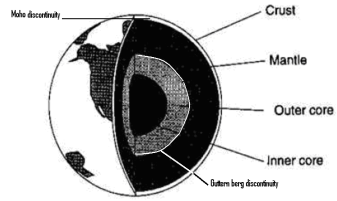
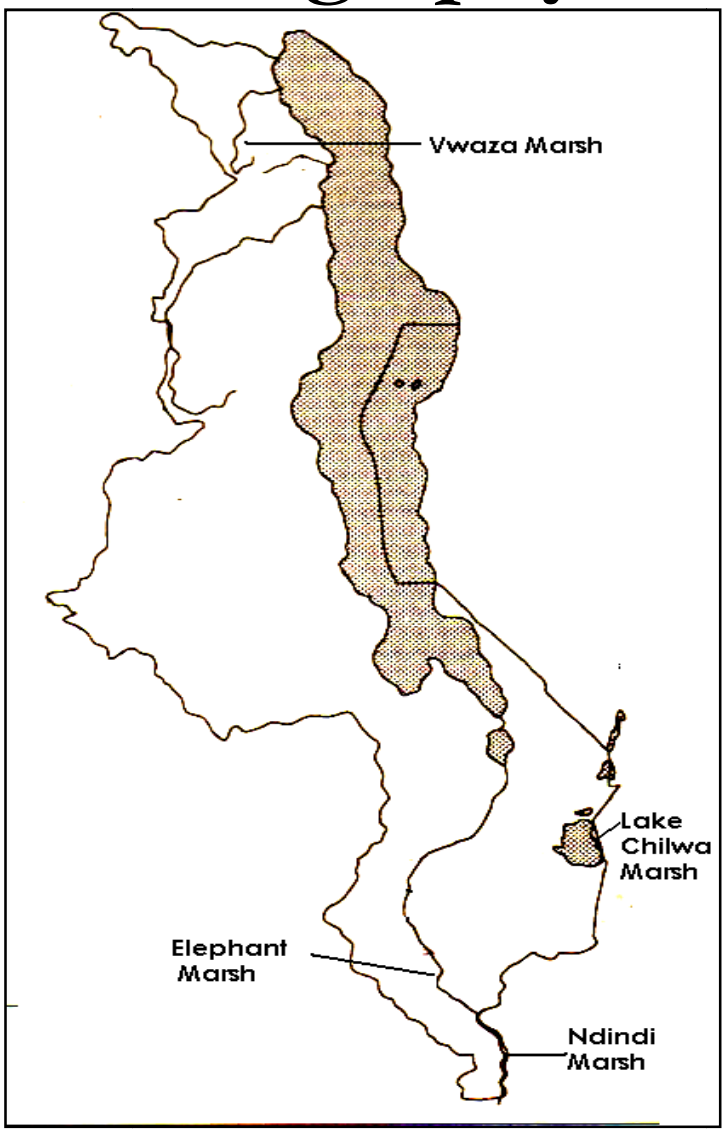
Malawi School Certificate of Education



Physical and Human Geography



SND Sakhuta

TABLE OF CONTENTS

PART 1: PHYSICAL GEOGRAPHY

THE STRUCTURE OF THE EARTH

Objectives

- Draw a labeled diagram of the internal structure of the earth
- Describe the characteristics of the different layers of the internal structure of the earth.
- Explain the continental drift theory
- Explain the plate tectonic theory
- Describe features produced along plate boundaries
- Describe mountain building process associated with plate tectonic.
- Analyze the effects of mountain building process on human activity

The earth is the planet in which we live and is divided into the following parts

a) The lithosphere
b) Hydrosphere
c) Atmosphere

1. The Lithosphere / Crust

- The uppermost part of the mantle is solid. This solid portion of the mantle and the crust above it makes the Lithosphere.
- It consist of
  - Soil
  - Mass of hard rock (where soil lies)

I. It is divided into
- Continental crust
- Oceanic crust

A**. Continental Crust**

- This is sometimes referred to as SIAL
- SIAL-This is the upper part of the earth's crust comprising of lighter rocks e.g. granite
  - Its mineral composition consist of Silica and Aluminum hence **SIAL**
  - This part forms the continents

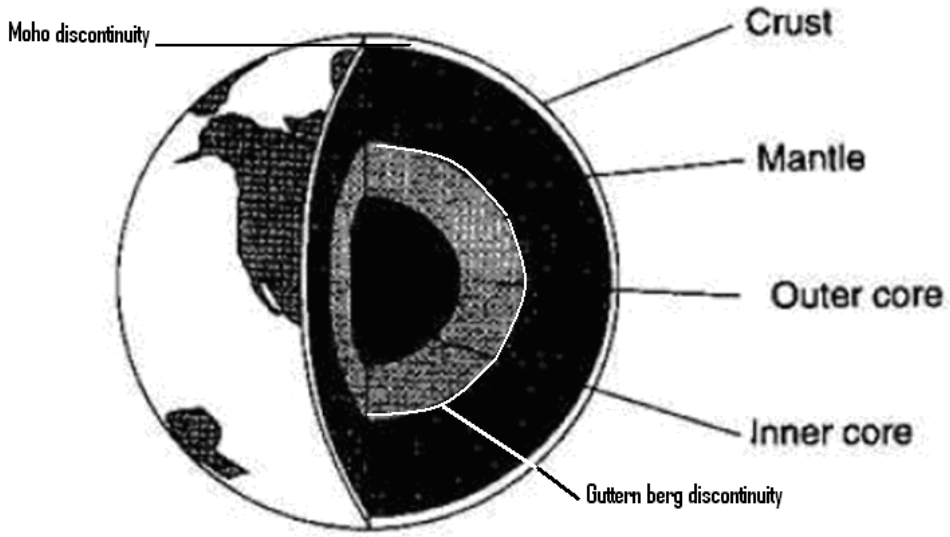
B. **Oceanic crust**

II. This is sometimes referred to as **SIMA**
III. SIMA: - This is the lowest part of the earth's crust comprising of dense rocks e.g. basalt
-Its mineral composition consists of Silica, Iron and Magnesium collectively known as **SIMA**
- The continent is believed to be floating on the layer of denser **SIMA**

The Internal Structure of the Earth

The internal structure of the earth consist of

i. Inner core (barysphre)
ii. Outer core
iii. Mantle (mesosphere) (Refer to the diagram below)



2. The Core/Barysphere

- The core is divided into two parts namely
  - Inner core
  - Outer core

a. The Inner Core

- It is solid
- It consists of Iron (fe) and Nickel, collectively called NIFE
- Its temperatures are very high therefore subject to high pressure hence liquid (however recent studies have shown that core is a solid mass)
- Its density is about 13.6g cm^{-3}

b. The Outer Core

- It is liquid
- Consist largely of iron
- Its density is about 10-12g cm^{-3}
- The earth's magnetic field is believed to be generated in this layer.

