fractures.

- The fracture of the crust and the elastic rebound on either sides of the fracture cause the ground shaking.

TYPES OF SEISMIC WAVES

An earthquake produces four main types of seismic wave. These are;-

Primary waves (P – waves)

- These are vibrations caused by compression
- They make crustal rock to move back and forth in the direction of wave movement.
- They are able travel through both solid rocks and the Earth's liquid core
- They body waves travelling within the crust.

Secondary waves (S – waves)

- These travel through the surface rocks.
- They at right angles to the direction of travel.
- They are slower than primary waves.
- They are body waves travelling within the crust

Love waves (L – waves)

- They are surface waves travelling through the surface rocks.
- They cause surface rocks to move from side to side in the horizontal plane at right angle to the direction of wave movement.

Rayleigh wave (R – waves)

- These are surface waves in which particles have a vertical circular movement similar to that of water in a sea.

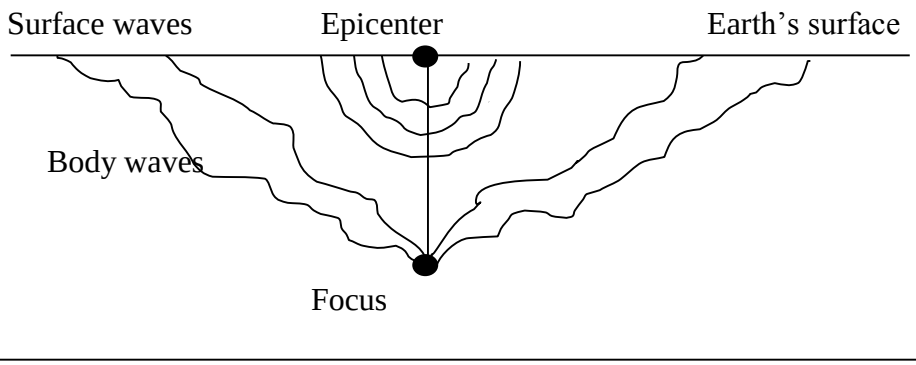
NOTE:

The four types of seismic wave outlined above can generally be grouped into two:

(i) **Body waves** – these are waves which travel within the crust. They include are **primary** and **secondary** waves.

(ii) **Surface waves** – these are waves which travel through surface rocks. They include **love** and **Rayleigh** waves.

Fig 1: Focus and Epicenter of an Earthquake



MEASUREMENT OF EARTHQUAKES

- The instrument used to record vibrations produced by earthquakes is called **seismograph.** It measures the intensity of an earthquake.
- Measurements are taken at the epicenter.
- The effect produced by the earthquake is called the **intensity of the earthquake**.
- The total energy released by an earthquake in form of seismic waves is the **magnitude of an earthquake**. It is measured on a **Richter scale.**

EFFECTS OF EARTHQUAKES

Earthquakes can be very destructive. These include

- Loss of human and wildlife
- Destruction of infrastructure such as roads, buildings, transport and communication facilities and electric transmission lines.
- Breakout of fire as a result of rapture of gas and water pipes
- Water, land and air pollution.
- Spread of epidemics such as cholera.
- Displacement of people.

- Landslides, rock fall and avalanches as ground shaking cause natural slopes to weaken and fail.
- Tsunamis
- Soil liquefaction – process by which water-saturated material can temporarily lose strength and behave as a fluid because of strong shaking.
- Raising and lowering parts of the sea floor.
- Vertical or lateral displacement of parts of the earth's crust.
- Damming of river course and occurrence of floods.

FACTORS CONTRIBUTING TO THE INTENSITY OF AN EARTHQUAKE

The amount of destruction caused by an earthquake depends on many factors. These include:

(a) **The duration of shaking** – the longer the period of shaking, the more damage done.
(b) **Population density** – the higher the population density, the more people will be at risk from earthquake.
(c) **Distance from the epicenter** – places far away from the epicenter experience lower levels of shaking. This is due to the decrease in energy as distance increases from the epicenter.
(d) **Building quality** – weak buildings are more likely to collapse than well designed and built structures.
(e) **Local conditions** – these can affect the nature of shaking. Soil and rock properties can change characteristics of waves.

MEASURES TO REDUCE ADVERSE EFFECTS OF THE EARTHQUAKE

Public education: educate the public on the causes and characteristics of an earthquake and preparedness measures.

- Organize sensitization meetings training programmes teachers, architects,engineers, community, contractors etc.
- Engineered buildings
- Community preparedness
- Planning

DISTRIBUTION OF EARTHQUAKES

- Most earthquakes are found in the Pacific Ring of Fire around the Pacific Ocean which is associated with plate tectonics.

The regions where earthquake are common include:

- The mid-ocean ridges
- Volcanic islands and ocean deeps
- Regions of crustal compression.

REVISION QUESTIONS

1. Mention any five causes of volcanicity and volcanic eruption
2. Discuss factors contributing to the intensity of an earthquake
3. The instrument used to record vibrations produced by earthquakes is called ……..
4. Discuss measures to reduce adverse effects of the earthquake
5. Show how earthquakes can effect human life
6. …… are fountain of super-heated hot steam that may spout up to the height of 45 meters from the earth's crust

WEATHERING AND MASS WASTING

DENUDATION

- It the wearing away of the earth which causes general lowering out of the surface
- There are four phases of denudation and these are:

i. **Weathering:** It is the gradual disintegration or breaking of rocks by atmospheric forces.
ii. **Erosion**: The active wearing away of the earth's surface moving agent like running water, wind, ice and waves
iii. **Transportation:** It is the removal of the eroded or weathered materials to a new position. It is the accumulation or dumping of materials in certain places
iv. **Decomposition:** It is the accumulation or dumping of materials in certain places

WEATHERING

- Weathering is done in two kinds and these are chemical and physical or mechanical weathering.

1. PHYSICAL OR MECHANICAL WETHERING

- It is the physical breaking of rocks by the actual rising apart of separate particles.
- Mechanical weathering takes place in the following ways;

(a) Repeated temperature changes

- It is sometimes called exfoliation and it is very common in desert areas.
- In deserts rocks are exposed to heat from the sun especially during the day.
- This makes the rocks to expand especially the outer layer.
- At night the temperature falls and the outer layer of rocks contracts.
- When there is repeated contraction and expansion of rocks for months or days then the rocks will crack and break.

(b) Repeated wetting and drying

- This is very common in tropical region where there is too much rainfall.
- This happens when rocks expand after being saturated by water and the water comes out of the rocks or dries up in them.
- Due to this repeated contraction caused by reaped wetting and drying the rocks breaks.

(c) Biotic factors

- This when plans and animals are involved in the breaking of rocks
- Plant grow on rocks and their roots penetrates through the joints of the rocks
- This makes the rock to expand and break after some time.
- Men are also involved in the breaking of rocks especially during mining, road construction, farming and many more activities.
- Giant wild animals like elephants also break rocks especially when stepping on them.

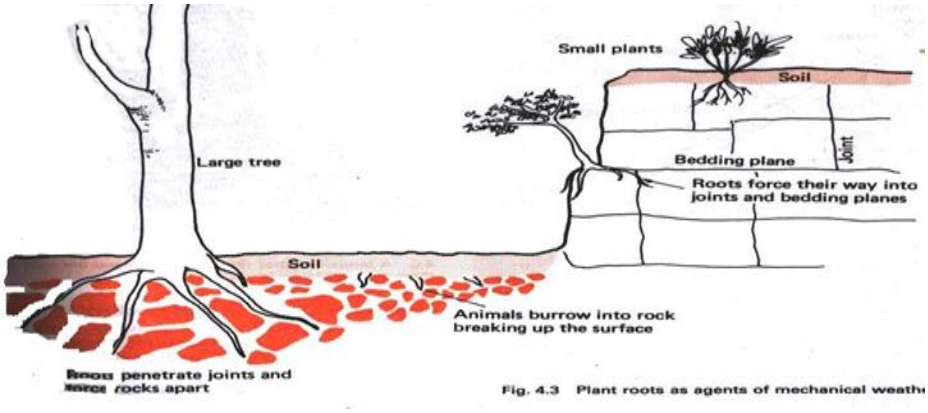


Fig. 4.3 Plant roots as agents of mechanical weath

2. Chemical weathering

- It involves chemical reaction of chemical that are found in the rocks
- It is extremely slow and gradual decomposition of rocks due to exposure to air and water.
- when the water is weathered some of the materials loosened is removed by erosive agents like wind and water

There are three types of chemical weathering processes these are

(A) Solution

- This is when many minerals are dissolve in water especially rain in water
- Rain water has enough carbon diode which makes it a weak acid
- This method is common in limestone areas because lime stone attacks and dissolves calcium carbonate of which the rock is chiefly formed.
- This dissolves calcium carbonate is carried away by the water

(B) Oxidation

- It is the reaction of oxygen in air or water with minerals in rocks

- For examples most rocks contain certain amounts of iron and when they come in come in contact air is changed to iron oxide which is called rust
- This makes the rocks to be very weak and breaks easily.

(C) Decomposition by organic acids

- The bacteria which are found in the soil produce acids which when dissolved in water help to help to speed up breaking of rock.

(D)Hydration: Some minerals absorb water and in doing so give rise to new compounds.

- For example haematite, an iron oxide combines with water to give limonite an iron compound.
- This weakens the structure of rocks which in turn break down.
- Hydration involves chemical and physical weathering. Therefore it is a physio- chemical process.

(E) Hydrolysis: this process involves hydrogen ions (in water) combining with certain ions (in a mineral).

- The mineral and the water react chemically which gives rise to the formation of new compounds.
- This weakens the rocks which break down.

3. BIOLOGICAL WEATHERING

- This is the type of weathering which involves biological agents like man, plants and animals
- Some Plants also have chemicals at the tips which produce acidic which cause rocks weathering.
- Thus biological weathering can also be regarded as it consist both chemical and physical process.
- Man disintegrate rocks through activities like building, farming, quarrying etc

MASS MOVEMENT

- It is the movement of weathered materials down the slope due to gravitation forces.

- The movement may be gradual or sudden, depending on the gradient of the slope and the weight of weathered materials there are many types

1. **SOIL CREEP**

- It is the slow, gradual but more or less continuous movement of soil down the hill slopes
- The movement is not noticeable, especially when the slope is gentle or when the soil is covered with grass or other vegetation

2. **SOIL FLOW**

- It is sometimes called solifluction
- This is when the soil is saturated with water and then individual particles are almost suspended in the water and soil acts like a liquid
- this makes a soil flow or mud flow to occur

3. **LAND SLIDES**

- it is sometime called slumping or sliding
- they occur when a large mass of soil or rock falls suddenly
- landslides usually occur on steep slopes such as in mountainous areas

4. **MUDFLOW**

- This is the most rapid and fluid type of downhill mass wasting.
- Mudflow is highly fluid and occurs in areas with abundant unconsolidated sediment.

CAUSES OF MASS WASTING

1. **Climate:** Areas most affected by mass wasting have wet and hot conditions
2. **Nature of slope:** This determines the speed of the moving material down slope.
3. **Removal of vegetation cover:** When vegetation cover is cleared through tree cutting, land is exposed to soil erosion
4. **Nature of weathered material:** Rocks that are highly weathered usually have thin particles, unconsolidated, highly porous and they are unstable and experience a lot of mass wasting.
5. **Human activities:** Some human activities lead to the disintegration of rocks and these loose particles which are easily carried away by agents of mass wasting.

MEASURES TO CONTROL MASS WASTING

- Afforestation
- Mulching
- Reforestation
- Agro- forestry
- Proper land use

REVISION QUESTIONS

1. Define the following terms

(a) Weathering

(b) Mass wasting

2. Discuss the agents of physical weathering

3. What are the causes of mass wasting?

4. Briefly explain the following types of mass wasting

(a) Soil creep

(b) Mudflow

(c) Rock fall/Landslide

5. Discuss the following types of weathering

(a) Physical weathering

(b) Chemical weathering

(c) Biological weathering

ENVIRONMENTAL HAZARDS

- Environment refers to the surrounding or a place (an area) in which human beings live.

- The environment is however, not always safer for supporting life.
- Hazard is a potential threat to humans and their welfare.
- It also means a source of risk or danger.
- There are two types of environmental hazards, namely:

NATURAL ENVIROMENTAL HAZARDS

- These are sometimes called 'acts of God' as man has no control over them.
- These include earthquakes, volcanic eruptions, floods, drought, landslides and tropical cyclones.

HUMAN INDUCED OR TECHNOLOGICAL HAZARDS

- These are human caused hazards.
- They are a result of man's activities through science and technology.
- These include pollution of air, water and land from industrial and agricultural practices, accidents such as dam bursts road and plane crashes.
- Hazards are not always negative to people.
- Sometimes they are beneficial to man. For example volcanic will bring lava which is fertile for farming and floods may provide fishing grounds and deposit fertile for farming.

1. VOLCANOES

- Volcanoes form when solid, liquid or gaseous materials are ejected to the surface of the Earth.
- The molten rock is called **magma** when it is below the surface of the Earth.
- It becomes Lava when it reaches the surface of the Earth.

NEGATIVE EFFECTS OF VOLCANIC ERUPTIONS

- Volcanic gases can burn with great heat resulting in thick blankets of smoke which can destroy in their paths including human and animal life.
- Violent explosions can hurl volcanic bombs of different sizes and shapes into space. These are accompanied by dust and can kill people.
- landslides and mudflows can destroy biological diversity or biodiversity

- People are left homeless or displaced.
- Short term climatic changes as volcanic dust absorbs solar energy lowering temperatures and increasing rainfall.

POSITIVE EFFECTS OF VOLCANIC ERUPTIONS

- Some volcanic ash and lava are rapidly weathered into fertile soils ideal for agriculture.
- Igneous and metamorphic rocks contain a variety of minerals and precious stones.
- Geothermal power or energy is being harnessed in **Iceland** and **New Zealand** where it is used to heat water for domestic and industrial use. Spring water has been believed to contain minerals with healing powers for people affected with various ailments like rheumatism.
- geysers and hot springs are tourist attractions
- Volcanic eruptions may produce spectacular and views.

2. EARTHQUAKES – CHECK NOTES ON EARTHQUAKES

3. LANDSLIDES AND MUDFLOWS

These can:

- Obstruct rail and road traffic.
- bury parts of villages, towns and cities
- abstract the flow of rivers and streams
- cause flooding of streams and rivers as the flood of sediments builds up
- destroy biodiversity

4. A VALANCHES

- An avalanche is a mass of solid snow or rock falling down the side of a steep slope.
- An avalanche can destroy life forms, villages, towns or cities.
- They can also obstruct or damage infrastructure.

5. DROUGHT

- Drought is a period of little or no rainfall.

- Although there is more water than land on the Earth, 97 percent of the total is found in seas and oceans and 2 per cent is stored as and snow.
- The remaining 1 percent is constantly recycled in the hydrological (or water) cycle. Drought is an environment hazard covering approximately 30 percent of the world's total land mass.
- The Sahel is a semi – arid region lying south of the Sahara Desert has been drought stricken since 1968.
- Drought may be caused by deforestation.

EFFECTS OF DROUGHT

- High temperatures and lack of rain causes reservoirs to dry up and underground water run low.
- Famers get affected as there is insufficient grass for their animals. Crops wilt and yields fall.
- Livestock also gets affected through high incidence of disease which is attributed to poor nutrition and to high concentration of sock in a few dambo areas.
- During the 1991 – 92 Zambian electricity cuts were introduced because the water level in the kariba Dam had fallen to a point where electricity generation had to cease. ZESCO introduced punitive tariffs for over use of power.
- During the 1991 – 92 Zambian drought low water levels led to easier fishing by fish eating and crocodiles which are not controlled.
- Drought reduced water levels leads to higher concentration of pollutants.

POSSIBLE SOLUTIONS TO THE PROBLEM OF DROUGHT

- A forestation and reforestation
- Grow drought tolerant crops such as cassava and sorghum
- Digging wells to reach permanent underground supplies.
- Using modern pumps
- lining the sides of the well with concrete (to prevent seepage) and adding a cover(to reduce evaporation)

6. FLOODS

- A flood is a great overflow of water on to a place that is usually dry.
- Floods can occur along river or the coast and on the land.
- Some of the areas in the world prone to flooding are the Ganges river delta valley, the Yangtze or Chang Jiang River in China, the Huang He in China, the Mississippi in the USA, and the Po in Italy.

EFFECT OF FLOODS

Primary or initial effects are:

- communication links such as roads and telephone wires get broken
- contaminated drinking water
- Flooding of villages, cities and farmland.
- loss of houses, animals and crops
- people drown
- water animals such as crocodiles and hippos cause havoc to people in flooded area

Secondary or later effects are:

- contaminated water causes the spread on diseases such as cholera
- Crops are destroyed and people starve because of no food and have no seed to plant the year
- People experience trauma as they lose family and friends.
- With communication links destroyed the rescue services cannot get to the area so peoplecould die due to lack of food, clean water shelter and the injuries they could have sustained.
- with no crops to sell people end with no income to repair houses or buy new seed to sow

POSITIVE EFFECTS OF FLOODS

- Flooding among the Lozi people of Western province of Zambia, facilitate the proactive of the Kuomboka traditional ceremony.
- Floods act as a signal for aquatic life such as fish to breed and spawn in great numbers.
- Floods deposit silt very rich in soil nutrients good for farming. Some flood plains provide the best arming areas in the world. For example rice farming in the Ganges delta, the Nile river valley and the Bulozi flood plain in Western Zambia.
- Floods provide wild plants with nutrients and moisture for growth
- This ceremony attracts a lot of tourists.

PREVENTIVE MEASURES

- A forestation
- Creating and improving drainage systems
- Dam construction to hold water
- Preservation of wet lands

7. TROPICAL CYCLONES, TYPHOONS, HURRICANES AND TORNADOES

- Tropical cyclones are areas of intensive low pressure.
- They are locally known in the Caribbean and America as **hurricanes**, in Australia they are known as Willy willies, in Asia as Typhoons and on the Indian Ocean between Africa and India they are known as cyclones.

Tropical cyclones tend to develop:

- Over warm tropical oceans where sea temperatures exceed 27^0C over a vast area and where there is considerable depth of warm water.
- In the trade wind belt between latitudes 5^0 and 20^0 north and south of the equator.
- In late summer and early autum when sea temperature is at their highest,an area of extremely low pressure is formed is usually, usually about 950 mill bars into which violent are drawn, spiraling round in an anticlockwise direction in the northern hemisphere and clockwise in the southern hemisphere.
- The cyclone begins with a diameter of about 50 kilometers but it grows rapidly to as much as 500 to 800 kilometers across.

- At the centre of the storm is a quite area known as the eye. Here winds reach over 120km/hour, they are very difficult to measure as few instruments survive and the strongest winds probably reach 200km/hour.
- Rainfall totals are extremely heavy with 15 to 25 cm falling in twenty – four hours.
- The storms move in a circular path to the west, then to the north west and finally in the northerly direction (in the northern hemisphere).
- Most cyclones last for about 7 to 14 days. One of the cyclones reaches the land and its source of heat energy and moisture is removed, it rapidly decreases in strength.
- A cyclone is given a name to identify it easily.

EFFECTS OF TROPICAL CYCLONES

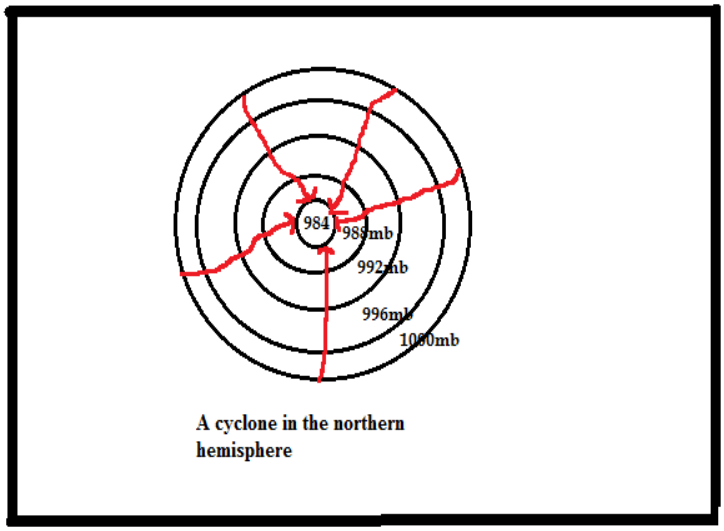
- Tropical cyclones are a major natural environmental hazard which can cause considerable loss of life and damage to property and the economy of the country
- High Winds often reach 160km/hour may destroy the whole village, uproot trees and disrupt telephone and electricity power lines
- Flooding in 1974, flush floods in Honduras caused 8000 deaths as people's flimsy homes were washed away. Flooding may pollute water supplies, increasing the rick cholera.
- Landslides may occur where heavy rainfall washes away building erected on steep, unstable slopes.

8. TORNADOES

- Tornadoes are small but very violent tropical and sub – tropical cyclones in which the air spirals at a tremendous sped of as much as 800km per hour.
- A tornado appears as a dark funnel cloud.
- As a tornado passes through a region it writhes and twits, causing complete devastation within the limits of its passage.
- Fortunately they are not common in many countries and their destructive effects are confined to a small area.
- Tornadoes are most typical of the U.S.A and occur mainly in Mississippi Valley.
- A tornado differs from a tropical cyclone in that it forms over land.

Cyclones: these are better known as depressions and are confined to temperate latitudes Winds blow inward into regions of low pressure in the centre, circulating in anticlockwise direction in the hemisphere and clockwise in the southern hemisphere.

- The lowest pressure is in the centre and the isobars are close together.
- The approach of a cyclone is characterized by a fall in barometric reading, dull sky and strong winds.
- Rain or snow falls and the weather is generally bad.

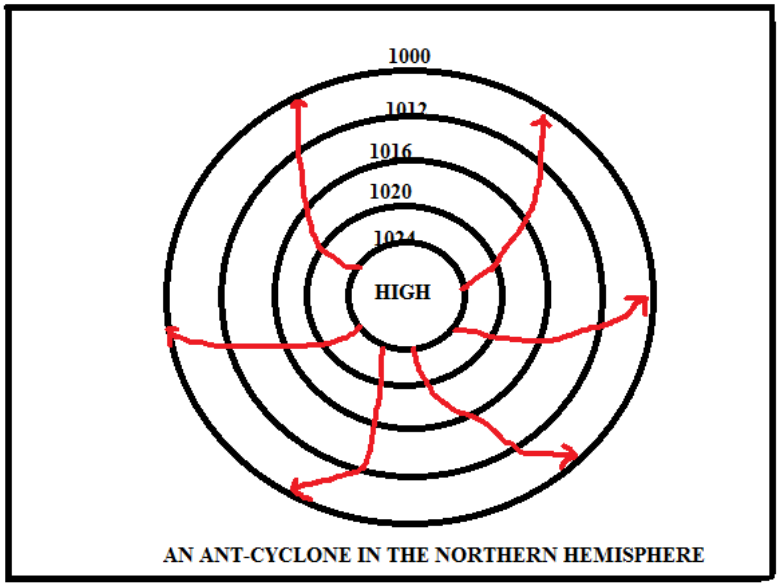


A cyclone in the northern hemisphere

ANTICYCLONES

- These are the opposite of cyclones, with high pressure and isobars far apart.
- Winds in anticyclones blow outwards, clockwise in the northern hemisphere and anticlockwise in the southern hemisphere.
- Anticyclones normally bring fine weather.

- Skies are clear, the air is calm and temperatures are high in summer but low in winter. In winter intense cooling of the atmosphere may result in thick fogs.



AN ANT-CYCLONE IN THE NORTHERN HEMISPHERE

HUMAN ENVIRONMENTAL HAZARDS

1. Deforestation

Deforestation is the complete clearance of forest land.

EFFECTS OF DEFORESTATION

- When trees are cut they are burnt or left to rot.
- Such processes lead to a lot carbon dioxide being released.
- Carbon dioxide being a greenhouse gas has been accelerating global warming.
- This has been leading to climate change.

- Deforestation has reduced the number of trees.
- With fewer trees, there is less evapotranspiration and therefore less water vapour in the air.
- With less moisture in the hydrological cycle there is already evidence of reduced rainfall totals together with the threat of possible increase in local droughts.
- **Soil erosion**: The removal of trees exposes top soil to wind and water erosion. This renders agricultural areas useless.

- **Siltation and sedimentation**: Streams, rivers canals and lakes become chocked with silt. That leads to flooding.
- **Loss of habitat**; Species which depend on forests lose their natural habitat.

2. DESERTIFICATION

- Desertification is the turning of land, often through physical processes and human mismanagement into a desert.
- It means turning the land into a desert.
- The effects of desertification are greatest in the Sahel.
- The Sahel is a narrow belt of semi – arid land which lies immediately to the south of the Sahara Desert and which extends to across most of Africa.
- Countries in the Sahel include **Ethiopia**, **Somalia, Sudan, Chad** and **Niger**.

CAUSES OF DESERTIFICATION

- **Climatic change** – a decrease in rainfall and possibly, the effect of global warming
- **Population growth** – an increase in the numbers of animals and people
- **Overgrazing –**this is when more than enough animals are put a small piece of land to graze on
- **Deforestation –** the general cutting down of tree
- **Loss of biodiversity** – when fauna and flora are destroyed, desertification can set in, poor farming methods – over cropping, monoculture, overgrazing, slope wise cultivation, shifting cultivation.

EFFECTS OF DESERTIFICATION

- It increases wind and water erosion.
- It reduces the land that supports life forms – people, domestic animals, crops and wildlife.
- Food insecurity becomes a threat to human survival.
- The rate of evaporation increases with rising temperatures.
- Bare land becomes prone to floods.

WAYS OF PREVENTING DESERTIFICATION

- Along the southern edge of the desert, trees and shrubs have been planted to create a green belt.
- reducing the number of livestock on the land
- allowing plants to generate
- afforestation
- Using environmental friendly methods such as conservation farming.

EXERCISE

1. Mention any four effects of Hazards on people and the Environment
2. Explain briefly the effects of land slides
3. Describe how environmental hazards can be controlled?
4. Discuss the causes of desertification
5. Mention the effects of tropical cyclones

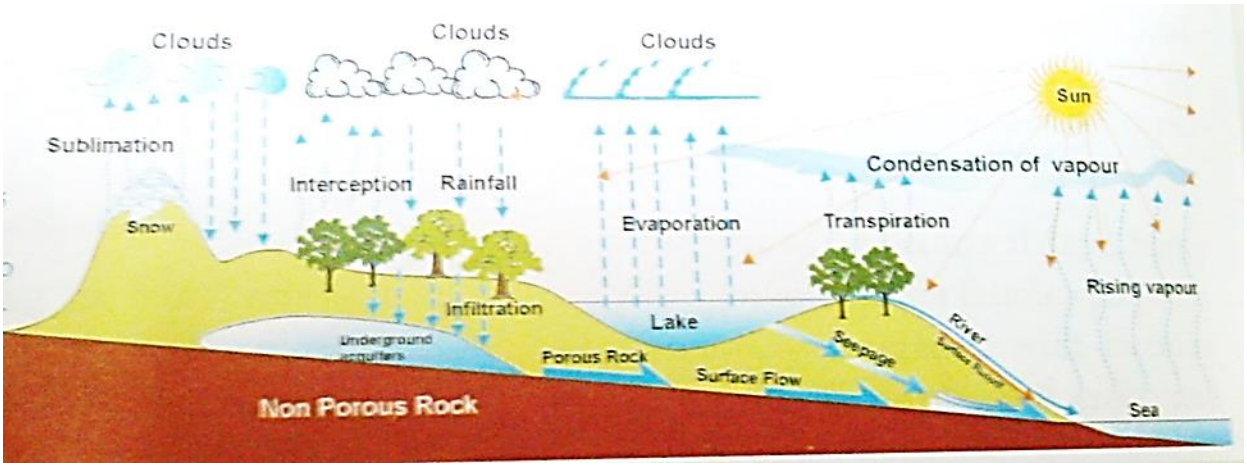
RIVER SYSTEM AND DRAINAGE PATTERNS

HYDROLOGICAL CYCLE

- This is the interchange of water between land, sea and air through the processes of evaporation, precipitation, percolation of water into the ground and the surface runoff.
- The amount of water that sinks into the ground, or flows on the surface depends on:
- Nature and amount of rainfall.
- The type of the soil.
- The underlying geological structure.
- The nature of the landscape.

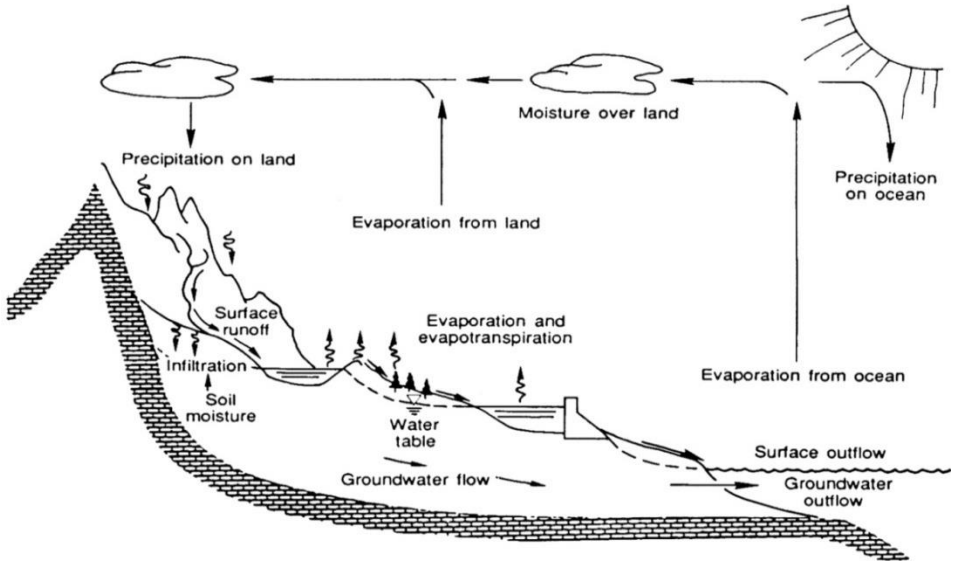
Significance of the Hydrological Cycle

- It leads to the formation of rainfall.
- It creates ecological balance in the water supply between the atmosphere and the round.



ROUND AND ROUND AND ROUND IT GOES

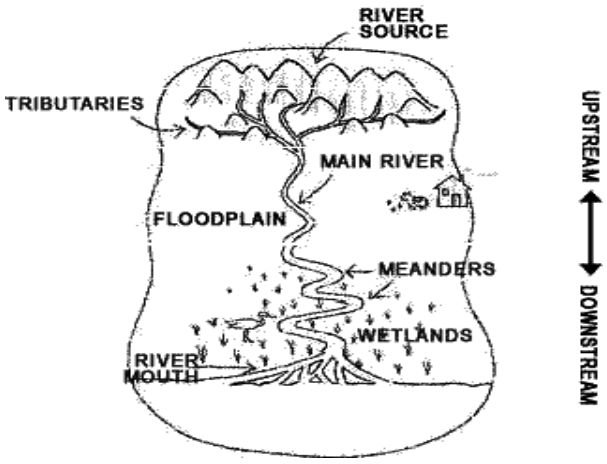
The pathway of water as it moves in its various phases through the atmosphere, to the earth, over and through the land, to the ocean, and back to the atmosphere is known as the hydrologic cycle (Figure 1.1).



Round and round and round it goes. Note how the dam fits naturally into the hydrologic cycle. Source: National Research Council (1991, 18).

THE RIVER SYSTEM

- Every river is part of a larger system—a watershed, which is the land drained by a river and its tributaries.
- Rivers are large natural streams of water flowing in channels and emptying into larger bodies of water.
- This diagram shows some common characteristics of a river system.
- Every river is different, however, so not all rivers may look exactly like this illustration below



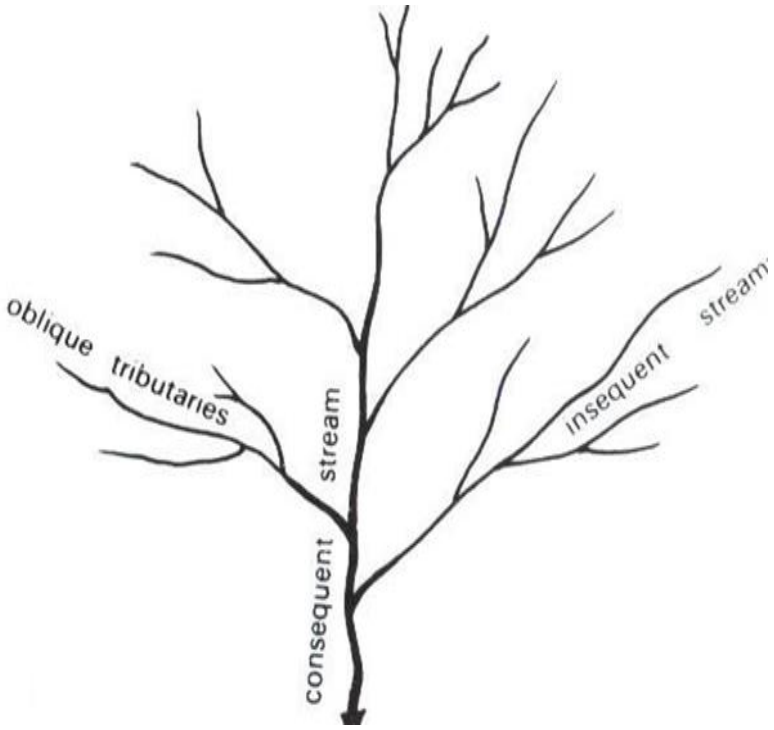
THE RIVER SYSTEM

DRAINAGE PATTERNS

- A drainage pattern refers to the total network formed by the river and its tributaries over the surface of the earth.
- There are three types of drainage patterns namely:
  - ❖ Dendritic drainage
  - ❖ Trellis drainage
  - ❖ Radial drainage

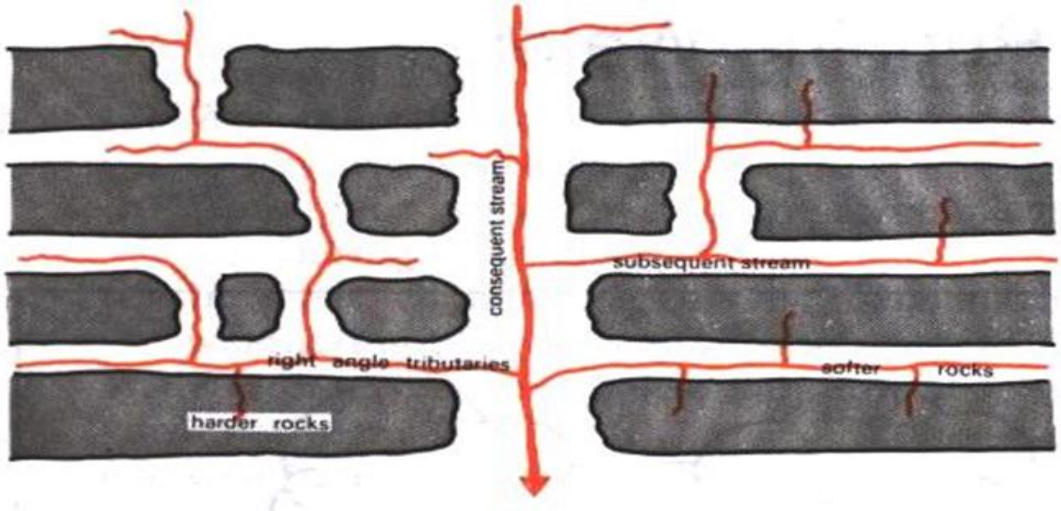
DENDRITIC DRAINAGE

- The word dendritic comes from a Greek word '**Dendron**' which means 'tree'
- Dendritic or tree like drainage pattern developed on homogenous rock or beds of equal resistance.
- The initial stream that exists as a consequence of the slope is called the **consequent stream**.
- If the rocks are composed of homogeneous beds of uniform resistance to erosion, the tributaries will join the main valley obliquely as **in sequent streams**.



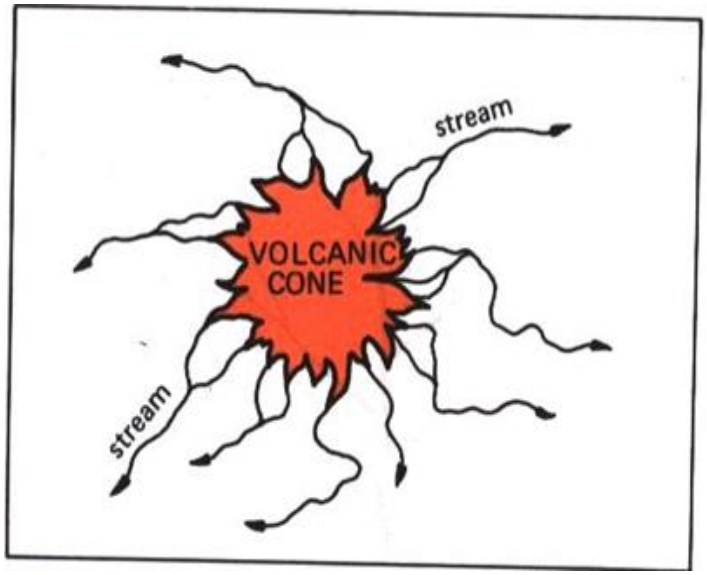
TRELLIS OR RECTANGULAR DRAINAGE PATTERN

- This forms when faulting causes rectangular rock joining on which rivers develop.
- The tributaries join the main streams at right angles ($90^{0)}$.
- The drainage pattern which will be developed will be rectangular in shape and is called trellis drainage pattern.
- Trellised or rectangular drainage pattern developed on alternating outcrops of harder and softer rock



RADIAL DRAINAGE PATTERN

- This is develops on a dome shaped landforms such as volcanic or glaciated hills from which rivers radiate into different.
- It appears just like the spokes of the bicycle wheel
- An example of radial drainage pattern is on Mount Egmont in North Island, New Zea-land

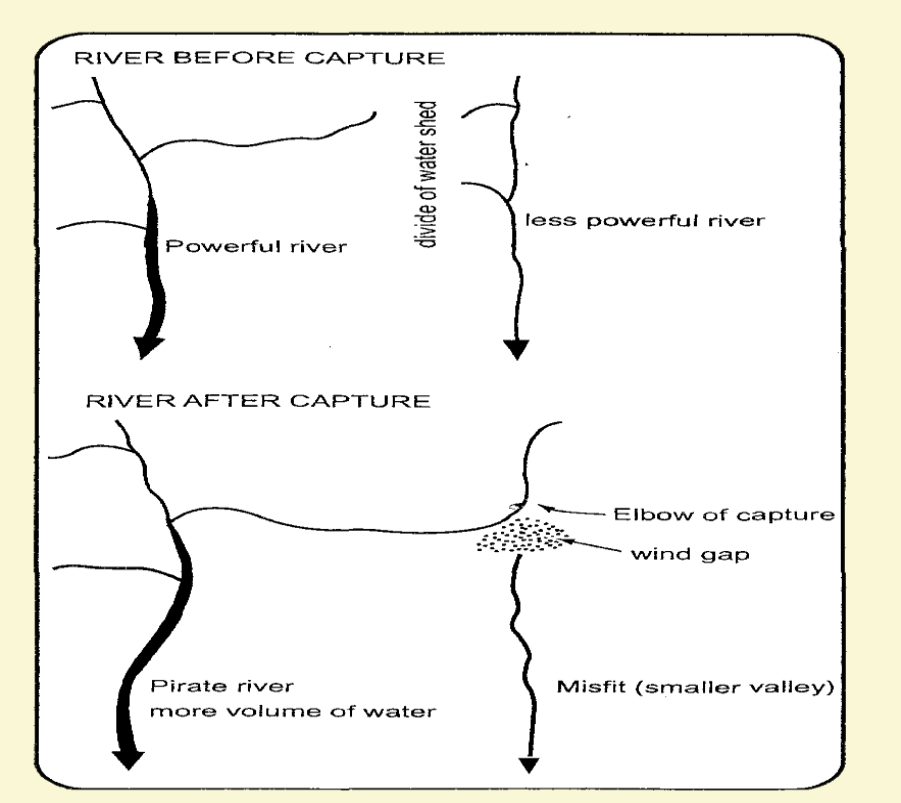


RIVER CAPTURE AND REJUVENATION

6. **RIVER CAPTURE**

- This is also known as river piracy or river beheading
- River capture is the diversion of a part or whole of a river from its own course and extends towards a weaker river.
- The bend at which the piracy occurred is called **elbow of capture**
- The beheaded stream is called the **misfit**
- The valley below the elbow is the **wind gap**

The diagram below shows River capture (a) before capture (b) after capture



- Difference in rock resistance causes river capture in that a river on a softer rock will erode its valley deeper and eventually capture the one on a harder rock whose valley will be on a higher altitude.

RIVER REJUVENATION

- River rejuvenation is the renewal in the rivers ability to erode its bed.
- River rejuvenation occurs when there is an increase in the rivers erosive power.
- If rejuvenation occurs in the upper course, the river valleys are deepened and steep sided gorges are formed.
- In the middle and lower course, vertical corrosion replaces lateral corrassion and the existing meanders are vertically eroded by the rejuvenated stream
- A distinct new inner trench is cut in the old valley which entrenched or incised meanders

RIVER ACTION AND ITS PROCESSES

1. **RIVER EROSION AND ITS PROCESSES**

- Erosion occurs when a stream has a lot of energy

Corrasion or abrasion - this is the **mechanical grinding** of the river's traction load against the banks and bed of the river.

- The rock fragments are hurled against the sides of the river and also rolled along the bottom of the river

Corrosion takes place in two distinct ways. These are:

1. **Lateral corrasion**- this is the **sideways** erosion which widens the V – shaped valley.
2. **Vertical corrasion**– this is the **downward** action which widens the river channel.

Corrosion or solution –this is the **chemical or solvent** action of water on solution or party - soluble rocks with which the river comes into contact for example calcium carbonate in limestone is easily dissolved and removed in solution.

Hydraulic action - this is the mechanical loosing and sweeping away of materials by the river water itself.

- Some of the water splashes against the river banks and surges into cracks and crevices.
- This helps in breaking of the rocks
- The water carries itself the softer it comes into contact with

Attrition - This is the wear and tear of the transported materials themselves when they roll and collide with one another.

- The coarser boulders are broken down into smaller, stones the angular edges are smoothened and rounded to form **pebbles**
- The finer materials are carried further downstream to be deposited

Headward erosion*:*

- This is when a river cuts back at its source thus increasing its length.

RIVER TRANSPORTATION AND ITS PROCESSES

The river transports its load in the following ways:

1. **SOLUTION**

- Minerals dissolved in water from rocks are carried and transported by solution form.
- Soluble minerals like calcium bicarbonate dissolve in water and are moved in solution.

2. **SALTATION**

- Medium sized rock particles which cannot be carried by the water all the time are moved by saltation

3. TRACTION

- The largest rock fragments which are too heavy to be picked up by the waves, and are transported by the process of traction.
- Under traction, particles are rolled along the river bed when the water picks up enough energy.
- The materials carried include; pebbles, stones, rocks and boulders.

4. SUSPENSION

- This occurs when particles are very fine or light enough to be held within the water and float in suspension
- Materials in suspension make up the greater load of the total and it gives water its brown or black appearance
- Sand, silt and mud are carried along suspended in water as the stream flows

RIVER DEPOSITION AND ITS PROCESSES

- Deposition of the load (eroded material) occurs when the river has insufficient energy to transport its load any more.

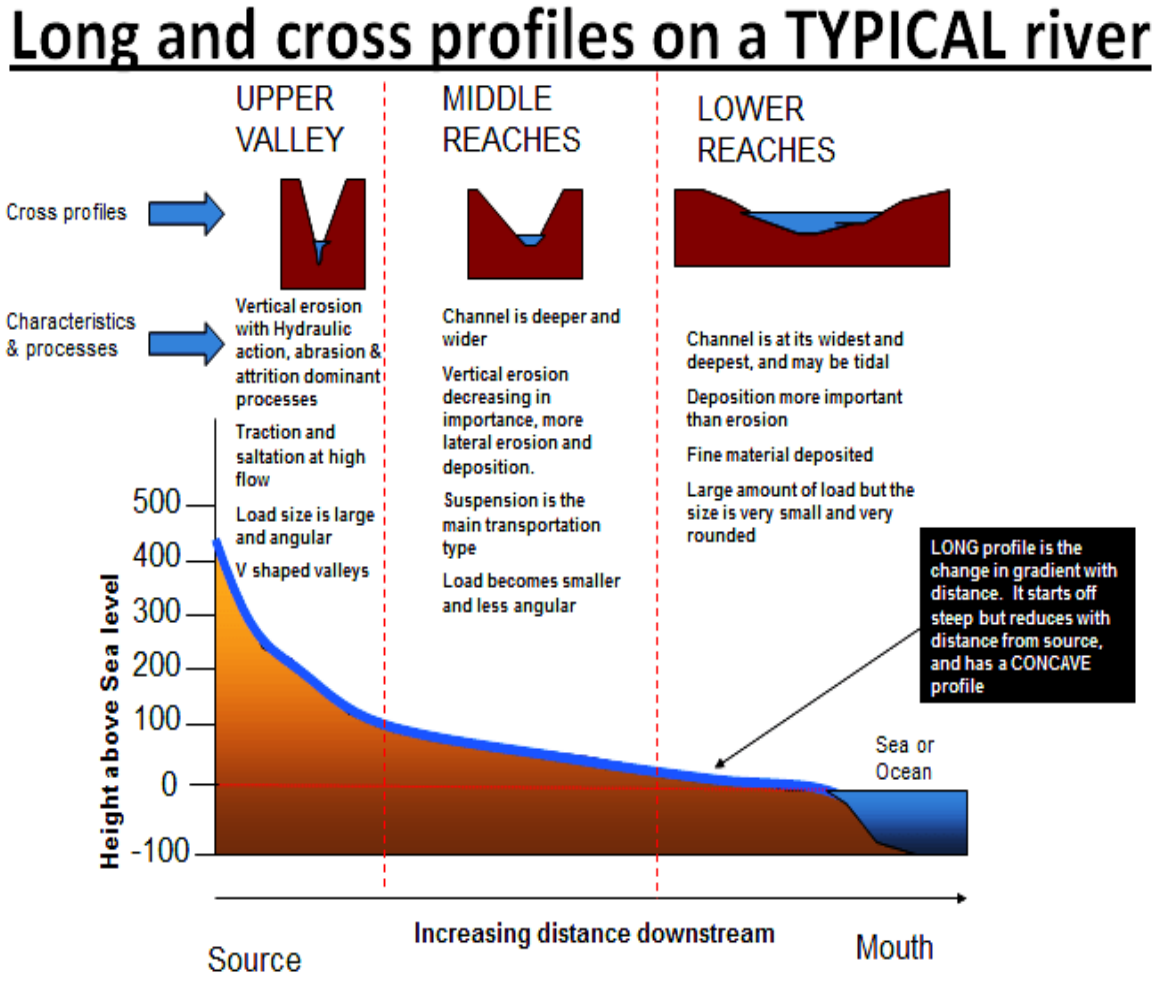
During this time the river energy decreased due to:

- Reduction in the stream steep gradient
- Decreased in speed of water
- Decreased in volume of water
- Obstacles in the stream channel
- Widening of the river

THREE STAGES OF RIVER DEVELOPMENT

The course of a river may be divided into three distinct parts and these are:

- The upper or mountain course.
- The middle or valley course (in the stage of maturity)
- The lower or plain course (in the stage of old age).



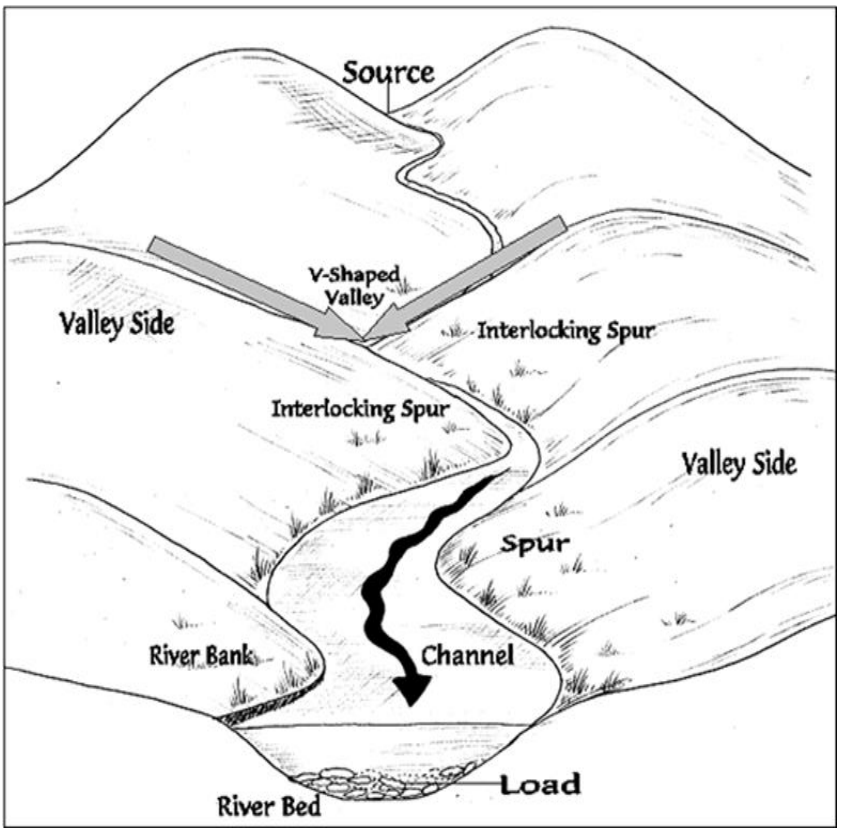
The upper or mountain course

- This stage is also called the Youth stage. This begins at the source of the river near the watershed.
- The predominant action of the river is vertical corrosion.
- The valley develop is thus deep, narrow and distinctively V- Shaped**.**
- A river in youth stage cuts a deep V-shaped valley as the fast moving water transports material downstream.
- Rivers in youth stage are dominated by erosion as the turbulent water allows for very little deposition to occur.

Features commonly seen at these stages of these rivers include:

- Rapids
- Waterfalls
- Interlocking spurs
- Gorges.

NOTE: Vertical erosion is greatest in the upper course of a river. As the result of these typical features includes steep valley sides, interlocking spurs, rapids, gorges and waterfalls

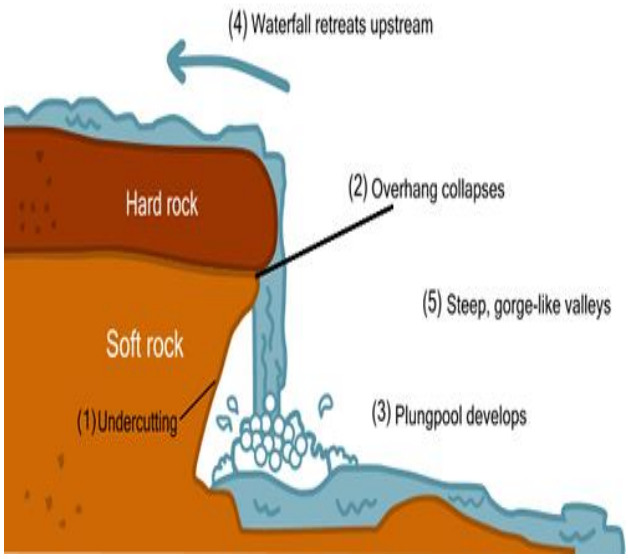


Rapids

- Rapids are areas of very turbulent flow in the upper course of a river where water flows rapidly over an uneven river bed caused by rocks of different resistance.
- The soft rock is eroded faster and the hard rock causes obstructions to the river flow.

Waterfall

- Waterfalls are caused by difference in rock hardness.
- The river erodes the softer rock faster forming a step in the river.
- Over time the step becomes more pronounced until the water is falling over it.

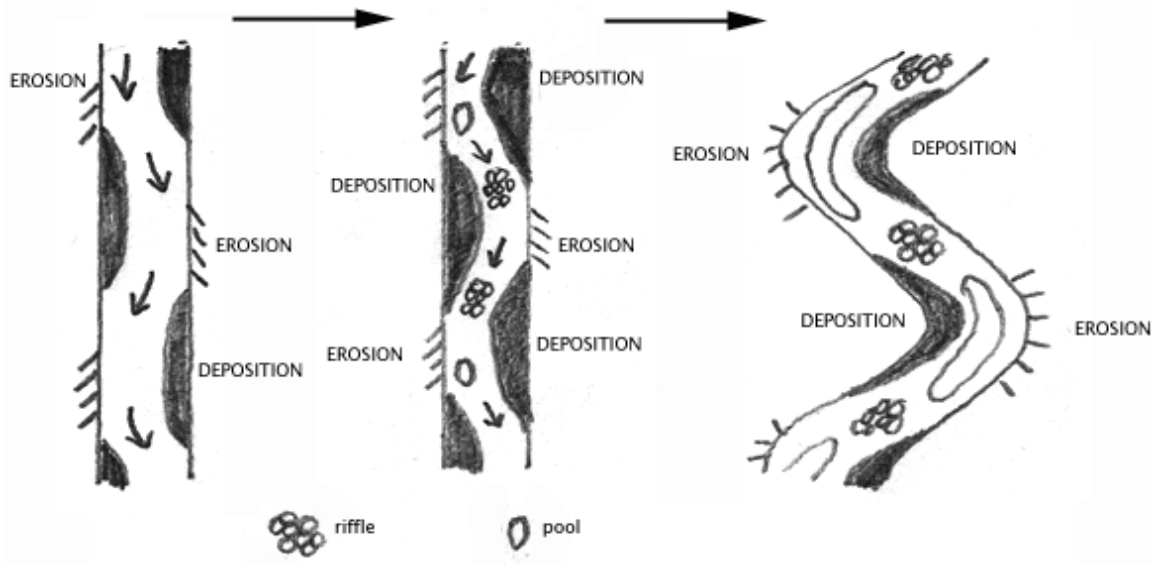


2. MATURE STAGE

- In the middle course lateral corrasion tends to predominate over vertical corrosion.
- Active erosion of the banks widens the V – shaped valley.
- The volume water increases with the confluence or many tributaries and this increases the river's load work which is predominately transportation with some deposition.
- Downstream, the interlocking spurs that project from both sides of the valley are cut back into a line of bluffs.
- The middle course of a river has more energy and volume than in the upper course.
- The gradient is gentler and lateral (sideways) erosion has widened the channel.
- The river channel has also become deeper.
- The more outstanding features associated with the valley course are; Meanders, Food plain, interlocking spurs.

Meanders

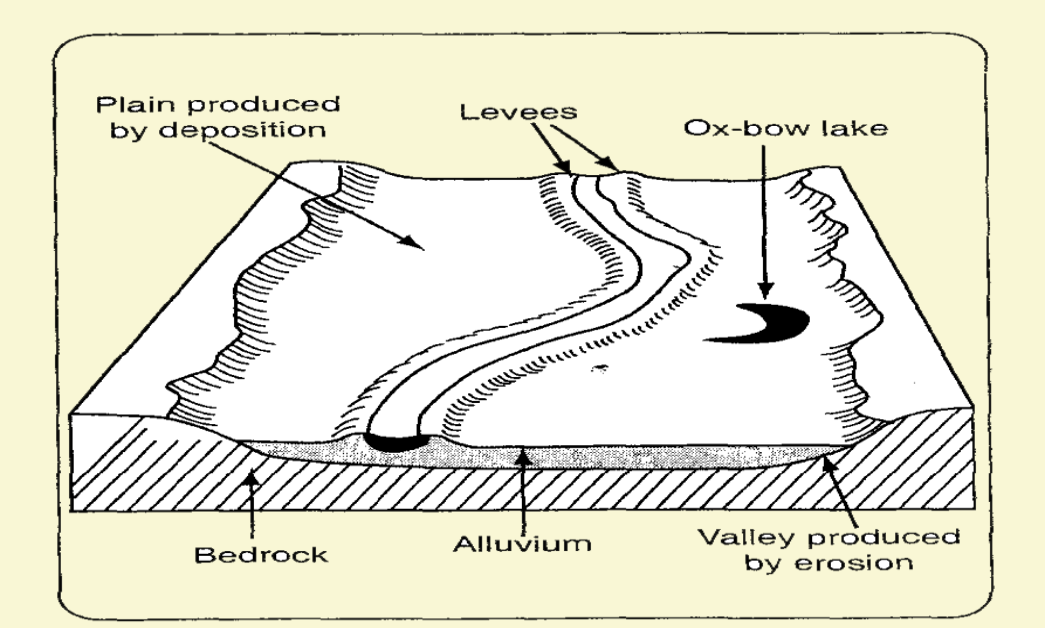
- A meander is a winding curve or bends in a river.
- They are typical of the middle and lower course of a river.
- This is because vertical erosion is replaced by a sideways form of erosion called LATERAL erosion, plus deposition within the floodplain



As a result of continuous meandering, the following feature will be formed.

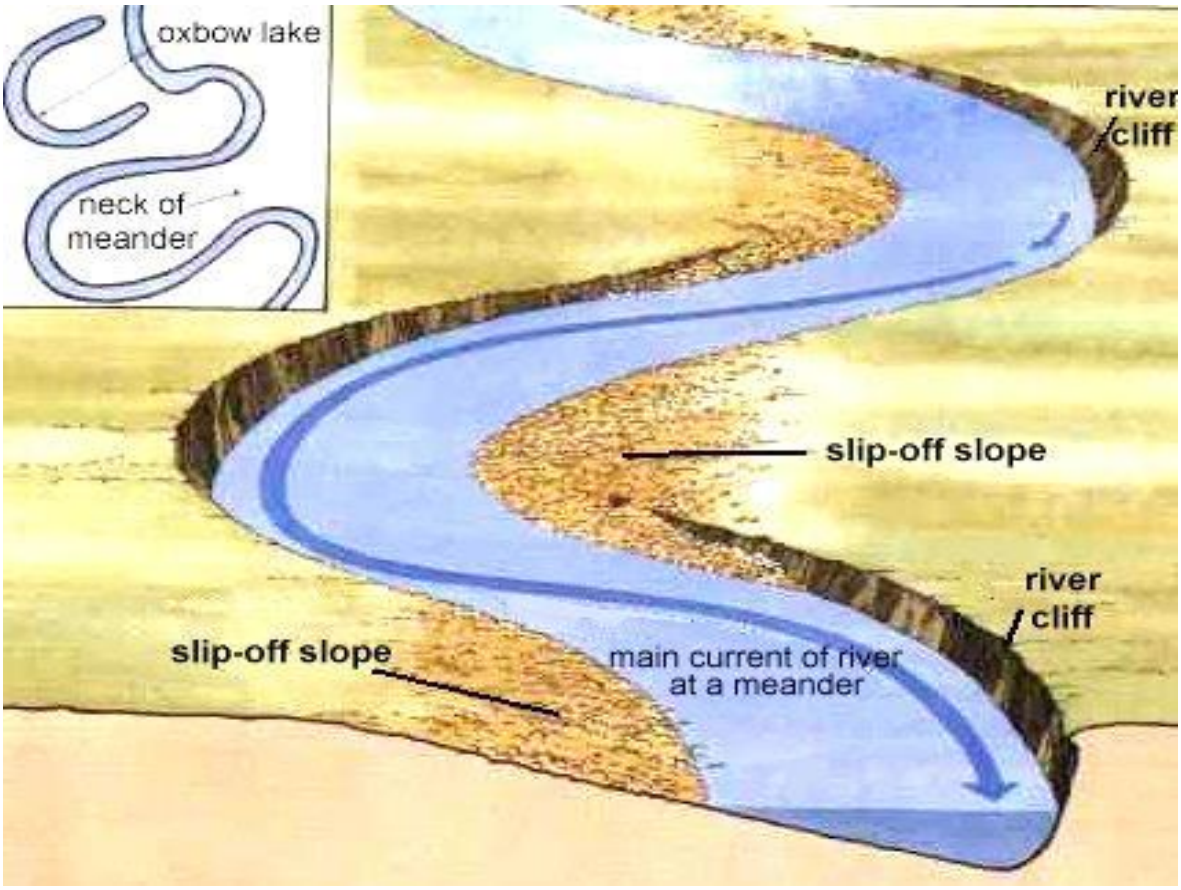
Food plain

- As the river nears the lower course the valley is wider and the gradient gentle.
- The flat area on either side of the river channel is the floodplain.
- During times of flood the river overflows its banks depositing alluvium hence the name floodplain



River cliffs and slip off slopes

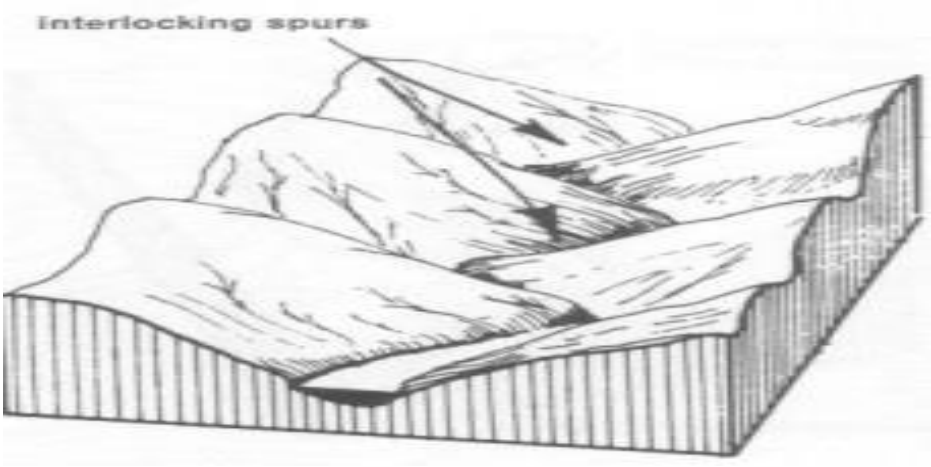
- When the flow of water enter to bend of the river eroding the outer bank into a steep river cliff
- The water piles up on the outside of the bend because of the centrifugal force.
- The outer bank is therefore the bank of continuous erosion and the inner bank is the bank of continual deposition.



THE RIVER CLIFF

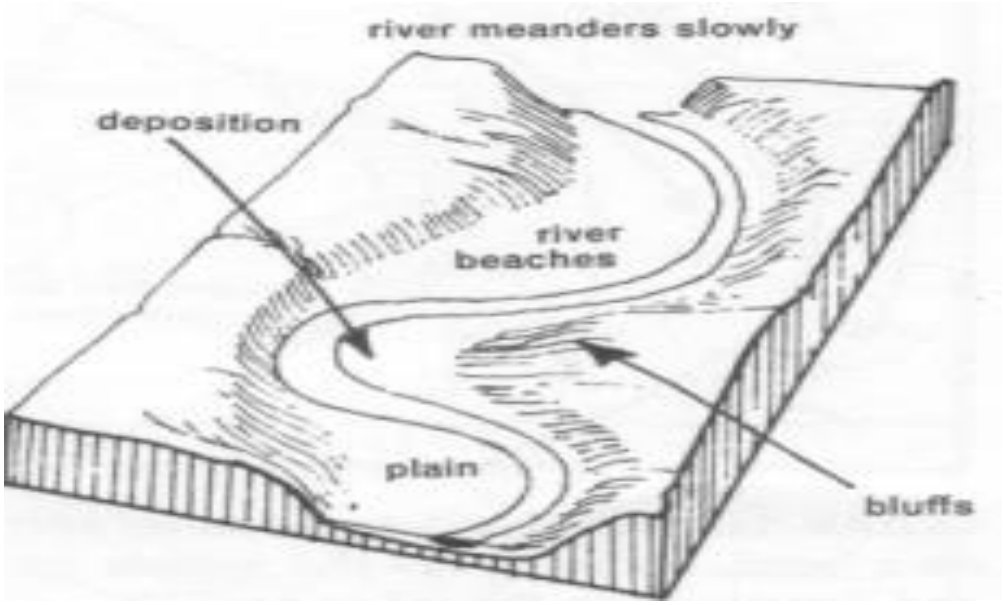
Interlocking spurs

- As the stream flows on, meanders migrate progressively outward with the interlocking spurs alternating with the undercut slopes.
- At this stage meanders in the middle course are only the beginning of the downstream swing, for bends are restricted by the interlocking spurs.



3. OLD AGE STAGE

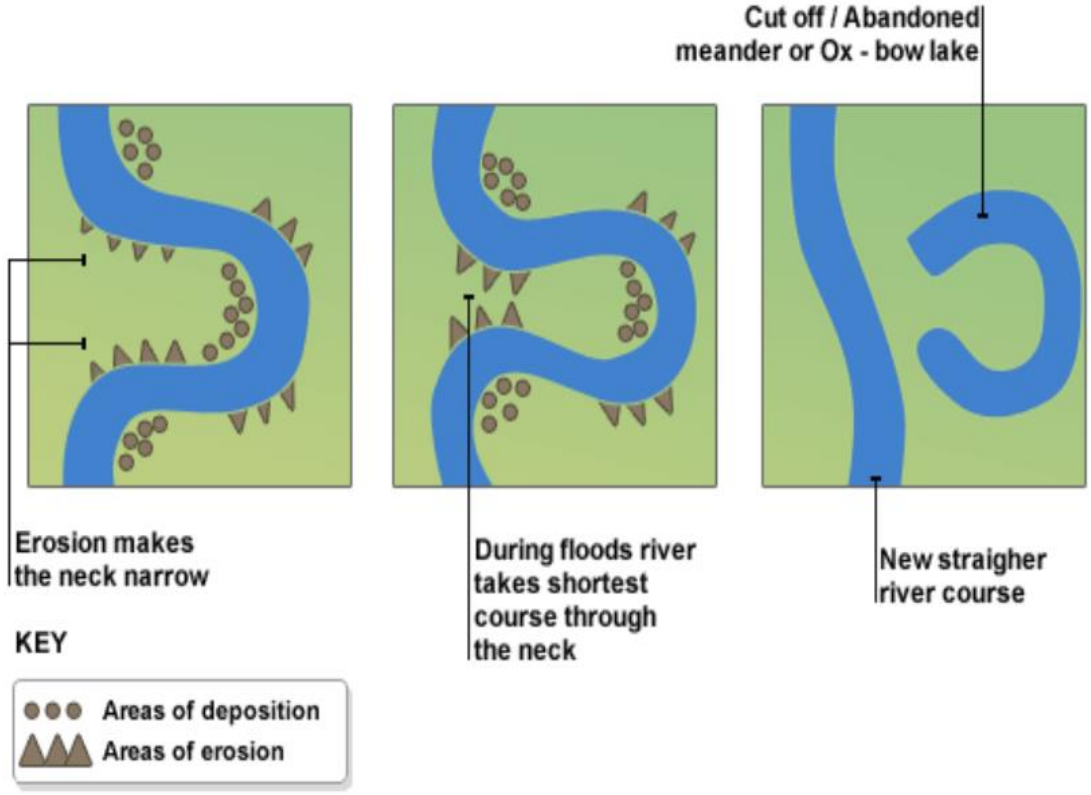
- In old age, the flood plain which began to form in mature stage continues to widen and extensive meandering occurs.
- The river even cuts across some meanders to create Oxbow lakes.
- The volume of water in a river is at its greatest in the lower course. This is due to the contribution of water from tributaries.
- The river channel is deep and wide and the land around the river is flat.



Oxbow Lake

- Ox – bow lakes are formed when the neck of a meanders becomes very narrow

- Formation of an ox – Bow Lake takes place when a meander bend is cut off from the main river
- This can occur when the river comes down in flood and cuts through the neck of the meander.
- It then deposits sediments on the sides of its banks cutting off part of the meander.



Levees

- During flooding the coarsest and heaviest materials are deposited alongside the river channel forming a natural ridge or embankment called a levee.
- Levees – they are formed whenever the lower course of river flows its banks in flood periods.

Delta

- Deltas are often found at the mouth of large rivers. An example is the Nile Delta.
- Deltas are formed when a river deposits material faster than the sea can erode it.
- When a river reaches the sea the fine materials it has not yet dropped are deposited at its mouth, forming a fan shaped alluvial area called a delta.

- Due to the obstruction caused by the deposited alluvium the river may discharge its water through several channels called distributaries or delta.

There are three forms of deltas. These are:

- Bird's foot- deltas have many distributaries
- Cuspate – delta is tooth-shaped
- Arcuate – delta is fan shaped with rounded outer edge.

DELTAS

- Most of the load carried by rivers is eventually deposited in the oceans, seas, and lakes into which rivers drain
- Sometimes the load sinks to the bottom in the mouth of the river
- When this happens, layer upon layer of sediment may collect to form a gently sloping platform
- The platform may extend up the surface, when this happens it is called a delta.

Conditions Necessary for the Growth of a Delta

- A river must have a large load. The velocity should be sufficiently low to allow deposition to take place.
- Deposition must occur faster than the load can be removed by currents and tides. Absence of a lake or swamp along the river channel.

TYPES OF DELTAS

ARCUATE

- Consists of both fine and coarse sediments and is in the shape of an inverted cone. It is crossed by numerous distributaries, e.g. the rivers Niger and Nile deltas.
- **Bird's Foot**: This consists of very fine material called silt, and has a few long distributaries, bordered by levees that stand out from the shore.

ESTUARJNE

- This kind of delta is formed from materials deposited in the submerged mouth of a river.

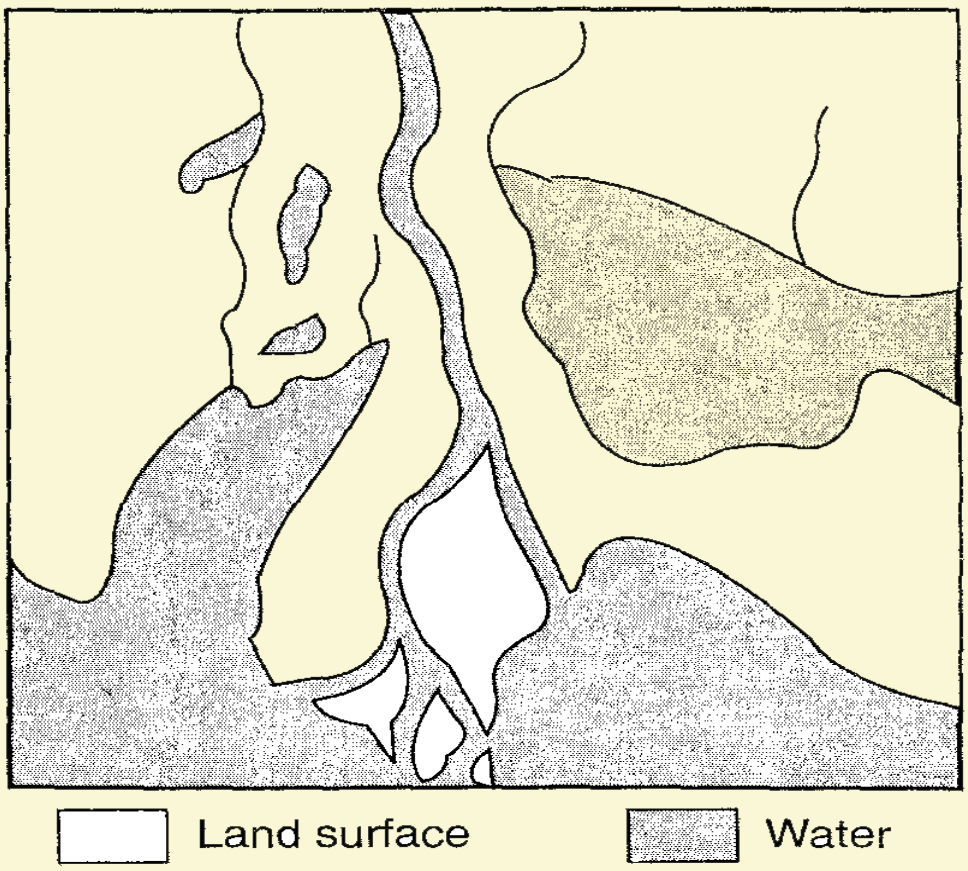


Fig. 8.10: A Bird's foot

BIRD'S FOOT:

- Consists of fine material called silt and has a few distributaries bordered by leaves that stand out at the shore

INLAND DELTAS

- These are formed where the velocity of a river is checked on entering an inland water body or a flat land, especially a swamp.

- An inland delta forms at a point before the river reaches its mouth, e.g. the Niger delta in Mali and the Okavango in Botswana.

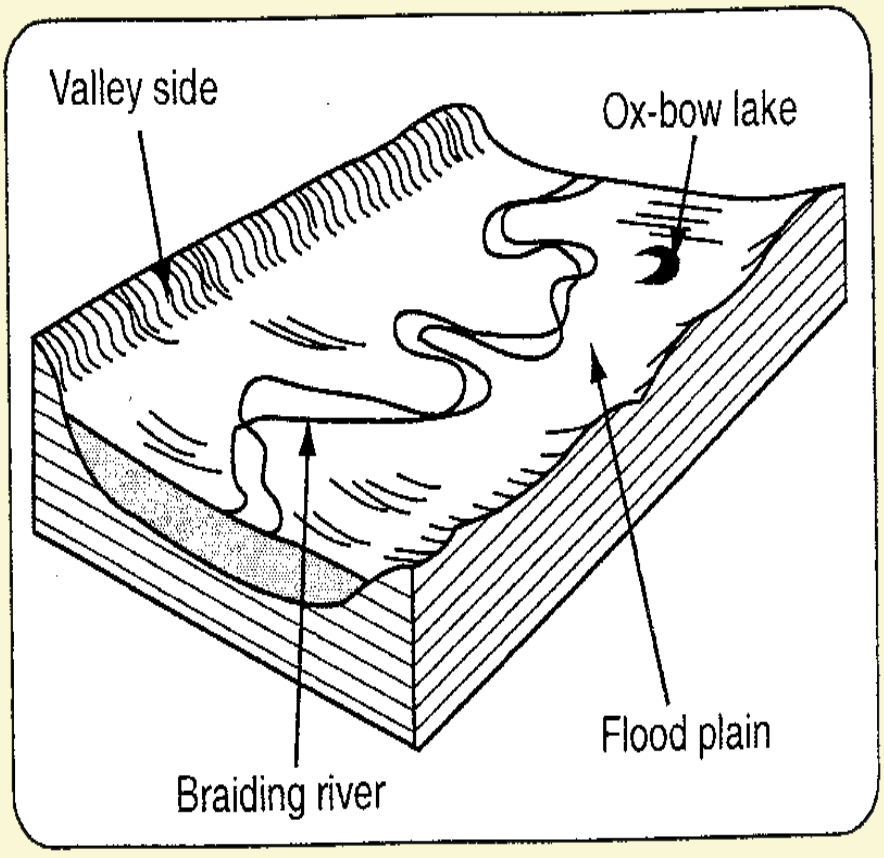


Fig. 8.9: A braided river

***Braided Channel**:* This refers to the splitting of a river channel into minor channels which later rejoin.

Conditions necessary for Braiding:

• Droughts which reduce the volume of water.

• High evaporation rate.

• Drop in slope

REVISION QUESTIONS

1. Mention the three types of Deltas

2.Discuss the conditions necessary for the growth of a delta

3.State whether the following statement are**true or false**

(a) Rejuvenation occurs when the energy of a river decreases

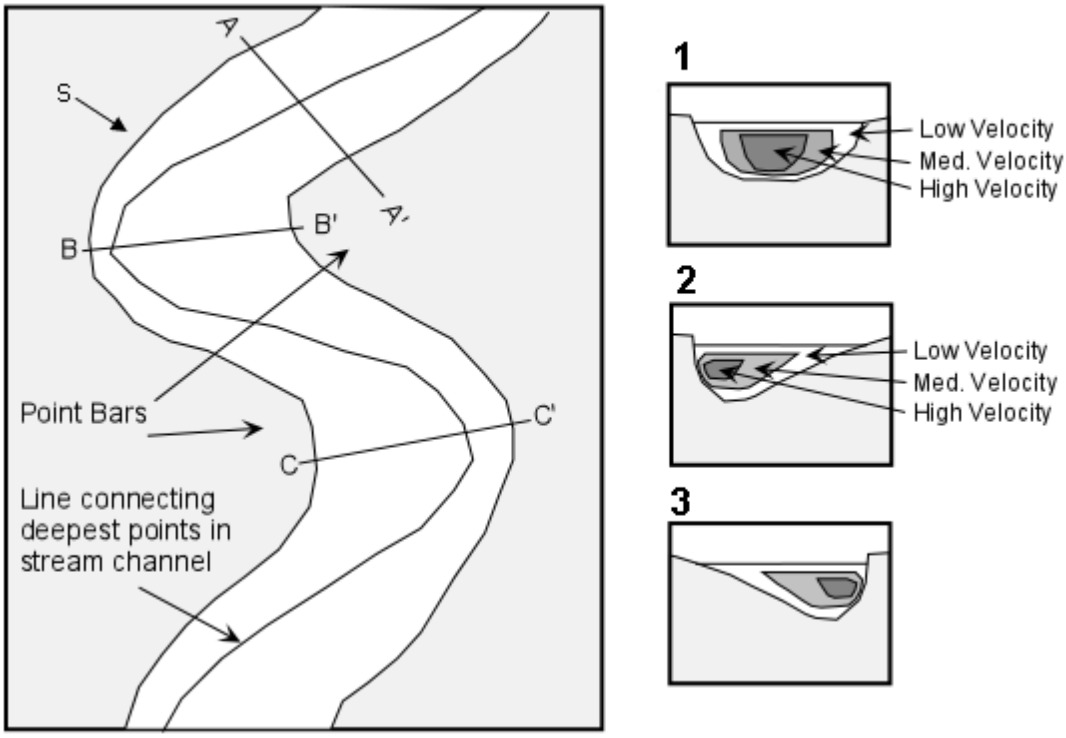
4. Explain the concept river capture

5. What is the name given to the erosion process which causes/starts river capture?

6.State **THREE** factors that cause river capture.

7. Study the diagram below

Meandering Channels



a. Identify stream pattern S.

b. In which stage of the river does stream pattern S mainly occur?

c. Explain the formation of stream pattern S.

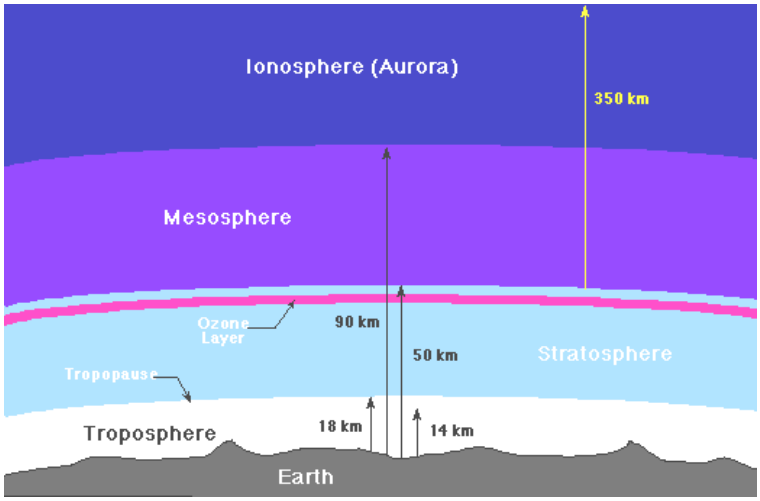
d. Name slopes B and B'

e. State the major geomorphological activity that occurs at B and B'

CLIMATE AND WEATHER

THE EARTH'S ATMOSPHERE

- The air that surrounds the earthy is called the **atmosphere.**
- It is about330 km thick and it consists of three main zones the atmosphere, the stratosphere, and the ionosphere thermosphere and parts of the mesosphere and exosphere.
- It is distinguished because it is ionized by solar radiation
- The ionosphere is a region of the Earth's upper atmosphere, from about 60km to 1000km altitude, and includes the thermosphere and exosphere



- The troposphere extents from the earth's surface to a height of between 13km at the equator to 8km at the poles.
- The troposphere contains about 90 per cent of the atmosphere water vapour**within it**.
- Temperature decreases with height at a fairly uniform rate of 6.5^{o}_{c} for every 1000 km ascent.
- This decrease in temperature is called the **normal lapse rate**.
- The stratosphere extents from the upper surface of the troposphere called the **troposphere**; to a height of about 100 km.
- The temperatures of this zone are very low and fairly constant at about -50^{o}_{c}.
- The **ionosphere** is above the stratosphere. This zone contains electrons and ions which influence radio waves.

The meaning of weather and climate

- Weather is the atmospherics condition of a particular place at a given time.
- Weather also can vary tremendously over a small area.
- It may be sunny at your school, but rainy a few kilometers away.

Elements of weather

a. Temperature
b. Rainfall
c. Humidity
d. Pressure
e. Cloud cover and sunshine
f. Wind direction and strength.

These elements are measured and recorded at a place called **weather station ormeteorological station**.

- A weather station is a place where the elements of weather are measured and recorded as accurately as possible.
- Each station has a Stevenson screen which contains four thermometers all hung from a frame in the centre of the screen.
- These are the **maximum thermometer, minimum thermometer, wet bulb thermometer, dry bulb thermometer.**

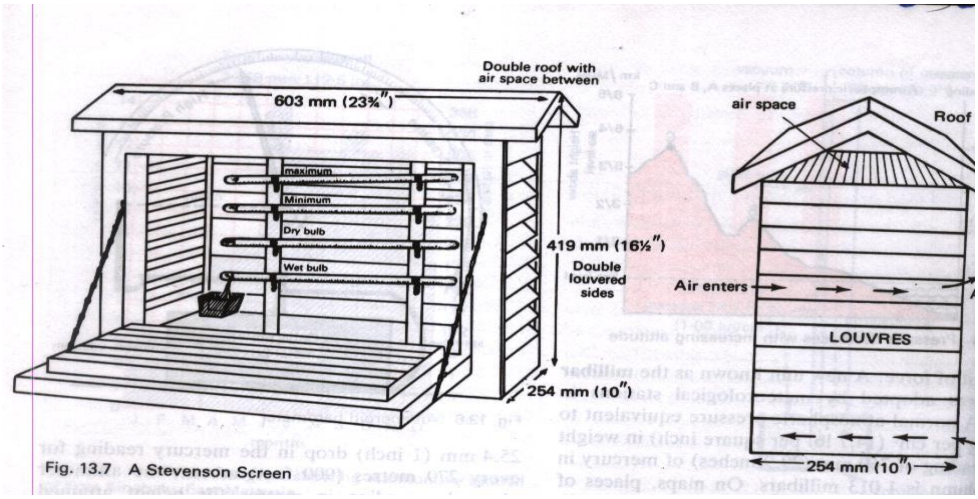


Fig. 13.7 A Stevenson Screen

The screen has the following features

a. It is built so as to measure the shade temperature of the air.

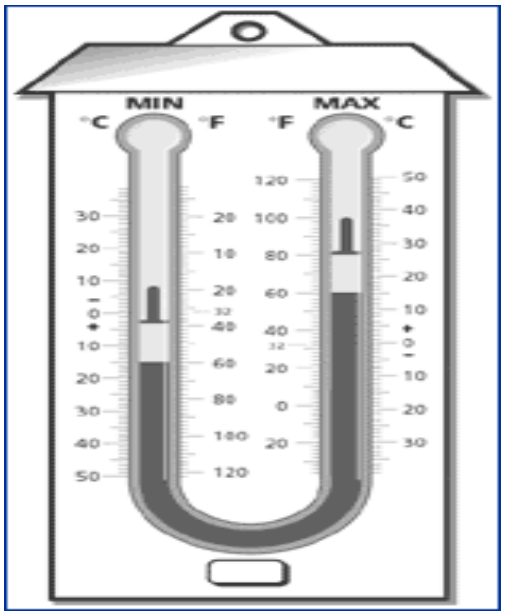
b. It has louvered sides of allow free entry of air.
c. The roof is made of two wooden layers to form a bad conductor of heat
d. The screen is painted white so as to improve insulation.
e. The screen is placed on a stand about 121 cm above ground level.
f. One side of the screen is hinged and it acts as a door.

Atmospheric temperature

- This is observed by **measure ring** the highest (maximum) and lowest (minimum) temperatures of a day
- Temperature is measured in degrees centigrade (^{o}c) or degrees Fahrenheit (^{o}F)
- The Celsius or centigrade scale is commonly used on this scale 0^{o}C represents freezing point of water, and the 100^o represents the boiling point of water
- On the Fahrenheit scale, the freezing point of water is 32^{0}F and the boiling point is 212^{o}F.

Measurement of temperature

- Maximum and minimum temperatures are measured by the maximum and minimum thermometers
- These are in form of separate thermometers or joined in a U – Shaped tube called a six's thermometer.



Maximum and Minimum Thermometer

To measure maximum temperature

a. Mercury in the glass tube expands when the temperature rises. This pushes the index in the right hand limb up to maximum
b. The end of the index nearest the mercury gives the reading of the maximum temperature this is 30^{o}C in our example
c. To reset the index for next day's reading; draw it back by a magnet.

To measure minimum temperature

Minimum temperature probably occurs early in the morning when temperature falls

a. The alcohol in the left – hand limb contracts
b. The mercury flows in the reverse direction
c. The index is pushed up along the left hand limb
d. When temperature rises, the alcohol flows past the index leaving it where it was pushed
e. The end of the index farthest from the bulb gives the reading of the minimum temperature. This is 10^{0}C in our example
f. To reset the index draw it back by a magnet.

Temperature Record

The following are used to keep a temperature record;

1. **Mean daily temperature** - this is the average of maximum and minimum e. g (30^{o}C+10^{o}C) ÷ 2 = 20^{o}C
2. **Daily or Diurnal Range –** this is the difference between the maximum and minimum temperatures of a day.e.g. (Max 30^{o}C- Min10^{o}C) = 20^{o}C
3. **The annual temperature –** this is the difference between the mean temperature of the hottest month and that of the coldest month.
4. **The mean annual temperature –** this is the sum of mean month temperature for one year divided by 12 months.
5. **The mean monthly temperature –** this refers to the sum of mean daily temperatures for one month divided by the number of days in that month. On weather maps places having the same temperature are joined by a smooth line. Such a line is called an **isotherm.**

Rainfall

- Rainfall is caused by the effect of solar radiation over land and water bodies.

- Solar radiation refers to the energy from sun.
- This energy gives rise, to various types of weather and climate.
- Solar radiation over sources or bodies of water causes evaporation.

The process of evaporation

Solar energy causes water to be transformed into vapor. This vapor enters the atmosphere by;

a. Evaporation from sea and land surfaces.
b. Transpiration from plants

   The combined total of evaporation and transpiration is termed **Evapotranspiration.**

The rate of evaporation depends on the following factors;

a. The temperature of evaporating surface. Evaporation is higher if the temperature of evaporating surface is higher than that of the air.
b. Relative humidity of the air evaporation is also highest if air is relatively dry.
c. Wind speed. It is also high if winds are strongest evaporation is greater in summer than in winter. It is also higher in tropical latitudes than in winter. It is also higher in tropical latitudes than in temperate and polar latitudes.

Condensation

- When warm air rises, it is cooled and its capacity to hold water vapour is reduced
- Condensation will occur if the rising air contains water vapour
- The water molecules will pass into a liquid state and subsequently return to land and sea as precipitation, condensation may take the form of minute droplets of clouds, rain, mist dew or fog
- Water of oceans, atmosphere and land moves in a great cycle
- This involves evaporation from sea and land, condensation to form clouds and precipitation in form of rain or snow
- This exchange is called the water cycle or hydrologic cycle.

Types of rainfall

There are three major types of rainfall and these are:

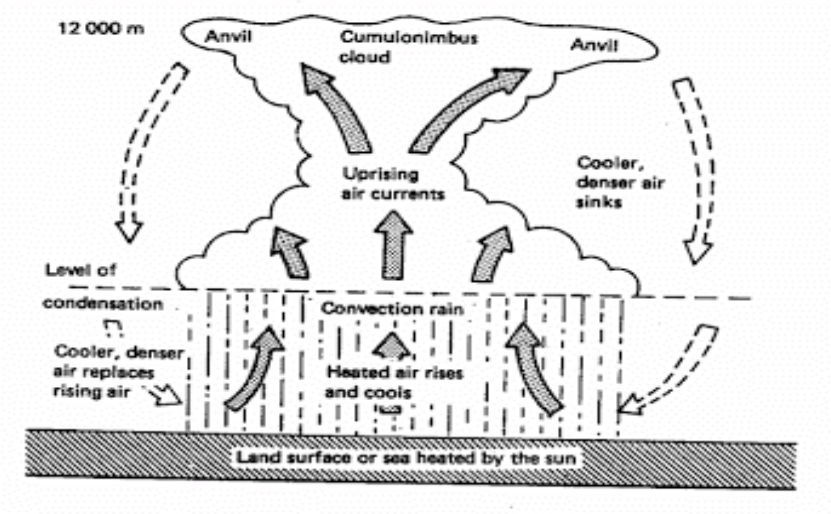
1. Convectional rainfall

2. Orographic or relief rain

3. Cyclonic or frontal rain

1. **Convectional rainfall.**

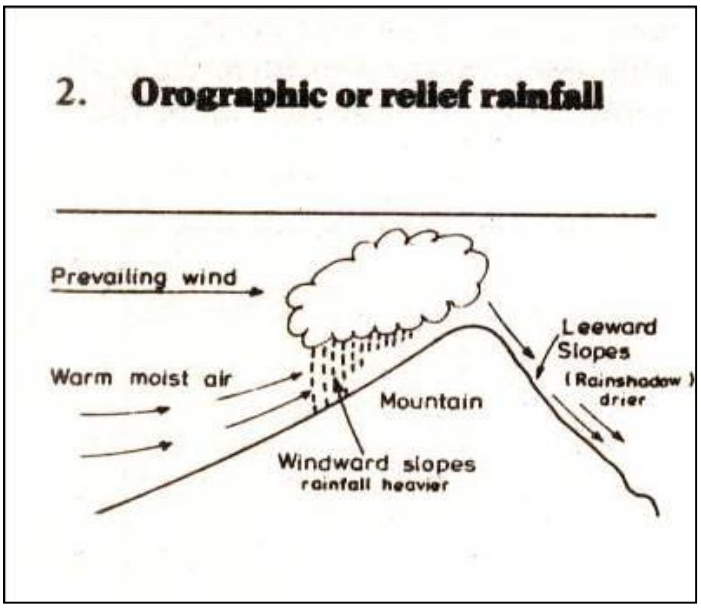
- This type of rainfall is most common in regions that are intensely heated, either during the day, as in the tropics, or in the summer, as in temperate interiors
- When the earth's surface is heated by conduction, moisture-laden vapour rises because heated air always expands, and becomes lighter
- Air rises in a convection current after a prolonged period of intense heating
- When ascending, the water vapor condenses into cumulonimbus clouds with a great vertical extent
- This probably reaches its maximum in the afternoon when the convectional system is well developed
- Hot, rising air has great capacity for holding moisture, which is abundant in regions of high relative humidity
- As the air rises, it cools and when saturation point is reached, torrential downpours occur accompanied by thunder and lightning.



Conventional Rainfall

2. Orographic or relief rain

- Unlike convectional rain which is caused by convection currents, orographic rain is formed whenever moist air is forced to ascend a mountain barrier
- It is best developed on the windward slopes of mountains where the prevailing moisture – laden winds come from the sea
- The air is compelled to rise and is thereby cooled by expansion in the higher altitudes and the subsequent decrease in the atmospheric pressure
- Further ascent cools the air until the air is completely saturated (relative humidity is 100 per cent)
- Condensation takes place forming clouds and eventually rain
- Since it is covered by the relief of the land it is also known as relief rain
- The other side of the mountain where there is little or no rainfall is called the leeward slope
- The wind is dry and does not bring rain
- The area is termed the rain shadow e.g. the Luangwa valley in the lee of the Muchinga Escarpment.



Cyclonic or frontal rain

- This type of rainfall independent of relief or convection

- It is purely associated with cyclonic activity whether in temperate regions (depressions) or tropical regions (cyclones)
- Basically it is due to the convergence (meeting) of two different air masses with different temperatures and other physical properties
- As cold air is denser, it tends to remain close to the ground
- The warm air is lighter and tends to rise over the cold air
- In ascent, pressure decreases the air expands and cools, condensation takes place and Light showers called cyclonic or frontal rain occur

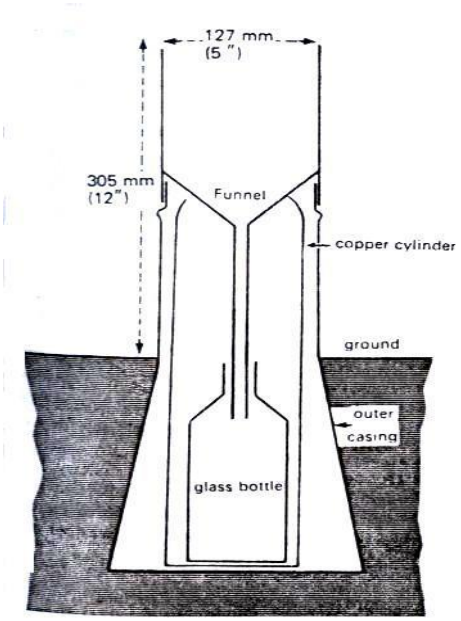


Fig. 13.1(a) A rain gauge

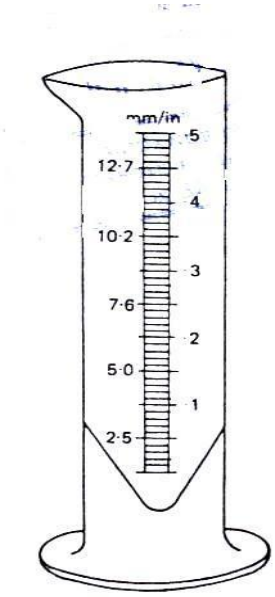


Fig. 13.1(b) An ordinary measuring cylinder

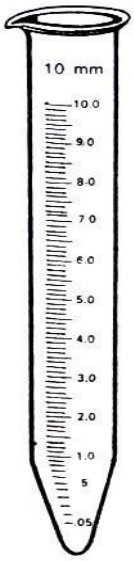


Fig. 13.1(c) A calibrated taper measure

Cyclonic or frontal rain (depression)

Measurement of rainfall

An instrument called a **rain gauge** is used to measure rainfall. Rainfall is measured in **millimeters or inches.**

A rain gauge consists of the following parts;-

a. A metal or plastic container
b. A funnel
c. A graduate jar or measuring cylinder.

- Rain falling in the funnel trickles into the jar or measuring cylinder shown above
- Measurements are taken every 24 hours. The reading obtained is the depth of rain that has fallen over area equipment to the top of the funnel.

Position of rain Gauge

a. It must be sunk into the ground level. This is to prevent rain from splashing into the funnel from the g round
b. It must be sunk into the ground to prevent excessive evaporation of rain water from the jar
c. It must be placed in an open space. This is to prevent run - off water from buildings and trees from entering the funnel.

Recording rainfall

- On weather maps all places having the same quantity of rainfall are joined by a line known as **isohyets.**

Humidity of the air

- **Humidity** refers to the amount of water vapour that may be present in the air.
- This amount of watervapour varies from what air can hold at a given temperature and the actual amount of water vapour in the air is very important.
- This is called **relative Humidity** (R. H.). It is expressed as a percentage (%).

Example;

- If R. H. is 60% a temperature of 30^{o}C, then air is only holding 6/10th of the water vapour it could hold at that temperature.
- There is a limit to the quantity of water vapour that can be held by the air.
- This limit is known as the **saturation point.**
- This means that the air is saturated when the R. H. is 100%.

Humidity and temperature

- The amount of water vapour air can hold depends on temperature. When temperature rises air can hold more vapour.
- When temperature falls it cannot hold as much wate4r vapour.
- When relative humidity is at 100% the air cannot cont6ain excess water vapour.
- Any further addition will cause condensation to occur.
- Condensation may take the form of;

a. Minute droplets of clouds

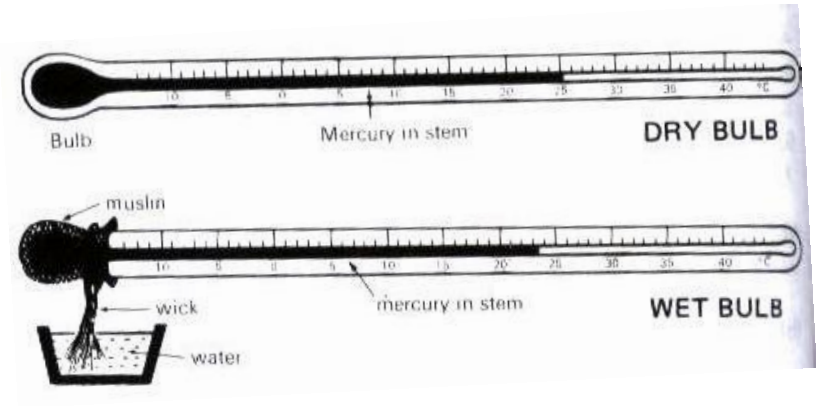
b. Rainy mist

c. Dew or fog

NOTE: The critical temperature at which the air is fully saturated is called the **dew point.** Below this point condensation will take place.

Measurement of humidity

- An instrument called a **Hygrometer** is used to measure Humidity.
- This consists of a wet bulb and dry bulb thermometers.



The hygrometer

*The **wet and dry thermometers,** (also called hygrometers) allow the calculation of the humidity of the air*

- When air is not saturated water evaporate from the container and the muslin become wet.
- This cools the wet bulb and caused the mercury to contract.
- The dry bulb is not affected and so the two thermometers show different readings.
- The difference between the readings of the two thermometers is an indication of humidity in the air.

Thermometer reading	**Amount of Humidity**
• Large difference	Low humidity
• Small difference	High humidity
• No difference	Air is saturated

Atmospheric air pressure

- Air exerts weight on the earth's surface.
- This weight is called atmospheric pressure.

- A column of air 1sq cm in cross sectional areas extending from the sea level to the top of the atmosphere weights 1. 034 kg.
- Hence at sea level the atmospheric pressure is 1.034 kg per sq cm or 14.7 ibs per sq in.
- Pressure is made up of a number of mixed gases and has weight.
- It therefore exerts a pressure on the earth's surface which varies from place to place and from time to time.
- On the maps places of equal pressure are joined by lines called **isobars.**
- Atmospheric pressure varies with both temperature and altitude.

Temperature and air pressure

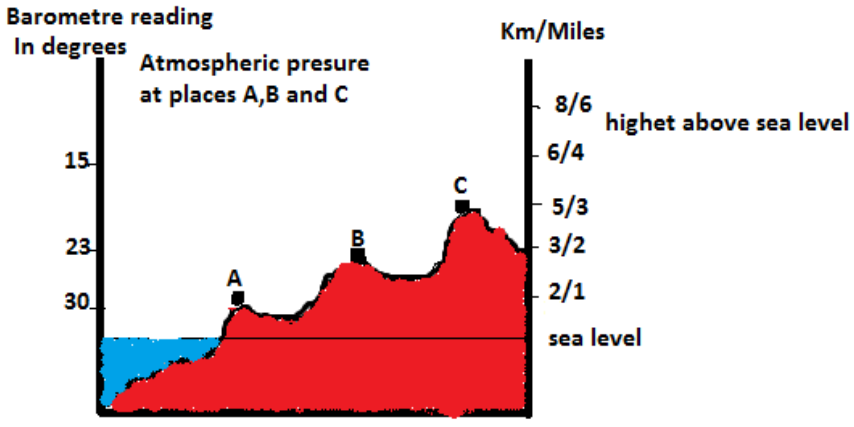
- High temperature causes air to rise.
- This lessens pressure acting on the surface. Hence;

a. High temperature areas are associated with **low pressure** (e.g. Equator belt). Regions of continuous low pressure belt are known as **doldrums areas.**

b. Low temperature areas are commonly associated with high pressure. This is because air is always descending.