Note: **Gutenberg discontinuity** separates the core from the mantle

3. The Mantle/Mesosphere

- It is found between core and crust
- It is solid, consist of lower density material known as *Peridotite*
- Its density is 4-5g cm^{-3}
- The upper part is capable of flowing
- It is composed of silicate minerals
- It is approximately 2900 km thick

Note: **Mohorovicic discontinuity** (Moho) separates mantle from the crust.

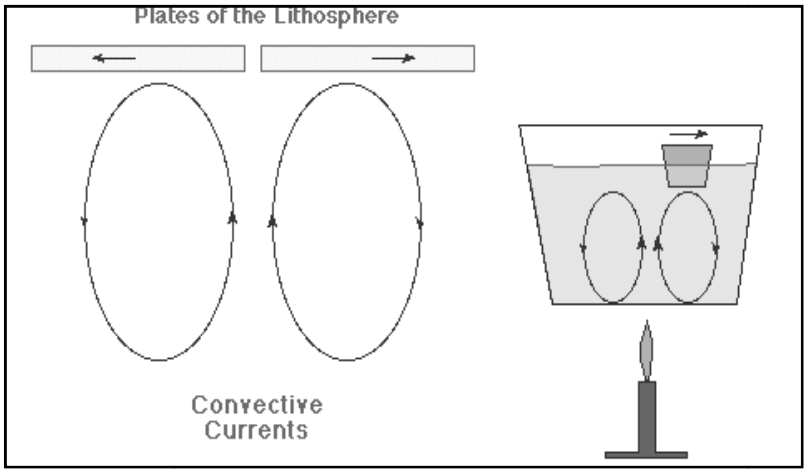
Continental Drift/Earth Crust Movement

- The theory states that the earth was once one large mass known as **PANGEA** which means 'all lands' .The land was surrounded by huge ocean known as **PANTHALASSA** which means "all seas"

- The internal movements within the earth's crust caused the pangea to be fragmented into large plate like segments which means plate tectonic referring to breaking of old major continent pangea into the present continents.
- This theory was developed by *Alfred Wegener* (Vay gen ner) in 1915, he was a meteorologist and geologist.

Causes of plate motion

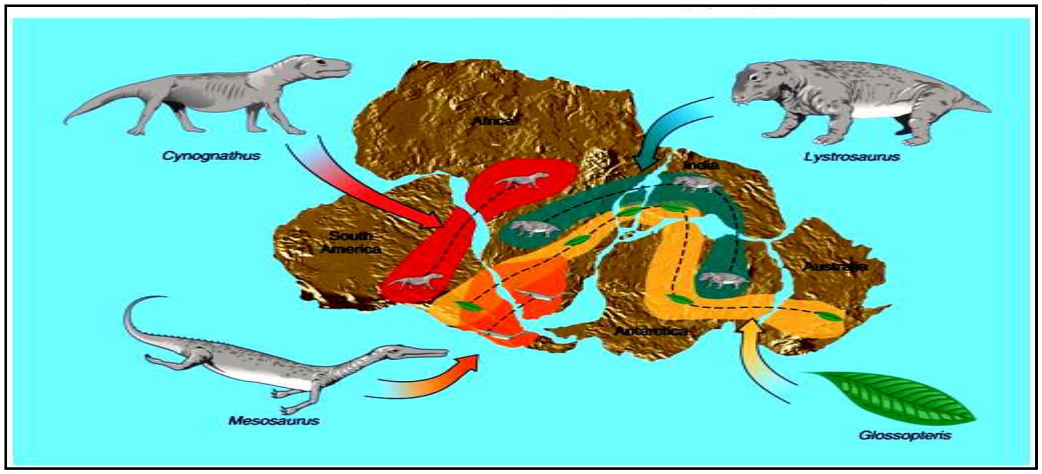
- The main cause of lithosphere plates is motion **convection (**see diagram bellow**)**



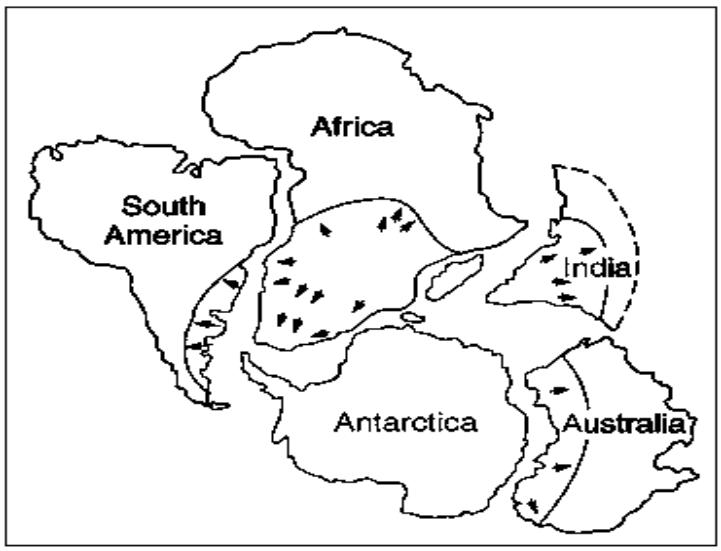
- Tidal influence on the moon

Evidence that the Earth Was One Land Mass

- Similarity of fossils found on both sides of Atlantic coast and especially east coast of south America and West Coast of South Africa. The presence of similar land based animals on both sides (see figure below).