Altitudes

- This is the height above sea level
- Air is compressible; Air which lies lowest is most greatly compressed, and is therefore densest.
- Upwards both density and pressure fall rapidly



Measurement of pressure

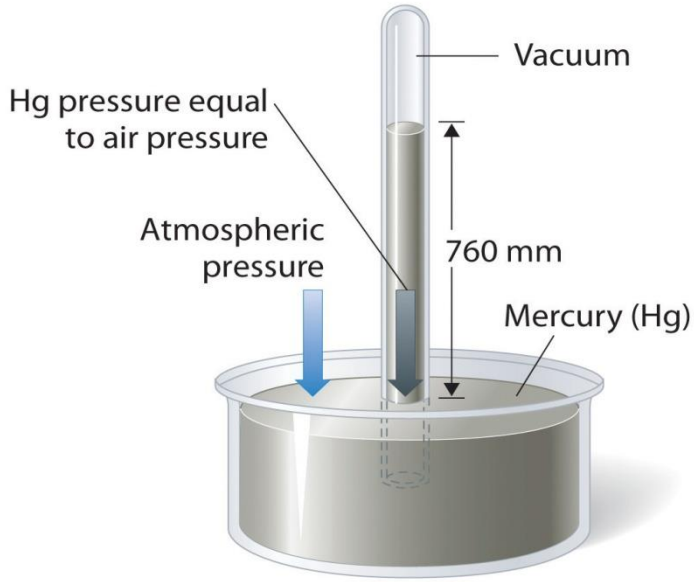
- Air pressure is measured in a unit known as**millibar (mb)** and instrument that measures atmospheric pressure is a **barometer.**

These are two types of barometers. These are:

1. **The Mercury barometer**

- This is a very accurate although cumbersome instrument.
- In this instrument pressure is read in inches or in height of mercury in the glass tube balanced by the atmospheric pressure.

At sea level this is 29.92 inches or 76 cm (760 mm) in metric units



A Mercury Barometer

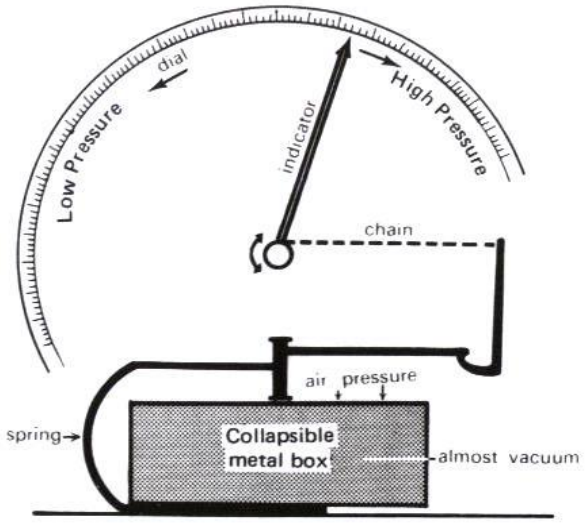
- A mercury barometer is an inverted tube which has a vacuum at the top, the open end is placed in mercury bath.
- The pressure of the air forces the mercury up the tube and the height of the mercury gives the air pressure, this is often quoted as 'inches of mercury'.
- This varies with the weather. Low air pressure usually suggests changeable weather, whereas high pressure usually means stable weather.

2. **The Aneroid Barometer**

- This instrument consists of a hollow metal box which contains very little air.
- The top of the box is flexible so that it expands and contracts according to changes in atmosphere pressure outside the box.

- This movement operates a hand which is read against the graduated circular diagram.

Aneroid Barometer

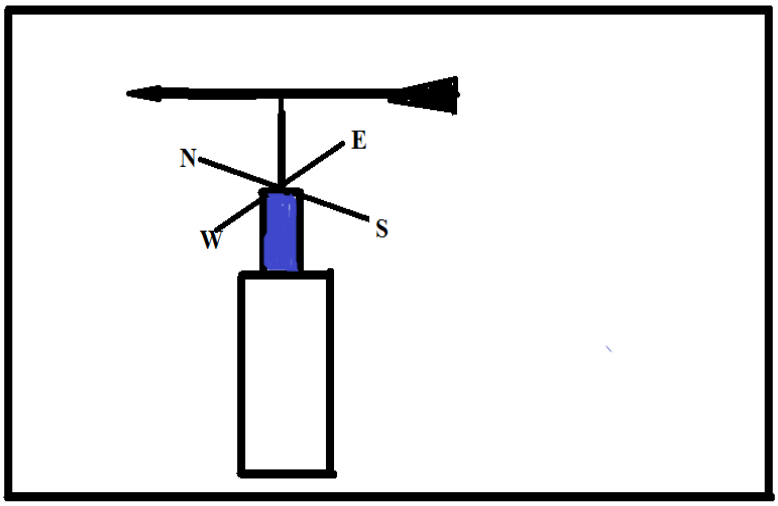


Wind direction and speed

- Wind is air in motion and has both direction and speed.
- The instrument widely used for measuring **wind direction** is a **wind vane** or **weather cock.**
- As wind direction is always deflected by trees and tall buildings weather cocks and wind vanes need to be created in an exposed position to get a true direction.

It is made up of top two parts. These are:

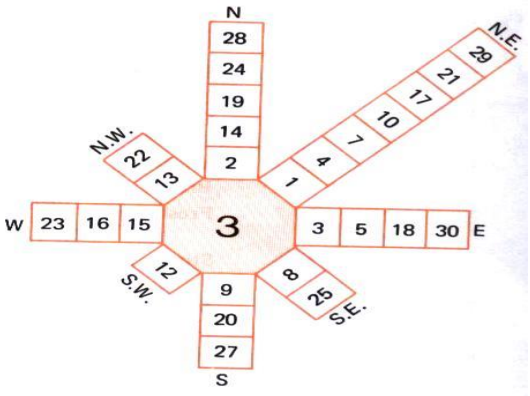
- One part is an arrow or vane on the top, which is free to move with the prevailing wind.
- The other part with the four compass points is stationery and shows in which direction the wind is moving
- Winds are always named from the direction they blow; an east wind is one that blows from east to west and a south –west wind is one that blows from the south to west.



AWIND VANES

Wind rose

- It is used for recording the direction of prevailing winds of a place over a period of a month.
- It consists of an octagon with the eight compass points.
- Each of the rectangles represents the date in which the wind comes from that direction (e.g.) on the fourth of the month, the wind is north east.
- These days which are without any wind is recorded in the box of the **calms,** and the number of calm days are indicated in the centre of the octagon e.g. 3 days in that month.

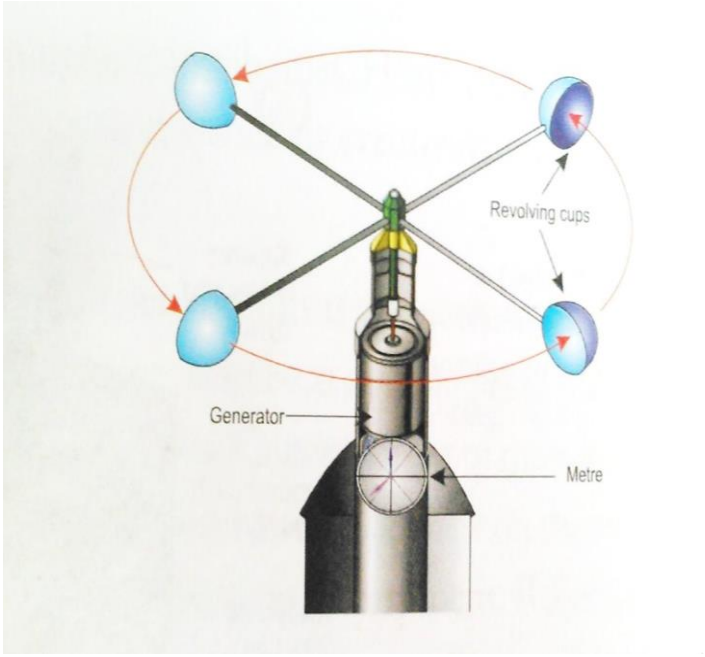


A WIND ROSE

Anemometer

- It is used to measure the speed of wind.

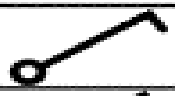
- It consists of three or four semi – circular cups attached to the ends of horizontal spokes mounted on a high vertical shaft.
- Metal cups are fixed to the ends of the arms, and they do rotate when there is wind.
- The movement operates a meter which records the speed of the wind in km per hour.



The Anemometer

- Since an anemometer is not easily available, a little practice of local wind observations will help us to assess the speed can be said about the strength of winds.
- The best guide is obtainable from the Beaufort wind scale

The Beaufort Scale

Wind	Symbol	Speed(mph)	Force #	Effect
calm		> 1	0	smoke rises vertically
light air		1-3	1	smoke drifts slightly
light breeze		4-7	2	leaves rustle; wind vane moves
gentle breeze		8-12	3	leaves-constant motion light flag extended
moderate breeze		13-18	4	raises dust and papers; small branches stir
fresh breeze		19-24	5	small trees sway
strong breeze		25-31	6	large branches move; use of umbrella difficult
moderate gale		32-38	7	whole trees in motion
fresh gale		39-46	8	twigs broken off trees; difficult to drive a car
strong gale		47-54	9	slight structure damage occurs
whole gale		55-63	10	trees uprooted; severe structural damage
storm		64-73	11	widespread damage
hurricane		above 75	12	devastation

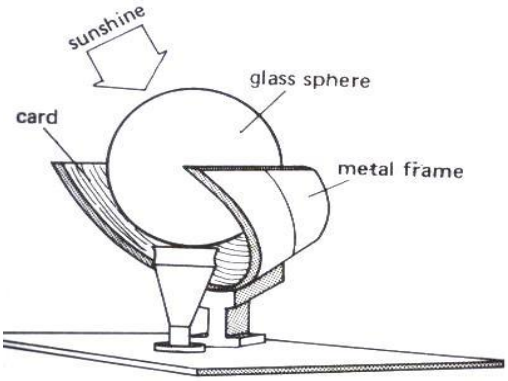
The Beaufort Scale has unofficially been extended to Force 17 to describe tropical storms exceeding 126 miles per hour

The Beaufort Wind scale

Sunshine

- The amount of sunshine a place receives depends on the seasons a factor determined by latitude and by the position of the earth in its revolution around the sun.
- In the tropics sunshine is abundant and at the poles there is less or no sunshine in the metrological station, sunshine duration is recorded by a **sun dial,** 102 mm (4inches in diameter, through which the sun's rays are focused upon a sensitized card graduated in hours.
- An instrument which is used to measure sunshine is called **sunshine recorder.**

- On the maps places with equal sunshine duration are joined by **isohels.**



Sunshine recorder

CLOUDS COVER

- When air rises, it is cooled by expansion.
- After dew point has been reached cooling leads to **condensation of water vapour**in the atmosphere.
- Tiny droplets of water vapour which are too small to fall as rain or **snow** will be suspended in the air and float as **clouds.**
- Their form shape, height and movements tell us a great deal about the sky conditions and the weather we are likely to experience.
- The amount of cloud cover in the sky is expressed in **eights or oktas** (e.g. $^{2}/_{8}$ is quarter covered $^{4}/_{8}$ is half covered; $^{6}/_{8}$ is three quarters obscured and $^{8}/_{8}$ is completely overcast).
- On the maps places with an equal degree of cloudiness are joined by lines known as **isonephs**

BASIC CLOUD COVER

- The classification of clouds is based on a combination of **form height and appearance.** Four major cloud.

a. **High clouds:** mainly cirrus of feathery form at 6100 – 12200 meters above ground. They include the following:

- **Cirrus (Ci).** This looks fibrous and appears like wisps in the blue sky; it is often called 'mares' tails'. It indicates fair weather and often gives a brilliant sunset.
- **Cirroculus (Cc).** This appears as white globular masses forming ripples in a 'mackerel sky'.
- **Cirrostratus (Cs)**. This resembles a thin white sheet or veil;, the sky looks milky and the sun or moon shines through it with a characteristic 'halo'

b. **Medium clouds;** mainly alto or middle height clouds at 2100 – 6000 meters. They include:

- **Alto cumulus** (alt –cu). These are woolly bumpy clouds arranged in layers and appearing like waves the blue sky.
- **Altostratus** (alt – st) these are denser, grayish clouds with a 'watery' look. They have a fibrous or striated structure through which the sun's rays shine faintly.

c. **Low clouds.** Mainly stratus or sheet clouds below 2 100 metres (7, 000 feet). They include:

- **Stratocumulus** (st–cu)this is a rough bumpy cloud with the waves more propounded than in altocumulus.
- **Stratus** (st) this is a very low cloud, uniformly grey and thick which appears like a low ceiling or highland fog.
- It brings dull weather with light dazzle. It reduces the visibility of aircraft and is thus a danger.
    - **Nimbostratus** (Ni –st) this is a dark dull cloud, clearly brings continuous rain snow or sheet.

d. **Clouds with great vertical extent** – mainly cumulus or heap clouds with no definite height 6100 – 9000 meter).

Cumulus (cu) – this is a vertical cloud with a rounded top and horizontal base typical of humid tropical regions, associated with uprising convectional currents.

- Its great white globular masses may look grey against the sun but it is a fair weather cloud.

Cumulonimbus (cu – ni)

- This is in fact an overgrown cumulus cloud extending for a tremendous vertical height from a base of 600 metres to over 9000 metres.
- Its black and white globular cauliflower top often spreads out like an **anvil.**
- This is frequently seen in tropical afternoons.

- It is also referred to as a **thunder – cloud** and brings convectional rain, accompanied by lightning and thunder.

Other elements pertaining to visibility

Other elements affecting visibility include:

1. **HAZE**

- This is caused by smoke and dust particles in industrial areas or may be due to unequal refraction of light in air of different densities in the lower atmosphere.
- The term is usually used in connection with the **reduction of visibility** in region of **lower humidity** less than 75 per cent.

2. **MIST**

- The condensation of water vapour in the air causes small droplets of water to about forming clouds at ground level.

3. **FOG**

- Ordinary fog is due to water condensing on dust and other particles like smoke from houses and factories.
- In industrial areas, like those of the Black Country and northern England very thick **smoky fog** called **smog** is formed.
- Fogs that occur on hills are called **hill fogs.**
- The lower layers of the air are chilled and water vapour in the atmosphere condenses to form **radiation fog** or **land fog**.
- When the cooling surface is over the sea or when a warm ocean current is brought into contact with a cold current as off Newfoundland, **sea fog** is formed.

CLIMATE

- This is the average atmospheric weather conditions of an area over a long period of time.
- A minimum period of 30 years is taken for climatic observation.

Important elements of climate are:

- Temperature
- Precipitation
- Pressure

- Wind

TEMPERATURE

- This is the coldness or hotness of a place
- The sun's energy is called isolation or solar radiation and this turns into heat energy at the earth's surface.

Importance of temperature

- Temperature influences the actual amount of water vapor present in the air and thus decides the moisture-carrying capacity of the air.
- It decides the rate of evaporation and condensation, and therefore governs the degree of stability of the atmosphere.
- As relative humidity is directly related to the temperature of the air, it affects the nature and types of cloud formation and precipitation.

Factors affecting temperature

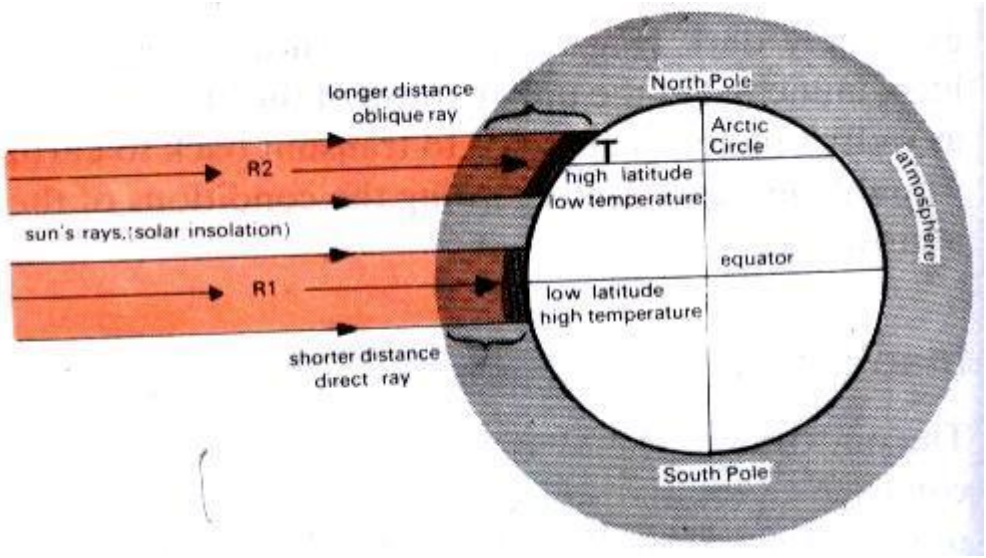
The temperature of a place is dependent on some or all of these factors**:**

- Latitude
- altitude
- distance from the sea
- Cloud cover and
- Humidity
- Slope
- Shelter
- Aspectlength of the day, ocean currents.etc

Latitude

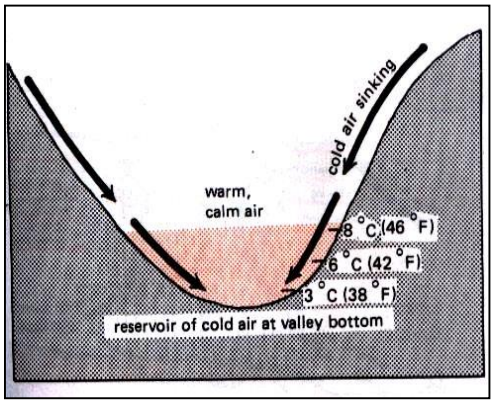
- The sun is overhead within the tropics only and hence high temperature is experience
- The area over which the sun is overhead directly will have higher temperatures than any other area on earth.
- This is because the distance from the sun to the ground is short than anywhere else.

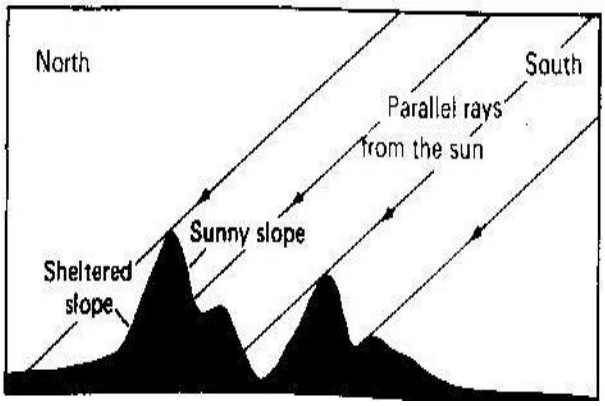
- The sun rays will reach other areas at an **oblique** angle.
- The distance covered by the sun rays at oblique angle is longer hence less heat reaching such areas.
- So as one move towards the poles from the equator there is a decrease in temperature, but temperature increase towards the equator.



Slope, Shelter and Aspect

- A steep slope experiences a more rapid change in temperature than a gentle one.
- Mountain ranges that have an east-west alignment like the Alps show a higher temperature on the south- facing "sunny slope" the north-facing "sheltered slope".
- The greater isolation of the southern slope is better suited for vine cultivation and has a more flourishing vegetable cover.
- Consequently, there are more settlements and it is better utilized than the "shady slope".
- In highly areas a hot day followed by a calm, cloudless night during which the air cools more rapidly over the higher ground may induce cold, heavy air to flow down the slope and accumulate at the valley bottom pushing the warmer air up wards.
- The temperature may then be lower in the valley than higher up the slope shown in the diagram. This is called a **temperature inversion**



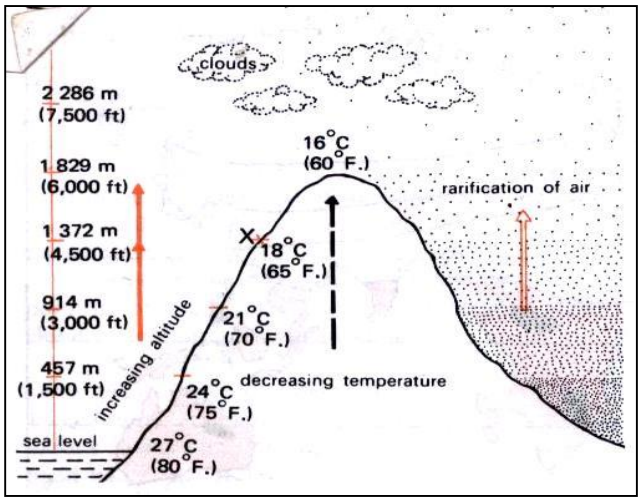


South-facing slopes are sunnierthan north facing slopes

Temperature invasion at valley bottom on calm, still nighte.g. alpine valley in spring

Altitude

- Water vapor and dust in the air prevent heat formed at the surface of the earth from rapidly passing back into space.
- But at high altitude e.g. on the tops of high mountains, the air is rarefied and it contains very little dust or water vapour.
- The heat from the earth`s surface therefore rapidly escapes, and the air remains cold



NOTE: The lapse rate: is the effect of altitude on mean annual temperature in a tropical area.

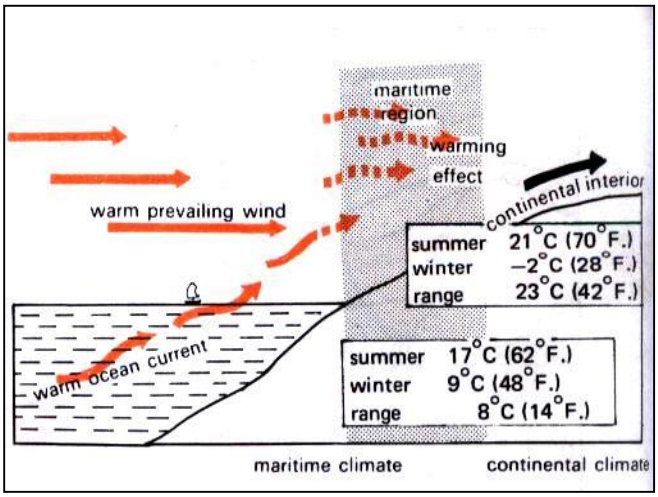
Length of day

- The length of day increases as latitude increases in the northern hemisphere, during the northern summer, and increases in the same manner in the southern hemisphere during the southern summer.
- Clearly, the average daily temperature of a place having 18 hours of day light is likely to be higher than a place having, say, only 10 hours of day light.

Distance from the sea

- Land surfaces heat and cool more quickly than sea surface.
- Water heats more slowly but it returns its heat for longer periods than does land.
- These characteristics have a marked influence on temperature, especially in temperature latitudes where the sea warms coastal regions in the winter, but cools them in the summer.
- The warming influence is confined to a narrow coastal belt because the sea air rapidly loses its warmth to the colder land .Air temperature decreases from the coast inland.
- Climates whose temperatures are influenced gently by the sea are called maritime, or oceanic, or insular climates.
- These occur in coastal regions which lie under prevailing on shore winds.

Ocean currents and winds- Both ocean currents and winds affect temperatures by transporting their heat or coldness into adjacent regions.

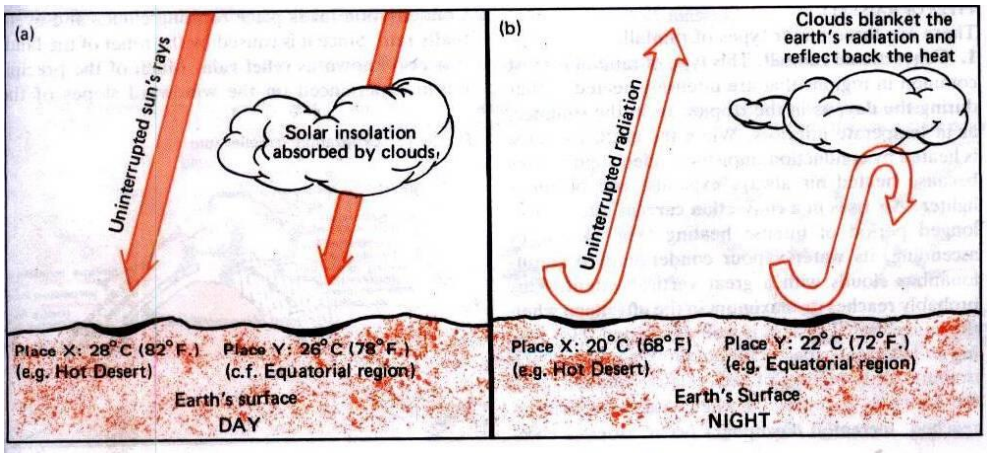


The warming effect of Warm Ocean currents are prevailingWinds on coastal regions with a Maritime climate in temperature latitudes

Cloud cover and humidity

- Clouds reduce the amount of solar radiation reaching the earth`s surface, and the amount of earth radiation leaving the earth`s surface.
- When there are no clouds, both types of radiation are at a maximum.
- In most parts of equatorial Africa there is a fall in temperature during the rainy season
- This is because the extensive covering of cloud reduces the amount of solar radiation reaching the earth`s surface.

The effect of cloud covers on temperature.



Natural vegetation and soil

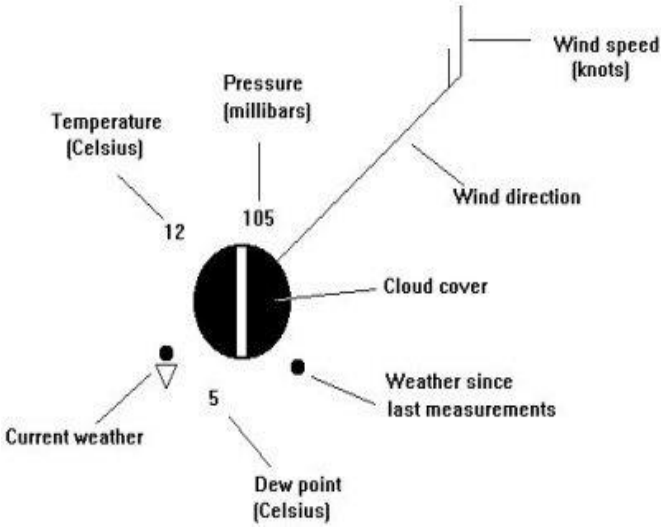
- There is a definite difference in temperature between forested regions and open ground.
- The thick foliage of the Amazon jungle cuts off much of the incoming isolation, and in many places sunlight never reaches the ground.
- It is in fact, cool in the jungle and its shade temperature is a few degrees lower than that of open spaces in corresponding latitudes.

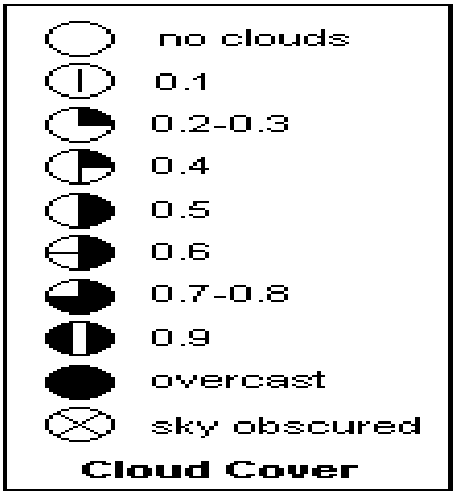
PRESSURE AND WINDS OF THE ATMOSPHERE

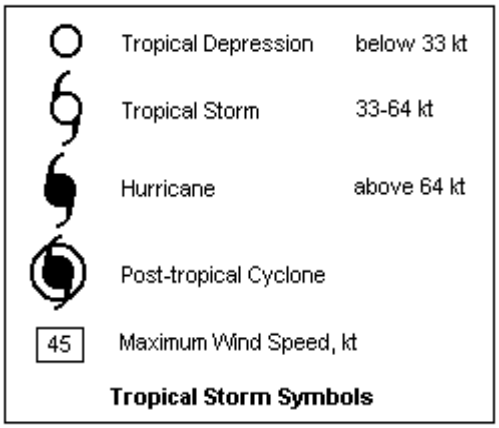
Pressure-origin and types

- Air has weight and it therefore exerts pressure called **atmospheric pressure**, on the earth`s surface.
- The pressure is not the same for all regions, nor is it always the same for any one region all the time, i.e. in some regions the pressure is higher for one part of the year than it is another part of the year
- Atmospheric pressure is affected by altitude, by temperature, and by earth rotation.

SOMEMETEOROLOGICAL SYMBOLS







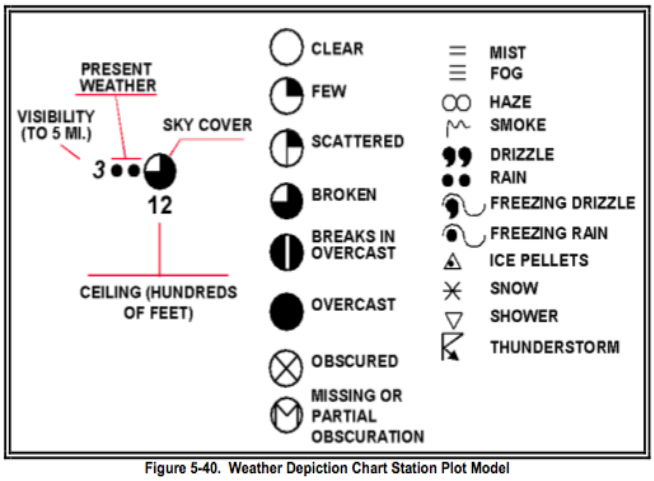


Figure 5-40. Weather Depiction Chart Station Plot Model

PRESSURE AND WINDS OF THE ATMOSPHERE

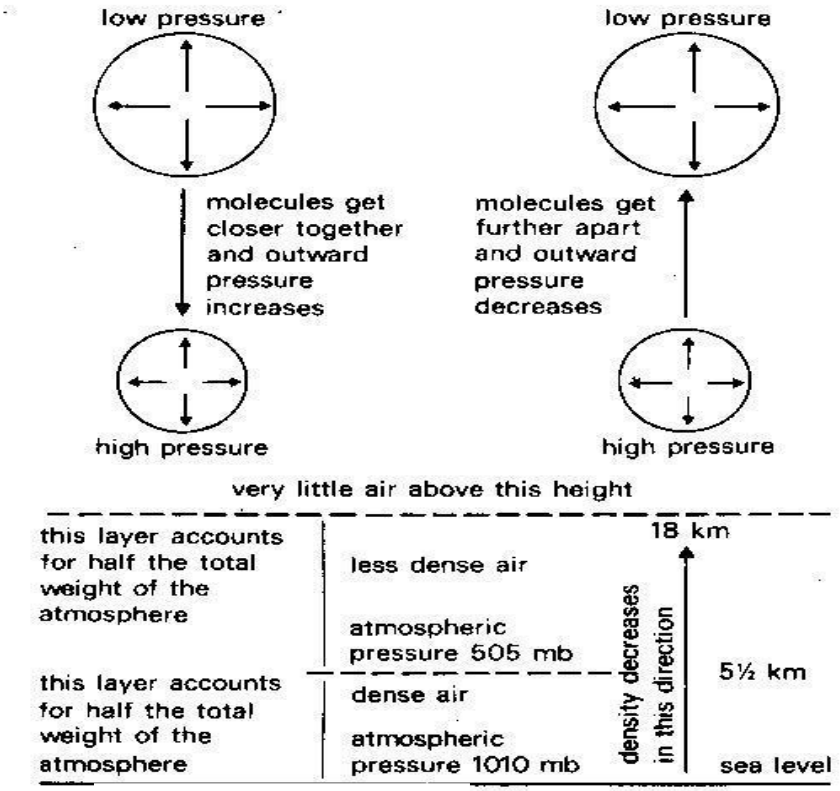
Pressure-origin and types

- Air has weight and it therefore exerts pressure called **atmospheric pressure**, on the earth`s surface.
- The pressure is not the same for all regions, nor is it always the same for any one region all the time, i.e. in some regions the pressure is higher for one part of the year than it is another part of the year, Atmospheric pressure is affected by altitude , by temperature , and by earth rotation.

Influence of altitude on pressure

- Air pressure at sea level is higher than it is at the top of a mountain.
- This is because at sea level air has to support a greater weight of air than does air on the top of a mountain.
- The molecules of the air at sea level push outwards with a force equal to that exerted by the air above it whereas the molecules of the air at the top of a mountain push outwards with much less force because the weight of the air above it is less.
- This explains why **air pressure increases when air descends.**
- When it descend volume decreases but the number of molecules in it remains the same
- The outward pressure of these molecules is spread over a smaller area

- Similarly when air rises, its volume increases and the outward pressure of its molecules is spread over a larger area and its pressure decreases.



Altitude affects pressure

Influence of temperature on pressure

1. When air sinks its pressure increases because it becomes compressed. When air becomes compressed its molecules move more quickly and heat is produced. **The temperature of air rises when its pressure rises.**

2. When airs raises its pressure decreases because it expands. When air expands its molecules move more slowly and heat is used up.

The temperature of air falls when its pressure falls.

3. When air is heated it expands and when this happens, the outward pressure of its molecules is spread over a large area. This means that the pressure of the air decreases

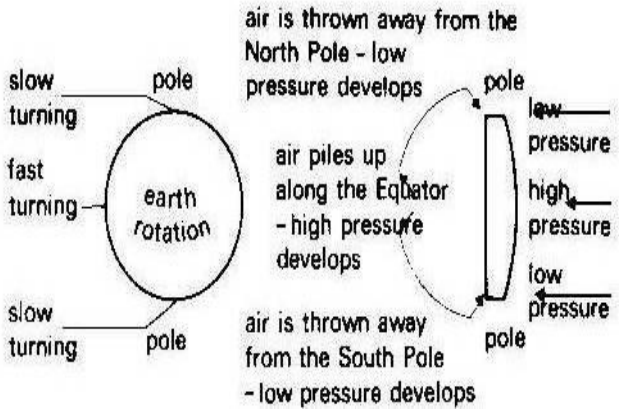
The pressure of the air falls when its temperature rises.

4. When air is cooled, it contracts and when this happens, the outward pressure of its molecules is spread over a smaller area. This means that pressure of the air increases. **The pressure of the air rises when its temperature falls.**

- If only temperature affected pressure , there would be a belt of low pressure pattern of the atmosphere around the earth at the equator, and two belts of high pressure, one cover each pole.
- But because altitude, temperature and earth rotation all affect pressure, the pressure pattern is not as simple as this.

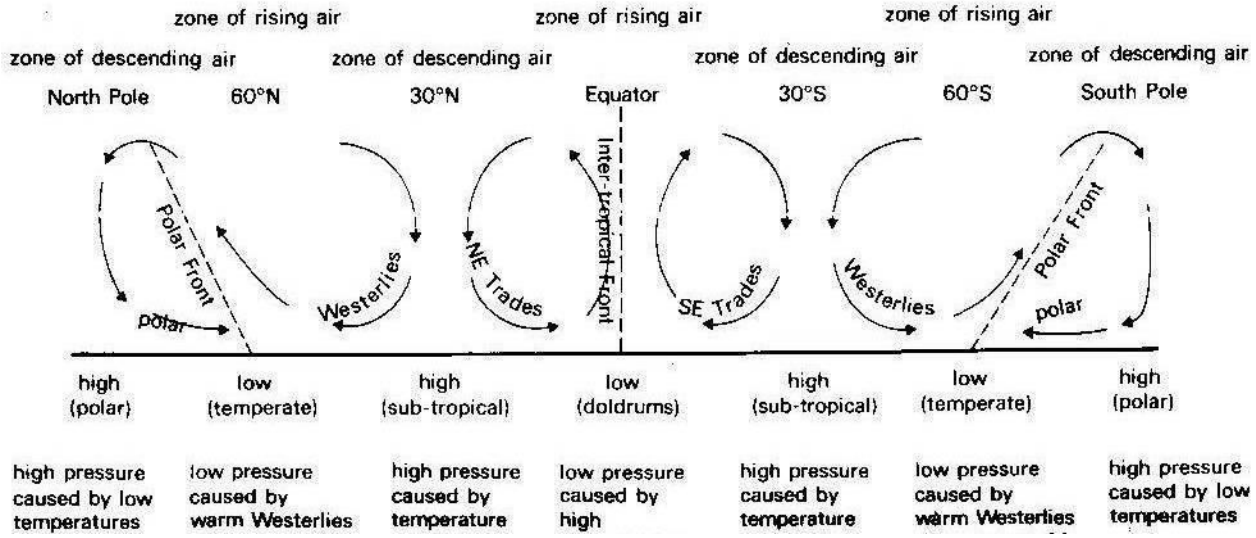
Influence of rotation on pressure

- The rotation of the earth causes the air at the poles to be thrown away towards the equator.
- In theory, this should result in air piling up along the equator to produce a belt of high pressure, whilst at the pole slow pressure should develop.
- But what actually happens is much more complicated and we must examine how temperature and rotation together affect the pressure pattern.
- Temperature – Low temperatures at the poles cause the air to contract, and high pressure develops.
- High temperatures along the equator cause the air to expand hence causes low pressure, called the **doldrums' low pressure**, develops.



Rotation

- Air blowing away from the poles crosses parallels that are getting larger and it spreads out to occupy greater space; i.e. it expands and its pressure falls.
- These low pressure belts are noticeable along 60 degrees north and 60 degrees south.
- They are known as the temperate low pressure belts.
- As the air moves away from the poles, more air moves in from higher levels to take its place some of this comes from the rising low pressure air along 60 degrees north and 60 degrees south.
- Air rising at the equator spreads out and moves towards the poles.
- As it does so, it crosses parallels that are getting shorter and it has to occupy less space. It contracts and its pressure rises.
- This happens near to 30 degrees north and 30 degrees south, and in these latitudes the air begins to sink where it builds up sub–tropical high pressure belts, sometimes called the **horse latitudes**.
- Some of the high pressure air in latitudes 30 degrees north and 30 degrees south moves over the surface towards the equator, and some of it moves towards the poles.
- The air that moves towards the equator replaces the air that rises there.
- The air moving towards the poles reaches latitude 60 degrees north and 60 degrees south where it replaces the air that rises there.



The pressure and patterns over the earth surface from the North Pole to the South Pole

Pressure belts and winds

- The planetary wind system are caused and controlled by the major pressure belts that have already been examined.
- The diagram below shows the distribution of the pressure belts, together with the wind systems, as they would appear on an earth that had a uniform surface, i.e. all land or all sea, and that did

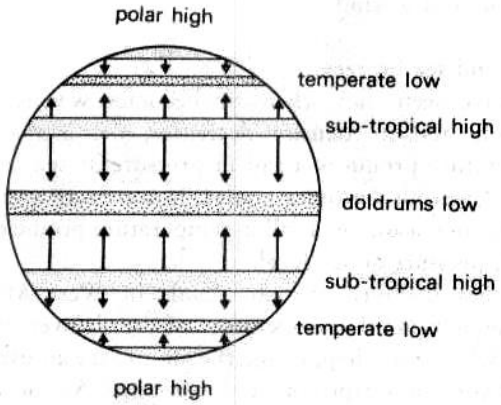
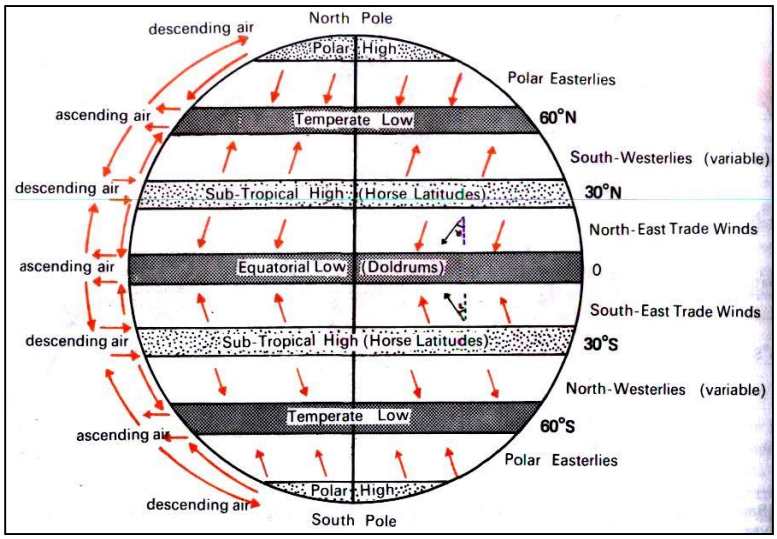


Fig. 15.9 What the pressure and wind patterns would be like if the earth did not rotate and if its surface was uniform

- The diagram below shows the same pressure belts and wind systems as they occur on the earth but remember that parts of the pattern of pressures and winds change seasonally because of seasonal changes of temperature, and hence of pressures and winds.



Distribution of world pressure belts and planetary winds

- The main difference these two diagrams is that the winds on a rotating earth are deflected to the right in the northern hemisphere, and to the left in the southern hemisphere.
- Planetary winds are sometimes called **prevailing winds** because they blow more frequently than most other winds.
- Winds are usually named after the direction from which they blow. There are three major wind systems in each hemisphere. These are:

NORTHERN HEMISPHERE

North East Polar Winds: blow from the polar high pressure towards the pressure in latitude 60 degrees north.

South West Wind: below from the sub–tropical high pressure, in latitude 30 degrees north, towards the temperate low pressure.

North East Trade Winds: blow from the sub–tropical high pressure towards the doldrums along the equator.

SOUTHERN HEMISPHERE

South East Polar Winds: blow from the polar high pressure towards the temperate low pressure in latitude 60 degrees south.

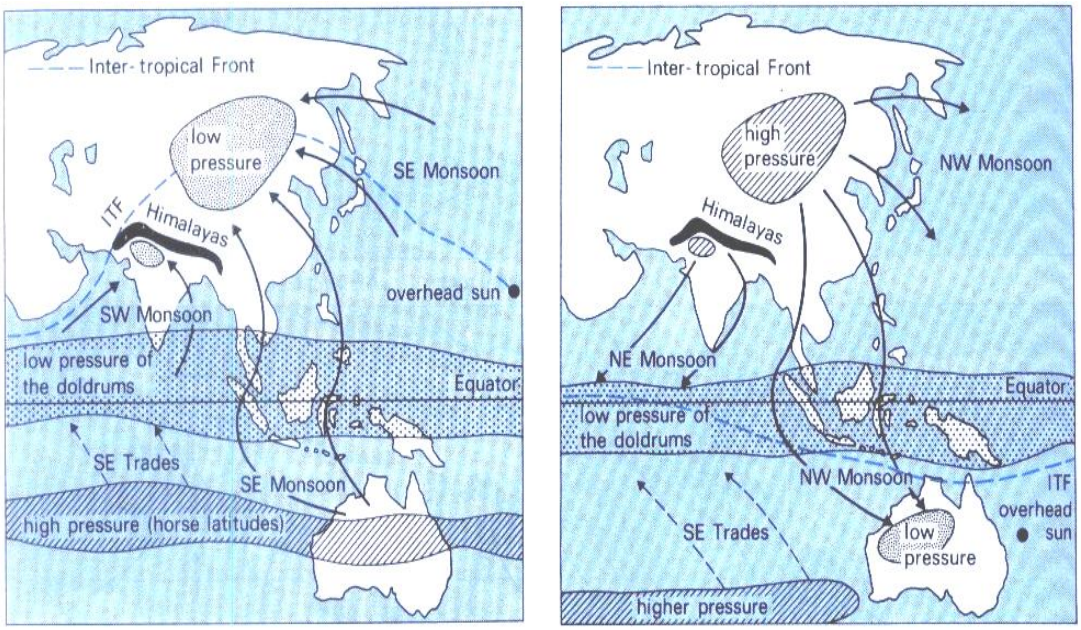
North East Winds: blow from the sub–tropical high pressure, in latitude 30 degrees south, towards the temperate low pressure.

South East Trade Winds: blow from the sub–tropical high pressure towards the doldrums along the equator.

Note: The seasonal changes to the pressure pattern are accompanied by changes to the pattern of winds.

Monsoon winds

- Monsoon is derived from an Arabic word mausim meaning season, and this is given to winds whose direction is completely reversed from one season to the next.
- The reversal is caused by a reversal in pressure systems.
- Monsoon winds are best developed in Asia [Japan, china, south East Asia and the Indian sub-continent] and to a lesser extent along the coast of West Africa and over northern Australia.



The monsoon wind pattern of Asia and Australia for July the monsoon wind pattern of Asia and Australia for January

Air masses

- An air mass is a large volume of air whose temperature and humidity are fairly uniform, and which covers an extensive surface area.
- An air mass only develops over an area which is extensive and which is uniform in build and shape e.g. a desert surface such as the Sahara, or central Australia, or an ocean surface.
- The characteristics of an air mass are derived from the region where it forms, and generally these characteristics are formed by air mass when it moves away, even to considerable distances from its source.
- Some air masses are warm and moist, some are cold and dry. There are four types of air mass:

Equatorial: This forms over the equatorial oceans. This air mass is hot and unstable. **Tropical:** This forms near the sub-polar low-pressure belt. These air masses are cool to cold.

Arctic and Antarctic:

- These air masses are very cold and stable.
- The Inter-tropical Convergence Zone [ITCZ]: The climate of Africa is greatly influenced by the movement of air masses [maritime and continental] which differ in moisture content and stability.
- The zone where these air masses meet is called the ITCZ.

LOCAL ATMOSPHERIC DISTABURCES

Cyclonic Activity

- TROPICAL CYCLONES, TYPHOONS, HURRICANES AND TORNADOES all these are different kinds of tropical cyclones.
- They are well developed low pressure system into which violent winds blow.
- Typhoons occur in the China Sea; tropical cyclones in the Indian Ocean; hurricanes in the West Indian islands in the Caribbean; tornadoes in the Guinea lands of West Africa and the southern USA in which the local name of *whirl wind* is often applied, and *willy-willies* occur in north-western Australia.

Typhoons

- Occur mainly in regions between six degrees and twenty degrees north and south of the equator and are most frequent from July to October.
- In extent, they are smaller than temperate cyclones and have a diameter of only 80 to 320 km [50-200 miles] but they have a much steeper pressure gradient.
- Violent winds with a velocity of over 160 km per hour are common.
- The sky is over cast and the torrential downpour is accompanied by thunder and lightning
- . In the wake of the typhoon, damage is wide spread.

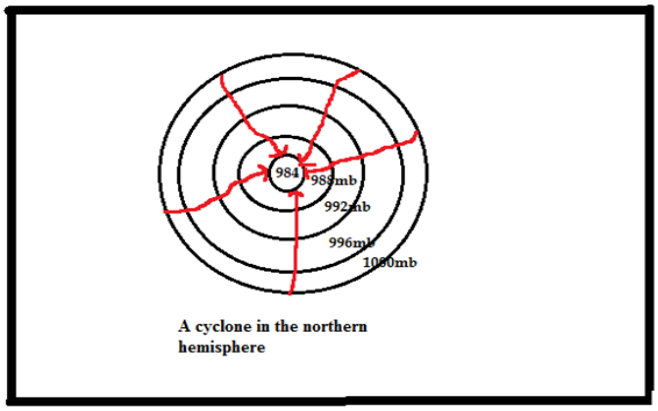
Hurricanes have calm, rainless centers where the pressure is lowest but around this "eye" the wind- strength exceeds force 12 of the beau fort scale [120 kw.p.h./75m.p.h.]. Dense dark clouds gather and violent stormy weather lasts for several hours.

Tornadoes

- These are small but very violent tropical and sub-tropical cyclones in which the air is spiraling at a tremendous speed of about 800km.p.h.
- A tornado appears as a dark funnel cloud 75 to 425 metres in diameter. As a tornado passes through a region, it writhes and twists, causing complete devastation within the limits of its passage.
- Tornadoes are most frequent in spring but can occur at almost any time.

Cyclones

- These are better known as depressions and are confined to temperature latitudes. The lowest pressure is in the centre and the isobars, as shown in climatic charts, are close together.
- They remain quite stationary or move several hundred kilometers in a day.
- Winds blow inwards into regions of low pressure in the centre, circulating in anticlockwise direction in the northern hemisphere and clockwise in the southern hemisphere.

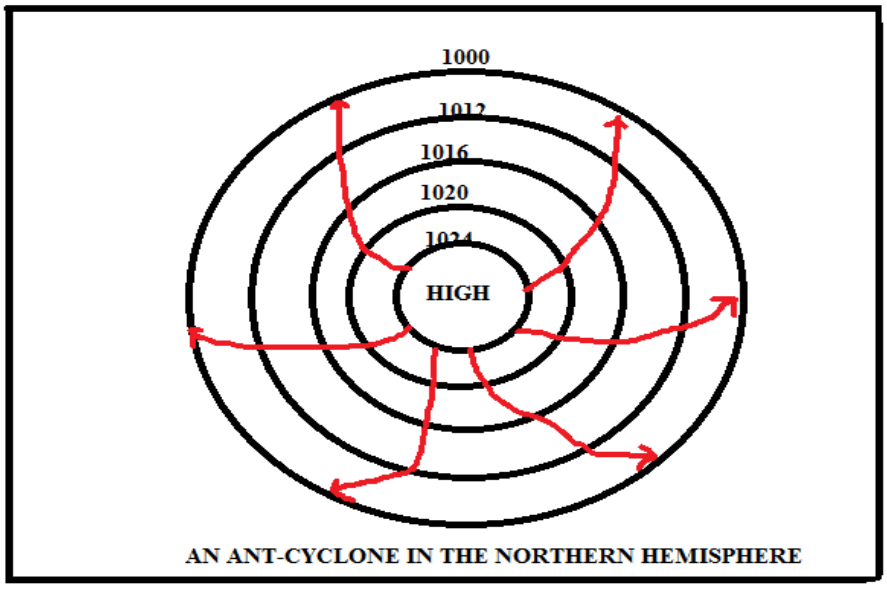


A cyclone in the northern hemisphere

A cyclone in the northern hemisphere (close isobars, anti-clockwise winds

ANTICYCLONE

- This is an area of high pressure which, when shown on a map, has an oval or circular shape of closed isobars.
- The highest pressure is near the centre.
- An Anticyclone develops in a region where the air is descending, and the winds associated with it blow outwards in a clock wise direction in the northern hemisphere, and an Anti-clockwise direction in the southern hemisphere.
- The direction of the winds is caused by the rotation of the earth.



AN ANT-CYCLONE IN THE NORTHERN HEMISPHERE

An Ant-cyclone in the northern hemisphere (well shaped isobars, winds blow in clockwise direction

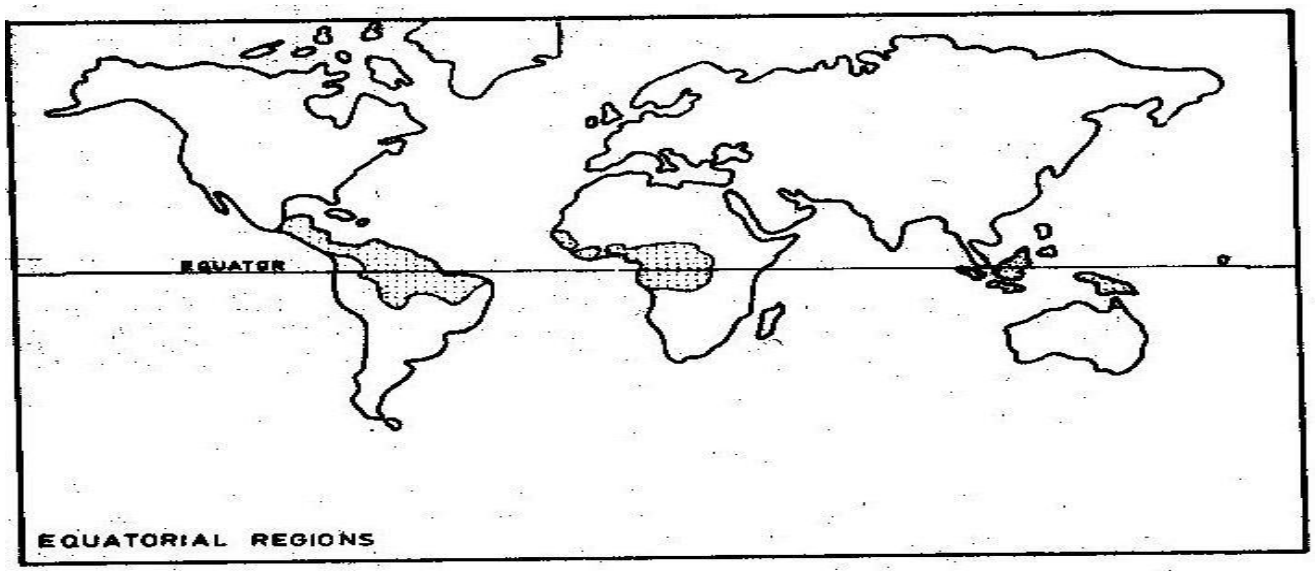
- An Ant-cyclone often remains stationary for long periods; sometimes it moves very slowly.
- Often it covers a large area, sometimes affecting a whole continent.

WORLD CLIMATIC REGIONS

THE EQUATORIAL CLIMATE

Location

- The equatorial climate is found between 5 degrees and 10 degrees north and south of the equator.
- Its greatest extent is found in the lowlands of the Amazon, Congo basin, Malaysia and East



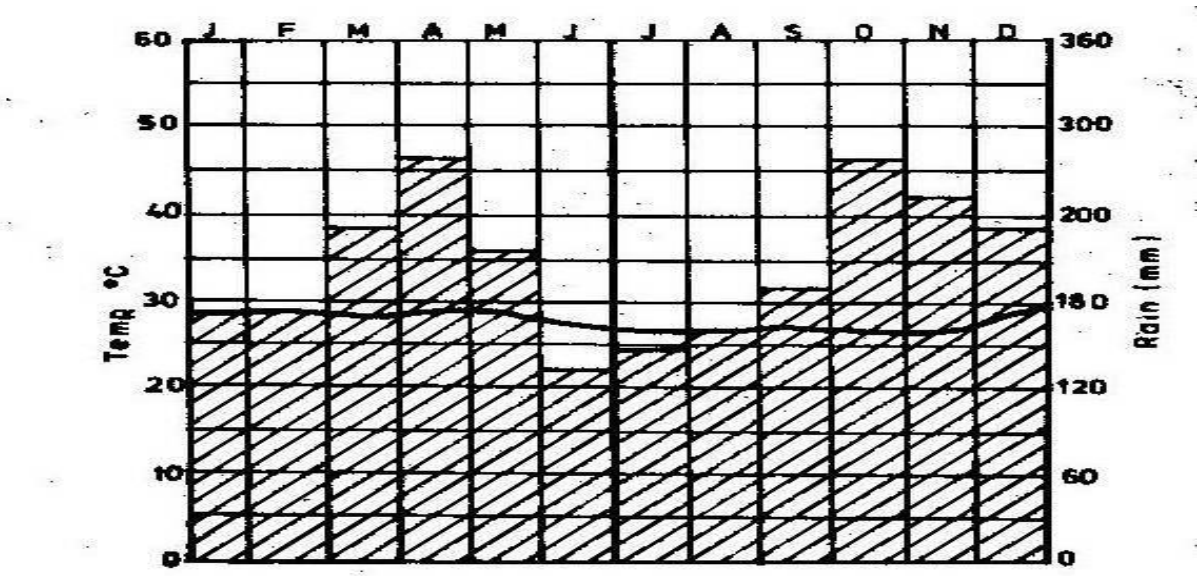
Indies, Papua New Guinea, Phillipians, Sumatra, Java

Climate Characteristics

TEMPERATURE

- Temperature – the most outstanding feature of an equatorial climate is its great uniformity of temperature throughout the year.
- The mean monthly temperatures are always around 27 degrees Celsius (80 degrees F) with very little variation.
- The diurnal range of temperature is small, and so is the annual range.

Months	J	F	M	A	M	J	J	A	S	O	N	D
Temp. °C	26	26	27	27	27	26	26	26	26	26	26	27
Rainfall mm	170	170	236	279	216	127	144	157	185	276	257	231



Precipitation

- Precipitation is heavy, between 1,524 mm and 2540 mm and well distributed throughout the year.

- There is no month without rain. Instead, there are two periods of maximum rainfall, in April and October as shown in the diagram above which occur shortly after the equinoxes.
- The double rainfall peaks coinciding with the equinoxes are characteristic feature of equatorial climates.
- Rainfall is of convectional type in the afternoons from the towering cumulonimbus clouds. Besides the convectional rainfall, mountainous regions also experience much Orographic of relief rain.

Natural Vegetation

Equatorial climate has the following tree species:

- Mahogany
- Ebony
- Greenheart
- Rosewood

Characteristic of Natural Vegetation

- Close cover of all tall trees of 20-50m metres
- Trees are evergreen
- The forests lack undergrowth because the canopy layers cut out light**.**
- Trees form a canopy
- Trees do not grow in pure stand

HUMAN ACTIVITIES

- **Lumberin**g- The trees are hardwood and are suitable for timber.
- **Eco-Tourism**- Equatorial rain forest has many birds, animals and plants which attracts tourists.
- Hunting and gathering of forest fruits, roots, insects and animals.
- **Agriculture**- Crops grown include: cocoa, oil palm and Rubber.

THE SAVANNA OR SUDAN CLIMATE

Savannah refers to grassland.

Savannah vegetation can be sub-divided into two:

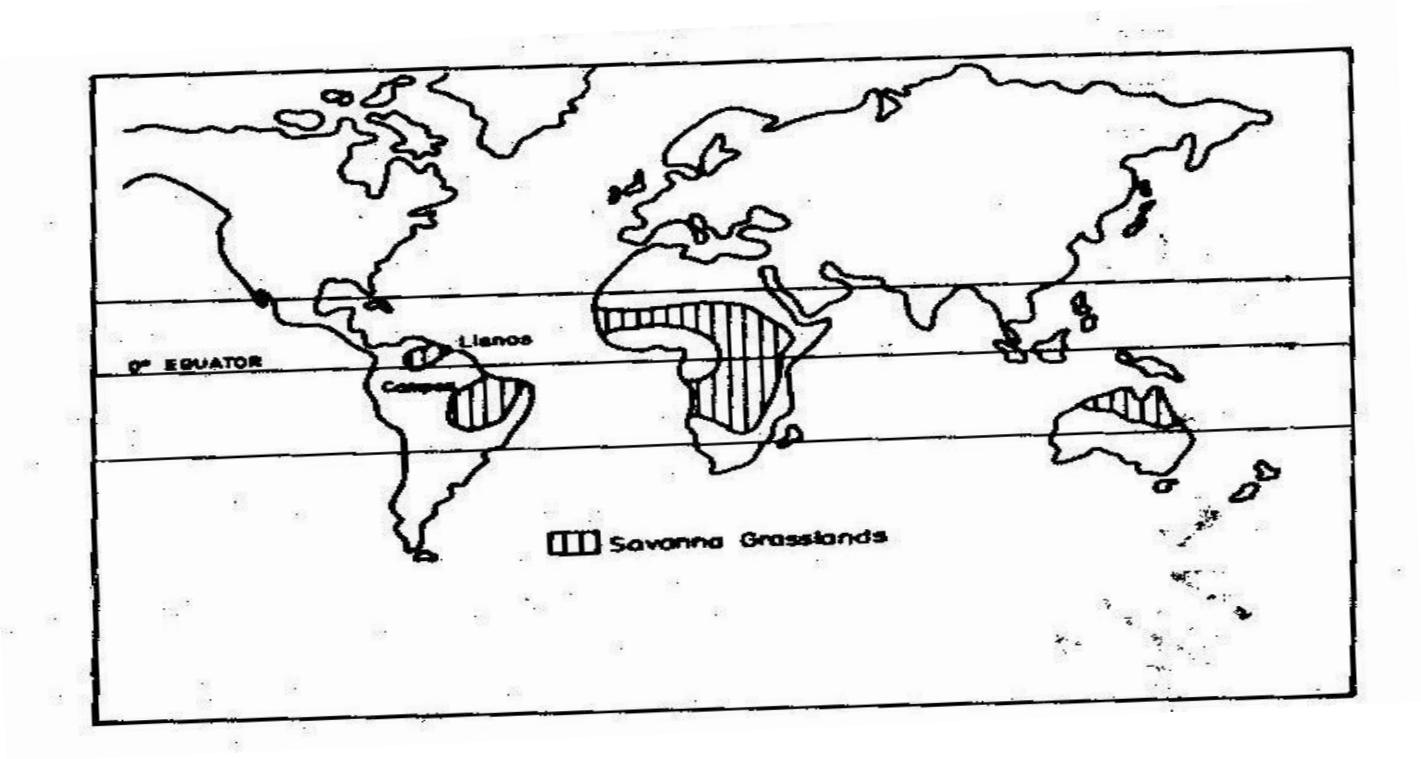
Savannah woodlands: it has a continuous cover of dense trees with little growth of grass.

Savannah grasslands: It has a continuous cover of grass with scattered trees

Distribution

The savanna or Sudan climate is confined within the tropics.

- The belt includes West Africa Sudan, and then curves southwards into East Africa and Southern Africa north of the Tropic of Capricorn.
- In South America, there are Llanos of the Orinoco basin and the Campos of the Brazilian Highlands.
- The Australian Savanna is located south of the monsoon strip running from West to East, north of the Tropic of Capricorn.

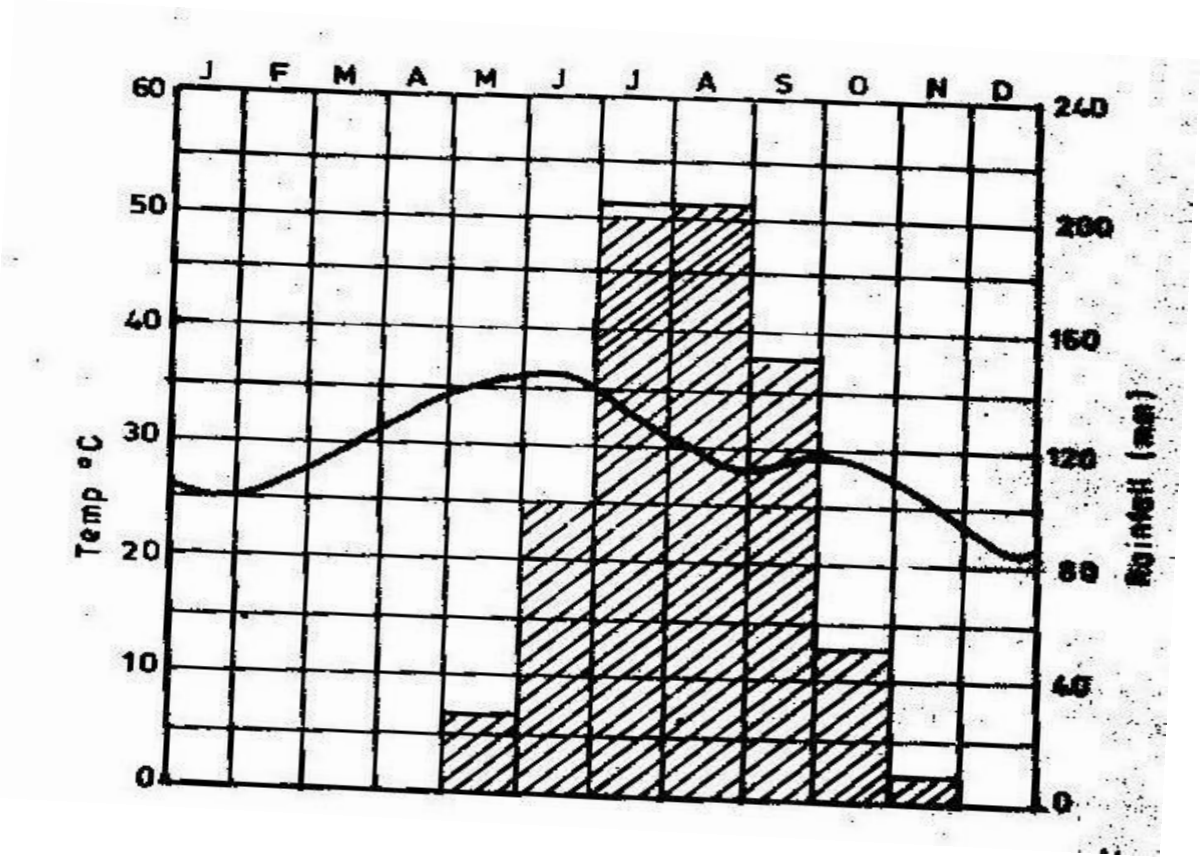


CHARACTERISTICOF THE CLIMATE

Rainfall

- The Sudan type of climate is characterized by an alternate hot, rainy season and cool, dry season
- In the northern hemisphere, the hot, rainy season normally begins in May and lasts until September.

- In the Southern hemisphere, the rainy season is from October to March (the Southern summer)



Temperature

- The monthly temperature hovers between 21 degrees C (70 degrees F) and 32 degrees C (90 degrees F) for lowland stations.
- An annual temperature range of 11 degrees C (20 degrees F) is typical,
- The annual temperature range increases as one move further away from the equator.
- There is a distinct drop in temperature in the rainy period, due to the overcast sky and the cooler atmosphere

Natural Vegetation

Equatorial climate has the following tree species:

- Miombo
- Baobab

- acacias

Characteristics of Natural Vegetation

- The savanna type of vegetation is made up of tall grass and short scattered trees
- They have long roots and thick bark to reduce loss of water due to transpiration.
- Many trees are Umbrella- shaped to shield their roots from the scorching heat.
- Trees are drought resistance trees such as Baobab.
- Trees are deciduous in nature that is they shed their leaves during the dry season.

HUMAN ACTIVITIES IN SAVANNAH

- Game conservation and tourism
- **Agriculture**: Crops grown include: millet sorghum, cassava, maize
- **Nomadic pastoralism**: Animals kept include: cattle, sheep, goats, pigs

HOT DESERT CLIMATE

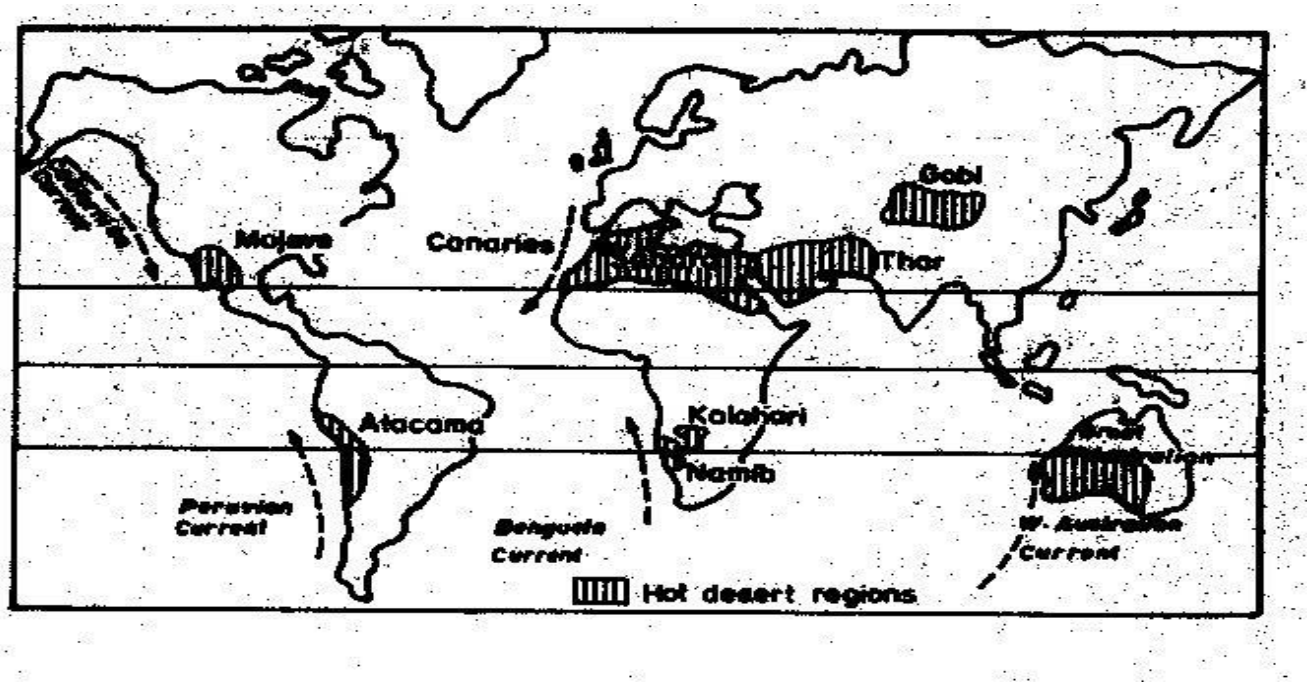
LOCATION

The major hot deserts of the world are located on the western coasts of continents between latitudes 15 degrees and 35 degrees north and south.

Distribution

Hot deserts include

- The Sahara Desert
- The Australian Desert
- Arabian Desert
- Iranian Desert
- Thar Desert
- Kalahari and Namib Deserts
- In South America, the Atacama or Peruvian Desert.



CHARACTERISTICS OF THE CLIMATE

Rainfall

- Deserts have an annual precipitation of more than 250mm. Some deserts, for instance, parts of the Sahara and the mid-Atacama, have practically no rain.

The reasons why there is less rainfall are as follows:

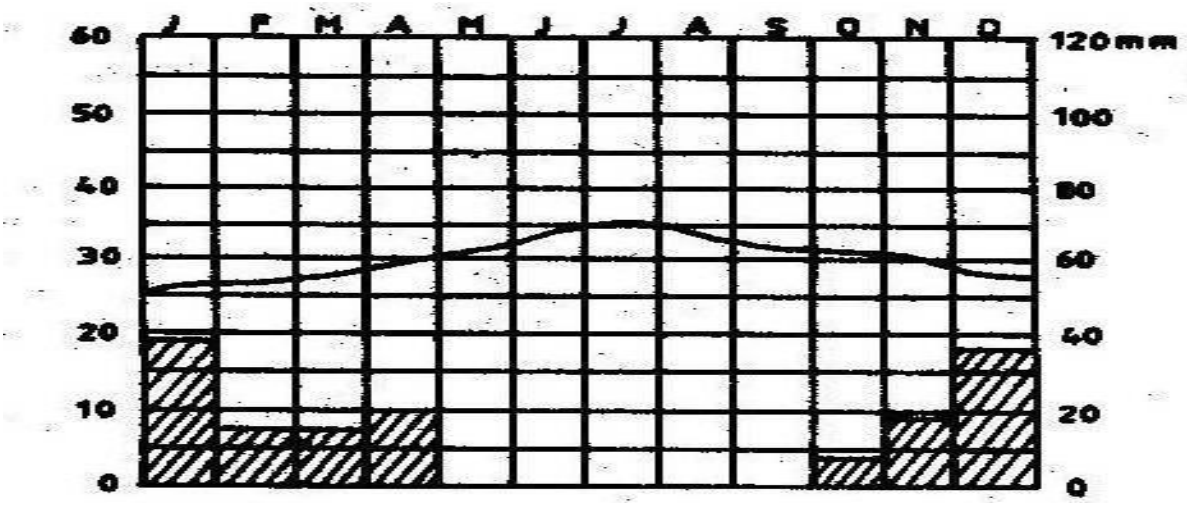
1. Hot deserts lie in high pressure belts where air is always descending. In such conditions rainfall does not develop.
2. The prevailing winds across desert areas are the South East Trade Winds and the North East Trade Winds. These winds blow off-shore and have a very low relative humidity. Condensation is impossible and hence there is permanent drought.

Temperature

- The deserts have high temperatures throughout the year and the average summer temperature is around 30 degrees C.
- The reasons for the high temperatures are: cloudless sky, intense isolation, dry air and a rapid rate of evaporation.

- Coastal deserts by virtue of their maritime influence and the cooling effect of the cold currents have much lower temperatures.
- The desert interiors however experience much higher summer temperatures and the winter months are rather cold.
- The diurnal range of the temperature in the desert is very high due to the great difference between day and night time temperatures.

	J	F	M	A	M	J	J	A	S	O	N	D
Temp.	26	26	27	29	31	33	35	34	33	32	30	27
Rain	38	15	15	20	0	0	0	0	0	8	18	36



Hot Desert Natural Vegetation

- Desert vegetation does not appear green and fresh all the time.
- Hot deserts have scant vegetation due to intense heat and low rainfall.
- The dormant vegetation of the hot desert regions are:

(a) **Xerophytic plants**-these are drought resistant plants such as cacti and dwarf acacias.

(b) Halophytes-These plants are adapted to survive in saline or salty soils of hot deserts caused by intense evaporation.

Characteristics of desert vegetation

i. Long roots to search for ground water

ii. Few or no leaves to reduce transpiration

iii. Waxy, leathery, hairy or needle shaped leaves to reduce loss of water through transpiration.

iv. Thick succulent stems to store-up water for long droughts.

v. Their seeds have thick though skins as protection while they lie dormant during very long dry periods.

HUMAN ACTIVITIES OF HOT DESERT CLIMATE

- Nomadic pastoralist by Tuaregs in North Africa who rear goats, sheep and camels.
- Oil mining in Libya and Egypt
- Irrigation farming in Libya, Egypt.

MEDITERANEAN CLIMATE

LOCATION

- Mediterranean lands are located on the western side of the continental land masses.
- They occur between latitude 30 degrees and 45 degrees north and south of the equator.

DISTRIBUTION

This type of climate is found in the following areas.

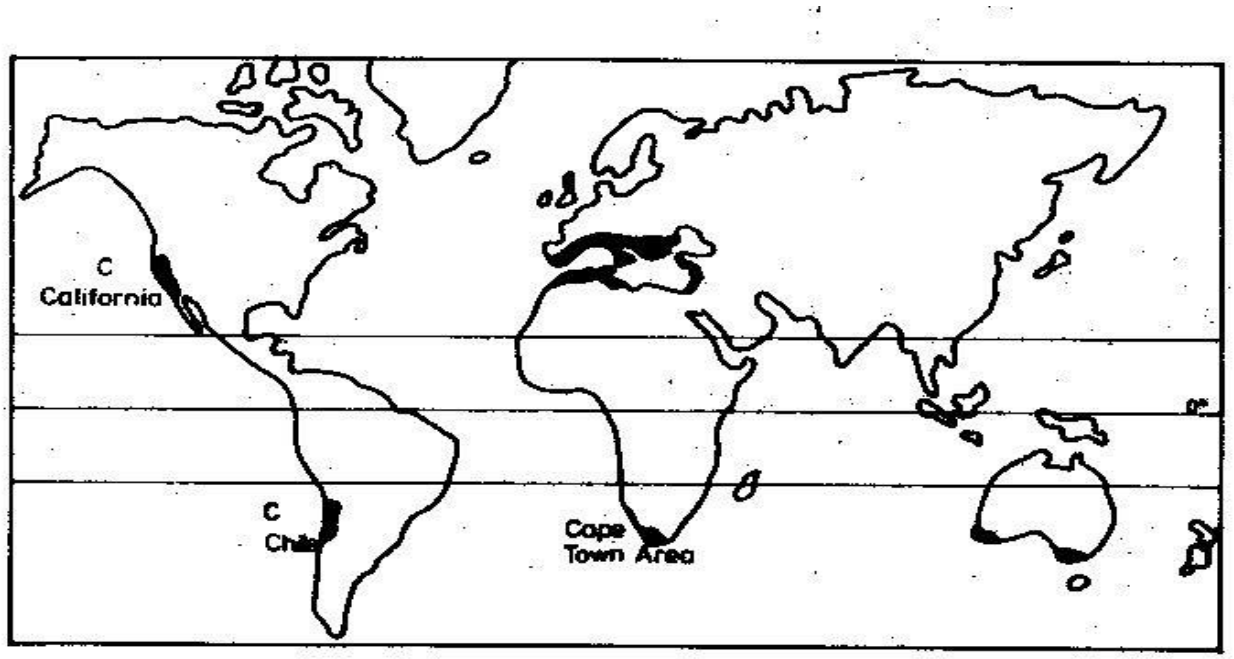
(a) The area around the Mediterranean Sea.

(b) Central Chile

(c) Central California around San Francisco

(d) The Southern and South-Western Australia

(e) The area around Cape Town in South Africa



CLIMATE

Characterized of Mediterranean climate

Summers

a) Warm and dry summers with dry offshore trade winds
b) Summer temperatures are moderated by the coastal location of these regions.

Winters

(a) Mild and wet winters
(b) Prevailing winds are wet on shore westerly
(c) Rainfall occur in winter

Natural Vegetation

(a) Plant growth is not luxuriant due to moderate rainfall, and high evaporation rate.
(b) Trees have small broad leaves and are mainly spaced

(c) Mainly trees are Xerophytic i.e. drought resistant due to dry air, excessive evaporation and prolonged drought.

The vegetation types are as follows:

1. **The Mediterranean evergreen forests**

(a) The trees of these are:

i. Cork oaks of Spain and Portugal

ii. Red wood or giant sequoia of Central California

iii. Eucalyptus of Mediterranean Forests of Australia

iv. The jar rah of S.W Australia

(b) These trees are evergreen with small leathery leaves and widespread root system to search for water.

2. **The Evergreen coniferous Trees**

- These evergreen trees include:

- Pines
- Cedars
- Firs
- Cypresses

The trees have needle shaped leaves to lessen transpiration.

3. Bushes and shrubs

(a) These are the most common in Mediterranean areas

(b) Most bushes are strongly scented. They include: Lavender, Laurel, and Myrtle

(c) Shrub vegetation has emerged in many areas due to man's exploitation of this vegetation. This is known as Macchia in Italy and Chaparral in California

4. **Grass vegetation**

(a) Grasslands are found in few places

(b) Climatic conditions do not suit grass-rain comes in winter when vegetation growth is slow

(c) Due to poor grassland vegetation, livestock farming is less important

HUMAN ACTIVITIES IN MEDITERRANEAN CLIMATE

Human occupation in Mediterranean lands includes:

(a) Cultivation of cereals

(b) Development of agricultural industries e.g. wine making

(c) Tourism

(d) Fruit cultivation: Fruits include:

(a) Orange
(b) (b) Limes
(c) (C) Lemons
(d) (d) Grape fruits.

REVISION QUESTIONS

1. List the major world climatic regions
2. Why do tropical rain forest lack under growth?
3. Outline the major economic activities carried out in:
   (a) Hot desert
   (b) Savannah
   (c) Equatorial
(d)Mediterranean
4. Give examples of areas which have hot desert climate in Africa
5.Describe the characteristics of Hot desert climate

HUMAN AND ECONOMIC GEOGRAPHY

WORLD AGRICULTURE

Agriculture refers to the growing of crops and rearing of animals

IMPORTANCE OF AGRICULTURE

- It is the most widespread form of human activity in the world
- It provides livelihood for more than three quarters of human race.
- It is a source of raw materials to a number of industries
- It is a source of employment to a number of people in the world e.g. farmers and drivers who transport agricultural goods.
- It is a source of revenue to a number of countries e.tc.

FACTORS INFLUENCING AGRICULTURE

Several factors affect the types of crop cultivated and the methods of cultivating them. These include;

1. **Climate**

- This is the greatest determining factor
- The amount of rainfall received in an area determines the crop to be grown in an area.
- Heat crops needs a lot of water for them to grow well e.g. rice

2. **Relief**

- The topography of an area also entails the type of crops that can be grown in an area.
- The lowlands are the most suited to a wide range of crops such as wheat, coconut, rubber e.t.c.
- An increase in altitude excludes most of the crops
- The well drained hill slops of the Assam Hills and the Brazilian Highlands are the home of the world's large tea garden and coffee plantations respectively.

- Terrace farming is one of the ways of providing lowland-flooded-field conditions on tropical hill slopes.

3. Fertile Soil

- Soil forms the physical support of the crops
- This role it plays is an important one
- Soils across the globe vary tremendously in their structure composition and fertility
- Soil fertility are further influenced by the presence or absence of organic matter or humus
- Sandy soils are suitable for rice
- Loamy soils posses intermediate properties between those of sand and clay and are most useful for agriculture purposes.
- Ploughing, manure, drainage and irrigation are the various methods that farmers employ to improve the soil structure, soil porosity(increase air spaces in soil) or soil aeration including fertility of the soil.

4. BIOTIC FACTORS

- The presence of biotic agents such as weeds, parasitic plants, diseases and insect pests will damage crops and hamper farming in many parts of the world
- Many fungus disease and insect pests do great damage to crops
- The boll-weevil is a dreaded pest in the cotton Belt of the U.S.A

5. ECONOMIC FACTORS

These include factors such;

- Capital
- Land values
- Market
- Maintenance costs of running a farm e.g. recurring expenses such as seeds, fertilizers, insecticides and food stuffs for the animal.
- Labour
- Transport

6. **OTHER FACTORS**

Farming practices are everywhere determined by local conditions such as;

- Type of farm ownership and inheritance
- Social and religious influence
- Agriculture indebtedness (credits with other countries)
- Social prejudices and wide spread illiteracy, which make technological changes difficult.

TYPES OF AGRICULTURE

Basing on the factors influencing agriculture, agriculture can base on the two;

1. **TROPICAL AGRICULTURE**

The following types of farming are best developed in tropical latitudes.

a. **Primitive substances agriculture**

- This is the type of farming system where crops are grown for home use.

Subsistence agriculture includes:

- Shifting Cultivation is the type of agricultural system which involves the cultivation of land and farmers will shift to the next land when soil has been destroyed.
- Crops grown include: sorghum, millet, beans, cassava and sweet potatoes.

B. **Plantation agriculture:** is a type of farming system which involves the growing of tree cash crops such as coffee, sugar cane, tea, bananas,

2. **TEMPERATE AGRICULTURE**

a. **Extensive mechanized cereal cultivation:**

- This is the typical of the new lands of the new world with a continental type of climate; Canada, the U.S.A etc.
- The yields are lower than those on more intensive farms.

b. **Pastoral farming:**

- This is the most common type of agriculture in the temperate region of the world.

- Sheep are kept in millions for either wool or meet or both.
- Large amounts of butter, cheese cream and condensed or evaporated milk are exported from these countries where the animals are kept.

c. Mixed faming:

- This is widely practiced in Britain and many parts of Europe.
- This is the combination of arable farming and animal husbandry (keeping animals).
- Cereals, roots crops, vegetables, even fruits are raised side by side with cattle, sheep, pigs and poultry.

SOIL EROSION AND IMPOVERISHMENT

- Soil is fundamental to all agricultural practices and great care has to be taken to ensure that it is not misused or destroyed.
- Soil erosion is the washing away of good top soil needed for agriculture
- Soil under natural conditions, soil fertility is fertility is replenished by such processes as leaf-fall, organic decomposition and animal decay.
- Soil erosion is caused naturally by running water, wind, rain, frost, ice and waves
- Human ignorance and mismanagement in soil use greatly accelerate these erosional processes.
- In other instances, cultivation has resulted in the deterioration of the mineral and organic content of soil.
- Though the soil is still physically present, it is highly deficient in plant nutrients and gives very low yields.

CAUSES OF SOIL EROSION AND SOIL IMPOVERISHMENT

- **Over-cropping;** this is when a lot of crops are grown on a small piece of land.
- **Mono-culture;** the growing of one same kind of a crop on the same piece of land year after year.
- **Over-grazing;** this is when more animals are forced to feed on a small piece of land
- **Slope-wise cultivation:** this is when a farmer grows crops along a slope.

- This encourages soil erosion. So farmers instead of slope-wise cultivation need to use contour ploughing (which is the ploughing across the slope)
- **Deforestation:** the general cutting down of trees without replacing them.
- **Shifting cultivation**: this is the cutting of trees for the purpose of farming. This may encourage soil erosion and soil impoverishment.

SOIL CONSERVATION AND SOIL SOUND TECHNIQUES INCLUDES THE FOLLOWING:

- **Crop rotation:** this is a kind of farming were crops are grown differently year after year.
- **Controlled grazing**: this is where people put animals in feed places according to their numbers. Animals are able to feed without any problems pertaining to pasture
- **Contour ploughing:** this is where people plough pieces of land across the contours.
- **Aforestation:** the immediate replanting of trees where there were once some trees which were cut.
- **Cover-cropping:** these are the crops that are grown on the plantations e.g. groundnuts.
- **Terracing:** this involves the cutting of flat terraces on steep hill slopes to create lowland conditions.
- **Strip-cropping:** this is the planting of crops and trees in alternate
- **Land Fallowing**: this is the situation where by farmers allow their lands to remain without cultivating on for some time.
- **Soil additives:** this is the addition of manure or fertilizers to the crops.
- **Irrigation:** this is the supply of water to the crop by farmers.

Agricultural crops of the world

There is such a variety of crops cultivated in the world. Their classifications are as follows:

1. **Cereals:** Rice, wheat, maize, or corn, barley, oats, rye millets.
2. **Beverages:** tea, cocoa, wine.
3. **Fibers:** cotton, flax, silk, and the rest of the hard fibers
4. **Raw materials and others:** Rubber, sugar-cane and sugar-beet, fruits, vegetable oils (oil palm, coconut, groundnuts, soya beans etc.)

5. **Silviculture:** the farming involving growing trees e.g. eucalyptus(gum tree or blue gums), and pine trees

SAMPLE QUESTIONS

1. Briefly explain **four** factors influencing agriculture

2. Discuss factors which cause soil erosion

3.Explain briefly why of agriculture is important

4. Classify the major agricultural crops of the world in order of importance

5. Explain how soil erosion can be controlled

SOURCE OF FUEL AND ENERGY

The energy sources include: Coal, Petroleum/Crude oil and Electricity

1. COAL

- Coal is one of the sources of energy which is used in a number of ways.

TYPES OF COAL

There are three basic types of coal. These are:

A. Lignite or Brown Coal

- This the lowest category of coal with a high moisture content
- It is smoke because it still retain some of its original vegetative matter
- It has low heat value and carbon
- It has a carbon content of less than 4% and which gives out only moderate amounts of heat.
- It is used mainly for the production of thermal electricity.

B. Bituminous Coal

d. It has a carbon content of between 45 and 80%. Because of this it gives off more heat than lignite.

e. This is the most common type of coal

f. Some bituminous coal has high gas content. This is called **gas coal or steam** and it is used for making gas.

g. Steam coal is the superior grade of bituminous coal

h. Another type of bituminous coal is used for making coke which is used in blast furnaces. This type is called **coking coal**.

C. Anthracite

i. Is a very hard coal which has at least 90% carbon content?

j. It is the best type of coal

k. This enables it to burn with great heat, and little smoke.

l. Due to its scarcity and its high prices, it is only used when other types of coal are less suitable

METHODS OF MINING COAL

- The methods used for mining coal depend upon the distance of the coal seams below the surface, and whether the seams are horizontal or tilted.

Three basic methods used for mining coal are:

1.**Shaft Mining**

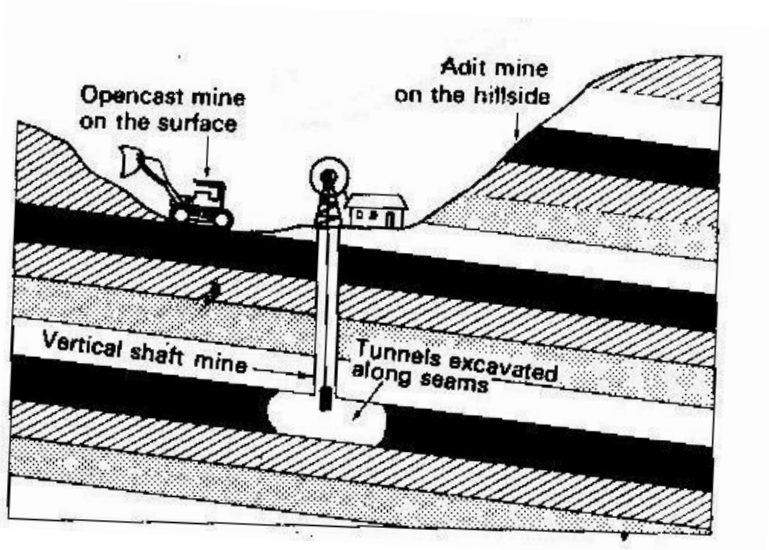
- This method is used when the coal seam lays several hundreds of meters below the surface, and it involves the sink-seams.
- Horizontal tunnels, called galleries are formed from the shaft as the coal seams are dug out. This is the most common types of mining.

2.**Open cast mining-**

- This method of mining is used when the coal seams lie near to the surface.

3.**Adit or drift mining**

- This method is used to extract coal from horizontal, gently sloping seams that outcrop along the sides of valleys.
- This is used in the valleys of the Appalachian coalfield, in the USA and North-East England.



IMPORTANT COAL – PRODUCING REGIONS

Coalfields of the USA

- The main coal mining regions of the USA lies in the eastern part of the country, and it is known as the Appalachian coalfields. There are four parts of this, which include the following:

1. **The Pennsylvania coalfield** – this occupies the northern part and it centre's on pittsbury.
2. **The North-east Appalachian coalfield** – the coal seams of this field are heavily faulted and mining is more difficult. However, the coal is excellent anthracite.
3. **The West Virginia coalfield** – this lies in the central part of the Appalachian coalfield and its coal is of very high quality.
4. **The Alabama Coalfield** – this field centers on Birmingham, which is one of the largest iron and steel centers of the southern states.

OTHER IMPORTANT COALFIELDS

These are the central and western interior fields but the coal of these is inferior to that of the Appalachian coalfield. Coal from the central coalfield is mainly used for developing power for Chicago.

COALFIELD OF THE RUSSIA

Russia is the second largest producer of coal, and most of its coal comes from two main areas

1. **The Donbass coalfield** – this is located between the river Donetz and the sea of Azov, in the area known as the western steppe
2. **The interior Coalfields** – these are located in Siberia. The Kuznetsk, or Kuzbass coalfield, which centers on novi-kuznetsk, is the most important of the interior coalfields.

OTHER COALFIELDS OF RUSSIAN

The region around Tula produces lignite which is used mainly for generating thermal electricity, as does the Vorkuta coalfield, which is located in the tundra belt of Russia.

COALFIELD OF THE EUROPEAN ECONOMIC COMMUNITY (EEC)

The E.E.C.B is comprised of the U.K, Holland, Luxembourg, Belgium, West Germany and Italy. There are three main coalfield regions in the E.E.C.

1. **Coalfields of UK.** There are several coalfields in the U.K. but the most import is in Yorkshire, Nottinghamshire and Derbyshire in Northumberland and in South Wales

2. **Coalfield or West Germany** – most of its production comes from the Ruhr coalfield.
   Other world coalfield – include India, South Africa and Argentina

USES OF COAL

i. Fuel: for domestic heating

ii. Source of power for driving steam engines in power stations to drive dynamos which produce thermal electricity.

iii. Raw material: the two chief carbonation products are released in the process.

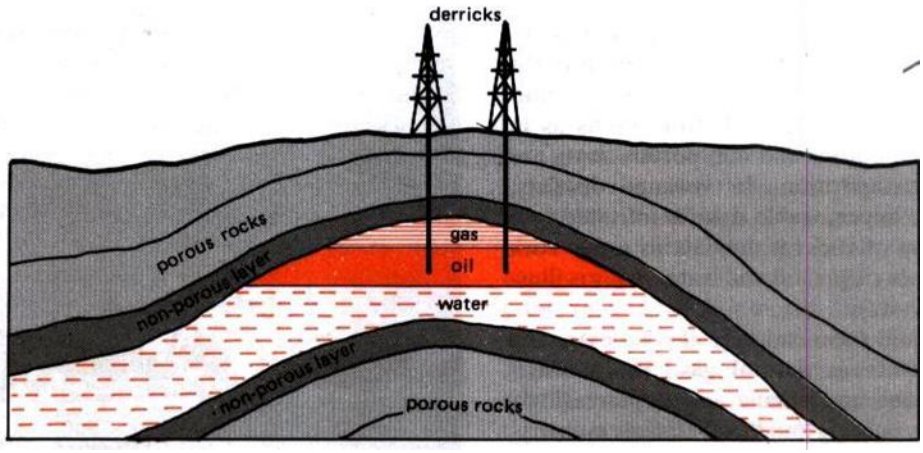
- Coal far: used for making fuel, oils, disinfectants, antiseptics, air line dyes (plastic performs) etc
- Benzole: used to make motor spirit, weed killers, aspirin, saccham and sulphonamide drugs
- Sulphate: of ammonia: used to make fertilizers insecticides, soap, explosives and chemicals for use in refrigerators.

D. PETROLEUM

- It is a mineral oil, organic in origin and occurs in the pore spaces of sedimentary rocks
- It is driven from the decomposition of marine or vegetative matter
- The oil is usually trapped in the crest of the anticline with gas above the water below
- Oil may also be extracted in its gaseous state as natural gas
- This consists mainly of methane and ethane and is used for heating, lighting and the chemical industry
- In developed nations, natural gas is pumped through pipes for use in homes and industrial plants.

OIL PROSPECTING AND DRILLING

- A survey of the geological structure of the area is carried out first, and then modern oil are sunk to the depth where oil is underground
- Once a drilling site is decided, a steel derrick will be erected and equipment for drilling brought in
- Steel tubes are inserted in the borehole and then oil is pumped out using pumps



OIL TRANSPORTATION

- For emergency purposes they use aircrafts
- For local use they sue oil trucks and railway wagons
- It involves construction of pumping stations at intervals along the pipe line
- Sea transports, oil tankers which are large are used
- The cheapest and the most efficient method of transporting oil over land are by pipe line
- The pipe line serves on money, time and labor and operation is very simple

OIL REFINING

- Mineral oil has many hydrocarbons and it has little use unless it is refined

OIL REFINERIES MAY BE LOCATED:

- At the port of export
- At the port of import
- In or near the oil fields. This is a temporary measure and applies only to small refineries.

THE THREE METHODS OF REFINING

Fractional Distillation:

- Fractional distillation is the most universal form of oil refining
- The mechanism splits the oil into various groups of hydrocarbons or fractions at very high temperatures

- As each fraction boils at different temperature, various groups of hydrocarbons are extracted at their own boiling point
- Lighter fractions like petrol, paraffin and benzene are evaporated and condensed first at the temperature below 30ºC
- The heavier fractions like diesel, lubricating and fuel oils are condensed later at the temperatures between 30º C and 427º C
- At the end of the line is the residue made up of the heaviest fuel oils like Vaseline, wax and asphalt.

Thermal cracking:

- This is a process by which the heavier fractions are heated too much at higher temperature until they break down or "crack" into the lighter fractions.

Catalytic cracking

- A process by which a catalyst such as powdered platinum is added to speed up the cracking process.

THE USES OF OIL

- As an indispensable motor fuel.
- As a lubricant. It is important in lubricating machine parts reduce friction
- As an important source of power.

OIL DISTRIBUTION AND PRODUCTION

- 60% of the world's oil is in the middle east
- Among the Middle East producers are Saudi Arabia, Iraq, Kuwait and Iran
- In Africa we have countries like Libya, Algeria and Nigeria
- In America we have countries like USA, Canada, and Mexico
- The major producers are USSR, Iran and USA
- Venezuela accounts for only 4% of the world's outputs

3. ELECTRICITY

- If it is derived from water sources it is called hydro electricity
- It is the cheapest and it is renewable
- The French have aptly described it as 'white coal' because of its cleanliness
- There are two different sources of electricity and these are thermal electricity and hydro electricity
- When it derived from generators using coal, oil and natural gas it is called thermal electricity.

REQUIREMENTS FOR HYDRO ELECTRICITY DEVELOPMENT

- A steep gradient or slope. It enables rivers to plunge down swiftly to turn the turbines that generate electricity
- A sufficient and constant volume of water throughout the year
- Heavy capital outlay
- Large domestic and industrial market for **HEP**

THERMAL ELECTRICITY

- Thermal electricity is the type of electricity which is derived from generators using coal, oil and natural gas.

ADVANTAGES OF THERMAL ELECTRICITY OVER HYDRO ELECTRICITY

- It can be set up anywhere

DISADVANTAGES OF THERMAL ELECTRICITY OVER HYDRO ELECTRICITY

- It causes pollution
- The source of energy used in thermal electricity is not renewable resource.
- Running costs are very high.

ADVANTAGES OF ELECTRICITY OVER OTHER FORMS OF ENERGY

- By use of devices like transformers, electricity can be adjusted from a fraction of watt to thousands of watts per hour
- Convenient transport. It is easily transported just by wires and plugs over very long distances
- It does not cause pollution; hence it is a clean source of energy
- It is a renewable resource
- Its unlimited degree of divisibility.

WORLD DISTRIBUTION OF ELECTRICITY

- Africa has the potential but it accounts for only 1% of the worlds output.
- Asia produces about a quarter of the European output. Japan alone has developed more water power than all the other Asian countries combined and accounts for 14% of the worlds output.
- Australia and new Zealand account for less than **2%** of the world's output
- Europe ranks second in the worlds totals **HEP** output
- Hydro electricity makes up only one third of the worlds electricity supply
- The other Countries include France, Sweden, Norway, the **USSR** and Switzerland
- The greatest producer is **USA** (23%) followed by Canada (15%) and the Japan (14%)
- The USA and Canada together accounts for one third of the World's total **HEP**
- Two thirds of worlds electricity comes from thermal plants

WORLD POPULATION

- Population is a collection or set of things or animals
- Population can also be defined as the number of people living in a particular given area at a given time
- The study of human geography is called ***demography***

Important concepts in the study of human population

Census

- It is the official counting of ALL people in a country
- This is normally done by the government every after 10 years because it is very expensive since it covers the whole country
- The census enables us to know the number of people living in an area. It gives us information about the age, sex (male or female), race/tribe, nationality, birthplace, education, occupation, marital status, number of children, and the number of dependants in a given country.
- There are many ways of counting people in any given area. Some of these are:
- Registration of births at hospital and clinics, deaths and registrations of marriages at Boma or Council offices.
- National registration(NRC) at the age of 16years
- Registration of pupils and students in schools, colleges and universities.

Importance of the census

It gives information to the local and central government so that:

- For good planning in order to provide facilities like hospitals, houses and schools to citizens
- They can provide resources e.g. agriculture materials like fertilizer and seeds
- They can know whether the population is increasing or reducing because such knowledge is needed for future planning
- They can know unemployed so as to create jobs

- In order to know whether to build a road or railway to a given area.

Population density

- It is the number of people living in a square kilometer area.
- Sometimes it is high and sometimes it is low

e.g. Population density = Number of People in an Area or Country

Kilometers squared (Km^2).

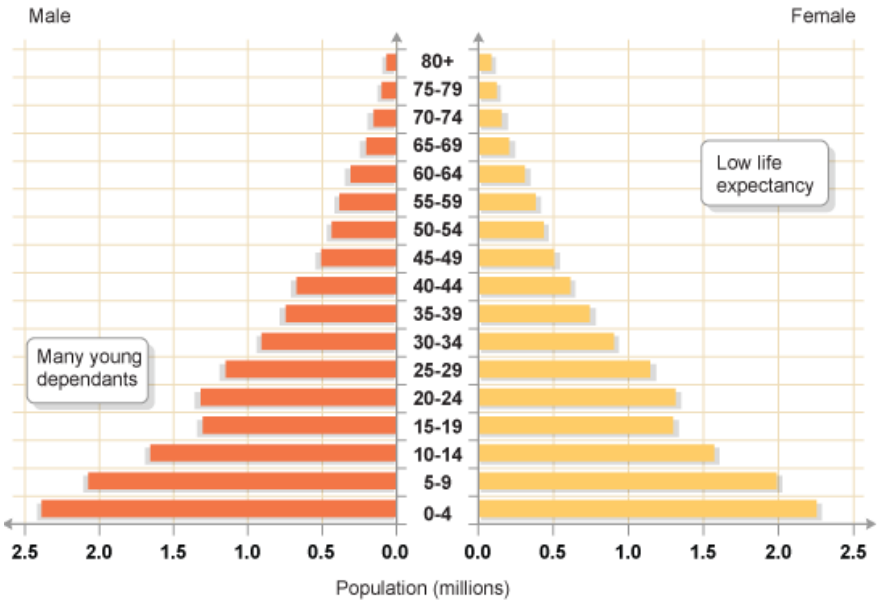
Population distribution

- It is the way the population is spread in a given area or space
- Some places are sparsely, moderately or densely populated

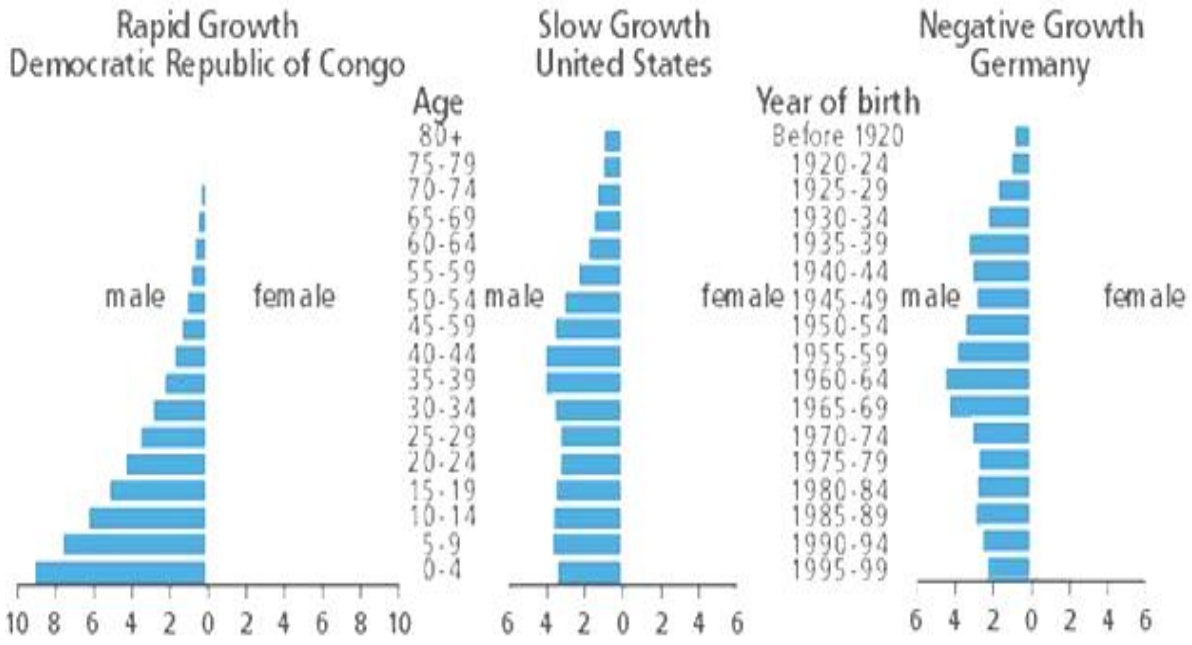
Population structure

- Population is made up of people of different age groups and sex.
- It comprises babies, boys and girls, adolescents, men and women.
- This composition is known as the structure of the population.
- Population structure is usually shown by diagrams called population pyramids which show the age, sex, and number of people of a given area.