- Similarity in the structure and rock type, that is rock of Eastern coast of American continent and the West Coast of Africa and North coast of Africa and Europe e.g. Rocks found at cape of Africa and North coast of Africa. (See figure below).
- Coast line fit (jig-saw) – The coast of continents fit if the continents are put or joined together e.g. South America and South Africa as illustrated below



- Formation of coal – Coal is believed to have been formed in areas in areas with equatorial climate. But large scale coal deposits are found in areas which do not have such characteristics e.g. Britain
- Study of magnetism in ancient rock – Rocks that have different alignment along boundaries shows that originally were not where they are but moved.

Weakness of the Theory

- The theory only dealt with continental crust and did not include the crust beneath the ocean.
- No explanation of what led to movement of pangea apart
- The theory suggested that one of the causes of plate motion was tidal influence on the moon yet if this was true meant that tidal friction of the magnitude needed to displace the continents would bring the earth's rotation to a halt, in a matter of few years.
- No evidence existed to suggest that the ocean floor was weak enough to permit passage of the continents without themselves being deformed in the process.
- Some of the plants that were found on the other side of the continents could be due to seed dispersal.

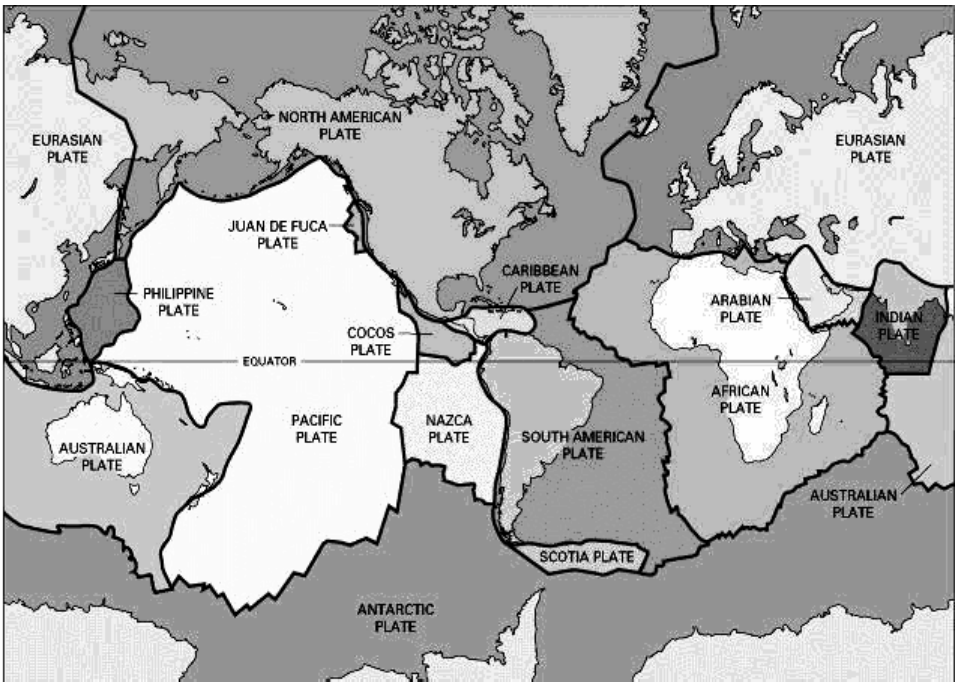
PLATE TECTONIC THEORY

Objectives

- Explain the plate tectonic theory
- Describe features produced along plate boundaries

The Plate Tectonic Theory

- This is the theory that describes continental movements and also explains how and why continents move.
- The term *tectonic* comes from Greek word '***tektonikos***', which means construction.
- Tectonic activity is the breaking and bending (deforming of rocks in the earths crust due to different forces
- The earth crust consists of two types of crusts, oceanic crust and continental crust.
- The figure below shows crustal plates formed due to earth movements.



- Crustal plates are portions of the crust (lithosphere) that float on molten underlying material.
- Places where plates collide are called <u>plate boundaries</u>

Causes of tectonic activity

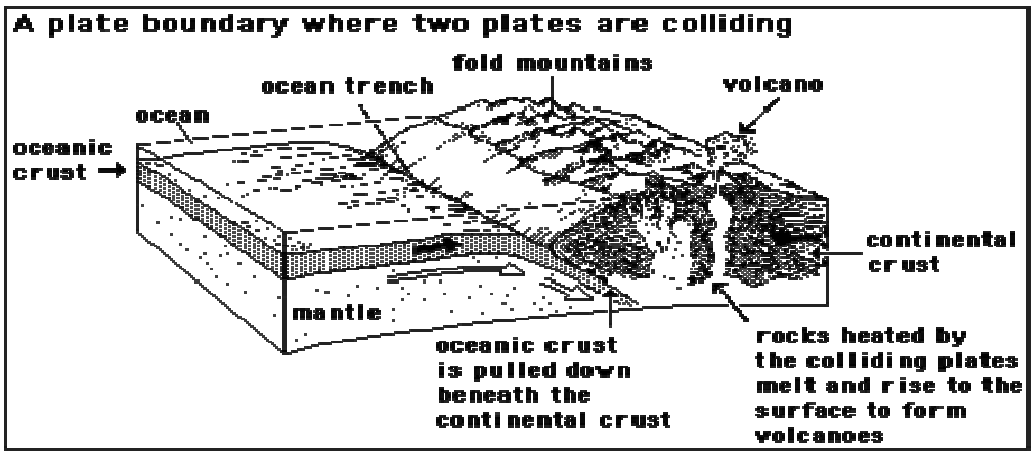
- The plates consist of an outer layer of the Earth, the **lithosphere**, which is cool enough to behave as a more or less rigid shell.
- The lithosphere due to pressure is broken into separate plates that float on a denser asthenoshere like block of wood that float on water.
- <u>Convection Cells</u> - Thought to be primary driving force for plate motion. Unequal heat distribution in the mantle may produce convection cells below the lithosphere. Hot material rises (correlates to spreading center), spreads laterally, cools and sinks deeper into the mantle to be reheated.