PYRAMID SHOWING THE STRUCTURE OF A POPULATION



POPULATION PYRAMIDS OF DEVELOPING AND DEVELOPED COUNTRIES



Birth rate

- It is the number of babies born in every 1000 people of a population. **Example;** if 30 births occur, this means that 30/1000* 100 = 3%, and is considered to be high.
- The birth rate is also called **Crude birth rate.**

Death Rate (mortality rate)

- It is the number of deaths happening in every 1000 people of a population. Death rate is also called **crude death rate**.
- The other name for death rate is **mortality rate**.

Population explosion

- This is the rapid growth in population

Infant mortality rate

- It is the number of babies dying in every 1000 people of a population

Morbidity rate

- It is the measure of the sickness in a population.

Fecundity

- This is the potential an individual who is 15-49 years has to bear a baby.

Fertility

- This is the natural capability to produce offspring

Fertility rate

- Refers to the reproductive performance of the population
- It is dependent on the number of females who are able to produce the off-springs in a population i.e. those women who are between 15years-49years
- Total Fertility Rate (TFR) is the average number of children born alive to a woman during her lifetime if she were to pass through her child bearing years (15 to 49 years).

Doubling time

- This is the time taken for the population of an area to double its present size given the current rate of population growth.

Population Growth Rate (PGR)

- It is the rate or percentage at which the population increases

e.g. PGR = $\frac{\text{Birth Rate – Death Rate}}{100}$ * 100

- It is rate or percentage at which the population increases in a year.
- Population growth rate is also called Crude population growth rate.

Population Boom (population explosion)

- This is when the population of the country increases at a faster rate than the resources.

Under population

- This is a situation where the resources of the country are more than the population of the country.

Over population

- This is when the resources of the country are less than the population of the country.

Optimum population

- It is a situation when the resources of the country are equal to the population of the country.

Aging population

- It is the population that has a greater number of older people.

A young population

- This is one with a relatively high proportion of children, adolescents and young adults with a low median age.

- This type of population has a high potential growth rate known as in built population momentum.

A median aged population:

- This is a population divided into two equal groups, where half the population is young, and the other half are old.

Dependency ratio

- This is the number of dependants (those under 15 years and those above 64 years old) per 100 economically active individuals (those who fall in the range 15 to 64 years old).
- Dependency ratio = population under 15yrs + population aged 64 and above divided by (**%**) Economically active population (15yrs to 64 yrs).

Sex ratio

- This is the number of male per 100 females in a population.
- This applies in a situation where there are more females than males.
- It's in a case where the males are more than the female; it is the number of females per 100 males.

Life expectancy or life span

- This is the average number of years a person is expected to live from birth to death.
- Life expectancy is affected by several factors such as the prevailing mortality trends and the standard of living of the people.

Migration

- This is the movement of people from one are to another
- This could be within the country (internal) or between countries (international)
- Migration can either lead to an increase or decrease in the population

Natural Population Increase (Natural Increase)

- A population can increase due to either

- Having **more births than deaths** and this is called **Natural Increase**
- The population can also increase by having **more people migrating into an area** than those leaving

Primate City

- It is the city with the highest population in a country

Mega City

- It is the city with a minimum of 10 000 000 (ten million) people

Conurbation

- This is when two cities growing towards each other merge and form one big city. E.g. Blantyre-limbe in Malawi

FACTORS AFFECTING THE POPULATION DISTRIBUTION

Natural Factors

- **Climate:** Most people have settled in areas the climate is favored for human habitation.
- Such areas receive adequate rainfall and temperatures are moderate. Areas where people are able to grow a variety of crops.
- **Relief:** very few people live on hilly areas and rift valleys because these areas are mostly composed of stone soils which are not suitable for farming.
- Most people live on flat land where the land is fertile. Such areas are densely populated.
- However, in countries where the population is very high and land is scarce, you still find many people living on sloppy land, for example in Nigeria and Malaysia
- **Availability of Water:** people tend to settled where the water is readily available, for example near dambos, rivers, valleys, mashes and lake shore areas.
- These attract settlements because of plenty of water and high potential for economic activities. For example, areas like Lake Bangweulu, Lake Tanganyika and Lukanga swamp have attracted people due to finish and other factors.
- **Soils:** fertile soils attract people due to farming opportunities.
- This has led to high population in areas with fertile soil.

- **Availability of resources:** Most people settle in areas where there is enough resources to exploit.
- A good example is at mine areas and the available mineral resources. Mining areas are highly populated.
- **Vulnerability to resources:** areas vulnerable to disasters are sparsely populated as most people avoid settling in such areas.

SOCIAL FACTORS

Municipal services

- Most people tend to settle in areas where there are good health facilities.
- This has led to an increase in the population of developed areas where municipal services are well organized.

Health services

- People tend to settle in areas where there are good health facilities.
- This has led to an increase in the population of developed areas where provisions of health services are well organized.

Education

- Most people tend to settled in areas where there are good education facilities.
- This has led to an increase in the population of developed areas where education facilities are good.

Social Clubs/ Facilities

- Most people tend to settle in areas where there are good social facilities.

Housing

- Most people tend to settle in areas where there is goo accommodation.
- This has led to an increase in the population of developed areas.

Social security

- People tend to settle in areas where they feel secure.

ECONOMIC FACTORS

The following economic factors that can influence settlement:

1. **Business opportunities:** Business opportunities attract an increase in population.
2. **Employment:** employment opportunities are an attracting factor that leads to population increase in a given area.
3. **Transport and communications:** Most people tend to settle in areas where there is good transport and communications. This has led to an increase in the population along highways (roads leading to cities) and developed areas.
4. **Good shopping areas and Availability of goods**: most people tend to settle in areas where there is good infrastructure like shopping malls and where goods and services are readily available.
5. **Industries:** industries are an attracting force for population growth. They create employment and business opportunities which attract people to settle where they are found.

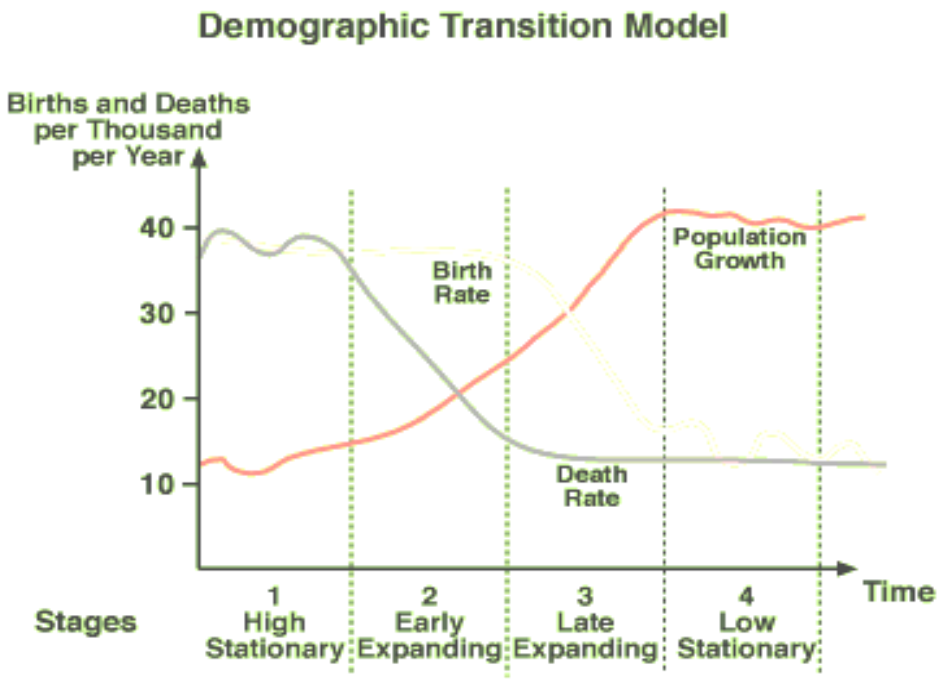
Political factors

- **Colonial influence:** Settlement patterns were to an extent determined by the colonialist who came up administrative boundaries.

- Certain areas were reserved as forests and game areas; as such these areas have very few people.

Government resettlement programs: sometimes the government decides to resettle people.

- This may sometimes be a result of capital development projects. e.g. The construction of Kariba dam.
- **Local Government Settlement Plans:** the government through the ministry of lands and the local government decide on where houses can be set up where to set up settlements.



- The growth of population in both developed and developing countries follow a pattern that has four stages known as **demographic transition**.
- As a society develops from a traditional pre-industrial level to an industrialized one, both fertility and mortality reduces.

Stage One (Traditional Society/High stationary)

- This is the early stage in the population development or growth.
- It is characterized by **high birth rates** and **high death rates**.
- As a result, the **population growth rate is small** and nearly **stationary**.

Stage Two (The Early Expanding Stage)

- This stage is characterized by high birth rates with declining death rates.
- This results in a rapidly growing population.
- Most developing countries are in this stage in terms of population growth for instance Zambia.

Stage Three (late Expanding Stage)

- This stage is characterized by **low deaths** and **declining birth rates**, resulting in a **gradual reduction** in the **population growth rate**.
- Some developing countries are at this stage.

Stage four (Industrialized Society/ low stationary Stage)

- This stage is where the population has **low birth rates** and a **low death rate**, the **population growth rate is slow** and **almost stationary**.
- It is also known as the stationary stage.
- Most developed or industrialized countries have reached this stage.
- Because of the **low birth** and **death rate,** the population is usually very old, **with more old people than young ones**, e.g. countries like Japan, Sweden and Denmark.

FACTORS CONTRIBUTING TO HIGH POPULATION GROWTH

- Early marriages.
- Lack of family planning.

Implications (effects, consequences) of rapid population Growth

1. **Demographic**

- Rapid population growth leads to a young population.
- The momentum for growth is already in built into the young are structure of the population due to the fact that the number of young females entering the reproductive age is much larger than the adult females who are moving out of the reproductive age range.
- Even if these young women were to have fewer children each, their total number of children births would be much larger, resulting in an increase in the future population.

2. **Natural**

- Rapid population growth coupled with poverty and inefficient management and utilization of the available resources leads to environmental degradation

- Environmental degradation threatens sustainable development and the depletion of natural resources.

3. **Social**

- Increase in crime rate.
- Increase in rural urban migration.
- Increased competition for education places in schools.
- Increased costs in the provisions of health services, leading to poor health service provision.
- Over crowing in cities

4. **Economic**

- An increase on poverty levels
- Increase in the cost of accommodation (High rentals and price of houses, lodges etc).
- Increase in the cost of goods and services.
- Increase in the labor force
- Increase in unemployment levels
- Leads to an increase in rural urban migration.

5. **Political**

- Can lead to ethnic conflicts.
- It leads to land conflicts.
- Problems on government budgeting and the allocation of resources in the country.

Measures to address population increase

- Building more schools, to carter for the population increase.
- Coming up with a population control policy.
- Education of communities on the importance of family planning.
- Improving agricultural production to promote food security.

- Promotion of sensitization of the public on the population related issues such as inter relation between population, environment and economic resources,.
- Provision of adequate social services.
- Provision of health services to the people in order to reduce mortality rates and improve the health status of the people.

PULL AND PUSH FACTORS BETWEEN RURAL AND URBAN AREAS

- Urbanization is the shift of population from rural to urban area to cities, and the resulting growth of urban areas.
- Most migrants to the cities can be assumed to have bettered themselves in comparison to their former standard of living, despite the serious problems of. The migrations are as a result of the push and pull factors.
- Rapid growth of overall population has deferred this event in most less-developed countries, but it is projected to occur in the early decades of the 21stcentaury.
- Some 29 percent of the world population was living in urban areas in 1950; this figure was 43 percent in 1990, and was projected to rise to 50 percent by the year 2005.
- Urbanization leads to a severe decline in the number of people living in the countryside, with negative population growth rates, in rural areas.

PUSH FACTORS

- Dislike of traditional way of life
- Hunger, poverty, drought,
- Lack of food
- Lack of good schools and health facilities etc.
- Lack of land
- Lack of rainfall
- Witchcraft

PULL FACTORS

- Good medical facilities,
- Good transport,
- Good schools
- Urban blight etc.

RESULTS OF URBANISATION

- Development of shanty compounds
- Inadequate municipal services that characterize life for many arrivals to urban centers.
- Increase in crime
- Increase in unemployment levels
- Overcrowding
- Poor substandard of housing
- Pressure on education and health facilities

WORLD POPULATION DISTRIBUTION

a) Densely populated areas of the world

These are found in the agricultural east and industrial west and include the following parts:

i) Industrial North west Europe

- This is where you can find the most industrialization countries like UK, Germany, France and Denmark.
- This area has been the center of civilization
- It lies within the temperature zone which has warm summers and mild winters
- It has good natural vegetation which supports lumbering
- It is also the home for the industrial revolution
- It has a long indented coastline which gives great opportunity for sea transport
- It has mineral resources which attract people to go and work in the mines.

ii) Industrial North East USA

- It is the industrial belt of USA and Canada
- It stretches from the great lakes through Pittsburgh to New York

- This area is also rich in minerals and has a good network of transport.

iii) Agricultural Monsoon Asia

- It includes countries like China, Japan, India, Sri Lanka, Bangladesh, and Indonesia
- The area has fertile soils which attract a lot of people
- It has plenty of water used by peasant farmers for irrigation.

b) Moderately populated areas

- It covers large areas of the cool temperate forests because these are lumbering area.
- It also include the coniferous forests of Canada
- This also includes the temperate and tropical grasslands where pastoralism and large scale mechanized farming are common.

c) Sparsely populated areas

- They include areas like the cold polar lands of the Arctic and Antarctic, the Canadian and Eurasian Tundra, Greenland and the high mountains of the Himalayas,

EXERCISE

1. Give reasons why areas like Copperbelt, Lusaka and a long line of rail are densely populated

2. Examine the Zambia's population structure in relation to pyramids.

3.Using a well labeled diagram discuss the Demographic model of population change.

4. At what stage is Zambia according to the demographic transition model?

5. Discuss pull and push factors between rural and urban areas

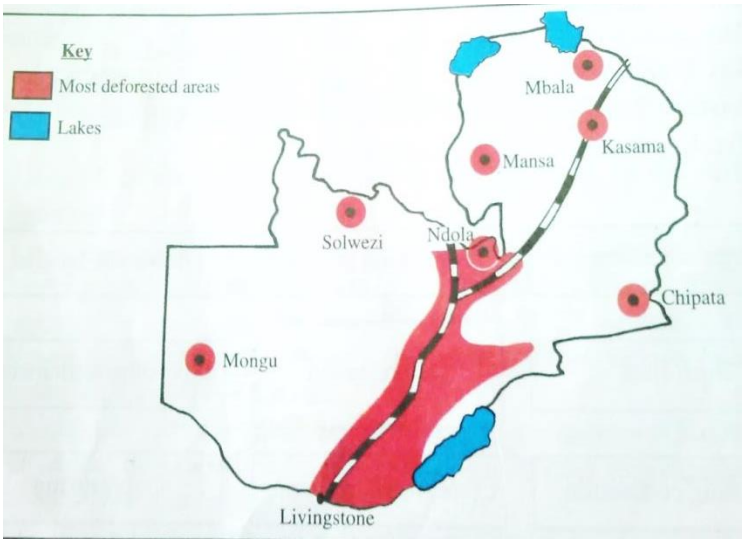
FORESTRY IN ZAMBIA AND THE SUB-REGION

FORESTRY IN ZAMBIA

- This is the planting and caring of trees

IMPORTANCE OF FORESTS

- Ensure adequate supply of water
- Forests helps in the formation of rainfall
- It is a source of employment to the people e.g. forest rangers
- Provide food and shelter for wild animals
- Provides traditional medicine or herbs
- Purifies the air
- They enrich soil by adding humus through decomposition
- They protect the soils from heat from the sun, wind and soil erosion



Deforestation means the general cutting of trees

Its causes are the following:

- Charcoal production
- Chitemene system of agriculture
- Clearing of land for development
- Commercial agriculture
- Increase in population

The general effects of deforestation

- Areas experience falling yields in forest products such as timber, fruits, charcoal and many others.
- Marked changes in climate. Areas experience reduced rainfall and increase in average
- Reduction in the amount of rainfall and water supply. Low rainfall is received due to less transpiration
- Several soil erosion with the consequence that the land becomes less fertile and may turn into a desert
- Shortage of wood fuel
- -There is general destruction of bio diversity
- There is reduction in the quality of the environment. An area without vegetation has less scenic beauty than one with plenty of vegetation
- Wildlife such as animals and birds lose homes when trees are cleared.

HOW TREES CAN BE RENEWABLE RESOURCE

- When they are well managed and maintained so that they grow well
- They should be cut down slower than new ones can grow
- When there is Afforestation and reafforestation

HOW TREES CAN BE NON-RENEWABLE RESOURCES

- When they are not cared for and hence they get destroyed
- When no trees are planted were there were trees before or were there were none before

TO THE VALUE OF INDIGENOUS FORESTS TO THE PEOPLE WHO LIVE NEAR THEM

- A source of building materials for huts and kraals
- A source of dugout canoes which are used for subsistence fishing
- A source of food such as fruits, mushrooms, honey, roots e.t.c
- A source of fuel wood i.e. firewood and charcoal for cooking
- A source of handles for axes, hoes,
- A source of traditional medicine encourage rain formation and prevent silting
- Provides a hunting ground for birds, big game, rodents, insects etc.
- Moderate temperatures provides shade when it is very hot

TYPES OF WOODLANDS

OPEN FORESTS

- ***Grasslands*:** There are in two types and these are grasslands of the dambos and grasslands of the higher plateau
- ***Kalahari Woodlands*:** Consists of trees with dense undergrowth of grass. Trees include, Kayimbi, Musheshi and Lozi
- ***Miombo Forests*:** they cover about 70% of the country which is found mainly on escarpments and plateau
- ***Mopane Woodlands*:** Is found along hot, dry valleys. It means butterfly and it is the favorable food for elephants. It is mixed with baobab trees
- ***Munga Woodland*:** This is found in drier areas where droughts are common

CHARATERISTICS OF TREES IN THE SAVANNA

- By having small shiny leaves
- They are resistant to fire
- They have an umbrella shape to shield the roots from heat from the sun
- They have long tap roots to reach underground water
- They have thick barks and swollen trunks to conserve water

- Trees are deciduous which means they drop their leaves once in a year

ORGANISATION CONCERNED WITH FORESTRY INDUSTRY

1. **FORESTRY DEPARTMENT**

- It has established plantations and saw mills throughout the country
- It is concerned with the management of forests
- It looks at research in disease prevention
- It also educates people on the importance of trees and forests

2. **ZAMBIA FORESTRY AND FOREST INDUSTRY AND CO-OPERATION (ZAFFICO)**

- Its activities are mainly in copperbelt in Ndola and Kitwe
- It has plantations which supply timber to many industries
- It concentrates on exotic soft woods e.g. pine trees and exotic hard wood like the eucalyptus

ADVANTAGES OF PINE AND EUCALYPTUS TREES

- The trees grow straight
- They are soft to work on
- They grow faster
- Trees grow in pure stands (they grow according to the types)

REASONS WHY MOST EXOTIC FORESTS ARE FOUND ON THE COPPERBELT

- Absence of diseases, pests and fungal attacks
- High demand for wood products on the copperbelt, Lusaka and Congo DR etc.
- High rainfall ranging between 1200mm – 1500mm ideal for tree growth
- Sandy clay soils are rich in plant nutrients
- The high altitude which is above 1200m above sea level
- The colonial government policy of supporting the mines
- Warm temperature ranging between 15 degrees Celsius – 22 degrees Celsius
- Well developed road network for hauling logs and distribution of the products

PROBLEMS FACED BY THE INDUSTRY

- Charcoal production and fire wood
- Chitemene system which brings about deforestation
- Commercial farming
- Creation of new towns
- Ignorance by cutting down trees for caterpillar
- Late bush fires
- Overgrazing by domestic animals

SOLUTIONS TO THE PROBLEMS OF GOVERNMENT

- Encouraging early burning
- Establishment of forest reserves
- Planting trees during the tree planting day
- Sensitization of the local people on the value of looking after trees

METHODS OF FOREST CONSERVATION

- Afforestation and reafforestationprogrammes
- Educating communities on the importance of caring of trees
- Fire control
- Introduction of tree planting projects at school and community levels
- Practicing agro forestry
- Restricting species of trees and types of trees to be cut
- The use of alternative sources of energy such as solar energy, wind, hydro-electricity and biomass

FACTORS LIMITING THE COMMERCIAL EXPLOITATION OF FORESTS

- difficult to access some of the forests
- droughts

- fires in the forests also destroys trees
- human activities such as Chitemene and charcoal
- lack of capital by small scale timber producers
- low demand for timber at times also affects production
- poor quality of timber
- trees do not grow in pure stands
- weak laws in forest management

INVASIVE TREE SPECIES AND THEIR EFFECTS

They include the following:

- Lantana camara
- Kafue weed

The following are their effects:

- displace indigenous tree species
- disturb HEP production
- inhibit navigation
- produce toxins which endanger animals
- reduce oxygen needed by aquatic animals

FORESTRY IN THE SUB REGION

MALAWI

- It is mainly done by the forestry department.
- The forestry department looks after two types of forests and these are the indigenous and the exotic forests.
- Most of the indigenous forests which are under the forestry department are forest reserves.
- Forest reserves are forests set aside by the forestry department where people are not allowed to cut down trees anyhow. These are four different purposes.
- Forest reserves in Malawi are found throughout the country especially in the northern part of the country.

- The found in indigenous forests are hard wood trees, they do not grow in pure stands, and they have a slow growth and do not grow straight.

IM PORTANCE OF FOREST RESERVES

- They protect the catchment area
- They help reduce soil erosion
- Forest reserves provide traditional medicine
- They are homes of wild animals
- They provide people with wild fruits
- They are tourist attraction
- They provide oxygen to the atmosphere through photosynthesis
- They provide materials for bridges and roofing of houses e.g. timber
- Most of the indigenous trees are very hard to work on and have a slow growth
- Forest guards have been employed to reduce un necessary cutting down of trees
- Most of the exotic type trees are from Europe and USA
- Plantations have been established in high rainfall areas of Malawi
- The areas where the plantation are found are Nyika, Vipya, Mlanje and Nkhata bay
- Soft wood trees have an advantage over hard wood trees because they are soft to work on, have a fast growth and grow in pure stands

CONSTRAINTS TO FORESTS

- Late burning of the forests
- Deforestation through charcoal burning and visoso type of agriculture
- Diseases and pests which attack the tress
- Frequent droughts or unreliable rainfall

EFFORTS MADE BY THE GOVERNMENT TO BOOST FOREST

- Allowing people to export timber to other countries
- Employment of forest guards to control deforestation
- Encouraging early burning of the forests

- Establishment of the forestry department to control forestry
- Establishments of sawmills in the entire plantation in Malawi
- Introduction of Licenses to all those willing to burn charcoal or cut timber
- Introduction of stiffer penalties to all those found cutting timber or production charcoal without permission
- To encourage people to plant trees during the tree planting day

REASONS WHY GOVERNMENT'S POLICY HAS BEEN TO ENCOURAGE REAFFORESTATION

- For the constant supply of timber
- Promotion of tourism
- Protection of the catchment areas
- Protection of the soil from the Sun's rays
- To reduce soil erosion in the country.

ZIMBABWE'S FOREST

- Zimbabwe has large areas under savanna woodlands
- These woodlands provide the people of Zimbabwe with forest needs e.g. charcoal and fuel wood

They savanna woodlands have limited supply of timber due to the following reasons:

- Few savanna trees yield timber that is commercially valuable
- Timber yielding plants such as teak, mukwa or muchibi do not grow in pure stand
- The rate of growth of trees is slow.

Zimbabwe's indigenous yielding timber trees are found in the following places:

- North of Bulawayo on the Kalahari sands
- On the slopes of Chimanimani in the Eastern Boarder Highlands

Zimbabwe's exotic trees are planted in the following places:

- Mtao near Masvingo

- North east of Bulawayo on the water-holding Kalahari sands
- Staple Ford.

The Eastern Boarder Highlands are suited for the growing of exotic trees because of the following reasons:

- Have a high annual rainfall of over 1,000mm
- Have cool temperatures which are ideal for the exotic trees like pines which are temperate trees
- Have reduced annual evaporation rates
- They are a highland area.
- The establishment of the expensive plantations has enabled the country to set up a pulp and paper mill at Mutare.

The map below shows the distribution of forest in Zimbabwe

FACTORS INFLUENCING THE GROWTH OF VEGETATION

There are a number of natural and human factors which influence the growth of vegetation. These are:-

- Careless cutting down of trees especially for fuel wood
- Clearance of vegetation for agricultural purposes
- Clearance of vegetation to accommodate urban development and expansion.
- Destruction of vegetation by fires caused by people
- Rainfall-water is responsible for the survival of all plant life.
- Soil- The medium ii which plants grow
- Temperature-This determines the environment in which plants grow because certain temperature levels promote plants growth whilst others retard it or even prevent it altogether.
- The main controlling factor is climate, especially the rainfall and temperature.
- The nutrients and water essential for plant's growth are stored in the soil

DEFORESTATION OF THE NATURAL WOODLANDS

- Deforestation means the removal or destruction of forest and woodland. The reasons for deforestation are as follows:-
- Population increase demands that more forests and woodlands are cleared for timber, farming, building of houses and wood fuel.
- For instance, the most useful species of trees such as Msasa were rapidly cut down because they are hard woods which make good fire wood
- Large-scale land clearance for commercial agriculture. This affected roughly a quarter of Zimbabwe's total area or nearly 100,000km.
- Increasingly demand for wood in industry and in urban areas e.g. for tobacco curing, fuel in towns, pit props in mining, sleepers for railways, and furniture.
- Destruction of wood lands by animals, especially by elephants which were much more widespread.
- Fire: man's use has been described earlier on and fires caused by lightning have added to the areas destroyed.

THE MAIN FEATURES OF INDIGNOUS TREES OF ZIMBABWE

Very few of these trees can be used commercially because:-

- Different species are mixed and scattered making it costly to exploit them.
- The trees are often gnarled or stunted.
- Some of the trees have sometimes been damaged by fire; in addition, their sapwood is often attacked by borers or their branches broken by fruit gatherers.
- The density per hectare of trees is low and decreasing as more trees are being chopped down.
- The rate of growth for most species is very slow.
- Only one area of indigenous forest is commercially useful. The umgusa or teak forest of Matabeleland

THE EFFECTS OF DEFORESTATION

There are many of these but the most obvious ones are:-

- Areas experience reduced rainfall and increase in average temperature.
- Reduction in the amount of rainfall and water supply. Low rainfall is received due to low transpiration.
- Shortage of wood fuel, tree around urban areas of Zimbabwe e.g. Harare, Bulawayo and people travel long distances to look for fire wood.
- There is a reduction in the quality of the environment, it loses its beauty.
- There is general destruction of biodiversity, few trees survive bush fire.
- Wildlife like birds and animals loose homes when trees are cleared.

MEASURES TAKEN BY THE GOVERNMENT OF ZIMBABWE TO ADDRESS THE PROBLEMS OF DEFORESTATION

- Afforestation and reforestation programmes
- Allowing people to plant trees during the tree planting day
- Alternative renewable sources of energy such as solar energy, wind and HEP
- Educating people on the importance of caring for forest resources
- Fire control
- Planting more trees for fuel on existing agricultural land e.g. on waste land, grassed contour strips, along river banks
- Planting more trees in rural and urban woodlands
- Practicing of agro forestry
- Restricting the types of trees to be cut
- Stiffer punishments to all those found cutting down trees unnecessarily
- Using wood fuel more efficiently, e.g. by improved stove designs like the tsotso stove

TYPES OF TREES FOUND IN ZIMBABWE

They include the following trees:

- Acacia
- Mahogany
- Cedar
- Msasa

The central highland veld grew deciduous forests and tree savanna consisting:-

- Msasa
- Mubvumira
- Mupaka (tree wisteria)
- Muzeze (African wattle)
- Munyuna (yellow wood)
- Mufuti
- Mutobwe (snotapel)
- Teak
- Mukwa
- Mucluibs.

REAFORESTATION IN ZIMBABWE

- Reforestation means the planting of trees on land where there was once forests or woodland which has been destroyed
- Each year some 750,000 families use 3.6 million tones of wood for fire wood, building and fencing poles. To replace this many villages have planted eucalyptus trees
- The total area of eucalyptus is only about 3,700 ha and 300 ha are planted additionally each year
- It has been estimated that, to secure Zimbabwe's wood fuel supplies, a planting program of 10,000 ha a year for ten years increased to 40,000 ha a year until the year 2000 would bring the total areas under eucalyptus trees to 600,000 ha.
- The National Tree Planting Day (every first Saturday in December) introduced by government since independence is a national wide collective effort to plant trees which will also help meet the great demand for wood

FACTORS INFLUENCING THE EXPLITATION OF COMMERCIAL FOREST

- Availability of markets. The higher the demand for trees and their by- products, the more prosperous lumbering becomes

- The composition of the trees, that is, whether the trees are found in pure stands (trees of the same species found in one area
- The depletion of forest resources can also affect the exploitation of forests because if there are no accompanying reforestation Aforestation programs; there will be no trees to cut
- The location of the forests
- The size of the trees. This determines whether the trees are easy to cut and transport to either saw milling plants or ports of exports

KENYA'S FORESTRY

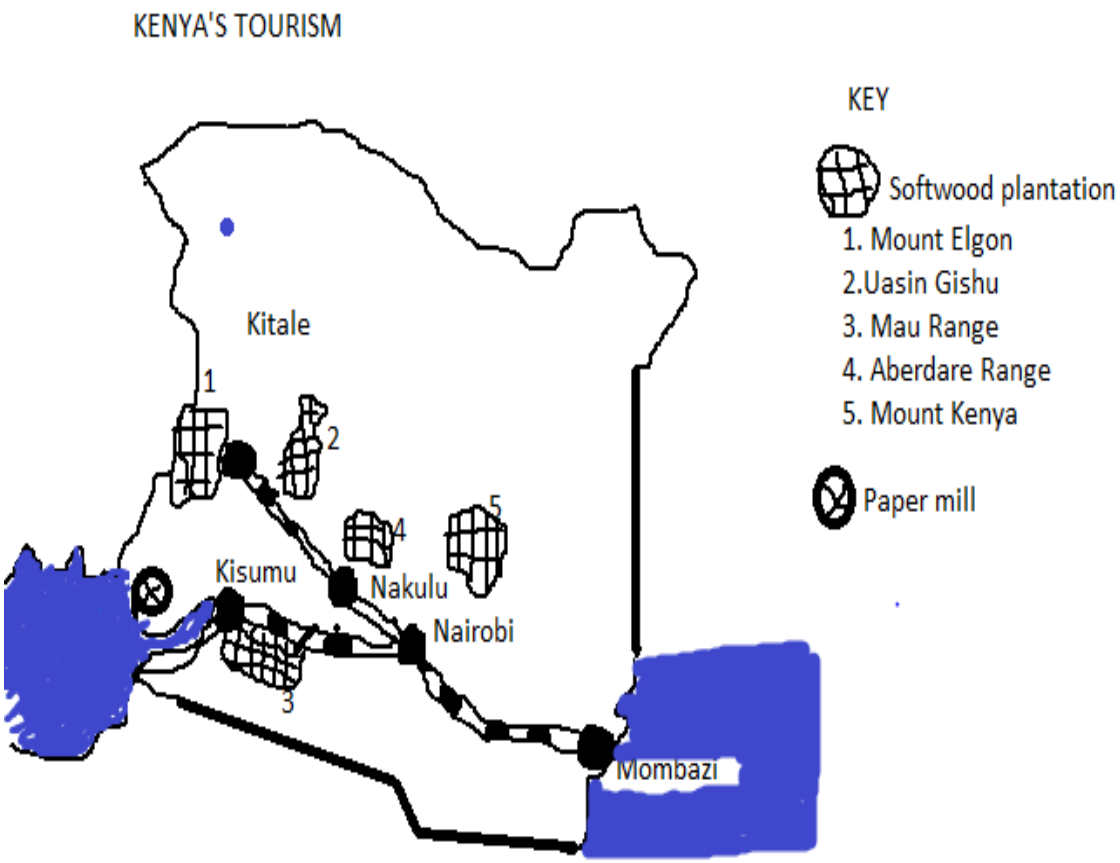
Natural forests in Zimbabwe occurred in the following areas:

- Along the Indian Ocean coastal area
- Along the shores of the lake Victoria in the west of the country
- On the central highlands:
    - ✓ On the slopes of Mount Elgon,
    - ✓ Mount Kenya,
    - ✓ UasinGishu Plateau
    - ✓ Abedare
    - ✓ Mau plateau

Exotic Trees are found on the following places:

- Mount Kenya
- UasinGishu Plateau
- Abedare
- Mau plateau

MAP OF KENYA SHOWING FOREST AREAS



Note: all the rest are just the same.

REVISION QUESTIONS

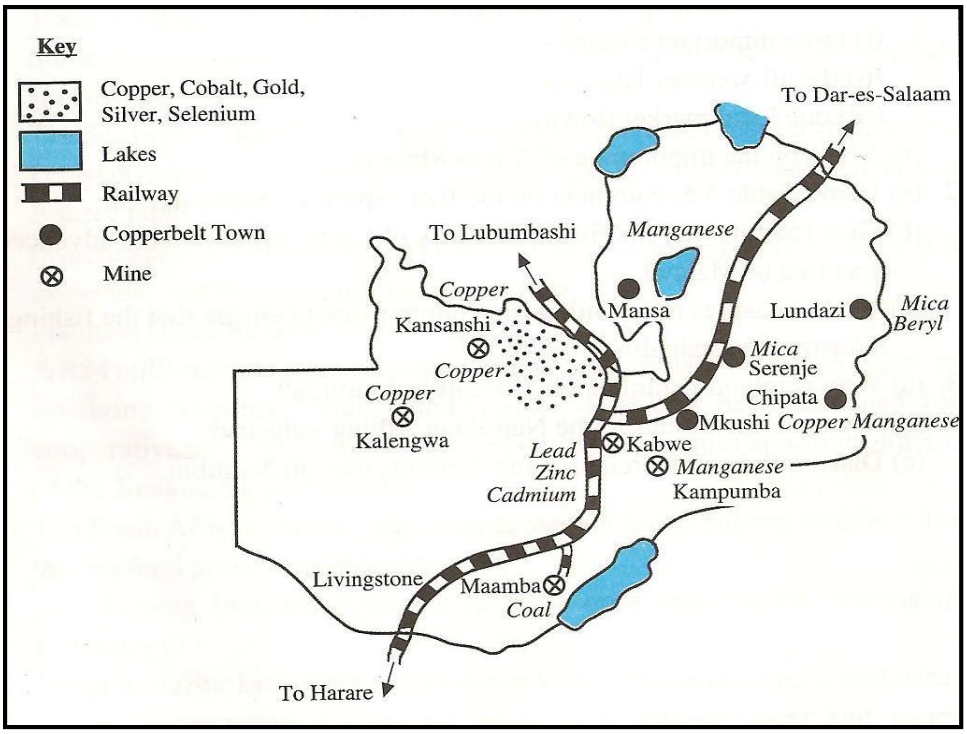
1. What is forestry?
2. How can trees be renewable resources?
3. What are the factors that influence the exploitation of forests in the sub-region?
4. Evaluate the main features of indigenous trees of Zimbabwe?
5. Draw the map of Kenya showing the Exotic trees in Kenya?
6. What are deciduous trees?
7. Give four examples of deciduous trees found in Zambia
8. Discuss the significance of forests to human beings?

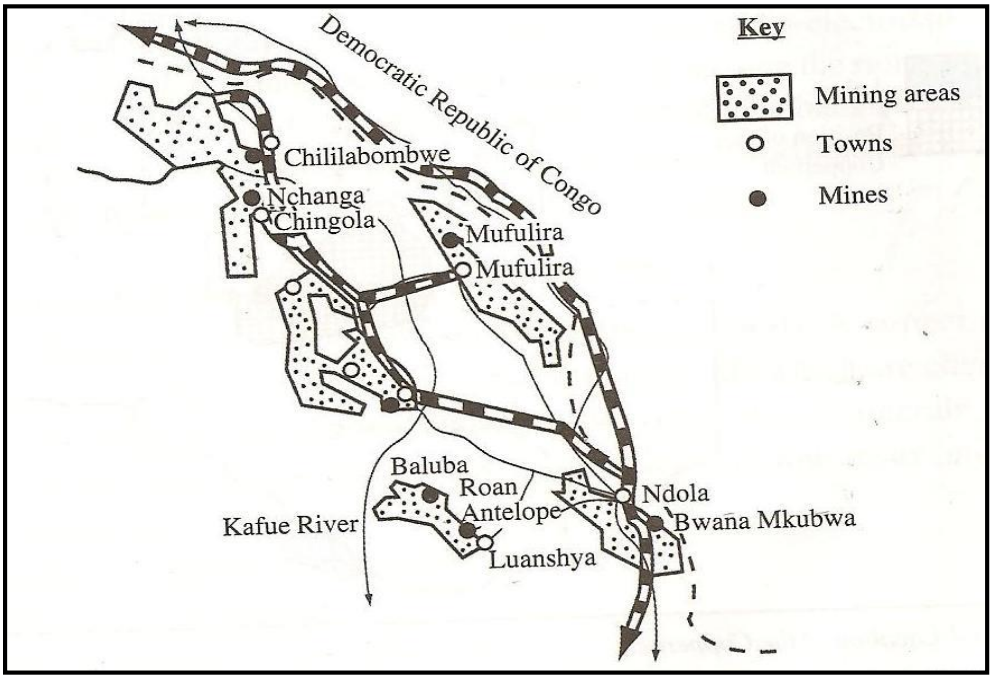
MINING IN ZAMBIA AND THE SUB-REGION

MINING IN ZAMBIA

- It is a process of extracting minerals such as coal and lead.
- Examples of minerals mined in Zambia are copper, Zinc, lead, coal and manganese

The mining areas of Zambia





Copper mining areas

MINING METHODS

1. *Open cast mining method*

- It is done at Nchanga Open pit mine in Chinogla
- It is done where the mineral ores are found near the surface of the earth
- It cheaper because it does not require heavy and sophisticated machinery
- It poses a danger to the environment , the mining may get flooded
- Humans or people are displaced when mines are opened

2. *Underground mining or shaft mining*

- It is done when the minerals are found very deep underground
- Most of the mining towns have shaft mines like Nkana mine in Kitwe, Konkola mine in Chililabombwe and Mufulira Mine in Mufulira.
- It is too expensive because it uses expensive and heavy machines.

IMPORTANCE OF MINING IN ZAMBIA

- It has created employment to most Zambians.
- Encourages tourism and investment
- It boosts the economy of Zambia
- It brings foreign exchange to the country
- It improves the standard of living of people in a country
- It leads to improvement of infrastructure

MINING TOWNS

- Chambeshi-Chambeshi mine
- Chilanga- limestone
- Chililabombwe- Konkola mine
- Kitwe- Nkana mine
- Luanshya- Baluba mine
- Maamba- coal
- Mansa- Manganese and is not in operation
- Mufulira- Mufulira plant

- Ndola- Bwana Mukubwa mine

TRADE AND MARKETING

- Copper is exported to other countries using TAZARA railway line, Great North road and Zambia Railways.
- Copper is sometimes sold and used locally
- Sometimes it is sold to Europe and Japan

RECENT DEVELOPMENT IN MINING SECTOR

- The MMD government introduced the structural adjustment programme (SAP) to privatize the mines.
- Privatization of mines led to the resuscitation of some closed mines

RESULTS OF PRIVATISATION OF MINES

- Many mines have turned into white elephants
- Many people have lost employment and it has brought suffering on many Zambians
- Most of the miners have not received their packages
- Vandalism of infrastructure and facilities has the life span of most mines

GOVERNMENTS EFFORT TO BOOST MINING

- Passing the environment protection and pollution Act which lead to the formation of the Environmental Council of Zambia
- Protect the local companies and industries by reducing taxes and support them with loans
- Scrutinizing the investors who are coming in Zambia and making sure that they follow rules
- The formation of the Environmental Council of Zambia controls the environmental pollution

USES OF COPPER

- It is used for making bullets ornamental things
- It is used for making electric wires

- It is used for making water pipes
- Used also for making car radiators

USES OF COBALT

- It obtained as a byproduct of a number of minerals
- It used to make cutting tools and magnets

LEAD AND ZINC

- The mine was found in Kabwe but it has been closed
- At first mining was done using open cast mining method and the later it was done using underground mining method
- The mine was closed in 1994 due to government policy of privatization
- It is used for making plates of electric storages batteries
- It is used as protective shield against radiation
- It is used in covering cables in white lead acid for paint, bullets and roofing materials
- Lead is used as an alloy
- Zinc is soft, white metal which resists fats and malleable
- It is used in alloys of brass
- It is also used as lining for coffins

USES OF MANGANESE

- It is used as an alloy and as a cleaner in extracting minerals

USES OF LIMESTONE

- A mineral called gypsum is added and the mixture is crushed to fine powder
- It is a white mineral used in manufacture of cement
- Limestone and clay are crushed and mixed with water and then burnt in a large oven
- The powder is cement which is used in the building industry

FACTORS INFLUENCING LOCATION OF MINERAL PROCESSING PLANTS

- Accessibility to the mines

- Geological occurrence of rocks containing the minerals
- Government policies
- Labour: skilled labour is hard to find at times
- Local and world demand iron ore, diamonds, coal, and petroleum
- Markets of the minerals fluctuates at the world market
- Power interruptions and shortages
- Transport costs to the market

STAGES OF MINERAL PROCESSING

Stage 1

- Smelting iron in blast furnace with the help of coal (coal) and limestone
- Coke produces heat which smelts iron ore while limestone combines with rock waste to produce slag
- The product is pig iron (molten)

Stage 2

- Molten pig iron is taken to steel making furnaces (the open – hearth, basic oxygen and electric – arc) where impunities are removed and alloys added
- The product is molten steel

Stage 3

- Steel is cast into various shapes in ingot moulds, ingots and soaking pits before being taken to blooms, billets and slabs.

Products include:

- Pipes and tubs
- Rails and joint bars (standard rails, crane rails and joint bars)
- Round bars (round, square, octagonal, flat, triangular etc)
- Sheets and coils
- Structural shapes (beams, angles, tees, zees and piling)

CONSTRAINTS ASSOCIATED WITH PRODUCTION AND SALE OF MINERALS

- Corruption

- Fluctuating prices and demand on world markets
- High production cost
- Specialized labour
- Theft and money laundering
- Transport routes to exports ports.

MEASURES ADOPTED TO OVERCOME SOME OF THE PROBLEMS RELATED TO MINING

- Crime prevention within the sub-region
- Creation of an enabling environment for investment e.g. giving of tax holidays to new investors
- Liberalization of the economies
- Opening new mines
- Privatization of mines which not doing fine
- Regional policies (harmonization of standards)

IMPACT OF MINING ON THE ENVIRONMENT

- Air, soil, and water pollution
- land degradation
- depletion of natural resources
- destruction of vegetation

MINING IN SOUTH AFRICA

- South Africa is one of the world's richest countries in terms of mineral wealth
- It has the largest reserves of gold, manganese, platinum, chromium and vanadium
- The four minerals which have contributed to the development in South Africa are Gold Diamond, Coal and platinum
- It employs about 500 000 people.

GOLD

- It is shiny yellow metal that never loses its colour, does not rust or deteriorates
- It is malleable and used in jewelry, ornaments, coins and medals

- South Africa is the world's largest producer of gold
- Mining started in 1886 in Wit watersrand, but this time the main mining town is Johannesburg
- Gold production has declined because of depressed word commodity prices, domestic inflation rate, unfavorable exchange rate and high production cost
- Mining is done by drilling and then blasted and transported to the surface
- They are crushed and grinded into powder
- They are now stared with a solution of cyanide which dissolves the finer particles of gold
- Then zinc dust is added to precipitate out the gold
- The gold is then melted down and formed into bars
- The mining methods used are drift mining, open cast mining and underground mining.

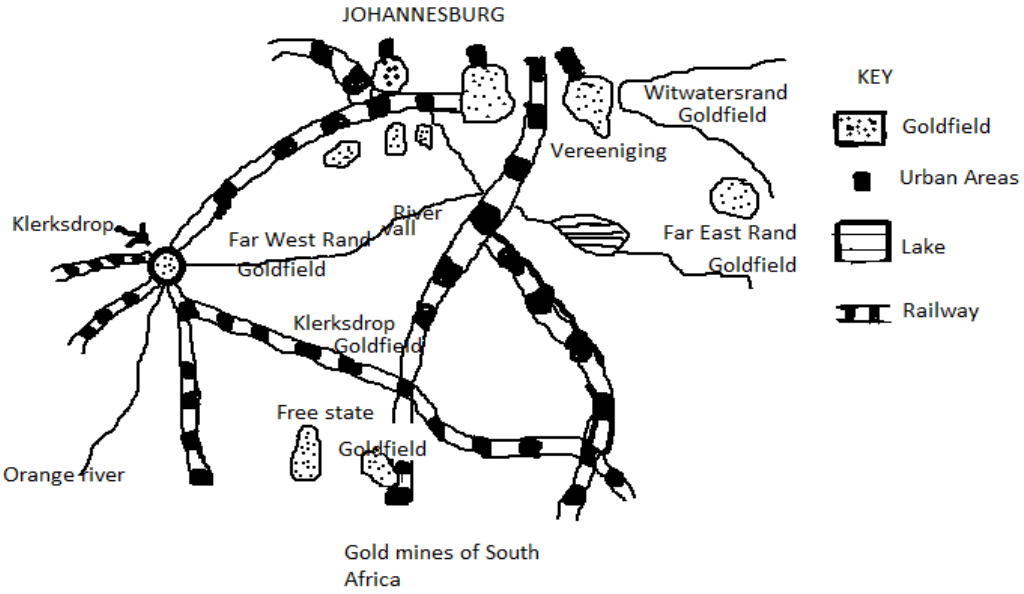
DIAMOND

- Diamonds are crystalline form of carbon and are found in big ingenious rocks
- They are also found in alluvial areas
- They are two types of diamonds and these are industrial and gem
- Industrial diamonds are small and contains impurities
- They are used as abrasives in cutting (oil drilling in rocks)
- South Africa is the fourth largest world's producer of diamond
- It's the largest gem diamonds
- Mining of diamond contributes about 11% of Gross National Product (GNP)
- It also provides 9% of employment in South Africa

INDUSTRIES WHICH BUY IRON AND STEEL PRODUCTS WITHIN SOUTH AFRICA INCLUDE:

- Manufacture of rail wagons
- Manufacture of mining machinery
- Manufacture of bicycles
- Manufacture of farm machinery
- Manufacture steel alloys

- Manufacture motor vehicles
- Manufacture of printing machines



MINING IN ZIMBAMBWE

- Mining of iron ore in Zimbabwe is done at red cliff
- Red cliff is 14 km from Kwekwe
- Mining is also done at Buchwan near Mberengwa
- An iron and steel industry has been established at red cliff because of nearness to iron ore, presence of lime stone and manganese
- As at now iron ore at Red Cliff is almost finished. So it now come from Buchwan and Ripple Creek

FACTORS THAT HAVE INFLUENCED THE LOCATION OF IRON AND STEEL INDUSTRY AT REDCLIFF

- Coal (bituminous) which is railed from Hwange is near
- Manganese comes from the Dam at Cactus poort
- The broad valley allows the allows for the expansion of the industry
- The central location of Redcliff makes it easy to transport the products
- The presence of high grade iron ore (haematite) with about 60% iron content near Redcliff

- There is a good road network
- There is also high quality of limestone near Redcliff
- Water for cooling is available at the nearby dam at Cactus poort and the additional water from Kwekwe

ZISCO: (ZIMBABWE IRON AND STEEL COMPANY)

The importance of ZISCO is:

- At Gweru, pig iron is used in the production of cast iron piping
- Development of transport and infrastructure
- Establishment of several industries e.g. in Kwekwe
- In Bulawayo and Harare, ZISCO iron and steel products are widely used in engineering industries
- Job creation

MINING IN ANGOLA

- Angola has also historically been a major producer of iron ore.
- Angola is the third largest producer of diamonds in Africa and has only explored 40% of the diamond-rich territory within the country
- Mining in Angola is an activity with great economic potential since the country has one of the largest and most diversified mining resources of Africa
- Production rose by 30% in 2006
- The government has been trying to attract foreign companies to the provinces of Bié, Malanje and Uíge
- Unfortunately, it has been difficulty in attracting foreign investment because of corruption, human rights violations, and diamond smuggling

ENVIRONMENTAL IMPACTS OF DIAMOND MINING

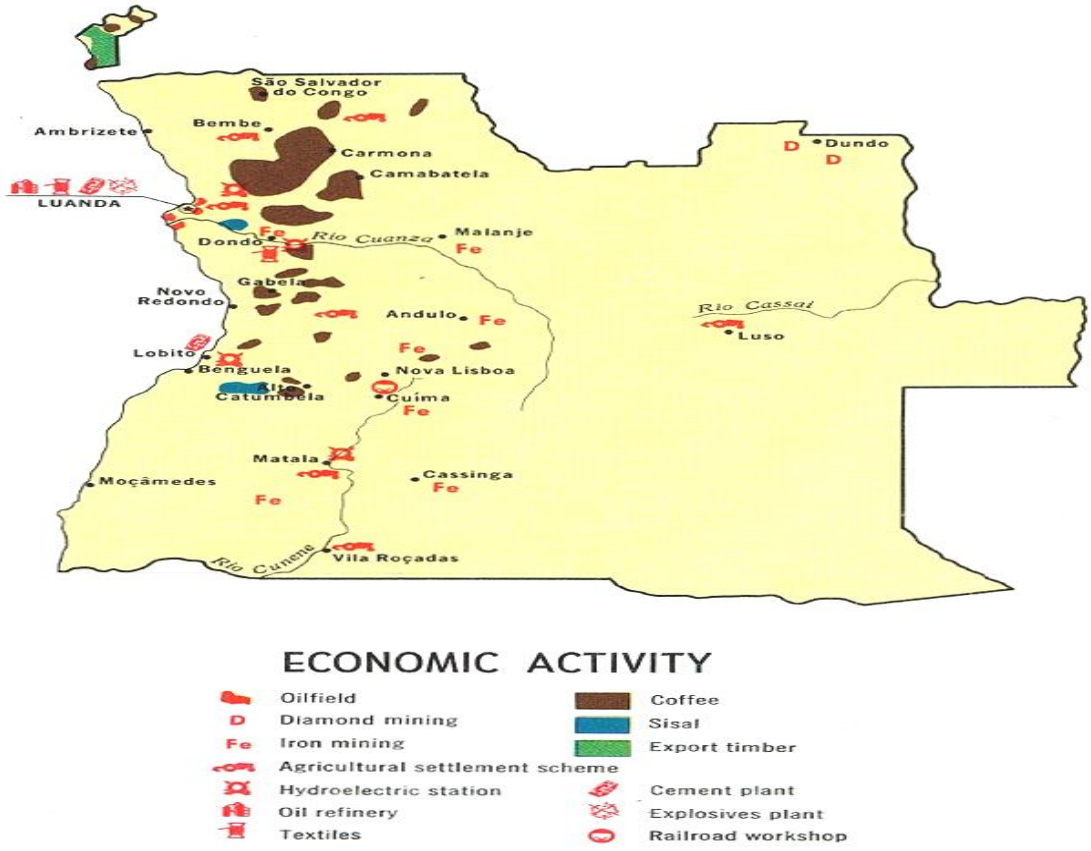
- Forests are disrupted when machinery uproots trees to make roadways to the mines.
- In Angola, diamonds are the second leading export for the country behind oil,
- In order for the machines and trucks to navigate, roads must be built, segregating the land.