Features Produced Along Plate Boundaries

There are different types of plate's boundaries and these produce different features

1. Convergent Boundary

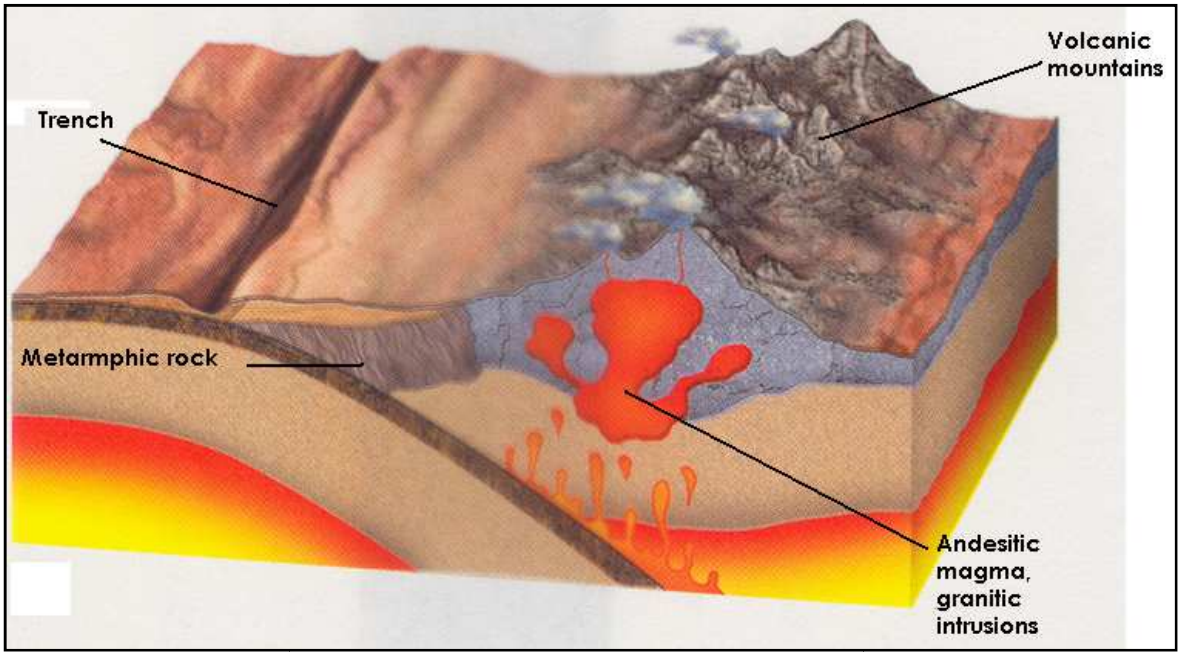
This is where crust is destroyed as one plate dives (meet) under another as shown below;



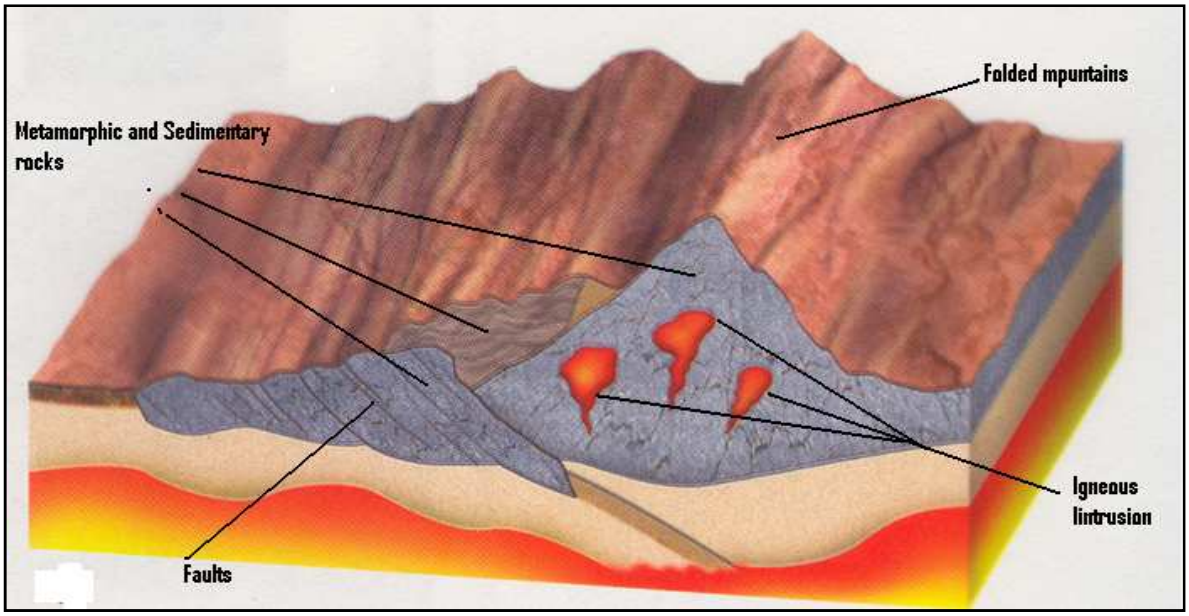
Types of collisions at Convergent boundaries

i. The first type occurs when a plate with oceanic crust at its leading edge collides with a plate with continental crust at its edge.

- Oceanic crust being denser is subducted or forced under continental crust.
- Result into volcanism
- Examples are Andes and Cascades