- Large sections of rock are removed by means of heavy machinery and hauled away to screening plants to search for diamonds.
- Many rivers are diverted so that mines can be exposed and, although they can be returned to their natural state, they typically are left how they are
- Of the two main methods of extracting diamonds (Kimberlite pipe mining and alluvial mining), pipe mining has the larger impact.
- Oil and chemicals from the pipe mines seep into the ground and into the water supply
- Pipe mining affects plants through the building of roads as well as other ways.
- Soil deposits are also affecting the water quality as the land is being unearthed
- The extraction of these gems causes harm to plants, water, and soil.
- The water becomes clouded by sediment and in result drinking water for animals is polluted
- Water quality is negatively affected by alluvial mining

DEVELOPMENT FOR THE FUTURE

- To provide sustainable jobs and income for the millions of displaced Angolan people will involve developing agriculture and industry that is not reliant on non-renewable resources
- The price of diamonds is going down due to the large mines opening in Russia and China, and oil is not owned by the people, with uneven allocation of funds occurring between politicians and oil companies.
- Angola has large rivers and delta regions, which could be dammed to create electricity to export to neighboring countries.

MINING IN ANGOLA



POPULATION STUDIES IN ZAMBIA

DEFINITION OF TERMS

- **Population:** is the number of people living in an area at a given point in time.
- **Census:** counting of the people in an area. Information such as employment status, age, sex, housing, education, agriculture and material status are also collected.
- **Population growth rate**: this is the rate at which population is increasing or decreasing in a given year due to natural increase, migration and other factors.

YEAR	POPULATION IN ZAMBIA (million)
1963	3.5
1969	4.1

1980	5.7
1990	7.8
2000	10.3
2010	13.4

Zambia Census results

- Population growth is influenced by demographic processes such as fertility, mortality and migration, birth rate, death rate and life expectance.

BIRTH RATE

- Birth rate is the number of births per 1,000 people per year in the population.
- If more babies are born per 1,000 people, the population is likely to grow, for example, if 30 births occur this will mean

30/1000 x 100= 3%

This is considered as a high birth rate.

Death rate

- This is the number of people who have died in a year out of every 1,000 people.
- From the birth rate and the death rate we can find the natural rate of increase of the population.
- The natural increase will indicate how fast or slow the population is growing.
- So the natural rate of growth is the difference between the birth rate and death rate expressed as a percentage (%)

Birth rate – Death rate = Natural rate of increase

For example, when birth rate is 70 and death rate is 50 then natural increase will be 70 – 50 = 20. The difference is divided by 1,000 and multiplied by 100 to get a percentage.

This means that:

20 ÷ 1,000 x 100 = 2%

Usually birth is higher than death rate. However, the above figure is considered as high.

FERTILITY RATE

- Fertility is the actual **reproduction performance** of an individual, a couple, a group, or population.
- **Total fertility rate (TFR)** is the average number of children that would be born alive to a woman during her lifetime if she were to pass through her childbearing years (15 to 49).

Mortality rate (**Crude Death Rate**)

- Mortality rate is the number of deaths occurring during the year, per 1000 population
- The levels of mortality, which declined considerably between 1963 and 1980, have been rising since 1980
- The crude death rate declined from 19.7 to 16.7 in 1980 and rose to 18.3 in 1990
- The decline in mortality rates was probably due to improved standards of living and adequate provision of health services.

Infant mortality rate

- This is the numbers of infants(children below one year) (dying before reaching the age of one year of age per 1000 live births in a given year.
- The increase in infant mortality rates could be attributed to the HIV/ AIDS pandemic and other diseases such as malaria, pneumonia, T.B and diarrhea.

Migration

- Migration is the movement of people from one area to the other
- This could be within the country (internal) or between countries (international)
- Migrations can either lead to increase or decrease in the population
- Immigration is the movement of people into a country where they are not native or citizens while emigration is the movement of people from a country where they are not natives.

CAUSES OF MIGRATION

Push factors

- Civil wars leading to refugees
- Lack of jobs in urban areas
- Natural disasters e.g. drought
- Political or ideological differences e.g. white farmers in Zimbabwe
- Tribal wars e.g. weak tribes migrate

Pull Factors

- Accommodation
- Education etc. (as discussed earlier)
- Employment
- Social services

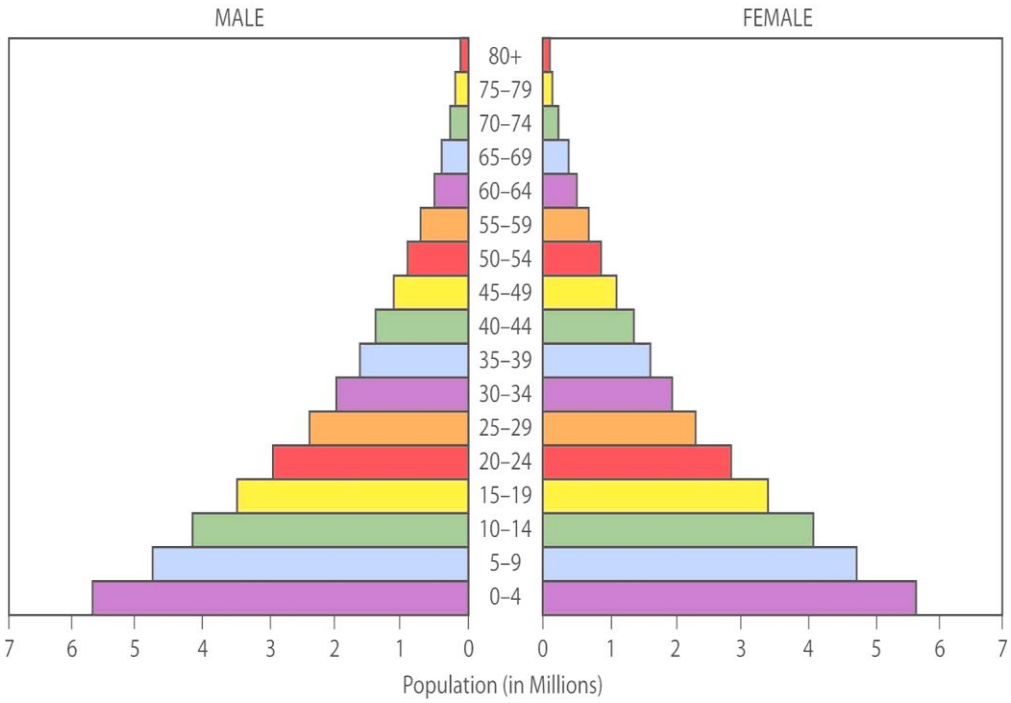
Life expectancy

- This is average number of years a person is expected to live from birth to death
- Life expectancy is affected by several factors such as the prevailing mortality trends and the standard of living of the people

Structure of the population

- Population is made up of people of different ages and sex
- It comprises of males and females, babies, men, women, boys and girls
- This composition is known as **the structure of the population**
- The age- sex structure is the composition of a population determined by the number of males or females in each age group
- The number of males and females can be presented in an age **sex pyramid** as shown below

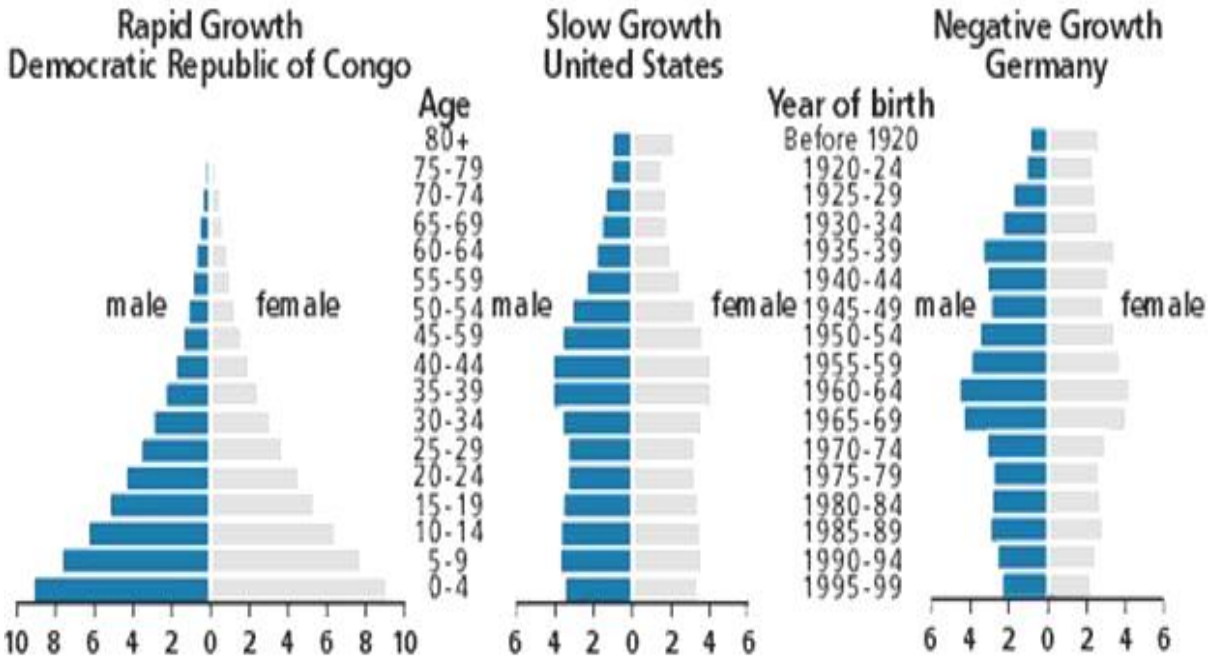
A **population pyramid**, also called an **age pyramid** or **age** picture diagram, is a graphical illustration that shows the distribution of various **age** groups in a **population** (typically that of a country or region of the world), which forms the shape of a **pyramid** when the **population** is growing.



Population Pyramid

- In Zambia the trends in fertility and mortality have led to a population that is young, with a median age of 15.2 and 16.8 years in 1980 and 1990 respectively
- A young population is one with a relatively high proportion of children, adolescents and young adults with a low media age
- This type of population has a **high potential growth rate** known as in- built population momentum.

Population Pyramids of Different Countries



TYPES OF POPULATION PYRAMIDS

A. STABLE PYRAMID

- A population pyramid showing an unchanging pattern of fertility and mortality
- **Stationary pyramid** – a population pyramid typical of countries with low fertility and low mortality, also called a constrictive pyramid

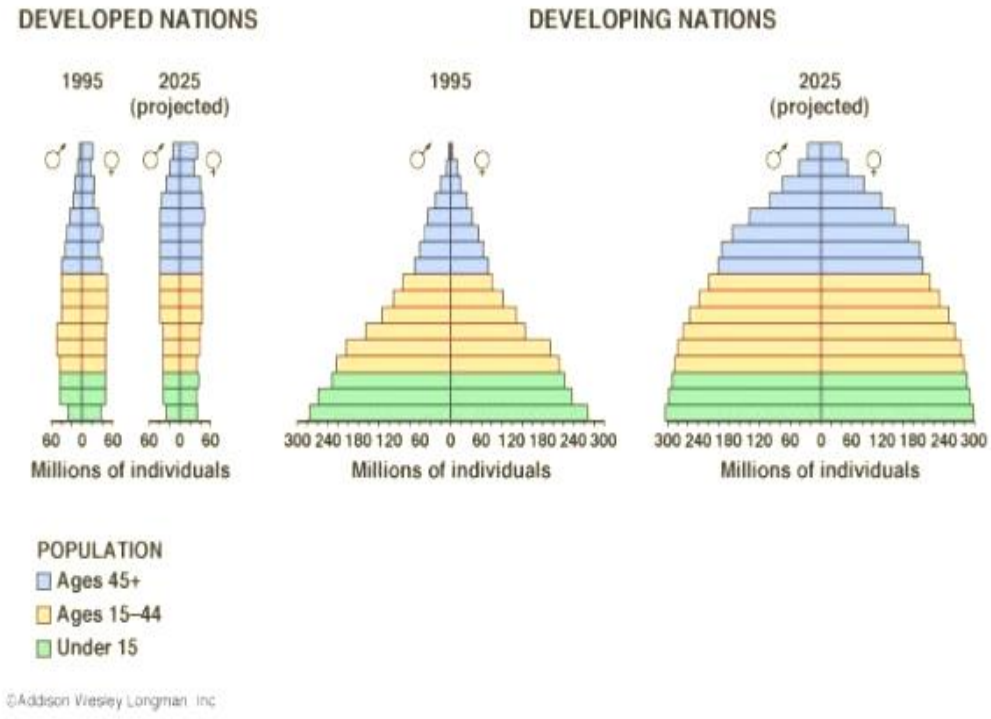
B. EXPANSIVE PYRAMID

- The population pyramid showing a broad base, indicating a high proportion of children, a rapid rate of population growth and a low proportion of older people
- This type of pyramid indicates a population in which there is high birth rate, a high death rate and a short life expectancy

C. CONSTRICTIVE PYRAMID

- It shows lower numbers or percentages of young people
- The country will have a graying population which means that people are generally older

Developed and Developing Countries



The medium age

- This is the age which divides a population into two equal groups where half the people are younger than this age and half are older
- In 1990 nearly half of Zambia's population (45.2%) was under 15 years of age
- The age will show whether a population is young or ageing, for example, Britain has an ageing population with a median age of 34

Sex ration

- This is the number of males per 100 females in a population

- The sex ration for Zambia shows that there are more females than males

Dependence ratio

- This is the number of dependants (those under 15 years and 65 years and above per every 100 economically active persons)
- The economically active people fall in the range of 15 to 64 years. The dependence ratio determines the economic status of any society

$$\text{Dependence ration} = \frac{\text{Population under 15 + Population aged 64 and above}}{\text{Economically active population (15 to 64 years}}$$

Population distribution

- Population distribution is how people are spread over an area
- On the average, Zambia is a very sparsely populated country
- This means there are few people living in a given area
- However, there are some densely populated areas, with more people

Population density

- This is the number of people found per square kilometer in a given area.

$$\text{Population density} = \frac{\text{Number of people in an area or country}}{\text{Unit of area}}$$

Every country has an optimum population.

Optimum population

- This is the size of population which is felt to be the most desirable for the full utilization of its natural resources and which produces the highest standard of living.

Under population

- These are the countries or areas where a high population could be supported without any drop in living standards.

Over population

- This is when a country or area has a higher population than its resources can adequately support.

FACTORS INFLUENCING POPULATION DISTRIBUTION

- Population distribution is influenced by many factors some of which are **natural** (physical), **social- economic** and **political factors**.

Natural factors

- The natural factors which influence population distribution include relief features, climate, Availability of water, soil and forests.

Relief features

- Very few people live in Hilly areas and Rift Valleys because these places are mostly composed of stony soils which are not suitable for farming.
- Most people live on relatively flat land for example areas around the line of rail are densely populated while places like the Zambezi and Muchinga Escarpments have very few people.

Climate

- Most people in Zambia have settled in areas where the climate is favorable. Such areas receive adequate rainfall and temperatures are moderate.
- People are able to grow a variety of crops, for instance on the Tonga plateau, Mkushi area and other parts.

Availability of Water

- People tend to settle where there is readily available water. For example near bamboos, river valleys, marshes and lake areas.

Soil

- Fertile soils attract people due to farming. Generally, soils in Zambia are poor as a result they are not suitable for cultivation.

Social- Economic factors

- Some areas tend to attract a number of people due to the economic activities that takeplace inthose areas.
- People go to such areas to look for employment.
- For example along the line of rail where there is concentration of industries and commercial farms.

Political factors

- Settlement patterns were to a large extent determined by the colonialists who came up with administrative boundaries
- Certain areas were reserved as forests or game areas have very few
- Many people in the 1950s were shifted to the lower Zambezi to pave way for a game park.

Factors contributing to High population Growth

- Demographic factors e.g. declining Mortality rates, high fertility rate, and migration.
- Social, cultural factors
- Social security- children are mostly regarded as an investment. In most African societies, children are expected to look after the aged parents by providing financial, moral and emotional support

Implications of Rapid Growth

The rapid population growth of Zambia has demographic, social, economic and natural resources implications. They include the following:

- Increase in corrupt practices e.g. in search of employment
- Increase in number of street kids
- Increased crime e.g. stealing

- Increased prostitution in search of money
- Lack of job opportunities
- Lack of social services e.g. poor housing
- Overcrowding and creation of shanty compound

Demographic implications

- Zambia has young population as almost half the population comprises young ones.
- The momentum for growth is already built into the young age structure of the population due to the fact that the number of young females entering the reproductive age is much larger than the number of adult females who are moving out of the reproductive age range.
- Even if these younger women were to have fewer children each, their total number of births would be much larger resulting in an increase in the future population.

Social Implications

- Due to high population growth rate and the economic recession, real per capital expenditure on the provision of social services such as health, education and housing has declined

Health

- The expenditure on Health care has declined over the years resulting in reduced expenditure on primary health care.
- This has in resulted in high infant, child maternal mortality rate, increase in malnutrition, a breakdown in health infrastructure and inadequate supply of medicines.
- This situation has been worsened by the advent of the HIV/ AIDS.

Education

- Although, the Zambia Government recognized Education as a basic human right, per capital expenditure on education has declined over the years.
- The government is facing problems in providing adequate education facilities due to high population growth.

Housing

- Housing is seen as one of the basic human needs as its availability and adequacy is a determinant of human development.
- However, in Zambia, the provision of adequate housing has declined, for instance more than half of the urban population lives in shanty townships.
- Such populations have little or no access to basic infrastructure and services such as good roads, piped water and sanitary facilities.
- This situation has greatly contributed to low health status.

Measures to Address Population Problems

The government has come up with some measures to address population related problems. The following are some of the measures put in place:

- Formulation of the National Population Policy
- Provision of family planning and health services in order to reduce fertility level and improve the health status of the people
- Implementation of programmes addressing population issues such as HIV/AIDS and Reproductive Health, Family life Education for both in school and out of school youths.
- Promotion of sensitization of the public on population related issues such as the inter relationship between population, environment, and economic resources.
- Provision of adequate social services though this has been hampered by the fast population growth rate
- Improving agricultural production to promote food security

REVISION EXERCISE

1. State and explain the three types of pyramids?
2. Explain the causes of population explosion?
3. Compare and contrast the population structure of a developing nation and adeveloped nation?
4. Give reasons why areas like Copperbelt, Lusaka and along line of rail are densely populated

5. Examine the Zambia's population structure in relation to pyramids.
6. Describe the causes of street kids in big cities of Africa such as Lusaka.

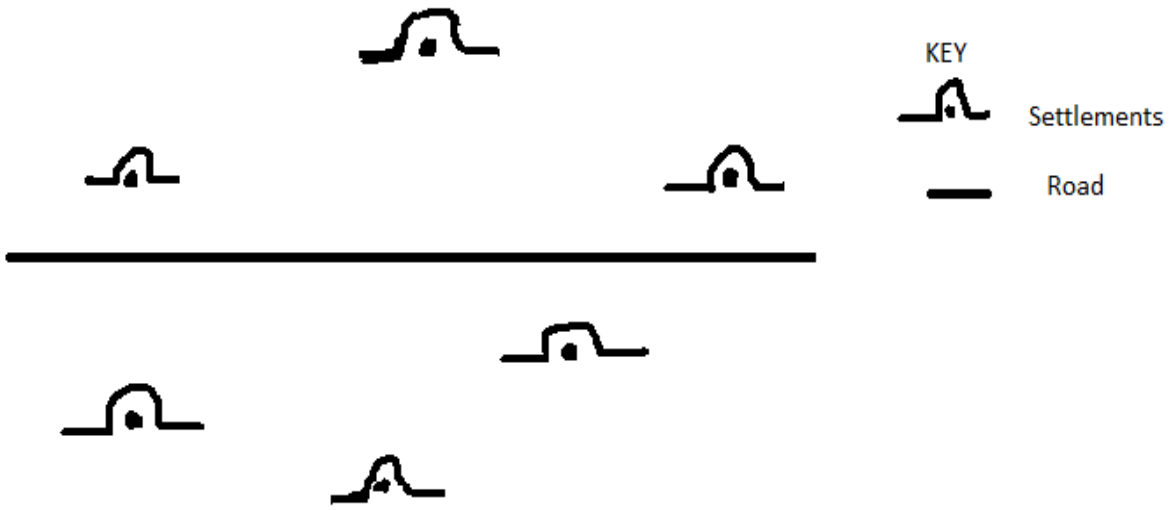
SETTLEMENT STUDIES

- A settlement is a place where people live
- A human settlement is defined as a place inhabited more or less permanently
- It includes the temporary camps of the hunters and herders
- Settlements differ from place to place to the other e.g. settlements in towns differ from those in rural areas
- The layout of settlement usually gives a pattern

The following are the types of settlement:

1. **Dispersed or isolated settlement**: This is the type of settlement where individual buildings lie isolated or part from one another.

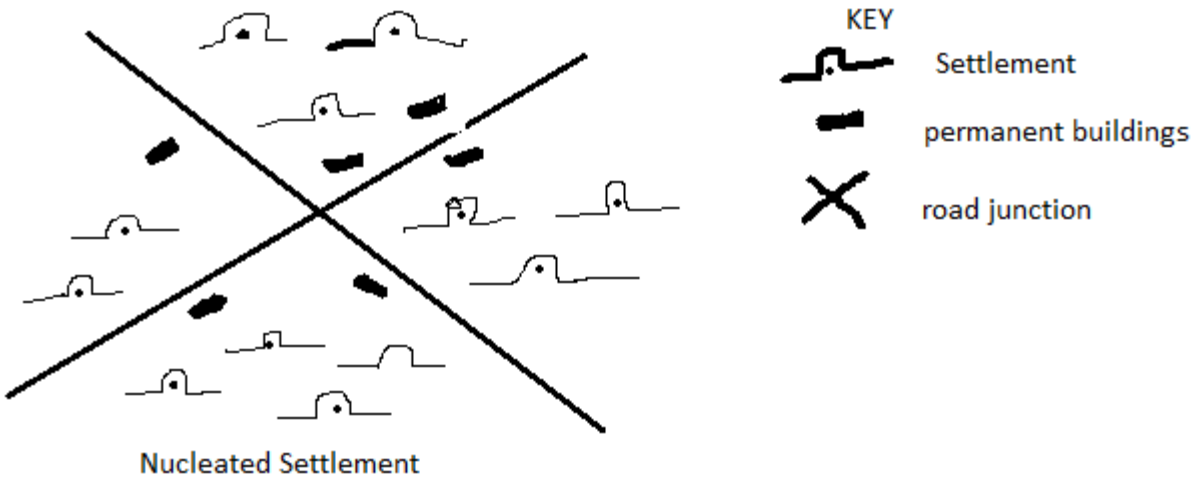
- This type of settlement is mostly common in rural areas where the population is sparse



Dispersed Settlement pattern

2. **Nucleated or clustered settlement**: these are settlement arranged in such a way that there are a number of houses close together

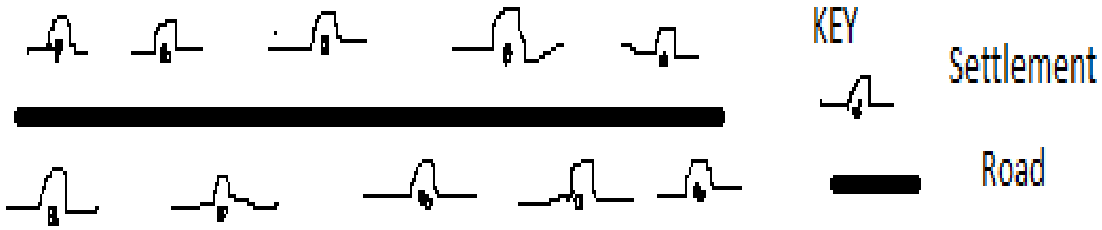
- In these settlements there are social amenities such as shops, schools, places of worship etc.



Nucleated Settlement

3. **Linear settlement**: This is the type settlement where buildings are built in a line along a road, river or stream

- This type of settlement is usually planned



A linear settlement pattern

TYPES OF HUMAN SETTLEMENT

Settlements are classified on the basis of size and function into urban and rural.

Urban settlements

I. These types of settlement are nodal in character and have secondary and tertiary activities.
II. The chief occupation of the people of urban areas is non-agricultural i.e. industry, trade and services
III. The major function of an urban area are trades and commerce, transport and communication, mining and manufacturing, defense, administration cultural and recreation
IV. Population density is high and settlement size is large

Urban settlement are classified on the basis of its size of the population, occupational structure and administration

Functional classifications of towns

Administrative Towns: National capitals, which have headquarters of the administrative offices of Central Government, are called administrative towns, such as, new Delhi, Moscow and Washington.

Defence Towns: Centres of military activities and are known as defense towns. They are of three types

Cultural Towns: towns famous for religious, educational or recreational functions are called cultural towns

Industrial Towns: these are towns which have developed due to setting up of industries

Trading and Commercial Towns: These were trade towns of the world e.g. Agra and Mumbai in India

TYPES OF URBAN SETTLEMENTS

Depending on the size and the services available and functions rendered, urban centres are designated as town, city, million city, conurbation, and megalopolis.

Towns: population size in town in town is higher than. Functions such as, manufacturing, retail and wholesale trade, and professional services exist in towns

City: a city may be regarded as a leading town

- Cities are much larger than towns has a greater number of economic functions.
- They tend to have transport terminals, major financial institutions and regional administrative offices

Conurbation: this is the merging of originally separate cities or towns into one

RURAL SETTLEMENTS

- These settlements are chiefly concerned with primary activities such as agriculture, mining, fishing etc.
- Most people in the rural areas are involved in agriculture
- The population density is small and the settlement size is small

FACTORS INFLUENCING RURAL SETTLEMENT

They include the following:

Water supply: people in the rural areas settle in areas with water bodies especially rivers

Land: people want to settle in areas with fertile soils for the to practice agriculture

Upland: villages are located on uplands which is not prone to flooding. Thus in low lying rivers basins people chose to settle on terraces and levees which are "dry points."

Building materials: the availability of building materials such as those for constructing houses

Mining: people have settled in areas with mineral e.g. in the copperbelt

Transport: most settlements tend to develop along the lines of communications e.g. along roads and railway line

INTERNAL STRUCTURE OF A STRUCTURE OF A TOWN

- A town is made up of different areas or zones where different activities take place. For instance, where people shop, where industries are located and where people live.
- Models have been developed to help us understand the shape of the town and its land use.

- Examples of the models are the ***sector*** and the ***concentric*** models

CONCENTRIC MODELS

- This type of model has rings for specific functions
- For instance the inner circle is known as **the Central Business District (CBD)**
- The inner circle has shops, banks, offices, business centres etc.
- Rentals start to fall with distance from the centre

*The second ring has the **Industrial Area***

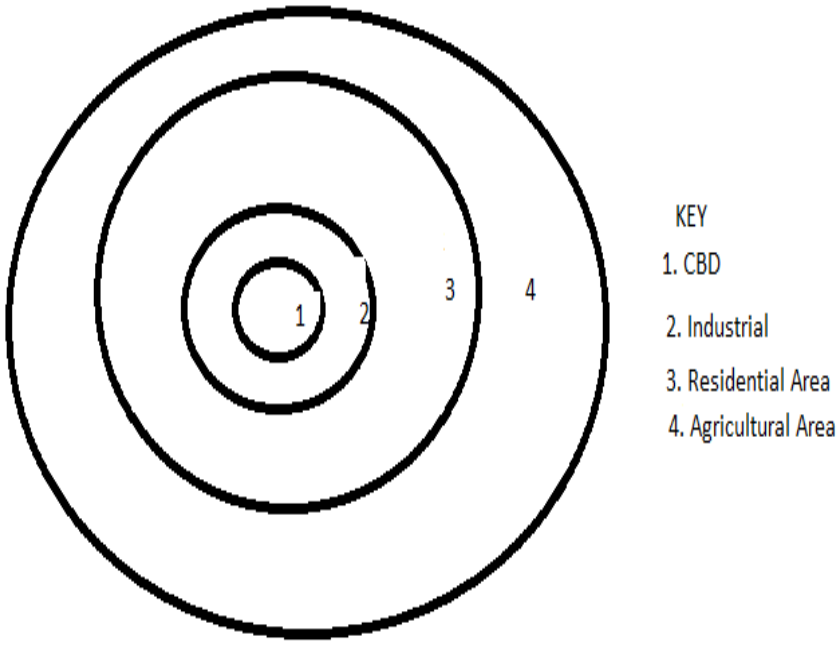
- This is the area where most industries and factories are located
- The industrial area is usually located close to a good road and railway system for easy transportation of raw materials and finished good
- The industrial area is usually located away from the CBD and residential areas

*The third ring has the **Residential Area**s*

- Residential areas are usually classified as high, medium and low density depending on the type of people who live there
- A high density area is one where houses and gardens with a small population e.g. Kambotole in Kasama Muombo in Mporokoso and Chisanga village of Kasama
- Low density have spacious houses and gardens with a small population for example, Mukulumpe, little poll land in Mbala
- The Medium density areas are those places with a fair population e.g. location in Kasama.

The fourth ring has the **Agricultural Area**

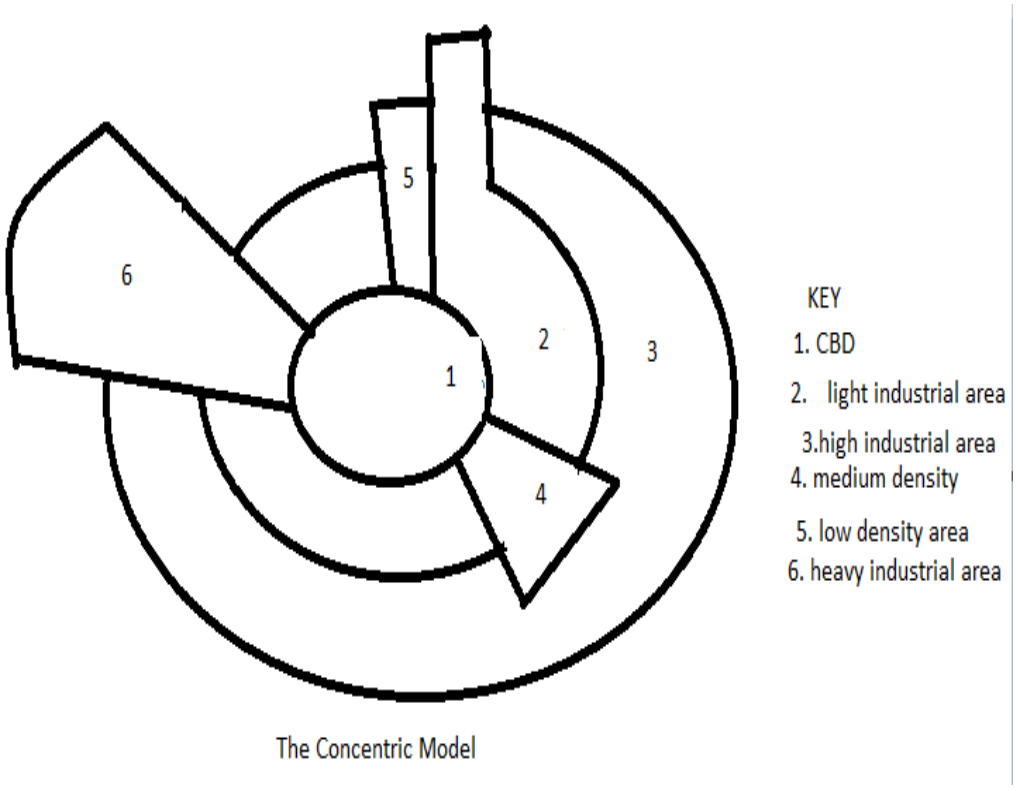
- On the outskirts of a town, land is usually used for agriculture
- The most common type of a farming that takes place is ***market gardening***
- A variety of crops such as vegetables and fruit



The Concentric Model

THE SECTOR MODEL

- This model depicts the land use in sectors from the Central Business District
- For example, well developed routes running to the centre of the city may lead to high land values as shown on the diagramme below
- Some industries are located along these routes for accessibility
- Some residential areas may also be found along the developed routes



The Concentric Model

URBANISATION

- This is an increase in the percentage of a country's population living in towns or urban areas
- This is usually caused by the movement of people from rural areas to towns
- Rural – Urban drift and population growth are major factors responsible for rapid urbanization

NOTE: Other issues are on the topic under world population such as the pull and push factors.

REVISION EXERCISES

1. Analyze the effects of urbanization?
2. Develop the your model of the concentric model of the town
3. Outline the types of settlements

FISHING IN ZAMBIA AND THE SUB-REGION

FISHING IN ZAMBIA

Importance of Fishing

- It is a source employment to the people
- It is a tourist attraction
- It is a source of income to the people and the government.
- It is a basis for some industries like the fish canning, boat and net making industries.
- It is also a source of foreign exchange through export of fish to other countries.

MAJOR FISHERIES IN ZAMBIA

- A fishery is a
- Place where fish is caught e.g. lake, swamp or fish pond. Chief fisheries in Zambia are

Lake Tanganyika

- There are individual fishermen and commercial fishermen.
- Scoop nets are used to catch Kapenta.
- Gill nets are used for Nile perch (BukaBuka). , lake sardines(dagga).
- A training school is at mpulanga.
- The problem faced by the fishery is distance to the market, Lusaka and the copper belt.

Bangweulu

- Gill nets are used mostly. Also seine nets lines, spears and baskets are used.
- Fish caught: Breams, Bull dog, Tiger fish, Barbell.
- Poor transport makes fish to be dried either by fire or sun.

There is little trade in fresh fish

Mweru – Luapula

- Gill nets are the most common lines and traps are the most common, scoop nets, lusenga nets are used for type of Kapenta called Chisense.
- Fish caught – bream, snout fish, tiger fish, mua fish, barbell.
- Most of the fish is sold fresh.
- There is an ice plant at Kashikishi.

Lake Kariba

- Gill nets are used for bream tiger fish and scoop nets for Kapenta.
- A fishing training centre is at sinazongwe where they make and repair nets, boat making and servicing engines.

Kafue fishery

- Gill nets are the most common method of fishing. Seine nets are banned.
- Fish caught in the Kafue fishery is; pike bream, Barbel, Bull dog, bottlenose.
- Fresh fish has great demand in urban centres of Lusaka, kabwe and Ndola
- Other fisheries include lukanga swamps, bulozi flood plain, Luangwa and fish farm ponds.

FISHING METHODS USED

1. **Small scale fishing methods. (Subsistence methods)**

- These are also called substance fishing methods.
- Methods used are those used to catch fish for home consumption.
- Examples of methods used are hooks,spears,basket,traps,poison and hand nets.

2. **Large scale of fishing methods (Commercialse methods)**

- These are also called commercial fishing methods.
- It involves use of fishing methods used to catch fish for sale.
- Methods used are the Seine nets or Draw nets,Gill nets and trawl nets.

PROCESSING OF FISH IN READINESS FOR TRADE

- The following methods of processing fish are used in Zambia and these are: smoking, salting, and sun drying and freezing.
- Frozen fish is common where refrigeration equipment is available e.gKashikishi, Sinazongwe, Kafue, mpulungu and Lusaka
- Most of the fish is marketed locally because there is high demand.
- Most fish from Lake Bangweulu and Mweru is marketed on the Copperbelt,
- Fish from Kariba, Kafue upper Zambezi is marketed in Lusaka.
- From Lake Tanganyika, market is also found in the copperbelt, Livingstone and other parts of Zambia.

- Fresh Kapenta and Buka fish are exported to Congo D.R, Zimbabwe, Namibia and Swaziland. Dry fish is also exported to D.R Congo

CHALLENGES FACED BY THE FISHING INDUSTRY

- Poor transport system in some fisheries.
- Lack of storage facilities in most fisheries
- Lack of capital among fishermen
- Lack of modern fishing skills among many fishermen
- Overfishing
- Lack of fuelwood

EFFORTS MADE BY THE GOVERNMENT TO BOOST FISHING.

- Discouraging of some fishing method like use of seine nets which even catches the smallest type of fish.
- Establishment of a boat making factory and net making factory at Kafue.
- Establishment of fish farming throughout the country.
- Establishment of the fisheries department to control fishing
- Introduction of fish bans during the certain period of the year to allow fish to breed.
- Introduction of new fishing methods like trawling
- Introduction of stiffer punishment to all those found catching fish during the fish ban.
- Maintenance of roads going to fishing areas
- Opening of a cold storage company in Mpulungu and Kashikishi where they store fresh fish.
- Provide special facilities to train local people and improve their fishing methods. E.g.
- Training schools at Mpulungu on Lake Tanganyika and Sinazongwe on Lake Kariba.

FISHING IN THE SUB - REGION

FISHING IN NAMIBIA

Types of fish

- About 99% of fishing in Namibia is Marine based.
- Namibia is well-known for many species of fish. Some of the most important commercial types are:

Orange roughy: Highly prized deep water fish caught at Gendor, world's leading Orange rough exporting town

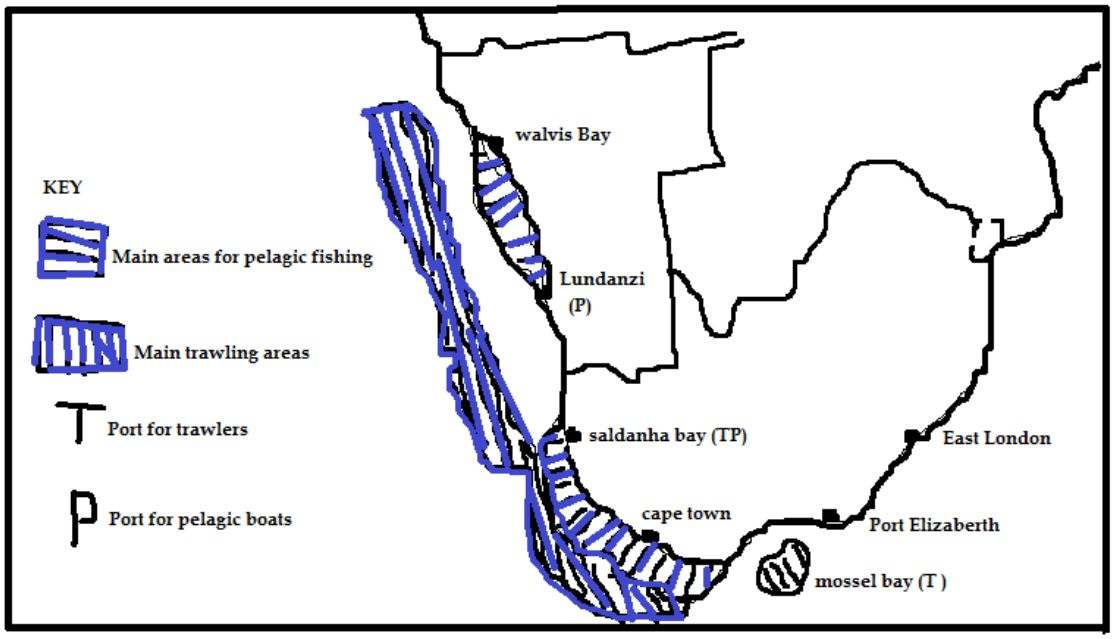
Hake: Plentiful in Namibia waters. Stokes have greatly increased

Pilchard: Pelagic species adversely affected by environmental conditions of the early and mid 1990's. In 1998, Total allowance catch (TAC) was 65, 000 tonnes

Horse mackerel: TAC declined from 1994 to 1997. By 1998 however, 1,900,000 tonnes were recorded

TYPES OF FISHERIES

The main and most important fisheries of Namibia are 146



- **Demersal**: specializes in hake, monk, king lip, sole
- **Midwater** : Targets horse mackerel

  Purse seine: Pilchard and horse mackerels are caught

  Deep water: Mostly orange roughly and alfonsino are caught

  Tuna: Varieties fished here include albacore big-eye, yellow-fin and skip-jack

  Rock Lobster – Based in Luderitz and brings live lobsters ashore daily

  Crab: Uses, traps to catch deep sea crabs

  Monk: Monk production is declining. Normally fished as a by- catch of hake

PRODUCTION PATTERNS

- In 1992-1993, and 1995 and 1997, there was a decline in fish production. This was because of the adverse environmental conditions.
- The temperatures were not good for breeding.
- Well articulated resource management policies by the government also led to a systematic recovery of fish stocks in Namibia
- It has been observed that the fishing industry faces short and long term changes every decade due to the Benguela warm water events termed as the Benguela El Ninos.
- These El Ninos occurred in 1963, 1974, 1984, and 1995.

THREATS/ CONSTRAINTS TO THE FISHING INDUSTRY IN NAMIBIA

Among the many issues that challenge fishing in Namibia are the following

1. **El Nino-** the impact of the 'El Nino' in 1995 heated the waters beyond average temperature for fish to live in.
2. **Pollution**- if not closely checked pollution, especially oil spillages, can be destructive to aquatic life.
3. **Depletion-** the total amount of fish cannot be expected to increase indefinitely since the demand is getting bigger.
4. **Company structure**- large company structures are not always the best and most profitable because they may lead to irresponsible destruction and over- exploitation of resources.
5. **Accidents**- Aging machinery cause accidents when not properly maintained, the most common being sinking of the vessel.
6. **Fires**- Fires are hazards that cause a lot of damage to human life, fishing vessels, fish and the environment.

SOLUTIONS TO PROBLEMS

- **Climate**- the ministry of fisheries and Marine Resources is trying to develop the scientific capability to monitor and receive precise forecasts of weather and climates.
- **Pollution** – this has been done by monitoring potential sources of pollution, including foreign vessels on their waters.
- **Depletion** – in order to guard against depletion of fish, there must be greater emphasis on value added fisheries which will continue bringing in high quality fish which could still fetch a lot of money in spite of the quantity going down.
- **Company structure** – Namibia should maintain small and medium sized companies which are mostly locally owned. There is more concern on sustainable fishing and utilization of the resource. Smaller companies enhance accountability.
- **Injuries, fires, sinking and aging machinery** – the ministry monitors safety standards and enforces strict adherence to Namibia fishing regulations.
- **Accidents** – these can be controlled to some extent by ensuring that fleets and other fishing vessels have fitness certificates. Such actions will improve the safety and standards of fleets.

- **Flags of convenience** – the use of flags of convenience on fishing vessels should be closely monitored by the Ministry of Fisheries and Marine Resources
- **Limited access** – Limited access the Namibian government uses the limited access to the fisheries method which cuts down on the numbers of participants within any given fishery.

National policies and measures

- Tight monitoring, control and general surveillance of the fishing activities
- Namibia undertook the reclaiming of its waters from Spaniards and Russians after independence.

The Ministry of Fisheries and Marine Resources is working towards

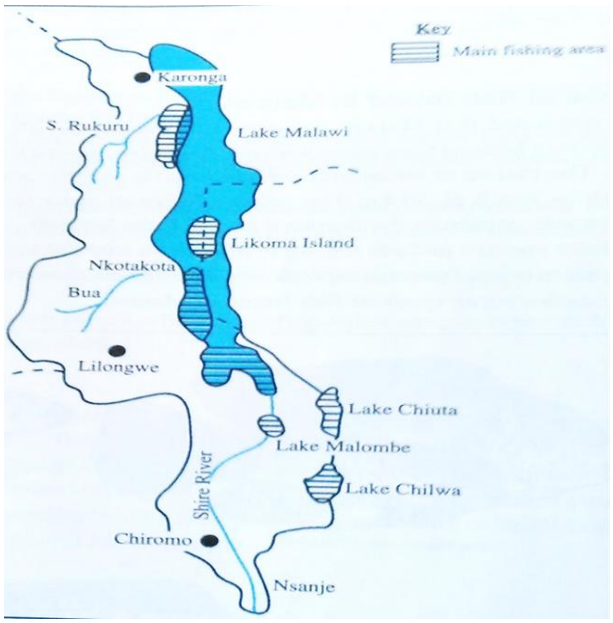
- The promotion and regulation of sustainable utilization of marine ecosystems

FISHING IN MALAWI

IMPONTANCEOF FISHING

- It is a source employment to the people of Malawi
- It is a tourist attraction
- It is a source of income to the people of Malawi and the GOVT.
- It is a basis for some industries like the fish canning, boat and net making industries.
- It is also a source of foreign exchange through export of fish to other countries.

FISHING AREAS IN MALAWI



Lake Malawi

- It is the biggest fishing area in Malawi.it covers almost the all eastern part Malawi.
- Fishing is mainly done in the southern part because the lake is shallow such that it allows fish to breed very fast.
- The southern part also allows the growth of plankton which is food for fish.

Lake Chiuta

Lake Malombe

- Lake Chilwa
- Shire River where subsistence fishing is very common.

FISHING METHODS USED

3. **Small scale fishing methods.**
    - These are also called substance fishing methods.
    - Methods used are those used to catch fish for home consumption.
    - Examples of methods used are hooks, spears, basket, traps, poison and hand nets.
4. **Large scale of fishing methods**
    - These are also called commercial fishing methods.

- It involves use of fishing methods used to catch fish for sale.
- Methods used are the Seine nets or Draw nets, Gill nets and trawl nets.

TYPES OF FISH COUGHT

- Malawi has over 400 types of fish.
- The main types of fish are Chambo or Bream, Nchila, Utaka, Catfish is caught for the home consumption.
- The Usipa (Sardines) is commonly caught in the Northern part of Lake Malawi.
- Other types include the small Mbuma fish which is ornamental fish (for decorations),Cichlids, sungwa, Mpasa,Sonjika,Mcheni,Kamango and Vumbu.

PROCESSING OF FISH

- The following methods of processing fish are used in Malawi and these are smoking,salting,sun drying and freezing.

PRODUCTION AND MARKETING OF FISH

Production of fish has increased because of the following reasons:

- Expansion of large scale fishing in the south of Lake Malawi
- Establishment of a net making in Blantyre-Limbe which enables people to catch more fish.
- Development of dams throughout the country where fish farming is done and this has increased fish production.
- Establishment of refrigerated trucks and an ice making plant.
- Most of the caught by small scale fishermen is sun dried and smoked.
- Fresh fish I transported to the cold storage company in Blantyre-limbe using refrigerated trucks.
- The vendors then buy and resell accordingly
- Mbuma fish is exported to Europe and USA because it is ornamental fish.
- A small percentage of dry fish is exported to Congo D.R. and Mozambique

EFFORTS MADE BY THE GOVT TO BOOST FISHING.

- Establishment of the fisheries department to control fishing.
- Introduction of fish bans during the certain period of the year to allow fish to breed.
- Establishment of fish farming throughout the country.
- Opening of a cold storage company in Blantyre-Limbe where they store fresh fish.
- Introduction of new fishing methods like trawling
- Discouraging of some fishing method like use of seine nets which even catches the smallest type of fish.
- Introduction of stiffer punishment to all those found catching fish during the fish ban.
- Establishment of a boat making factory and net making factory in Blantyre-Limbe.
- Allowing people to export fish to other countries like Europe,U.S.A
- Maintenance of roads going to fishing areas,

REVISION QUESTIONS

1. What are the threats/ constraints to the fishing industry in Namibia?
2. Discuss the solutions to the above constraints
3. Give reasons why the fishing industry is importance
4. Mention the major fishing methods used by both small scale and commercial fishermen
5. Discuss the methods used by fishermen in processing fish in readiness for trade
6. What are the major problems faced by the fishermen in Zambia
7. Discuss the effort made by the government of Zambia to boost the fishing industry

POWER AND ENERGY ZAMBIA

IMPORTANCE

- It has stimulated both small and heavy industries
- It has stimulated commercial agricultural activities
- It has created employment
- It has stimulated demand for electrical appliances
- ZESCO exports power to neighboring countries and earns foreign exchange

SOURCES OF POWER

- H.E.P
- Thermal electricity
- Solar electricity
- Coal
- Petroleum
- Wood fuel

1. TYPES OF ELECTRICITY

- Thermal electricity is the power got by burning fuel in either steam or diesel engines
- Solar is electrical power which is got from sunlight through solar panels
- Hydroelectric is when they use the force of running water to generate electricity.
- A reservoir is made by building a concrete wall across the river.
- It is built where rainfall is high or constant supply of water. It also needs a large domestic and industrial market

PRODUCTION OF HYDRO ELECTRICITY

- Dam or reservoir stores water
- Water flows in steep slope pen stock
- Fast running water turns turbines
- The turbine turns the generator
- The generator produces electricity which goes in a transformer
- Electricity produced reaches homes

USE OF ELECTRICITY

INDUSTRIAL USE

The power is used in industries for lighting, driving machinery, processing and manufacturing.