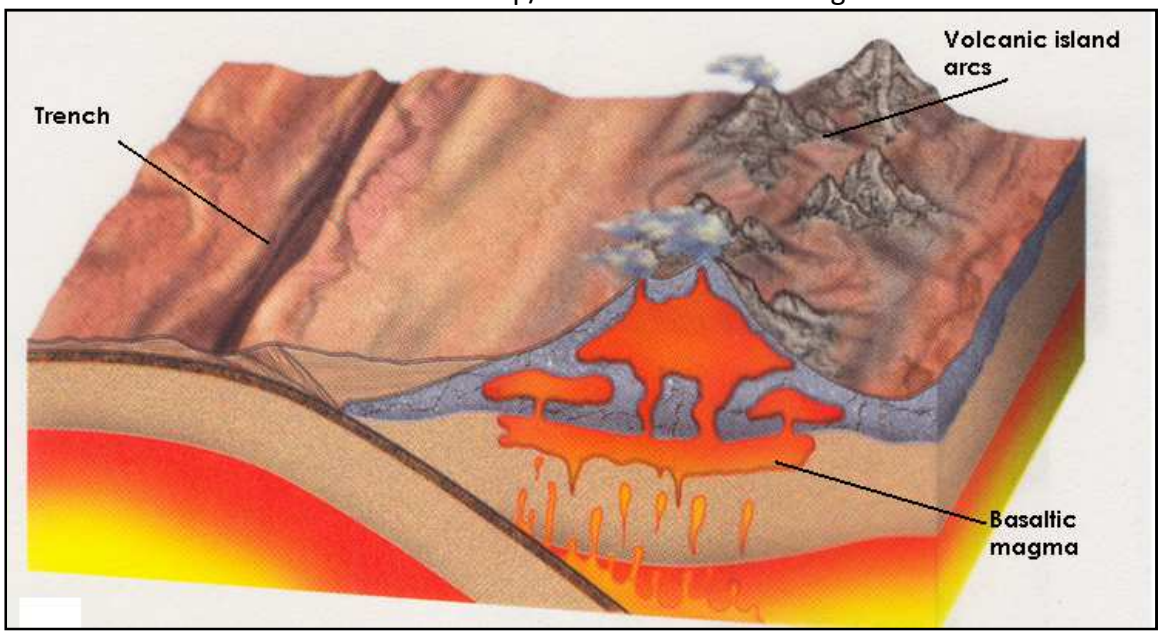


ii. The second type of collision occurs when two plates with continental crust at the leading edges come together hence colluding edges crumple and uplift producing large mountain ranges e.g. Himalaya Mountains result from folding



iii. The third type of collision occurs when oceanic crust collides with oceanic crust and these form;

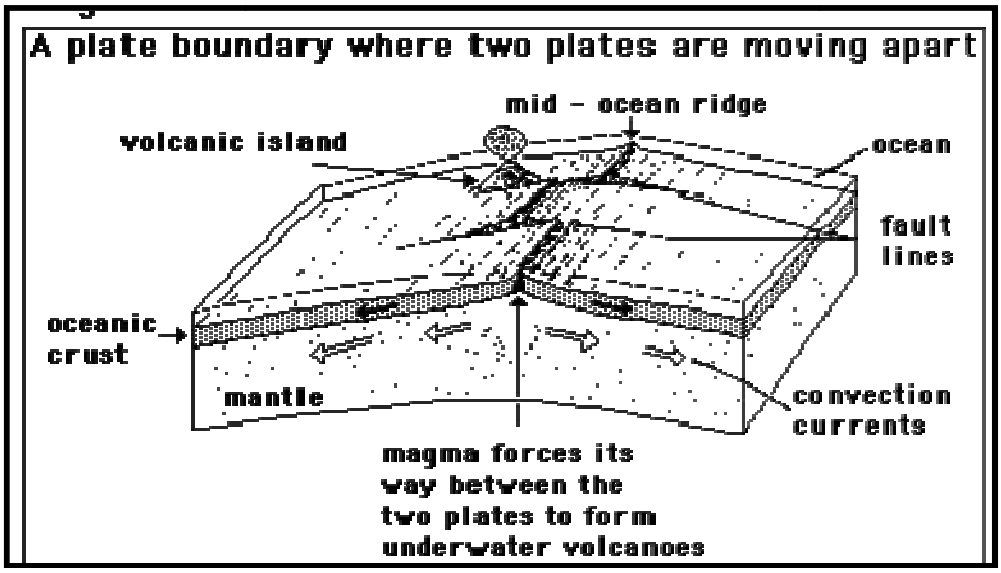
a. Oceanic Islands b. Oceanic deep/trench c. Oceanic ridges



- Examples are Phillipines, Japan, Aleutian islands

2. Divergent Boundary

- This occurs where two plates move away from each other as shown below;



- As plate move apart, molten rock from asthenosphere rises and fills the space between the plates creating new oceanic crust.
- Most of these boundaries are found on the ocean floor
- There location are marked by mid-oceanic ridge
- In the center of mid-ocean ridge formed a valley called rift valley.

3. Transform Fault Boundary

- Occurs where crust is neither produced nor destroyed as the plates slide horizontally past each other.
- Plate edges do not slide along smoothly instead they scrape together and move in a series of sudden spurts of activity separated by periods of little or no motion. E.g. San Andreas fault in California.

Note: Earths movements explained above may result into folding and volcanism.
These movements may be either lateral/ sideways (Orogenic) or Vertical (Epeiorogenic) which are caused by two forces namely

i. Compression force
ii. Tensional force

Mountain Building Processes

There are five basic kinds of mountains:

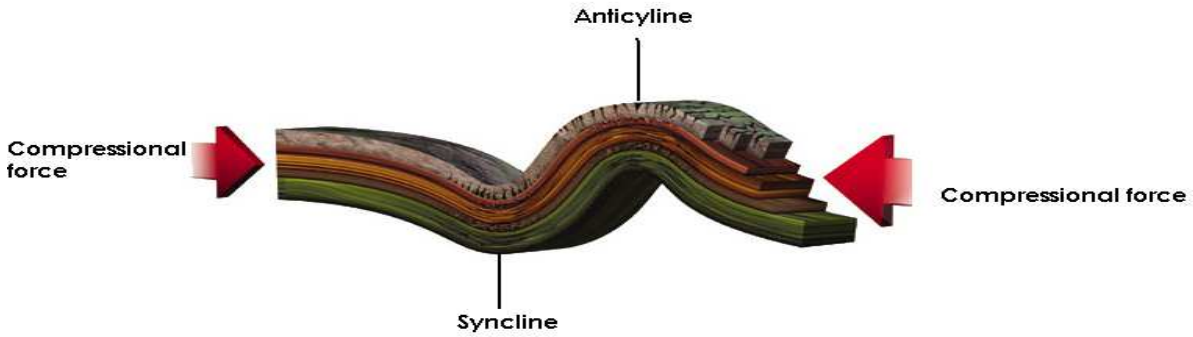
1. Fold Mountains (Folded Mountains)
2. Fault-block Mountains (Block Mountains)
3. Dome Mountains
4. Volcanic Mountains
5. Plateau Mountains

1 . Fold Mountains

The formation of Fold Mountains

1. Where an area of sea separates two plates, sediments settle on the sea floor in depressions called geosynclines. These sediments gradually become compressed into sedimentary rock.
2. When the two plates move towards each other again, the layers of sedimentary rock on the sea floor become crumpled and folded.
3. Eventually the sedimentary rock appears above sea level as a range of Fold Mountains.

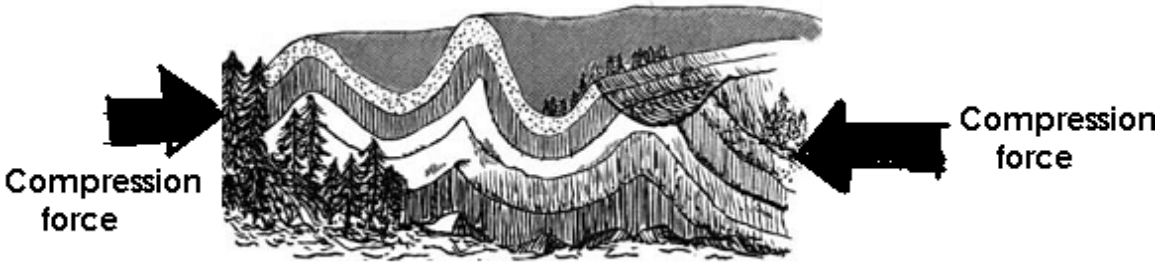
Note: Where the rocks are folded upwards, they are called **anticlines**. Where the rocks are folded downwards, they are called **synclines**. Severely folded and faulted rocks are called **nappes**.



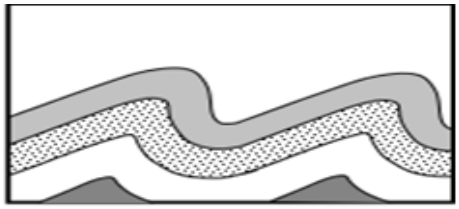
- Examples of Fold Mountains include:
  - Himalayan Mountains in Asia
  - the Alps in Europe
  - the Andes in South America
  - the Rockies in North America
  - the Urals in Russia
- The Himalayan Mountains were formed when India crashed into Asia and pushed up the tallest mountain range on the continents.
- In South America, the Andes Mountains were formed by the collision of the South American continental plate and the oceanic Pacific plate

Classification of Folds

- Folds can be classified based on their appearance.
- If the two limbs of the fold dip away from the axis with the same angle, the fold is said to be ***symmetrical fold*** / simple fold as shown below;

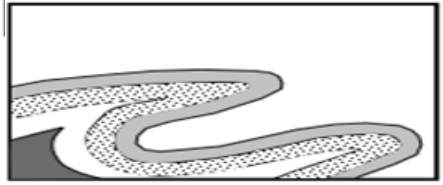


- If the limbs dip at different angles, the folds are said to be ***asymmetrical folds*** as shown below



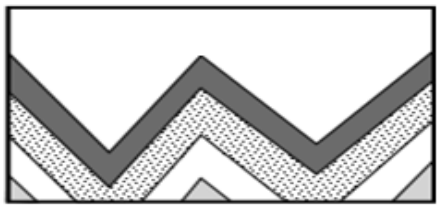
- If the folding is so intense that the strata on one limb of the fold become nearly upside down, the fold is called an ***overturned fold*** as shown below

- An overturned fold with an axial



plane that is nearly horizontal is called a ***recumbent fold***.

- A fold that has no curvature in its hinge and straight-sided limbs that form a zigzag pattern is called a ***chevron fold***.



Features formed due to folding include

i. Ridges
ii. Valleys
iii. Escarpments
iv. Fold mountains

Characteristics of Fold Mountains

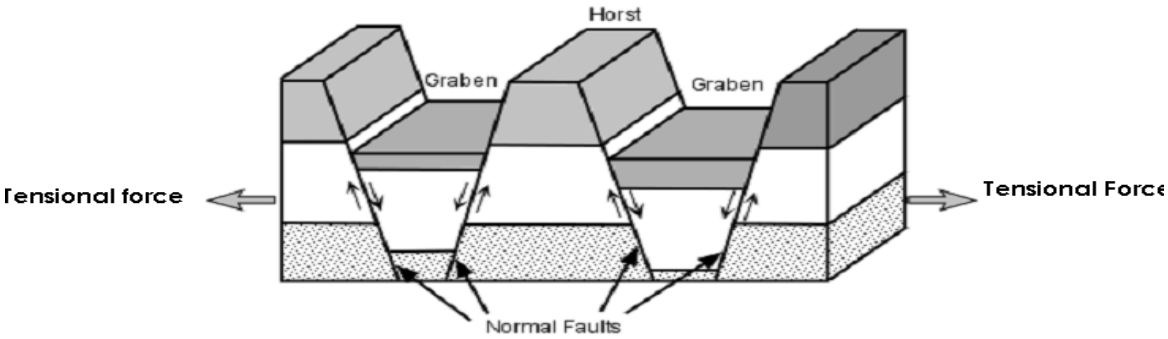
i. They are high
ii. Some of them are formed in parallel sets
iii. They have igneous rocks that form from the root

Importance of Fold Mountains

i. Ridges in folded mountains make good areas for forestry
ii. Their valleys make rich agricultural areas
iii. Some folded areas are rich in minerals such as limestone and coal.
iv. Folding helps in transformation of some resources into more economically beneficial resources e.g. anthracite and slate.
v. Most fold mountains attract tourists
vi. They help to bring rainfall.

2. Fault-block Mountains

- These mountains form when faults or cracks in the earth's crust force some materials or blocks of rock up and others down.
- Instead of the earth folding over, the earth's crust fractures (pulls apart). It breaks up into blocks or chunks. Sometimes these blocks of rock move up and down, as they move apart and blocks of rock end up being stacked on one another.