DOMESTIC USE

- In homes (domestic) it is used for lighting, cooking, and operation of electrical appliances.

COMMERCIAL USE

- In commercial establishments it is used for lighting, operating tills, e.t.c.

ADVANTAGES OF HYDRO ELECTRICITY

- It is a renewable resource
- It is clean and does not cause pollution
- It is easily transported through cables
- It has a broad range of uses in modern households and agriculture
- It is cheaper as compared to thermal
- Ease to use, it is a matter of a flick

DISADVANTAGES OF HYDRO ELECTRICITY

- High cost of building a power station
- It is affected by drought
- It cannot be stirred like petroleum
- Leads to re allocation of people when constructing

SUPPLY

The companies which generate and distribute electricity are ZESCO and copperbeltenergy

The following are the power stations found in Zambia:

a) Karibahydroelectric power station supplies power to Lusaka, copperbelt and central provinces

c) Victoria falls supplies power to Livingstone, Mongu, Kalabo, Senanga and Sesheke

d) Kafue HEP station was constructed at Kafue gorge in 1972 and supplies lusaka, central and copperbelt provinces

ZAMBIA'S MINOR H.E.P STATIONS INCLUDE:

- Chishimba Falls (6 mw) power station in Kasama
- Lunsefwa (18mw)
- Lunzuwa power station found in Mbala
- Lusiwasi (12 mw), power station in Serenje
- MulungushiHEP (20 mw) supplies power to Kabwe, lead and Zinc mines,
- Musonda falls (8 mw) power station in Mansa

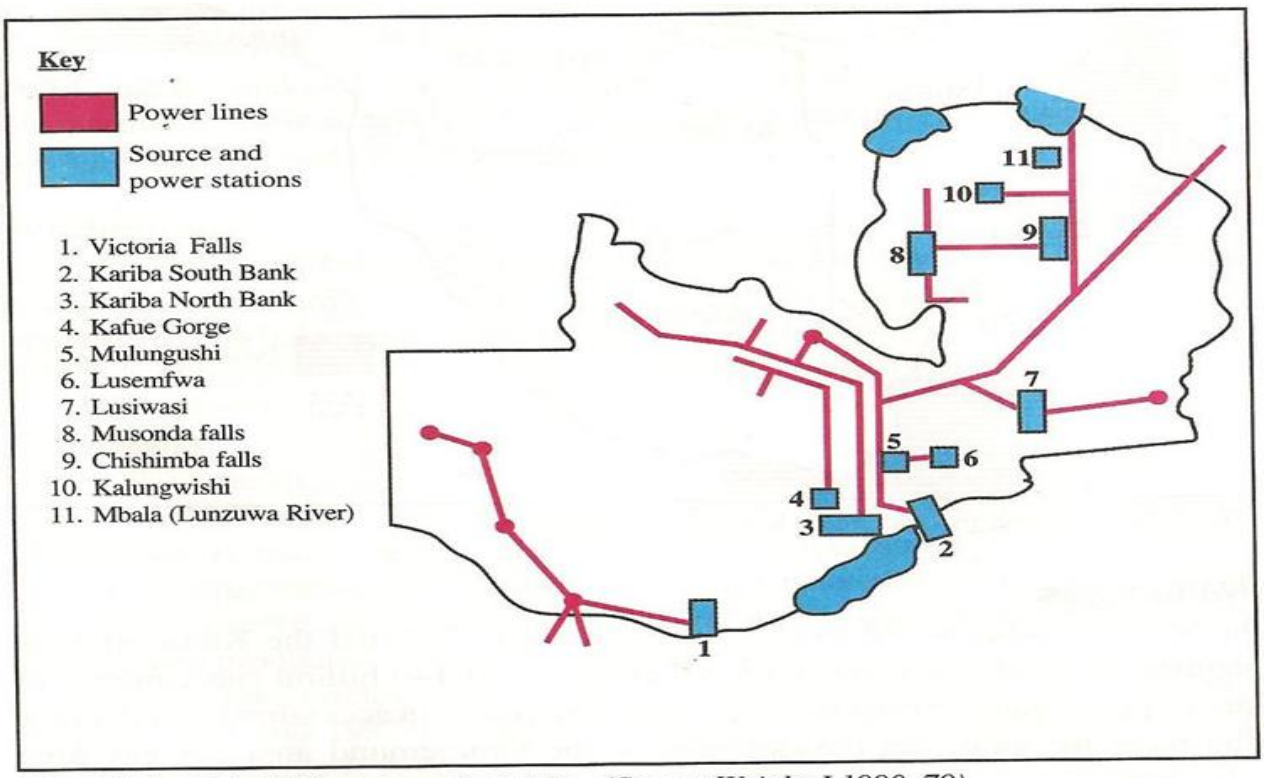


Fig. 5.5 Zambia's HEP stations electricity. (Source Wright J 1990, 79)

3. COAL

- It is mined in the Gwembe basin at Maamba in southern province
- Power stations of coal are in Lusaka and copperbelt

3. **WOODFUEL**

- It is mainly used in rural and urban for cooking
- It has the disadvantage of deforestation

4. **PETROLEUM OR CRUDE OIL**

- Zambia has no oil resources of its own
- It imports oil from the middle east using the port of Dar-es-salaam
- They use TAZAMA pipeline
- This is used to run engines

Advantages of Zambia importing crude oil:

- Able to collect the byproducts of crude oil
- It is cheaper

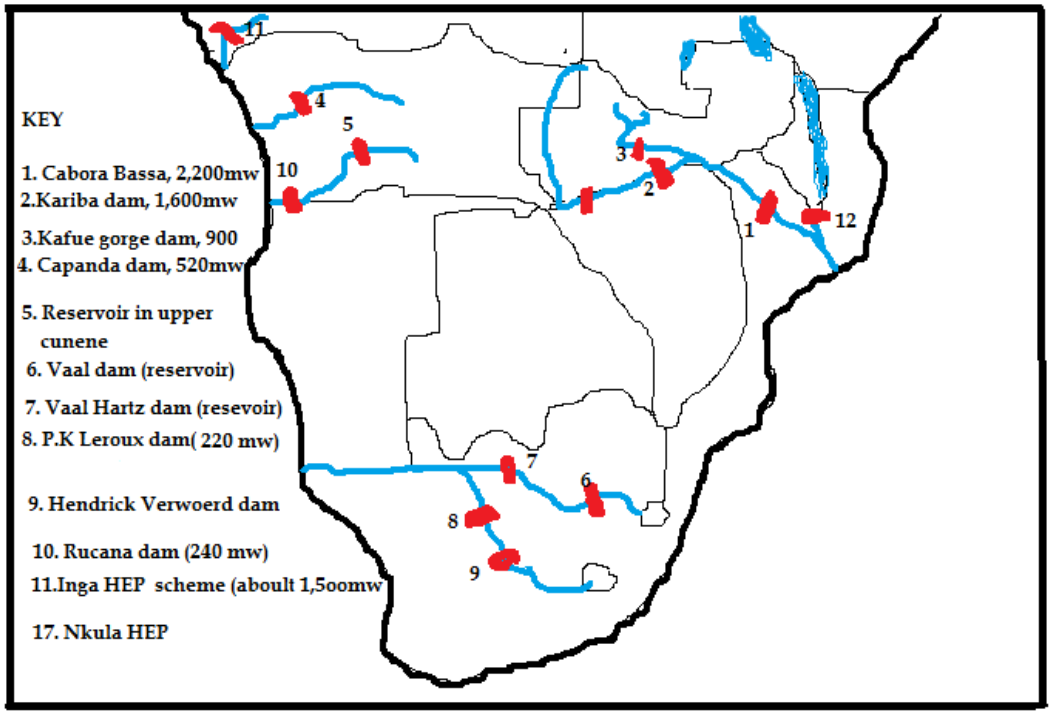
Bad effects of the high costs of fuel on the national economy:

- Huge sums of money on the national budget is spent on fuel instead of other developmental programs
- Transport becomes expensive
- Social amenities suffer at the expense of fuel prices
- Low wages and salaries

POWER AND ENERGY IN THE SUB REGION

Major hydropower stations in the sub region include:

- Coborabossa (2200km)
- Kariba dam (1600)
- Inga HEP (1500)



Trade in energy within the region

- The southern Africa Development Community (SADC) has been working towards intergrading the national electric power grids of member countries into one regional power grid.
- This would link up all power generating units within the region by a system of pylons and high tension wires.
- Already, power grids of South Africa, Namibia, Botswana, Zimbabwe, Mozambique, Zambia and Congo DR are inter linked. The Zambia- Tanzania inters- connector project will link Zambia and Tanzania with 200 mw of power from Zambia.
- Zambia will supply this power by a 220 kv 0r 330kv transmission line and will earn an estimated US$153 million per year.

Sustainable energy production in the Sub- Region

- Sustainability is the capacity of people or institutions to continue to provide goods and services without fail.

- Energy sources such as coal, petroleum and natural gas are depleted at one point, hence are not sustainable.
- However, Hydro- electric power is sustainable.

HOW HYDRO – ELECTRIC POWER CAN BE PROVIDED IN A SUSTAINABLE WAY

- The catchment areas and courses of rivers must not be deforested
- Equipment's at HEP stations must be maintained and replaced from time to time.
- Enough storage dams must be constructed to hold enough water for use during dry season.

MEASURES TO ENSURE SUSTAINABLE ENERGY PRODUCTION IN THE SUB-REGION

- Stock-pilling of other energy sources like petroleum, coal and natural gas for future use**.**
- Recycling is another way of ensuring sustainability.

Threats to sustainable energy production

There are many threats to sustainable energy production.

The main ones among these are as follows:

- **Uncontrolled increase in human population**- rapidly growing human populations create immense pressure on food production, provision of Electricity to houses at an ever increasing rate, provision of clothing, provision of ever increasing quantities of water for domestic use and demands for quantities of fuel and power.
- **Lack of long term planning-** hydro power plants and their sustainability should be planned on along term basis. Long term plans should be made, for example on;

- Maintenance of generating machinery such as servicing, complete overhaul and replacement.

- How to increase the discharge of tributary rivers into the main river.

- How to hold and store floodwaters in order to increase generating capacity in dry months and maintain high water levels in reservoirs.

- **Inability to put aside financial resources to support maintenance and replacement of equipment**- lack of funding for maintenance of Hydro- Power plants and for replacement of equipment and spare parts greatly threats sustainability of Hydro- power plants.

PROBLEMS ASSOCIATED WITH ENERGY PRODUCTION AND PROVISION IN THE REGION.

- Inaccessibility to electricity by a large number of rural people even in countries where surplus power has been produced.
- Electricity grids of SADC countries are not all connected and this makes it difficult for countries with power deficiency to access power from those that have surplus.
- Southern Africa countries have little access to cheap crude petroleum produced in the region (e.g. Angola) because of contractual arrangements with energy mining companies buy most of the crude oil.
- Lack of technical know- how prevents countries that have known deposits of natural gas to exploit them to meet the local demand for energy.
- Political interference.

REVISION QUESTIONS

1. **With specific reference to power and energy in Zambian**
   i. Discuss conditions needed for the construction of a Hydro- electric power station
   ii. Explain the advantages of Hydro electricity over other forms of energy (4).
   iii. List any two sources of power in Zambia
2. What are renewable resources
3. what problems associated with energy production and provision in the region
4. Discuss the Threats to sustainable energy production in the sub-region.
5. Mention measures to ensure sustainable energy production in the sub-region

PROCESSING AND MANUFACTERING INDUSTRIES IN ZAMBIA AND THE SUB REGION

Importance of industries

- They provide employment to the people
- They increase the national wealth
- They enable a country to earn foreign exchange
- They help to improve the standard of living of the people

TYPES OF INDUSTRIES

Primary industries

- These involve the extraction and production of raw materials from the environment
- Examples of these industries are farming, mining, forestry and fishing

Secondary industries

- These are industries that use machinery to change raw materials into new products by adding value to the items made and they are divided into the following industries :

a) Processing industries

- They prepare primary produce before they can be used for example maize into mealie meal

b) Manufacturing industries

- It changes raw materials into new products e.g. sugar cane into sugar

Service or tertiary industries

- It is an industry which provide services like education, banks, health, security and transport

Quaternary industries

- It is a new industry which came into existence in the 1980s
- This type of industry is like tertiary but it does not produce any thing
- It is involved with office work and research work

CLASSIFICATION OF INDUSTRIES

a) Heavy industries use machinery and produces large quantities of raw materials

b) Light industries use small amounts of raw materials and light machinery

c) Factory industry it is an industry which is factory based and needs heavy capital, land, machinery and large labour force

d) Cottage industry is an industry which is home based and is mainly practiced by individuals, small families or cooperatives e.g. making of baskets, chairs, tables animal and human shapes

FACTORS INFLUENCING THE LOCATION OF INDUSTRIES

- An industry needs to be located near cheap transport
- Raw materials are processed close to where they are found in order to cut on transport
- Abundant labour includes both skilled and unskilled labour force and is needed in an industry
- Power is needed for most industries to operate properly
- Government policies encourage the establishment of industries in all parts of the country in order to ensure equitable**.**

PROBLEMS FACING MANUFACTURING INDUSTRIES IN ZAMBIA

- High energy costs especially to electricity whose rates increases frequently
- Long routes to sea makes the transportation of goods expensive
- Many industries depend on imported raw materials
- Stiff competition for the produce at local and international level due to their poor quality
- Frequent depreciation of the currency

IMPACT OF PROCESSING AND MANUFACTURING ACTIVITIES ON THE ENVIRONMENT

- Air pollution resulting from emissions of pollutants
- Contributing to climate change by altering the chemical composition of the atmosphere
- Water pollution through the discharge of effluent (liquid waste)
- Land pollution through leakages and dumping of solid wastes
- Hazardous materials used in industries if not properly handled can cause damage to the environment
- The environment is also at risk from exposure to dangerous radiation from industrial machines such as x-rays

- Vegetation is affected by acid rain. In Kankoyo (Mufulira), roofs were corroded by acid rain. In Kabwe, deforestation was being accelerated by mining activities.
- Bio- diversity is destroyed by chemicals and dumping of waste from industries.

GOVERNMENT POLICY ON INDUSTRIAL DEVELOPMENT IN ZAMBIA

HISTORY AND CURRENT DEVELOPMENT OF INDUSTRIES IN ZAMBIA

It is basically divided into three stages and these are:

a) Pre independence period

- During this period most of the industries were not fully developed in that the government was only importing most of the goods from the developed countries

- It was during this period that Zambian federal government was given the role to produce copper and other minerals

b) The post colonial period up to 1991

- After independence the government formed the industrial development cooperation (INDECO) which aimed at improving industrial development
- By 1968 INDECO controlled about 68 companies
- It made the government to achieve the following :
  - I) Employment opportunities were increased
  - II) Foreign exchange was saved by reducing on the importation of goods
  - III) The country started all sorts of industries, for example agriculture and tourism

c) The post 1991 period

- After changing the government in 1991, the new government brought in new ideas of bringing new investment into the system in order to improve the quality of products
- The new policy was called structural adjustment program
- The policy involved the following :

i) Privatization

- It is the transfer of state owned companies and industries to individuals or private investors
- Companies which were sold were Nakambala sugar estate, Kawambwa tea, Chilanga cement and many others

THE AIM OF THE POLICY OF PRIVATIZATION

- To bring new capital investment into the enterprises.
- To enhance efficiency of operation of companies
- To improve quality of products.
- To reduce over employment in former state enterprises**.**

ii) Liquidation

- This is the selling of unprofitable and unsuccessful state companies by dividing up their shares to pay the debts e.g. UBZ and Zambia airways

iii) Liberalization

- This meant that the government was not going to involve itself in the control of prices and even to restrict the flow of goods and services in and outside the country.

THE AIM OF THE POLICY OF LIBERALIZATION

- To allow imports without restrictions so as to give consumers a choice.
- To encourage many players in the production and sale of goods in the market.
- To promote competition in the market.
- To reduce or abolish monopolies in the manufacture of goods.

iv) Withdraw of subsides

- The money which the government was giving to various companies was removed
- People now stated paying fees in schools , colleges, universities and even in health institutions

ADVANTAGES OF STRUCTURAL ADJUSTMENT PROGRAMME

- It has shown an improvement in transport sector due to the introduction of efficient motor vehicles
- There has been no shortage of goods on the market
- Local companies have been forced to work hard in order to compete with international companies

DISADVANTAGES OF STRUCTURAL ADJUSTMENT PROGRAMME

- Most Zambians have lost employment due to massive retrenchment
- There has been un controlled price hikes in the country
- Life has become difficulty for most people
- It has brought the birth of most towns
- Exploitation of man power by investor

MANUFACTURING CENTRES OF ZAMBIA

Most of the industries in these are located in these areas due to:

a) Copperbelt

- Good network of transport by road or rail
- Cheap and plenty hydro electric power from Kariba and Kafue gorges
- Cheap and plenty of labour
- Ready market provided by many people who are in copperbelt

b) Lusaka

- Good network of transport
- Its centrally located
- Nearer to areas of raw materials
- It has access to hydro electric power
- Large population improves the marketing of goods and even provides cheap labour

NEGATIVE IMPACTS OF THE POLICY OF LIBERALIZATION AND PRIVATIZATION

- Close of some enterprises which could not compete in the new economic environment. eg Mansa batteries, Kapiri Glass factory.
- Decline in manufacturing activities in the country.
- Dumping of foreign goods on the local market.
- Flooding of the domestic market with all kinds of imported goods
- Loss of Jobs to many people due to retrenchments.
- Many state enterprises like chilanga cement and Zambian Breweries were privatized.
- Relocation of some manufacturing industries to other countries, eg Dunlop.

PROCESSING AND MANUFACTURING IN THE SUB-REGION

ZIMBABWE

THE TEXTILE INDUSTRY

- Agricultural based industry

- An example of import substitution
- Involves both processing and manufacturing

LOCATION

- Access to transport routes such as roads and railways
- Close to cotton farms such as kadoma, chegutu
- Closely integrated
- Proximity to large market areas

COTTON PROCESSING AND CLOTH MANUFACTURING

There are three stages involved;

8. **Ginning**

- The lint is separated from the seed
- Lint is cotton fibres that surround a cotton seed
- Lint is sent for spinning
- The seed is sent for production of cooking oil
- Residue from the oil is made into stock feed

9. **Spinning**

- Yarn and cotton wool are produced
- Yarn is a strand of cotton fibre
- Cotton wool/absorbent cotton is one whose natural wax is removed but is un processed

3. **Weaving/knitting**

- Weaving: yarn is blended with wool or polyester to produce cloth such as shirts, trousers
- Knitting: produces heavy cloth like jerseys, blankets

SOUTH AFRICA

SA is the largest industrial nation in Africa because;

- It Produces half of all electricity produced in Africa
- Exports more than any other country in Africa
- Best transport and communication system just like Europe
- Has diverse industries

IRON AND STEEL

- Highly integrated
- Concentrated around the rand region

FACTORS SUPPORTING IRON AND STEEL INDUSTRY IN SA

- Abundant Coal and iron ore deposits
- Large market for iron and steel products
- Availability of water from the Vaal and Natal rivers
- Favourable government policy

IMPORTANCCE OF IRON AND STEEL INDUSTRY

- Import substitution allows the country to save money
- Provide raw materials for the growth of other industries such as production of motor vehicles
- Led to further mining at the rand and other areas
- Essential to modern construction industry

EXERCISE

1. Clearly explain the difference between processing and manufacturing

2. Explain why the government of Zambia is promoting the development of processing and manufacturing industries in Zambia.

3. What factors have limited the development of processing and manufacturing industries in Zambia?

4. **With reference to Processing and manufacturing industry in Zambia:**

   (a) Explain **fou**r factors affecting the location of manufacturing industries (4)
   (b) Discuss any **four** problems faced by manufacturing and processing industries (4)
   (c) Mention any two impact that processing and manufacturing activities may bring on the environment (2)

TOURISM IN ZAMBIA

- Tourism is the movement of people from one place to another for leisure education, religion
- A tourist is a person who travels to another place for leisure and recreation education within their own country

IMPORTANCE OF TOURISM

- brings foreign exchange to the country
- conservation means any wise use of vegetation and animals
- it encourages conservation of wild life
- it helps people to maintain culture and historical sites
- it improves other areas of the economy like airports, hotels and transport
- it promotes cottage industry/ home based industries
- provides employment to the people of Zambia
- provides market for farm products
- wild life means any wild animal and any kind of natural vegetation

IMPORTANCE OF WILD LIFE

- Animals are a tourist attraction
- Creates the balance of nature
- Future generations need to see these animals

- Many people enjoy watching wildlife
- Wild animals gives us meat, skins for many products
- Wild life is connected to the food chain

Differences between game management and Game Park are:

- Game management area has people living in as well as people
- Game park is a place reserved only for animals
- A game management has few animals as compared to a game park
- A game management has a small area while a game park has a big area
- In a game management hunting is allowed while in a game park it is not allowed

DANGERS TO WILD LIFE

- Deforestation which means an necessary cutting down of trees
- Droughts
- Late bush burning which destroys trees or vegetation
- Many animals are being killed by poachers
- Overstocking.(keeping of many animals on a small piece of land)

SOLUTIONS TO THESE DANGERS

- Stiff punishments must be given to poachers
- Game cropping must be done. This means selective killing of old animals which have become too many
- Afforestation which means planting of trees where the natural vegetation has been cleared
- Early burning must be encouraged

TOURIST ATTRACTIONS

- Tourist attractions are things which people come to see in Zambia

  Some of the tourist attractions of Zambia are:
- Natural resources and this includes rivers, lakes, mountains, waterfalls
- Cultural activities
- Historical sites are sites or areas where certain events took place in the past e.gNachikuvu, Mwela, Nsaluetc

- Museums like Livingstone, Lusaka and Motomoto
- National parks and game reserves
- Traditional ceremonies such as kuomboka, umutomoloetc
- Good or favourable climate

PROBLEMS FACED BY TOURISM INDUSTRY

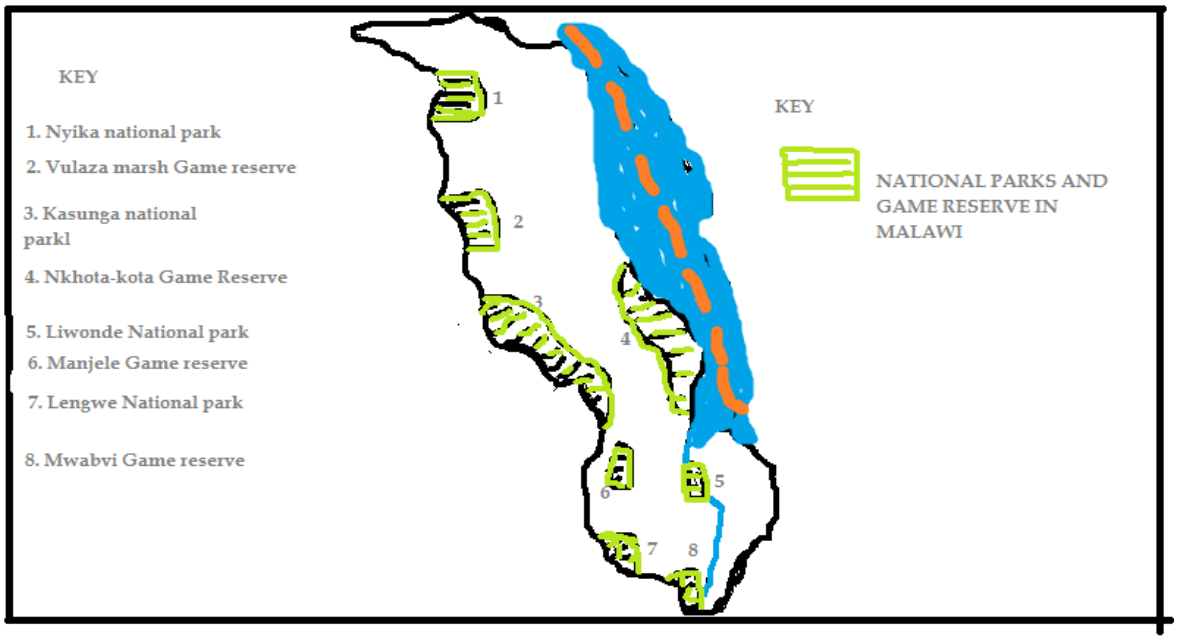
- Bad roads which goes to some tourist attractions especially in the rain season
- Un favorable or bad climate e.g. high temperatures
- Tourism industry is seasonal. It is active in the dry season
- Adoption foreign cultures from western countries like USA and Britain
- Very few tourist infrastructure like lodges
- Floods and droughts

GOVERNMENTS EFFORTS TO BOOST OR PROMOTE TOURISM

- Banning of selling of ivory
- Catering of foreign foods
- Employment of game guards to protect wild animals
- Encourage people to conserve or protect tourism
- Encourage people to invest in tourism
- Improvement of community facilities of people living in Game management areas
- Introducing stiff punishments to poachers
- The GOVT has formed the Zambia National Tourist Board to control tourism in Zambia

TOURISM IN THE SUB-REGION

1.0.TOURISM IN MALAWI.



1) **National parks and Game Reserves.**

- Malawi has five National parks and four Game Reserves.
- The National parks are Nyika, Kasungu, LakeMalawi (marine national park),
- The Game Reserves are vulanza,Mwanvi,Nkhota Kota and Majeje.

2) **Natural Resources.**

- Important rivers and lakes are Shire River,LakeChirwa,LakeChiuta,LakeMalombeand Lake Malawi.
- This also includes mountains like Nyika,Vipya and mlanje.it also includes natural vegetation of Malawi.

3) Historical sites e.g. the independence arch along kamuzu high way.
4) Friendly people and stable GOVT.
5) Good and favorable climate e.g. Very hot summers and cool winters.

PROBLEMS OF TOURISM IN MALAWI

- Inadequate infrastructure e.g. hotels.

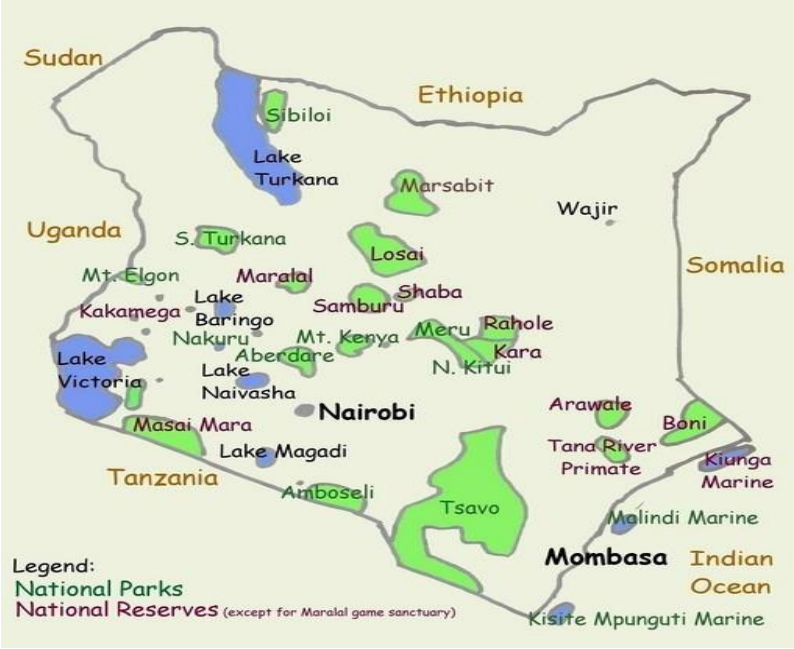
- Lack of certain types of food for some international tourists.
- Lack of national air line.
- Limited number of tourist due to stiff competition with other countries.
- Poor network of transport to tourist attraction.
- Some tourists come as spies
- The activity is seasonal. It is very active in the dry season.
- They have no offices in foreign countries to advertise tourism outside Malawi.

GOVTS EFFORTS TO BOOST TOURISM

- Advertisement of tourism inside and outside Malawi through magazines, radio and news papers.
- Allowing people to invest in tourism by privatizing some tourist attractions
- By encouraging people to conceive wildlife and natural resources
- By joining the African tourist board which helps in advertising the tourist attraction found in member countries.
- Developing of infrastructures like roads and clinics.
- Establishment of tourist board of Malawi to control tourism.

TOURISM IN KENYA

TOURISM ATTRACTION



a) National parks and Game Reserves.

- Kenyan has many national parks and game reserves.
- Some of the national parks and game reserves found in Kenya are

  Amboseli, Tsavo, Meru, Nsumbu, Masai, MarsabitandeNakuru.

b) Coastal Resorts

- There are so many beaches along the coasts of the IndianOcean.
- The country has about 300km of coastline.
- Tourist centers along the coast are Diana beaches South of Mombasa and Mombasa port has beautiful sand beaches and marine features.

c) Scenic Attractions

- Kenya has natural resources like Kenya Mts,MtElgon,the great East Rift valley, volcanic peaks like Mau Range and Aberdare.

d) The Masai.

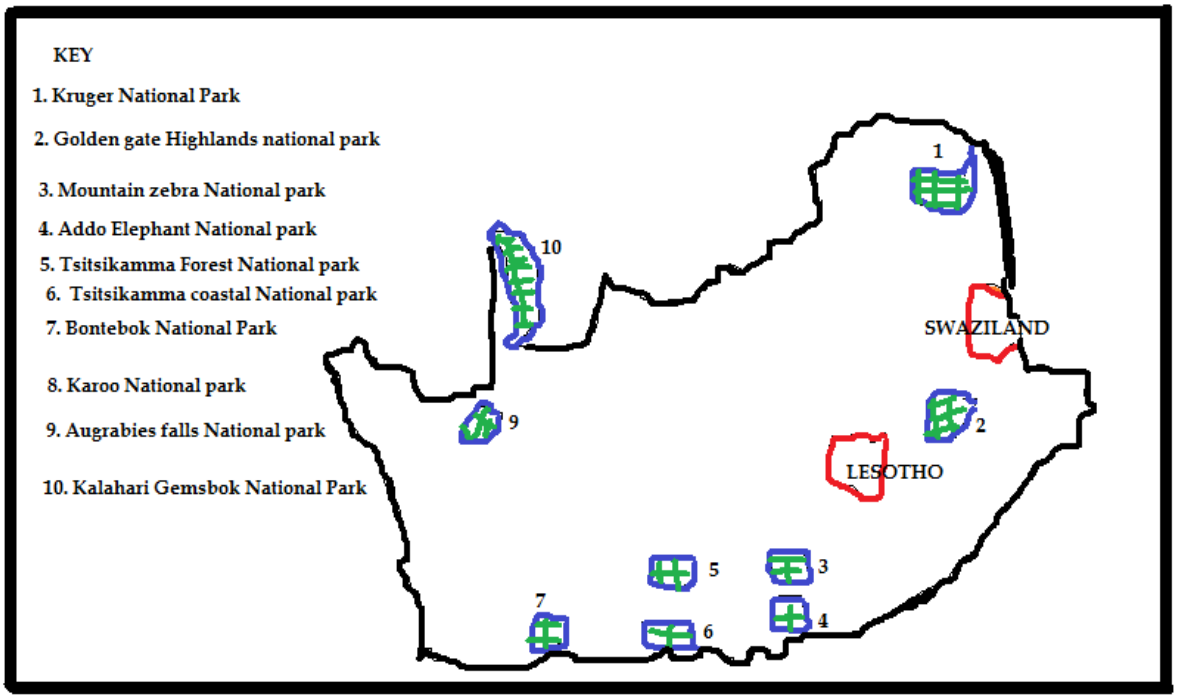
- The masai people perform some traditional ceremonies which attracts a lot of tourists
- This brings some foreign exchange to the government.
- The Masai people also use traditional way of grazing animals where they move from place to another in search for graving areas.

Tourism in Kenya is fully developed because:

- It has abundant wild life
- It has opened offices in foreign countries in Europe and USA.
- It has so many tourist attractions
- The country has been politically stable since independence
- The GOVT has embarked on the comprehensive training programme for tourism staff.
- The Kenyan GOVT advertises tourism inside and outside Kenya.

TOURISM IN SOUTH AFRICA

Map showing tourist attraction areas in South Africa



Tourism attraction

- Eco-tourism is the common type of tourism in South Africa.
- Eco-tourism includes beach attraction birds and animals watching, hiking, mountain climbing and visiting cultural heritage sites.

- Most of the beaches are found around Cape town,Durban,portElizaberth,and other coastal location.
- The favourableclimate (sunny Mediterranean summers and tropical climate) attracts a lot of tourists.
- The cable car ride to the top of the table bay mountain
- South Africa has 17 National parks with Kruger National as the largest park. It has an area of 19485 square kilometers.
- The main animals found in the Kruger National Park are Lions, Zebras, Leopards,Hoppotamus,cheetah,Giraffe,Elephant and Buffalo.
- The other national parks are Kalahari and Gemsbok,Bonebok,karoo, AddosGorden gate highlands and tsitsikammaforest.
- Robbenisland is a tourist attraction because this is where Nelson Mandela was imprisoned for almost 2 decades. Tourists visit the island to see the prison where the words famous political prisoner lived for a long time.

Constraints on tourism

- Competition for land for settlement and farming poses a danger to the national park distanceand game reserves.
- High crime rate especially in Johannesburg and Durban scare away tourists
- It hascontributed to destroying of local culture in south Africa
- Long distance between tourist attractions in South Africa.
- Mass tourism endangers the environment especially in the national parks and game reserves
- The activity is seasonal. It is very active in the dry season.
- The competition with other countries is high.
- There are some tourists who go to that country as spies.
- There is a high risk of infection with malaria, bilharzias and AIDS.

GOVERNMENT EFFORTS TO BOOST TOURISM

- Development of hotels, lodges in order to improve accommodation for tourist.

- Establishment of museums where visitors can obtain some past information.
- Establishment of the hotel board to manage and expand Accommodation for tourists
- Establishment of the tourist board or the department of tourism to control tourism in south Africa
- Maintenance of national parks

THE SOUTH AFRICA TOURISM INDUSTRY IS DEVELOPED BECAUSE:

- Of large capital investment in the industry.
- There is too much publicity mounted in Europe.
- High standard and efficient services in hotels and lodges, air and car hire films.
- Abundant cheap and comfortable accommodation offered by hotels, lodges and guest houses.

EXERCISE

1. Describe the main tourist attractions and activities
2. Explain the contribution of air transport to the development of the tourist industry.
3. Explain why the government of Malawian attaches great importance to the development of both domestic and international tourism
4. What is the Malawian government doing to the develop the tourism industry.

TRANSPORT AND COMMUNICATION IN ZAMBIA

TRANSPORT: Transportation is the movement of people and goods from one location to another

COMMUNICATION: is the exchange of information between people by means of speaking, writing, or using a common system of signs or behavior.

TYPES OF TRANSPORT AND COMMUNICATION USED IN ZAMBIA

- **ROAD TRANSPORT:** Road transport is sometimes called Land transportation
- Road transport is the dominant form of transportation in the world.
- Major roads which facilitate road transport in Zambia include: Great North Road, Great East road, Cairo road in Lusaka and other roads leading to various provinces and districts etc.
- People can move about land under their own power, either by walking or by other forms of human-powered transportation such as:
  - ❖ **Car**
  - ❖ **Bicycle**
  - ❖ **Ox-cart using animals.**

RAIL TRANSPORT: It is another important form of transport commonly used in Zambia

- In Zambia rail transport include the following:
  - ❖ **TAZARA Railway line:** This railway line starts from KapiriMposhi up to Dar-essalam in Tanzania**.**
  - ❖ The railway line is used to transport people, goods between Zambia and Tanzania.
  - ❖ **ZAMBIA RAILWAYS:** It runs from Livingstone via Lusaka up to copperbelt.

AIR TRANSPORT: Another transport used in Zambia

- Zambia has four international airports that is Kenneth Kaunda International Airport, Harry mwangaNkumbulaair port in Livingstone, Simon MwansaKapwepwe airport in Ndola and Mfuwe international airport in Chipata which provide services to various international and local airlines.

WATWER TRANSPORT: Another transport used in Zambia.

- Water transport in Zambia is used in areas which are close to rivers and lakes.

(B) COMMUNICATION

- A communication service is also provided by television and radio. e.g, ZNBC, MUV TV, radio phoenix.
- Communication services are also provided by print media such as Newspapers.eg, Post Newspaper, Zambia Daily Mail and Times of Zambia.
- Communication services is also provided by Internet services such as Facebook, twitter, whattsup
- In Zambia various means of communication are used such as phone, telecommunication and radio.
- Many utility companies such as MTN Zambia, Airtel, and Zamtel provide phone and telecommunication services to people.

IMPORTANCE OF TRANSPORT AND COMMUNICATION

- Exchange of information
- Movement of goods, services and People
- Promotes trade, allowing a nation to accumulate wealth and power.
- Reliable transportation allows a population to expand throughout a country's territory and to live comfortably in remote areas far from factories and farms.
- Transportation provides access to natural resources
- Transportation systems and the routes greatly influence both how and where people live.

PROBLEMS OF TRANSPORT AND COMMUNICATION

- Access to transport and communication infrastructure
- Inadequate safety standards
- Movement of goods and services slows
- Network failure hinders communication effectively

SOLUTIONS TO POOR TRANSPORT AND COMMUNICATION

- compliance with safety standards
- Infrastructure development,

- To improve network system.

Transport and Communication Prospects for landlocked countries

- Construction of new railways and roads.
- Maintenance of old roads and upgrading of gravel roads to bituminous standards.
- Regional integration.

EXERCISE

1. Discuss the importance of road and water transport to the economic development of the sub-region.
2. Name four areas in Zambia were water transport is important
3. What is the importance of feeder roads to the economy of Zambia?
4. Explain why countries in the sub-region are at different levels of development with regard to road and water transport
5. Describe some of the constraints of transport and communication in the sub-region

AGRICULTURE IN ZAMBIA AND THE SUB-REGION

AGRICULTURE IN ZAMBIA

- Agriculture is the growing of crops (arable farming) and keeping of domestic animals (pastoral farming) as well as keeping of birds (poultry farming) for sale (commercial) and for home consumption (subsistence farming)

LAND TENURE SYSTEMS

- This is the legal right to own land
- Land in Zambia is owned under tradititional (traditional land) and state (state land)
- This can be said to be a dual land tenure system
- **Leasehold**: owning land for the length of your lease agreement with the freeholder. When the lease ends, ownership returns to the freeholder unless you are able to extend the lease.
- **Freehold**: this is when one owns the land outright

Map of Zambia showing State land and customary land

- The black parts of the map represents the land owned by the state while the remaining parts shows the land under customary
- One key aspect of traditional tenure is free access to land by all members of a community

- In customary areas in Zambia individual ownership, concurrent interests, and communal interests are recognized
- Individual ownership means that the landholder or occupant has more rights and interests in the land than any other person
- The individual owns the land for as long as he wishes
- Concurrent interests occur where persons, other than the landholder, can go onto someone's land and use it for their own purposes
- Communal interests involve the use of certain tracts of land, which are not individually owned

IMPORTANCE OF AGRICULTURE

- Brings in foreign exhange through exports like tobacco, coffee and cotton
- Generates 22% of the gross domestic product (G.D.P)
- It contributes to food security, income and economic growth
- Provides role materials such as cotton, soya beans and sugar canes for industries
- Source of employment for the majority rural zambians
- Source of food to the people and livestock

TYPES OF AGRICULTURE

There are three types of agricultural systems practiced in Zambia. These are:

1. **Subsistence/Traditional Agriculture**

- It is also refered to as small-scale farming
- It is the cultivation of crops and the keeping of animals as well as birds enough to keep the family and no surplus to sale
- The main intention of the farmer is to grow crops for home consumption

2. **Emergent Agriculture**

- This is also known as semi commercial farming
- This is the growing of crops and the keeping of animals as well as birds enough to keep the family and sale the extra food
- Unders this system the farmers use modern methods of farming e.g. spraying crops with chemicals

3. Commercial Agriculture

- This is the growing of crops, keeping of animals as well as birds on a large for sale

Subsistence/Traditional Agricultura System

Characteristics

- Abandon farm plot each year for new ones due to leaching (loss of soil nutrients by runoff and percolating water
- Farms are small
- Mainly food crops such as maize, millet, cassava, beans, potatoes etc
- Simple tools are used such as axes, hoes, pangas, and even sticks
- The yeilds are always low
- They do not use chemicals and fertilisers

Types of Subsistence farming

There are three types of agricultural systems in zambia. These are:

a. The Chitemene System
b. The Mambwe Lung u System
c. The Lozi System

A. CHITEMENE SYSTEM

- In North Western Province it is known as '**Ntena'**
- It is also practiced in various forms in provinces such as Central, North-Western and Copperbelt Provinces
- The term 'Chitemene' is a bemba word which means **a cut over area**
- This system is practiced mainly among the bemba speacking ethnic group of Northern and Luapula Provinces

How Chitemene is done

- Between May and August, small trees are chooped down by men and boys
- Small trees are chopped about a metre above the ground
- In September/October women carry the branches and pile them together in circular stacks (heaps) within the cleared area

- Around October/November, at the onset of the rains, the stacks are burnt to produce an ash bed
- The ash-covered patch is then cultivated
- Sowing/planting is done in November/December
- After using the piece of land for 3-4 years, it is abandoned and then the farmer shifts to a new piece of land (normally virgin) as the old one has lost fertility (hence the name shifting cultivation).

Crops grown;

Millet, cassava, maize, pumkins, sorghum, groundnuts etc.

Factors favouring chitemene system

a. Physical Factors

- Burning the trees makes the soil makes it possible to nuetralise the acid in the soil
- Poor infertile soils
- Presence of heavy rainfall between 1000mm to 1600mm, which encourages the growthof trees
- The rains makes the soil leached and acidic

b. Social Factors

- Bembas are not traditional cattle keepers
- Low population densities in places where chitemene is practiced

c. Economic Factors

- The farmers are poor to afford to buy the farm inputs such as fertilizer and pesticides

Advantages of Chitemene

- Cheap labour (family members provide labour)
- It is not time consuming as it avoids stumping which is time consuming (slow)
- Makes constant weeding unnecessary
- Soil is not disturbed by deep ploughing
- There is no need of buying fertilizer (ash acts as fertilizer)

Demerits of chitemene

- It encourages deforestation

- It is very wasteful of trees
- Nitrogen is lost in the atmosphere as a result of burning
- The Eco-system is disturbed
- The habitant for the wildlife are destroyed
- The production is low though it needs a lot of effort
- Useful soil bacterias are destroyed as a result of heat from the fire

Reasons for the decline in Chitemene

- The decline in the amount of woodland or forests
- The government is educating people on the importance of trees
- There is population pressure due to an increase in the number of people in the areas where chitemene is practiced

B. THE MAMBWE – LUNGU – NAMWANGA SYSTEM

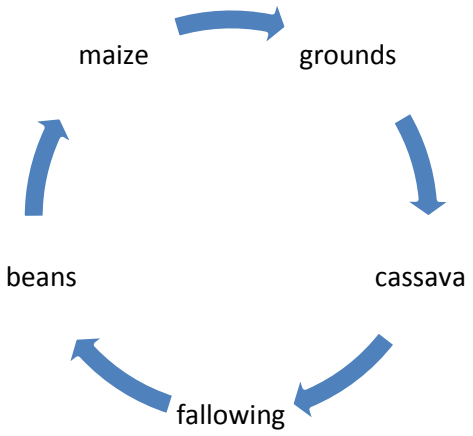
- It is practiced by the three tribes of Northern Province
- It is also known as 'slash and burn' or Fundikila
- This systen ivolved due to population pressure and lack of trees hence use the grass

How it is done

The system involves:

- Making mounds towards the end of the rainy season, between May and April
- A grass patch is usually chosen so that the covered grass can serve as manure
- Opening of the mounds and spreading the manured soil at the beginning of the rainy season, October/November
- Sowing of millet which is the main staple food crop interspaced by maize, pumpkins and myungu
- After the first harvest of millet, stubbles are collected in heaps and covered with soil to make mounds for the second year
- When these are opened up another crop of millet can be planted

Below is a rotation system employed by the Namwanga



Advantages of the system

- Allows for intensive cultivation of crops such as millet, beans, cassava, maize and groundnuts
- Can support large population settled on permanent basis
- Maintain soil fertility through grass manuring and crop rotation
- Require no use of chemical fertilizers
- Trees are not destroyed as fields sre made over grassy patches and uses grass as fertilizer

C. THE LOZI SYSTEM

- Practiced by the lozi people
- It is practiced on the upper Zambezi flood plain
- There is also the seaonal movement of the lozi people and their animals from the flood plain when it gets flooded and back when from the upland during the rain season is known as Transumance

The lozi system includes:

a. Litapan(sitapa)

- Done in plains with large shallow depressions which receives annual flooding
- Sometime crops are flooded before they become mature

b. Mazulu (Lizulu)

- Involves cultivation of crops on raised mounds in the flood plains

c. Lishango (Litongo)

- It is practiced at the edge of the plain, which has constant seepage of water from the plateau

d. Matongo (Litongo)

- This is practiced at the edge above lishango zone
- Most villages are located in this area because it is suitable for human settlement

e. Matema (Litema)

- These are found on the Barotse sands of the plataeu
- Fields cultivated are large because soils are not fertile

Advantages of the system

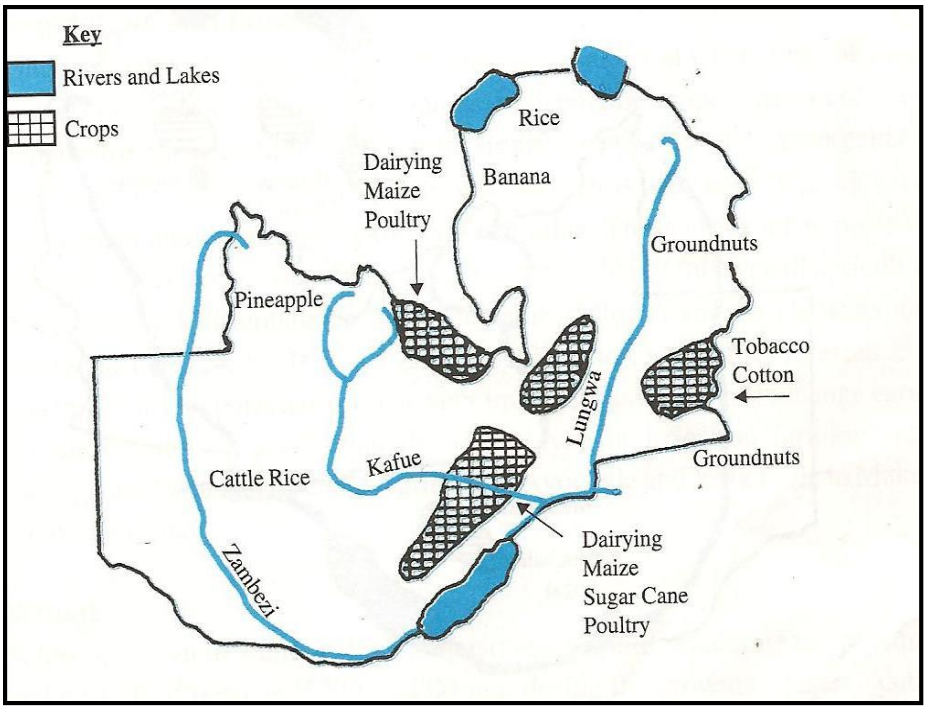
- It allows the growing of crops throughout the year
- It allows the growing of a variety of crops
- It provides rich and productive grazing land for cattle throughout the year

COMMERCIAL AGRICULTURE

Charateristics of Commercial Farming

- Involves inputs such as fertilizers, certified seeds, pesticides etc
- Involves large capital investment
- Large farms
- Mainly monoculture type of farming is done annually
- Uses large labour force both skilled and unskilled
- Uses machinery eg. Tractors, combine harvesters and many more

AREAS OF COMMERCIAL FARMING IN ZAMBIA



Types of Commercial Farming

I. Horticulture
II. Irrigation Farming
III. Market gardening
IV. Mixed Farming
V. Plantation Farming (Estate)

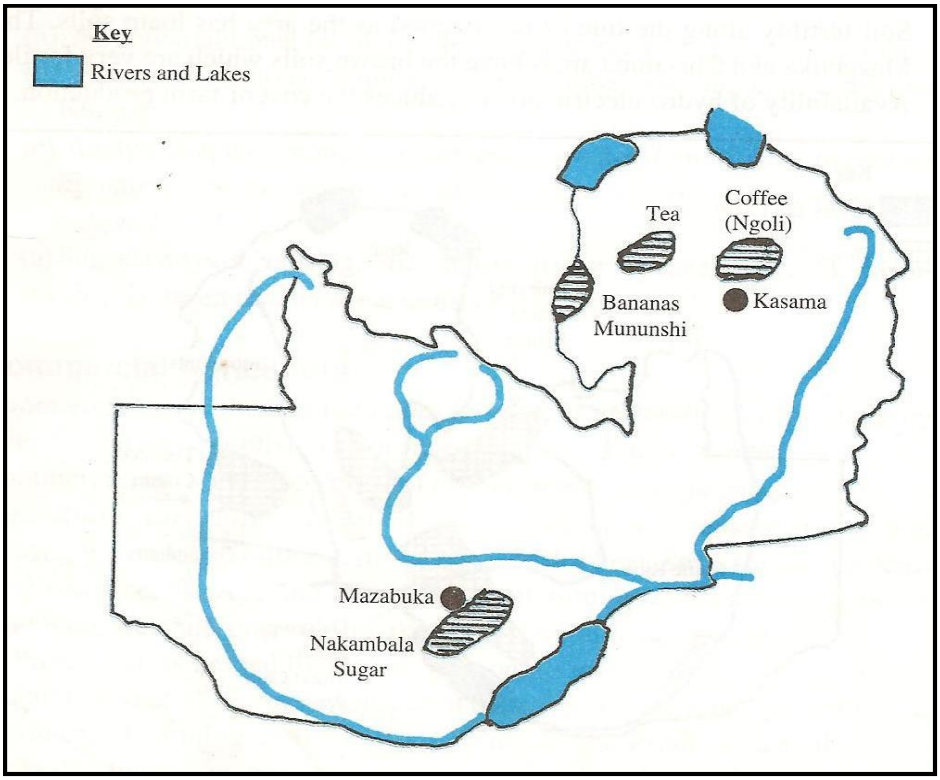
PLANTATION FARMING

- Plantation or Estate farming is concerned with the growing of tree crops such as cotton, tobbaco, sugarcane, coofee, rubber etc