- Often fault-block Mountains have a steep front side and a sloping back side.

Causes of faults

i. Stress of the rock mass that is tensional forces lead to the stretching of the crust or compression force that tend to squeeze the rock together.

ii. Faults occur in rocks that are old and usually become hard such that when compressed or pulled apart they don't bend but break.

Results of fault occurrence

i. Rocks slips: this is where layers of rocks get separated.
ii. Displacement along the plane of breakage takes place.
iii. Earthquake.

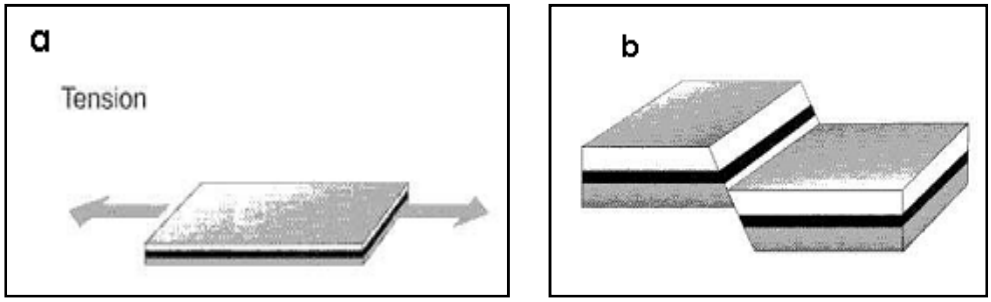
Examples of fault-block Mountains include:

- the Sierra Nevada mountains in North America
- the Harz Mountains in Germany
- Ruwenzori (Congo/Uganda border)
- Ethiopian Highlands
- Congo horst
- Khana mountain in Namibia

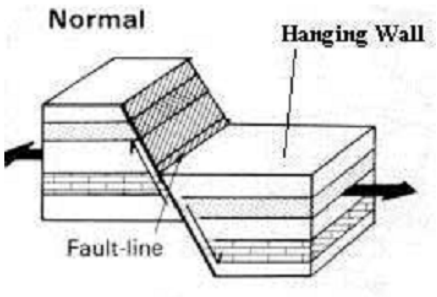
Types of Faults

i. Half-Grabens /Normal fault

- This is the fault which has a curved fault plane with the dip decreasing with depth can cause the down-dropped block to rotate. In such a case a half-graben is produced, called such because it is bounded by only one fault instead of the two that form a normal graben as shown below;

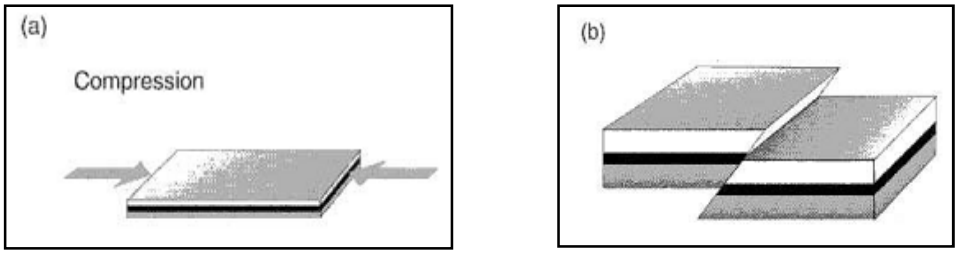


- If the hanging wall of a fault appears to have moved down the fault, then the fault is called **NORMAL FAULT**



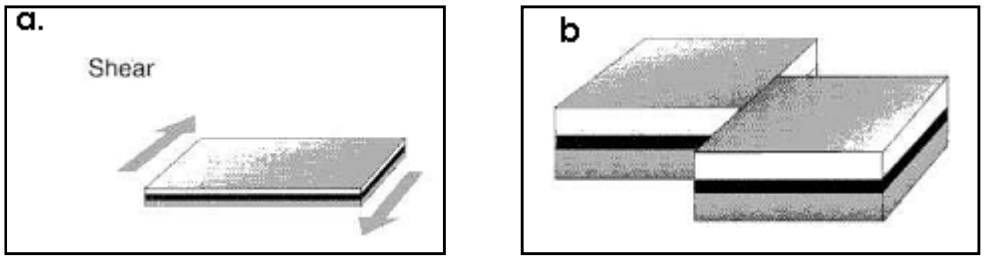
ii. Reverse/ Thrust fault

- If the hanging wall of a fault appears to have moved up the fault, then the fault is said to be reverse or thrust fault.
- Below is the process from which a reverse fault is formed



iii. Strike Fault

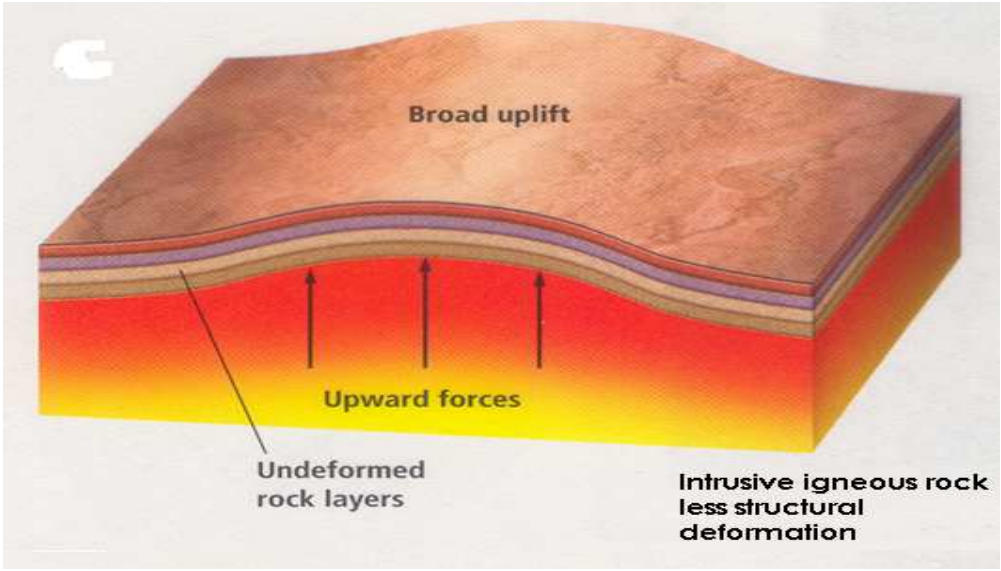
- If the movement along the fault is horizontal, then the fault is called Strike slip as shown below