The main Estates in Zambia include:

- Nakambala sugar estates in Mazabuka
- Ngoli Coffee Estate in Kasama
- Kawambwa Tea Estate in Kawambwa
- Mununshi Banana Scheme in Luapula
- Dunlop rubber plantation in Nchelengethis is the cultivation of different crops and the rearing of livestock at the same time on the same farm

AREAS OF PLANTATION FARMING



Mixed Farming

- This is the cultivation of crops and rearing of livestock at the same peace of land
- Crops grown are maize, wheat and soya beans and many more
- Livestock reared are cattle, goats, sheep etc

Market Garden Farming

- This is the intensive growing of vegetables and mainly for sale near urban areas
- It is also called truck farming (transportation)
- This is carried out near the urban areas where transport is available and ready market for the products
- The chief vegetables grown are potatoes, tomatoes, onions, cabbage, beans etc
- Fruits such as bananas, mangoes, avocado, guava and pineapples are produced seasonally

Horticulture

- This involves the production of ornamental plants such as flowers for sale locally and forexport

IRRIGATION FARMING

- This is the growing of crops in the dry part of the year by supplying water from rivers, boleres, reserviors etc

IMPORTANCE OF IRRIGATION

- It enables farmers to produce crops two or three times in a year
- It is one way of increasing food production to achieve household and national security (self sufficient)
- It transforms bare lands into areas of green vegetation

METHODS OF IRRIGATION

- Splinklers
- Canals
- Flooding
- Over-head irrigation

AREAS OF IRRIGATION

a. Areas around lusaka for green maize, vegetables, flowers and wheat
b. Chisamba area mainly for wheat but also coffee
c. Mazabuka area for wheat and sugar
d. Mpongwe area mainly wheat but also coffee

FACTORS WHICH MAKES NECESSARRY TO UNDERTAKE LARGE SCALE IRRIGATION AT NAKAMBALA

- Its flat land, which gently slopes towards the river, is ideal for irrigation
- The presence of Kafue River and its tributaries as follows are made from there

Conditions necessary for sugar cane growing are:

- Annual temperatures between 1,800mm to 2,500mm
- The temperatures between 25 degrees and 30 degrees Celsius
- Sugar canes also need fertile clay soils

- A flat land which gently slopes towards the river necessary for flood irrigation

MAZABUKA IS SUITABLE FOR THE GROWTH OF SUGAR CANES BECAUSE OF THE FOLLOWING REASONS:

- It experiences high temperatures with an average of 26.5 degrees celcius for most parts of the year without frost
- It has fertile clay loamy soils ideal for growing of sugarcane
- It has a gently slopes towards the river ideal for flood irrigation
- Irrigation is highly used in order to cution the balance of the remaining water received from the Kafue river

CROPS GROWN BY IRRIGATION

- Maize, (sweet corn), cabbage, tomatoes onions, irish potatoes etc

POSITIVE EFFECTS OF IRRIGATION

- Growing crops twice or three times in a year increases food and raw material production in the country
- If the land is planted with tree crops like coffee, bananas and tea, this increases the land's retention of rainwater as ground water
- It tranforms bare land into an area of green vegetation
- Large scale growing of tree crops aided by irrigation makes the climate wetter in the end

NEGATIVE EFFECTS OF IRRIGATION

- Fertilizers used on agricultural lands next to the river under irrigation will be washed into the river
- Salination : when the land is continously used for irrigation, the fertilizer used make it saline and this reduce productivity
- This leads to the growth of acquatic plants, which may sometimes be obstacles to navigation on rivers
- Water diseases: irrigated areas have an increase snails and mosquitoes which transmit bilhazias and malaria

THE SOCIAL AND ECONOMIC VALUE OF PLANTATION FARMING IN ZAMBIA

1. ***Social value***

- Estates provides decent houses for their workers
- Estates provides social services like clinics, schools, entertainment facilities, sports facilities
- Estates provides infrastructure such as roads and ralways
- Promotes international relations

2. ***Economic value***

- Contributes to the country's GDP
- Provides employment to field, factory and office workers
- Save foreign exchange by producing essential products instead of buying them from abroad
- Some local workers are given additional training to make them more productive and reduce on reliance on imported skilled labour
- Source of income when the products are sold within Zambia

THE ENVIRONMENTAL PROBLEMS CAUSED BY PLANTATION FARMING

- Agro-chemicals cause water pollution
- Continous use of fertilisers in irrigated areas make the soil saline (salty) and reduce its productivity
- Irrigation causes water logging and lowers crop yield
- Large scale use of machinery affects soil structure by compacting it thus making it less productive, and leads to reduction of aeration
- Many trees are removed through land clearance, thus contributing to deforestation and soil erosion
- Oils from machinery cause land pollution
- Pesticides used contribute to air pollution
- The fertilisers used on irrigated land are washed into rivers where it can encourage the growth of aquatic plants such as the Kafue weeds which limits navigation

BAD AGRICULTURAL PRACTICES

A number of unsound methods of agriculture have led to soil erosion and impoverishment. They include the following methods:

- Deforestation
- Overgrazing
- Shifting cultivation
- Slopewise cultivation

THEIR EFFECTS

- ***Deforestation***: this leads to the evils of climate change in the world
- ***Overgrazing***: this is when too many crops are grown on the piece of land without replacing the nutrients leads to infertility of the soil
- ***Shifting cultivation*****:** it leads to desertification and climate change
- ***Slopewise cultivation*****:** this type of farming leads to the carrying away of loose soil and hence increasing the gullies

SOIL CONSERVATION MEASURES AND SUSTAINABLE AGRICULTURE

The following are measures that can be taken for soil conservation:

- ***Afforestation****:* trees are planted in order to ensure that they replace those that havebeen cut
- ***Contour ploughing****:* contour ploughing is done at right angle as opposed to Slopewise cultivation
- ***Controlled grazing:*** to prevent over grazing animals are put within the grazing land which can allow only a number of animals that can feed on a piece of land
- ***Cover-cropping*****:** regumes are planted so as to maintain the fertility of the soil especially in young plantations
- ***Crop rotation:*** it allows different types of crops to be grown on a piece of land year after year. Crops are rotated each year
- ***Fallowing****:* this when the farmers allow the pieces of land to rest for a year or two after an intensive use of the land
- ***Irrigation:*** this is the adding of the water to the crops especially in areas with poor rainfall and it also helps in aeration in the soil
- ***Soil additive****:* this is the adding of fertilizers or manure in order to maintain the soil fertility

- ***Strip-cropping****:* this the planting of crops and trees in alternative strips parallel to one another

LOCATION OF COMMERCIAL FARMS

Most commercial farms are located in the following areas:

I. Along the line of rail: areas near Livingstone, Choma, Monze,Mazabuka, Lusaka, Kabwe, Mkushi and Copperbelt
II. Eastern province from petauke through Chipata to Lundazintry

Reasons why commercial farms are located along the line of rail are:

- Availability of Hydro-electric power reduces the cost of farm production
- Much of the line of rail is a plataeu and free from tsetse flies
- Suitable climate for farming as the area experience moderate temperatures of between 15 degrees Celcius to 24 degrees celcius and an average rainfall of about 1000mm. This type of climate is ideal for human settlement
- The presence of large urban market e.g. Copperbelt and Lusaka where there are a lot of people
- There is availability of over 900mm per annum

Reasons why some commercial farms are located in Eastern Province from Petauke to Lundazi

- Favourable rainfall of over 900mm per annum
- Road transport network is also good most roads can be used through out the year
- Soils in Eastern Province are fertile rich in humus
- There is ready market due to high urban population

CONSTRAINTS

Agricultural growth has been below its potential due to a number of constraints. The following are some of the constraints that need to be addressed in order to increase production and economic growth in the sector:

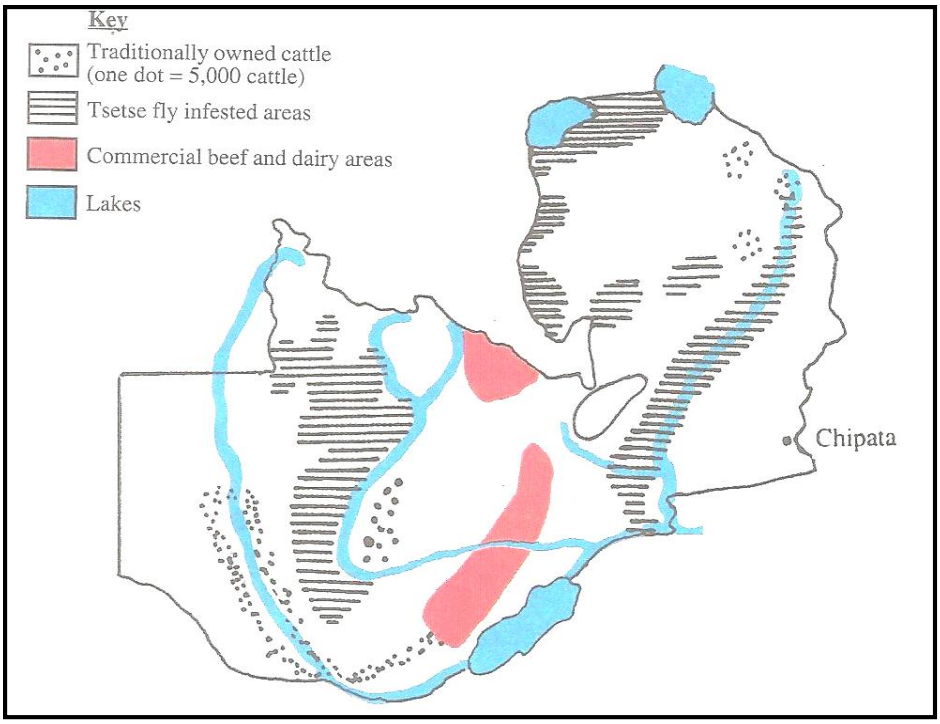
- Deficiencies in the early warning system and inadequate strategic food reserves
- High dependence on rain fed agriculture and related risks, and limited utilization of irrigation
- High incidence of crop and livestock pests and diseases
- High post-harvest losses
- Inadequate infrastructure and high energy/transport costs leading to poor market access by farmers resulting in loss of income and poor access to inputs
- Limited access to affordable credit especially for medium and long-term investments
- Limited diversification of agricultural production
- Limited domestic market
- Low productivity - due to lack of access to resources and agricultural service support and loss of draught power
- Poor functioning agricultural grain markets, which limit small farmers to access markets
- Restrictive trade policies which affects price volatility and regional specialization
- Security of land tenure and land acquisition issues

CATTLE REARING IN ZAMBIA

The cattle in Zambia are reared mainly in southern province with moderate in Eastern and Central Provinces. *The following are the reasons restricting cattle rearing in Zambia:*

- The presence of tsetse flies that carries trypanosomiasis which kills cattle
- The absence o pastures in some parts of the country
- Absence of the tradition of cattle keeping among some ethnic groups such as the people of the Luapula Province Diseases such as foot and mouth and east coast fever ravaged the two leading cattle rearing provinces of Southern and Western province.
- A cattle rustling is a serious problem that needs to be checked. Rustling has led to loss of life (both cattle owners and rustlers)
- Pricing mechanism needs to be monitored so that cattle owners receive economic prices for their animals.

LIVESTOCK FARMING AREAS IN ZAMBIA



MEASURES THE ZAMBIAN GOVERNMENT TOOK TO INCREASE BEEF PRODUCTION IN ZAMBIA

- Importation of better breeds of cattle such as Boran and Afrikander bulls to cross with the local cattle aimed at improving the quality of local cattle
- Initiating glazier schemes for farmers living close to state ranches as a way of transferring animal husbandry knowledge and encourage cattle keeping
- Provision of credit for the purchase of cattle, oxen and implements through Lima Bank and Agricultural Finance Company
- Setting of provincial dairies to produce milk and milk products to increase the intake of proteins among the people
- Setting up Cold Storage Board of Zambia to purchase cattle from farmers and sell the meat to the public
- Setting up state ranches to encourage and popularize cattle keeping in the whole country and offer extension services to new cattle owners

ZAMBIA'S AGRICULTURAL POTENTIAL IN THE SADC REGION

- abundant arable land
- adequate rainfall
- enough water for irrigation
- favourable government policy
- good soils which supports agriculture
- human labour which is cheap is available
- large market is readily available within the sub-region
- power is available especially from the H.E.P

AGRICULTURE IN MALAWI

SHIFTING CULTIVATION

- The type of shifting cultivation practiced in Malawi is bush fallowing or visoso
- This is what is called Chitemene system in Zambia
- Bush fallowing means cut over area
- This mainly done in the northern part of Malawi because of thick forests found there
- The activity is done by subsistence farmers
- Cutting down of trees starts in May and the branches are left to dry to two to three weeks to get dry.
- Then these branches are piled together in a circular manner.
- In October the pilled branches are burnt.
- The ashes act as fertilizer.
- First crops like pumpkings, cucumbers, cassava and maize are grown in November
- In late November the main crop which is millet is grown.

ADVANTAGES OF BUSH FALLOWING

- A variety of crops is grown.
- It uses family labour.
- No artificial fertilizer is used.
- Simple tools like axes and hoes are used.

DISADVANTAGES OF BUSH FALLOWING

- A very small area is used for cultivation of crops, but a very big area is cut.
- After 3 to 4 years the area is completely abandoned.
- It disturbs the rain cycle.
- It enables the soil to become infertile after 3 to4 years.
- It encourages soil erosion.
- It finishes trees (deforestation)
- It may turn an area into a desert.
- Production is not high.
- Useful bacteria's are killed in soil.

COMMERCIAL AGRICULTURE IN THE SUB REGION

TEA GROWING IN MALAWI

- Malawi is the oldest tea growing country in Africa
- It Is Malawi`s main crop for export
- It reduces over 20% of export revenue
- It employs over 38 000 people
- Some of the notable tea growing areas are Mlanje, Thyolo and Nkhata bay
  These are growing areas of tea because
- They have a very high rainfall of about 1150mm 1500mm.Tea can grow well in areas where rain fall is less than 1000mm
- It needs high temperatures of about 21 C with no chance of frost
- Well drained soil which is loamy with good drainage. The soil should also be acidic.
- A large labour force is required especially during the picking time of tea.
- Large ready market.

PROCESSING OF COFFEE

Tea must be processed as soon as it is plucked. The stages of processing tea are as follows:

1. **Withering**

   It is the cutting of fresh leaf into troughs which air is blown to reduce the moisture content by 30%

2. **Cutting**

   It is when the leaf is fired into the processor to reduce the withered leaf into small particles

3. **Fermenting**

   The cut leaf is then fed to the fermenting machine which turns the leaf while keeping it cool. This is the process which changes the colour of the leaf from green to copper. It takes 1 hour

4. **Firing**

   The tea is now fired. Tea leaf is now put into driers to stoop fermentation and reduce the moisture content of the leaf to 3.5%

5. **Sorting**

   The tea is sorted over machines with different mesh sizes. This produces different grades of tea

6. **Packing**

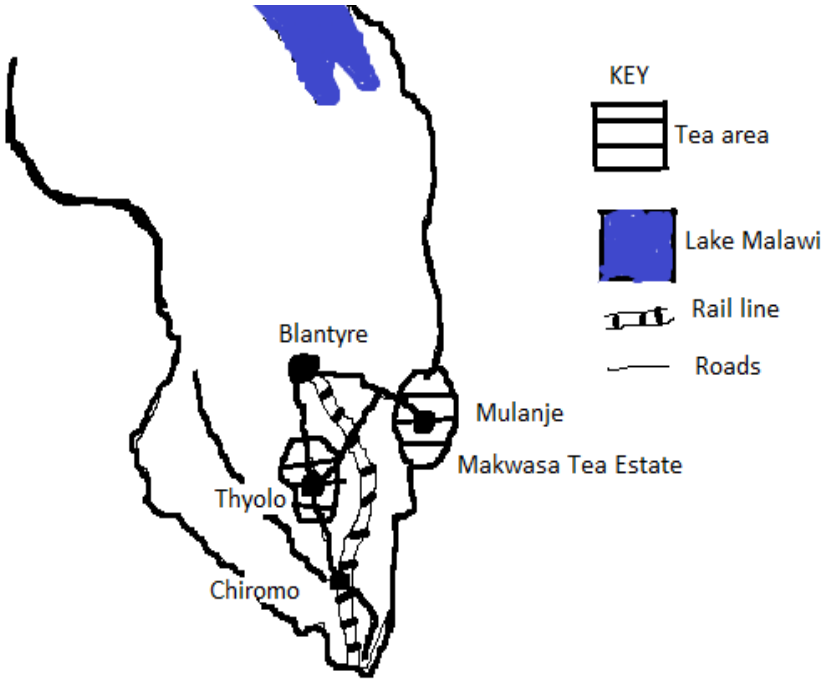
   It is done into plywood chest which are lined with tissue paper and aluminum foil to prevent moisture from spoiling the tea

***Some of the tea growing areas are*:**

a) Mukwasa tea estate this part of Thyolo highlands tea estate and was developed 1924 with 15.7 hectares. It has about 2000 workers

b) Thyolo

   It was formerly known as Cholo. This area provides about 20% of the export revenue to the country and employing over 38000 people.



Tea growing areas in Malawi

PROBLEMS ASSOCIATED WITH TEA GROWING IN MALAWI

- Fluctuations of prices of Tea on the world market
- Lack of knowledge of Tea growing by most small scale farmers
- Production is affected when the area receives less rainfall
- Tea growing depends seasonal rainfall
- The high population density in the Southern Province of Malawi poses a challenge in terms of land for the growing of Tea

COFFEE GROWING IN EAST AFRICA

- East Africa produces about 7% of the world's coffee
- The crop is grown on small and large scale and it is an important export product of the region
- The region produces two types of coffee and these are Robusta coffee and Arabica coffee

The main coffee growing areas are:

a) Buganda region in Uganda produces about 80% of Uganda's coffee

b) Kenya's central highlands
c) Mt Elgon in Uganda
d) The slopes of Mt Meru and Kilimanjaro in Tanzania
e) The highland area of north of lake Malawi

- The growing conditions for coffee are that it needs the altitude of about 1100m and 1400mm, Arabica coffee does well in higher areas of 1500mm to 2000m, needs temperatures of 22^0C, rainfall of about 1000mm and 1500mm, needs shed and shelter, it also requires cheap and abundant lab our
- Seeds are first planted in nurseries and these nurseries covered with grass to protect the seedlings from sun light
- Spraying of plants is done regularly to protect the trees from insects and plant diseases
- Continuous weeding is also carried out
- Trees begin to bear fruit after three years and they are picked by hand
- The picking of coffee is done for three or two months
- The flesh pulp is removed to release the coffee beans and the beans are washed and sundried
- They are packed and dispatched to the roasting mills
- Small holders farmers have formed cooperatives
- These cooperatives collect, process and market the coffee produce
- Uganda and Kenya coffee is exported through the port Mombasa and coffee is exported through Tanga port
- The main importers are the USA, West Germany, France, Italy and Sweden

PLANTATION FARMING IN SOUTH AFRICA

- South Africa has a highly developed commercial agriculture
- It has developed because of the high demand for agricultural products within and outside South Africa

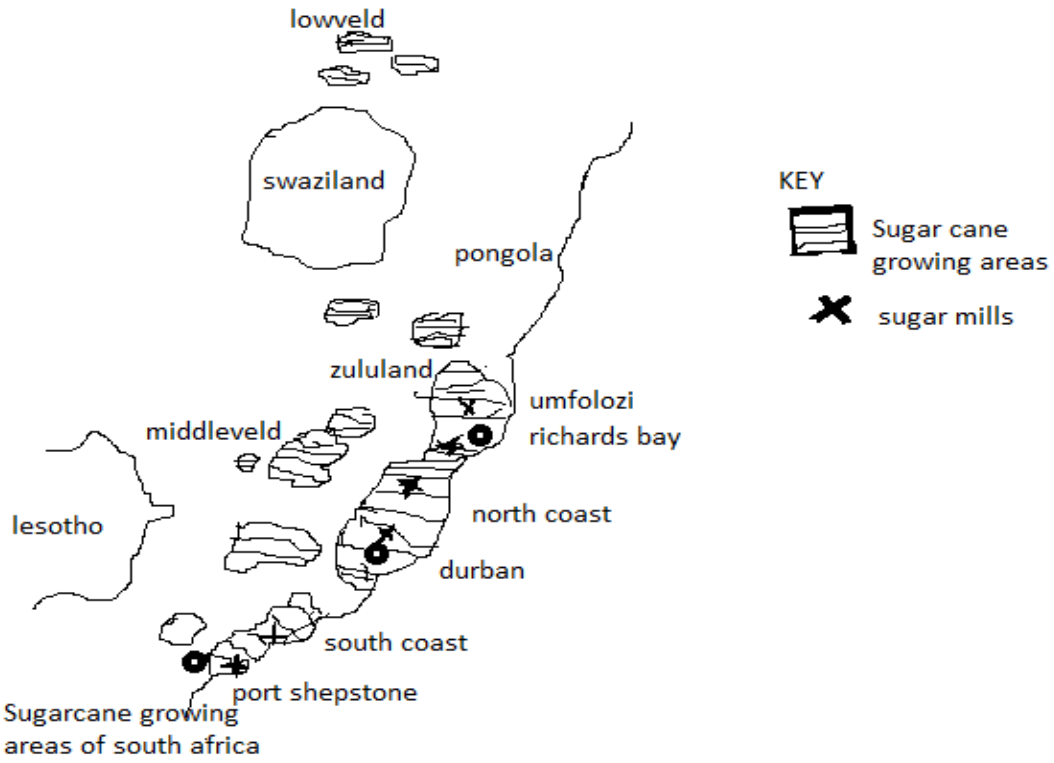
SUGAR CANE PRODUCTION IN NATAL

- This is the main sugar cane producing region South Africa
- Sugar cane was introduced in natal in the 1850s

- The was rapid expansion of Sugar cane production because of indentured labour from India
- Sugar cane covers over 200,000 hectares
- This area stretches along the coastline 400km long and 15 km wide north and south of Durban

The natal region supports the growing of sugar canes because of the following reasons:

- Though natal region receives less rainfall (1000mm) from the required, there was a high water table in region and supplementary irrigation
- The temperatures received in the area are far much below the required but the warm Mozambique current makes it possible for the growth of sugar canes
- The soils are variable which have allowed the growth of sugar canes
- Soil fertility is also maintained by artificial fertilizers, planting of legumes and fallowing



REVISION EXERCISE

1. Describe any traditional system of agriculture
2. State theproblems associated with tea growing in Malawi
3. What are the environmental problems caused by plantation farming

MAP WORK: BASIC TECHNIQUES AND SKILLS

Map Reading and Interpretation

INTRODUCTION

- A Map is a representation of both physical (natural) and manmade features in a given area on a flat sheet of paper using symbols**.**
- A map is a representation of all or part of the Earth drawn on a flat surface at a specific scale.
- A map is simply a drawing or picture of a landscape or area of a country.
- A map uses symbols, colours and labels to represent features found on the ground.
- The symbols used are accepted all over the world and called conventional signs
- To use a map one should be able to read and interpret the characters used
- Map reading refers to the identification, interpretation and analysis of geographical information from maps.

CHARACTERISTICS OF A MAP

1. **A title.**
    - The title describes what a given map represents by explain the subject of the map.

2**. Location**
    - Every map shows the Location or position of a place using a grid reference.

3. **Direction/north symbol**
    - A compass shows the direction of the map which has cardinal points
    - A Compass shows the position of places or features in relation to others.

4. **Scale**
    - Scale can be defined as the ratio of the distance between two points on the map and the same two points on the Earth's surface.
    - Scales provides the reader with important information regarding linear relations on the map.
- A map scale gives the relationship between distance on a map and distance on the actual ground.

TYPES OF SCALES

Statement of scale(word scale): A statement of scale or word sale uses words to describe the relationship between the units measured on the map and the units measured on the actual ground.

- For example, one centimeter on the map to represent two Kilometres on the ground. This can be abbreviated as 1 cm represents 2km.

Ratio scale (Representative fraction (R.F. scale): This type of scale uses only numbers to describe the relationship between the distance on the ground and that on the map. For example,1:50,000 or 1/50000

Line scale: A line scale is a line drawn below the map that shows the relationship between map distance and ground distance.

- The length of the line matches the distance on the map. The units of measurement that are labeled on the line represent the distance on the ground.

5. **key/legend**
    - A key is also known as a legend.
- A key is a list of symbols which try to explain features to the reader for easy interpretation and understanding

6. **GRID**

- The map needs to have a co-ordinate system inform of latitude and longitude so that the place can be placed in its geographical position on the globe.

LOCATING OF PLACES ON THE MAP USING GRID REFERENCE

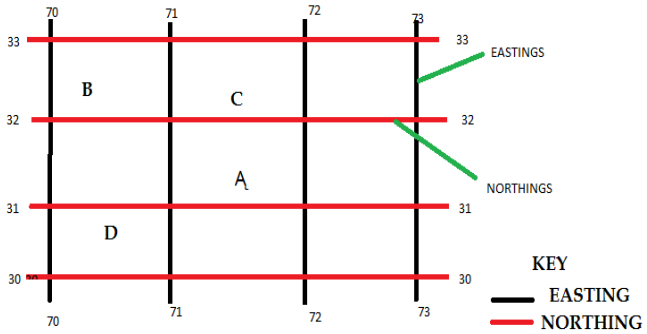
GRID REFERENCE

- Grid Reference is a way of defining where you are in the country
- A map grid reference is combination of parallel vertical and horizontal lines
- The grid is made up of the Easting's (Vertical lines) and the Northings (Horizontal lines)
- The grid lines running from North to South (Vertical) are called Eastings because they show increasing distances eastwards from the origin (X Co-ordinates).
- The grid lines running from West to East (horizontal) are called Northings because they show increasing distances Northwards from the origin (Y Co-ordinates).
- Grid Reference are given in one of two ways:
    - ❖ Four Figure grid reference - Used to identify a 1km x 1km square

❖ Six Figure grid reference - Used to identify a location 100m x 100m

FOUR Figure Grid Reference

- We use a four figure grid reference if we want to identify a large object e.g. a lake
- The four figure grid reference depicts only a the general location of the point in the grid square.



- When taking a reading from a grid reference map, you take the **EASTING** first
- After taking the eastings, **NORTHINGS** are then read**.**

EXAMPLES

1. What is the four figure grid reference for station A?

- **The EASTING for station A is 71**
- **The NORTHING for station A is 31**
- **Therefore the four figure grid reference for station A is 7131**

EXERCISE

1. What is the four figure grid reference for the following points?

(A) B

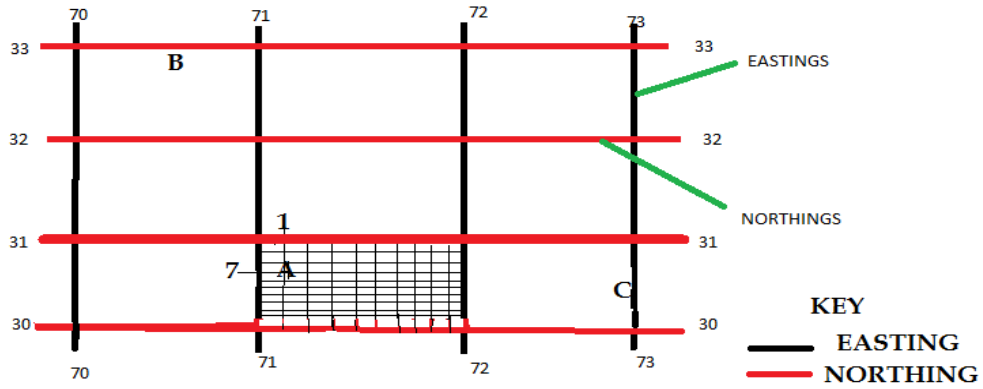
(B) C

(D) D

SIX Figure Grid Reference

- The six figure grid reference is used when you want to identify a smaller object inside a square e.g. a stream junction

- A six figure grid reference gives a precise or accurate position of a point in a given grid square.
- We need to subdivide our 1km x 1km square into smaller 100m x 100m squares
- Write down the two figures representing the easting on the immediate left
- Divide the space between the easting in which the point is found into 10 equal lines and mark the lines 1 up to 9
- write down the line that passes through or on the left of the point next to the first two digits



- When taking a six figure grid reference, a four figure grid reference is taken first
- Therefore, the six grid reference for point A can be taken in the following steps:
    1. The four figures is taken first starting with EASTING and then then the NORTHING.
        71—30---
    2. Then the box is divided into 10 units of Easting's and Northings
    3•write down the line that passes through or on the left of the point next to the first two digits
- Starting with easting first (1) and then the Northing (7).
- Therefore, the six figure grid reference for station A is 711307

What is relief?

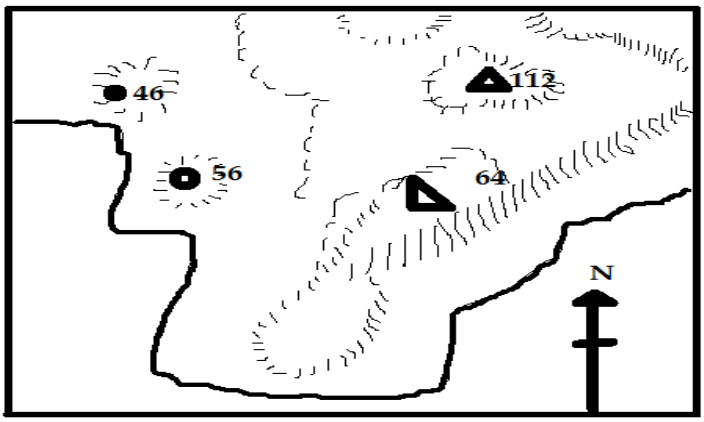
- Relief is the difference in elevation (or height) between parts of the Earth's surface
- Relief is a central component of topographical and physical maps

- There are a number of techniques which have been developed over time to accurately represent relief features on a map.

Ways of representing/Identifying and interpreting relief

1. **Hachuring**

- Hachures are short lines of varying thickness which show the shape and slope of the land.
- In accordance with this technique, the steeper the slope is, the thicker the lines are which represent it.
- They do not represent exact elevations, but are mainly used to show large, rocky outcrop areas.
- Hachures are used extensively on small-scale maps to show mountain ranges, plateaus, and mountain peaks**.**



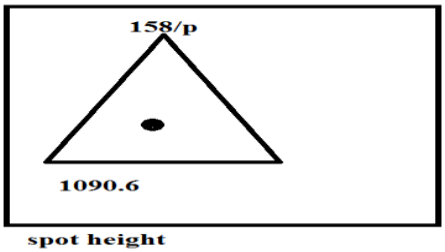
2. **Hill shading**

This method also shows the steepness of slope but it differs from hachuring in that it does not show the steepness using lines but uses shadow .

This method does not show the exact height of the slope

3. **spot heigts**

- Spot heights are used to show the exact height of the land at a particular point.
- Spot heights are depicted using a dot (or triangle) and a corresponding number, which represents the altitude (height above sea level) at that point
- Spot height provide accuracy in elevation

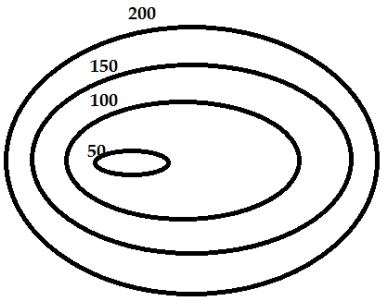


spot height

4. **Layer tinting (colouring)**
   - Layer tinting uses different colours (or shades) to represent different heights.
   - It is a mapping convention for darker colours to signify greater height.
   - When using layer tinting, green is often used for low land, yellow for higher land and brown for the highest land.

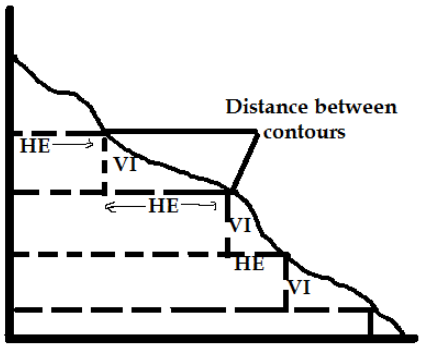
5. **Contour Lines.**

- Contour lines are the most common method of showing relief and elevation on a standard topographic map.
- A contour line represents an imaginary line on the ground, above or below sea level.
- All points on the contour line are at the same elevation.
- The elevation represented by contour lines is the vertical distance above or below sea level**.**



   - A contour interval (VI) is the difference in height between contour lines.
   - Contour lines always increase or decrease by the same amount.
   - This means that if one contour line represents points 50 metres above sea level and the next contour line shows points at 100 metres above sea level, then the third contour line will be 150 metres above sea level. In this example, the contour **interval is 50 metres.**

- **The Horizontal equivalent (HE)** is the distance between two contours expressed as a horizontal measurement.
- The horizontal equivalence will vary according to how the steep or gentle the slope of the land is.



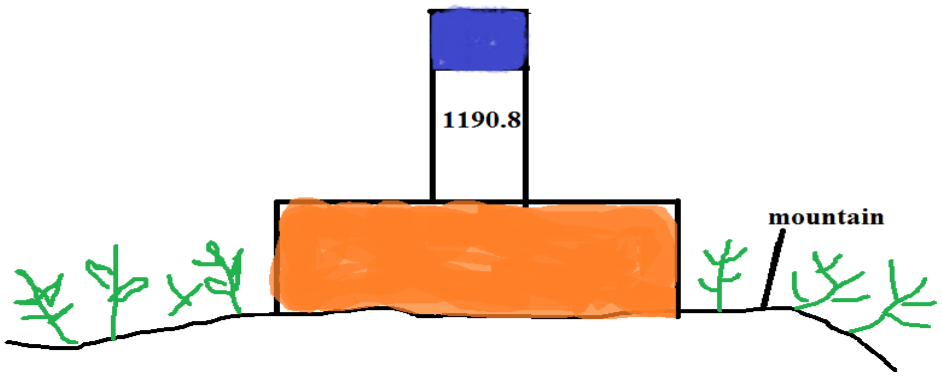
KEY

HE-Horizontalequivalent

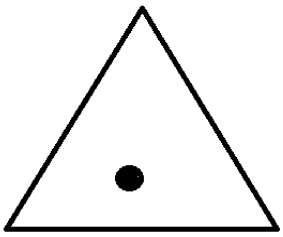
VI- Vertical Interval

TRIGONOMETRICAL POINTS

- A Trigonometrical point or station is a permanent survey mark situated at the top of a high hill or mountain
- These are found at the hill summit on which the height of the hill is shown.
- Some Trigonometrical stations are substantial concrete structures or pillars while others are simple survey marks embedded in concrete



On maps a Trigonometrical station is represented by a triangle and height in meters



1190.8 meters

CALCULATING DISTANCE ON THE MAP

1. **Measuring straight line distance:**

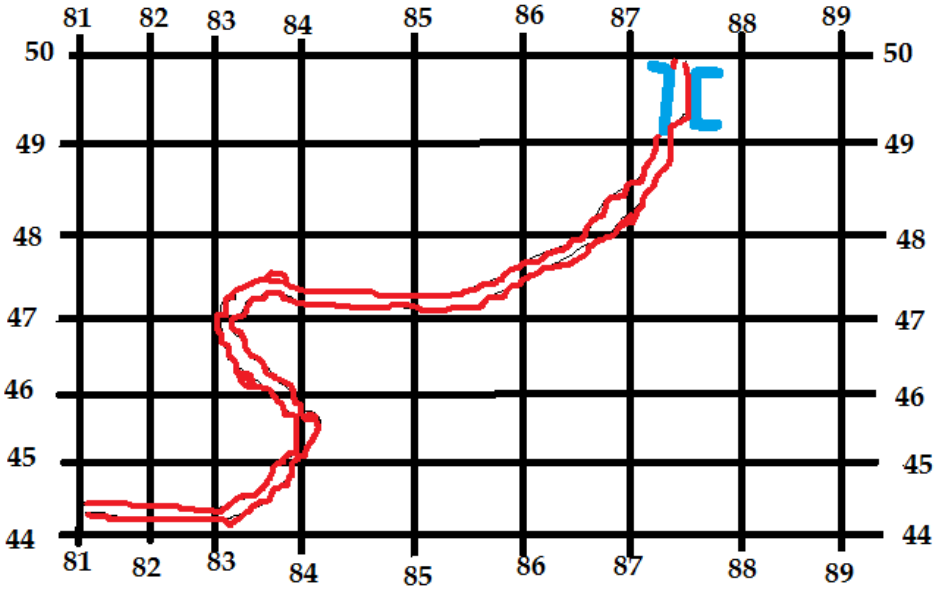
The following steps are followed:

a. Draw a straight line connecting the two points as shown below in the example.

b. Get a piece of paper and place the edge of the piece of paper along the line and mark the two points on the piece of paper.

c. Measure the length on the linear scale by placing the piece of paper along the scale with the first marked point at 0.

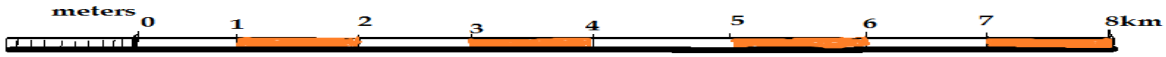
2. Measuring distance not straight (i.e. Road, Railway) or River:



- **What is the distance of the road from grid square 8144 up to the bridge in grid square 8749.**
- This can be done in the following way as follows:

A. Using a string

- A string is put along the road starting at easting 81 up to northing 50.
- The string is then straightened and put along the scale and measure the distance it represents.

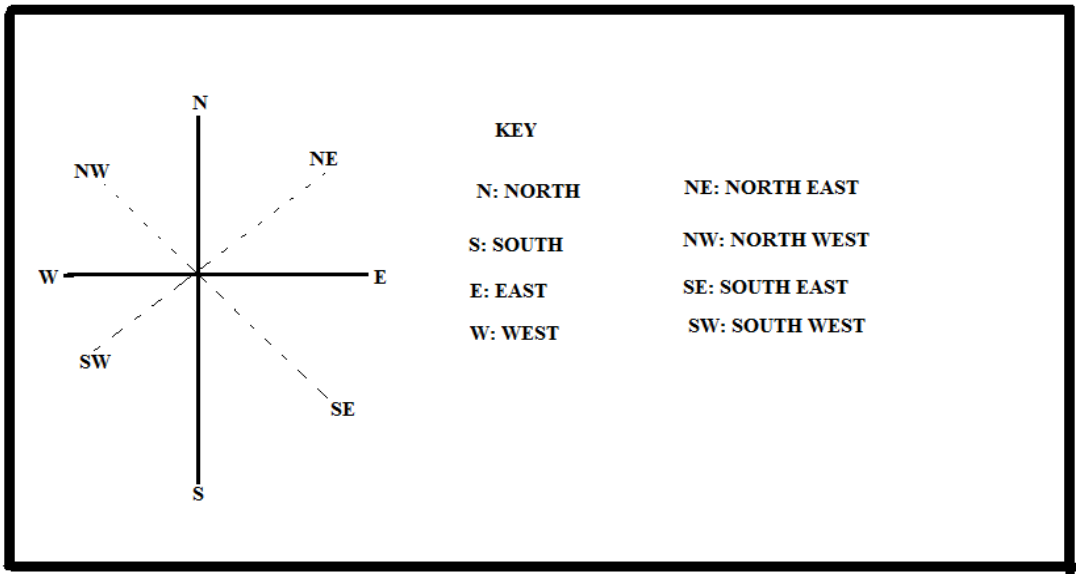


DETERMINING THE DIRECTIONS OF PLACES ON THE MAP

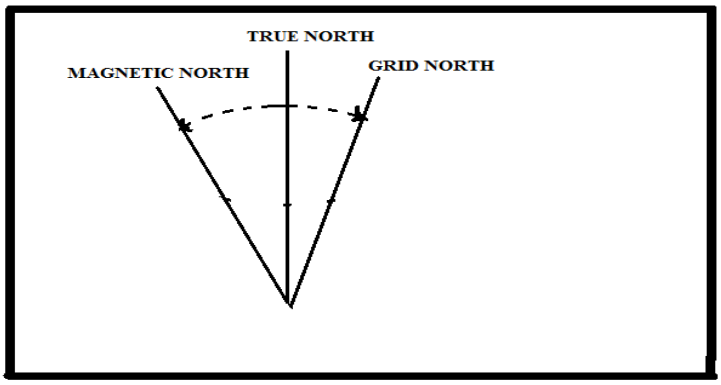
- The direction of a place on the map can be determined by using:
    - ❖ Compass
    - ❖ Bearing

COMPASS

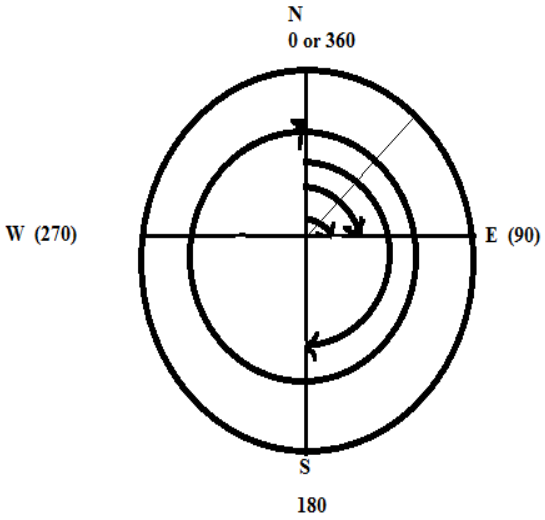
- A compass is an instrument used to determine direction
- The compass has the magnetic needle which responds to earth magnetic force
- The needle always points northwards
- The compass has four main points which are known as **primary or cardinal points**
- The cardinal points are **North, South, East and West**
- From cardinal points other points are created which are known as **subsidiary points**
- The subsidiary points include: **North East, South East, South West and North West**and these subsidiary points provide accurate direction of places.



- Direction is usually measured relative to the location of North Pole.
- Direction determined from this location is said to be relative to the True North
- Apart from the True North there is also the magnetic North and Grid North



- Describing direction using the magnetic North, True North and Grid North compass direction is known as **Azimuth system**
- The Azimuth system calculate direction in degrees of full circle **(360^0)**
- The North has the direction of either **0^0 or 360^0**
- The south has the azimuth direction of **180^0**
- The East has the azimuth direction of **90^0**
- The West has the azimuth direction of **270^0**



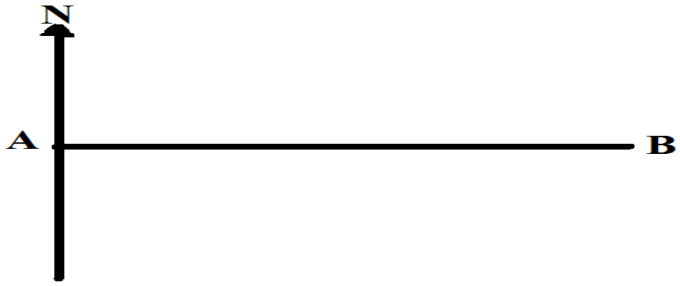
Measuring Bearings

- Bearing is an accurate way of giving the direction of one place in relation to another
- Bearing is the direction measured as an angle.
- Bearing is measured in degrees.

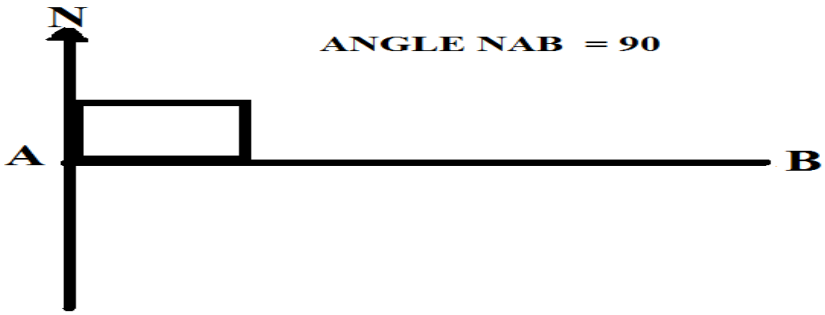
- The measuring of the angle is made from the true north and measured in a clock wise direction.
- True North is shown by the vertical straight line.
- True North is known as Geographic North or Map North.
- Magnetic North is shown by the arrow pointing to the west of True North.
- To find the bearing of a place from one another, the following steps are followed:

5. Join the two places involved. e.g point A and B using a straight line.

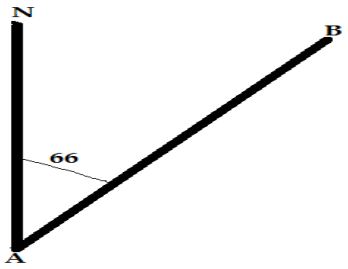
2.Draw an arrow showing the direction of the True North through A, the place from which the bearing of B is being considered.

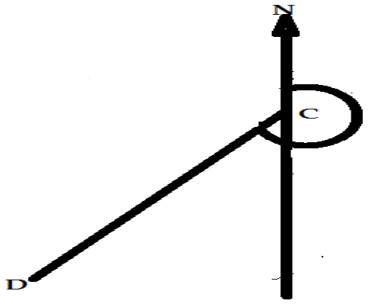


10. Using a protractor, measure the angle between the North and the line which joins the two places A and B. Angle NAB. The angle you get is the bearing of B from A



EXAMPLE





EXAMPLES

1. What is the bearing of B from A= 66^0

2. What is the bearing of D from C= $180^0 + 50^0 = 230^0$

GRADIENT

- Gradient is the steepness of a slope.
- To calculate the average gradient, there is need to know:
    - ❖ The altitude or height of two points.
    - ❖ The distance between the two points
    - ❖ Then find the different in height between two points
    - ❖ Then measure and convert the distance in height of two points by their distance apart.
    - ❖ Finally divide the difference in height of two points by their distance apart (horizontal equivalence)
    - ❖ Therefore gradient is calculated by the following formula

      Gradient = $\frac{\text{Difference in Height}}{\text{Difference in equivalence}}$

Example:

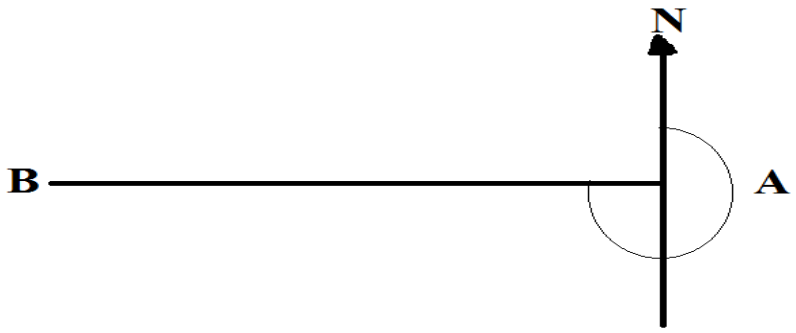
1. Find the average gradient between point A, 3000 meters high and point B, 2,000. B is 10km from A**.**

- **Difference in height between A and B is** 3000-2000=1000 meters
- **The distance between A and B is** 10 km (10km x 1000 m)= 10,000 meters.
- **Divide 1000 by 10000 as shown below:**

Gradient = $\frac{1000}{10,000} \quad \frac{1}{10}$

or 1 in 10

2. What is the bearing of **B** from **A?**



Angle NAB is $180^0 + 90^0 = 270^0$, Therefore the bearing of **B** from **A** is **270^0**

REPRESENTING HUMAN ACTIVITIES ON THE MAP

- The major human activities that appear onthetopographical map include:
  - Farming and forestry
  - Tourism
  - Mining
  - Fishing
  - Sports

REPRESENTING SETTLEMENT PATTERN ON THE MAP

- A Settlement is any place where people live
- Pattern of settlement are varied and include the following:
  - Dispersed settlement
  - Nucleated settlement

- ❖ Linear settlement

- Details on settlement refer to settlements notes discussed earlier on.

FIELD PROJECT

INTRODUCTION

- Field project is an organized unit of work conducted outside the usual place of learning. Also known as field study; a research conducted outside the usual place of learning.
- A research can be conducted within the locality or from a distant place, in which case the researchers take a **field trip**-a trip/excursion undertaken by students/researchers to study something first hand. Broadly there are two types of field studies:
- *Case study*: detailed study of a particular situation or problem
- *Survey*: study of selected factors pertaining to a particular problem
- The purpose of a research is to find out more about the unknown or misunderstood, therefore the findings of any research need to be presented in a scientific/ orderly manner-Project report.

REPORT WRITING

An academic field project report should contain the following parts/chapters;

1.0 INTRODUCTION

1.1 Background

- ✓ Historical aspect of the problem under study
- ✓ When, why, how

1.2 Location

- ✓ Sketch map of the study area
- ✓ The map should be well framed with a key, title and direction.

1.3 Problem statement

- ✓ The main theme that will be investigated.
- ✓ States the irregularity that needs understanding.

1.4 Aim and objectives

- ✓ The aim is the main goal that the research intends to achieve.
- ✓ Mainly a research has one aim
- ✓ Specific actions that are undertaken in order to achieve the aim.

- ✓ Since objectives are actions, they should therefore always be identified by using action words

2.0 LITERATURE REVIEW

- ✓ Study of previous works on the same problem
- ✓ So as; identify ignored areas and contribute new knowledge to the field.
- ✓ It's important that the subtitles under this chapter are according to the objectives

3.0 METHODOLOGY

- ✓ Explain how the project was carried out;
  - ➢ Type of study
  - ➢ Instruments used
  - ➢ Other equipment use

4.0 PRESENTATION OF FINDINGS

- ✓ Present the findings using various tools;
  - ➢ Tables
  - ➢ Flow diagrams
  - ➢ Graphs
  - ➢ Statistical maps

5.0 INTERPRETATION OF FINDINGS

- ✓ Explain the findings
- ✓ State their implications

6.0 CONCLUSION AND RECOMMENDATION

6.1 Conclusion

- ✓ Confirm findings
- ✓ Contradict findings
- ✓ Bring out new information

6.2 Recommendation

- ✓ Suggest possible solutions to the problem
- ✓ Increase understanding of the topic under study