- Features formed due to faulting
  i. Valleys (rift valley) or Grabens
  ii. Lakes(rift valley lakes)
  iii. Block mountains
  iv. Fault scarps

3. Dome Mountains

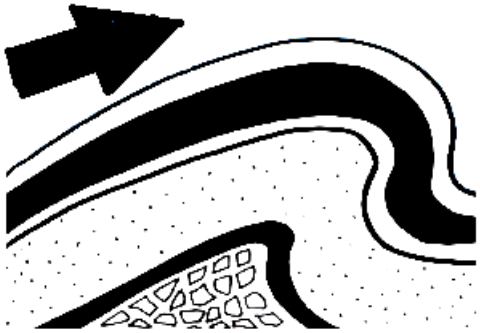
- Dome Mountains are the result of a great amount of melted rock (magma) pushing its way up under the earth crust. Without actually erupting onto the surface, the magma pushes up overlaying rock layers.
- The magma cools and forms hardened rock. The uplifted area created by rising magma is called a dome because of looking like the top half of a sphere (ball).
- The rock layers over the hardened magma are warped upward to form the dome. But the rock layers of the surrounding area remain flat.



- As the dome is higher than its surroundings, erosion by wind and rain occurs from the top.
- This results in a circular mountain range. Domes that have been worn away in places form many separate peaks called Dome Mountains.

4. Volcanic Mountains

- As the name suggests, volcanic mountains are formed by **volcanoes**.
- Volcanic Mountains are formed when molten rock (magma) deep within the earth, erupts, and piles upon the surface. Magma is called lava when it breaks through the earth's crust. When the ash and lava cools, it builds a cone of rock. Rock and lava pile up, layer on top of layer

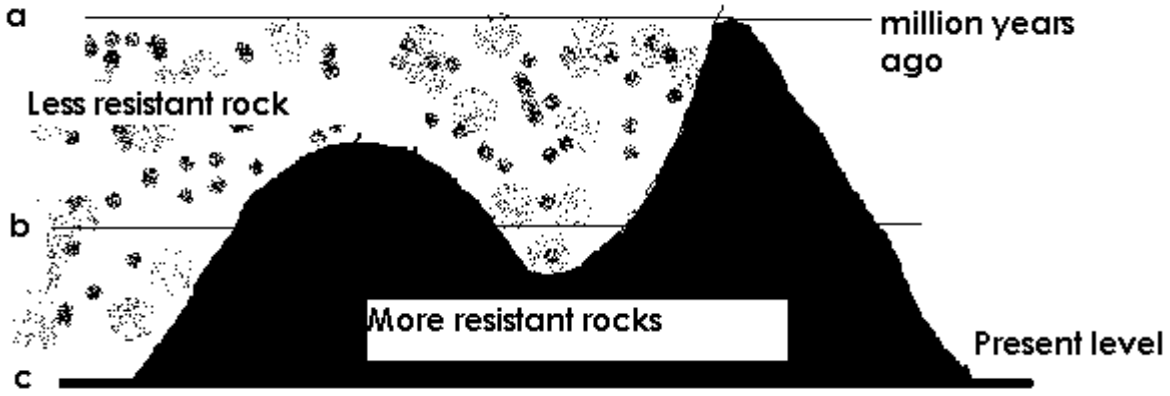


Examples of volcanic mountains include:

- Mount St. Helens in North America
- Mount Pinatubo in the Philippines
- Mount Kea and Mount Loa in Hawaii

5. Plateau Mountains (Erosion Mountains)

- These mountains are formed by erosion.
- Plateaus are large flat areas that have been pushed above sea level by forces within the Earth, or have been formed by layers of lava.
- Plateau Mountains are often found near folded mountains. As years pass, streams and rivers erode valleys through the plateau, leaving mountains standing between the valleys.
- The mountains in New Zealand are examples of Plateau Mountains.



Sample Questions

1. a. Explain continental drift theory.
   b. With aid of diagrams where possible give any **three** evidences that the earth was one super continent.

c. What are the weaknesses of continental drift theory (give three)
d. explain the causes of the disintegration of pangea.

2. Explain the different kinds of plate boundaries.
3. Explain with an aid of a diagram how Ethiopian highland were formed.
4. a. Differentiate simple fold from recumbent fold.
   b. Give ant **two** features formed due to folding
4. Define the following terms
   a) Lithosphere b). Sial
5. With the aid of a clearly labeled diagram describe the internal structure of the earth.
6. Give any **two** features formed when oceanic plate meets another oceanic plate.

ROCKS

Objectives

- Define a rock
- Explain the formation of rocks
- Identify different types of rocks
- Explain how rock are classified
- Explain characteristics of rocks
- Assess the importance of rocks.

- This is any naturally formal aggregate of minerals
- Rocks are classified according to the following factors
    - Texture
    - Structure
- Permeability
- Degree of resistance to erosion

Generally rocks may be classified according to origin and appearance

Types of Rocks

There are three types of rocks

i. Igneous rocks

- Igneous rocks are created when magma (molten rock under the Earth's crust) cools and becomes solid.
- The name comes from Latin word '*ignis*' which means fire.
- These rocks are formed by the cooling and solidification of molten material called magma from the interior of the earth crust.

Characteristics of Igneous rocks

- They are crystalline in nature
- They do not occur in strata
- They contain no fossils
- They are less dense and lighter in colour e.g. granite
- They contain basic oxides formed from magnesium or aluminum
- They contain high proportion of silica which are said to be **acidic**

Classes of Igneous Rocks

There are **two** classes of igneous rocks

a) <u>Plutonic or intrusive rocks</u>

- These are formed when magma cools deep down the earth crust and have large crystals because they cool slowly.

Examples are

i. Granite
ii. Diorite
iii. Gabbro
iv. Periodite

b) <u>Volcanic or extrusive rocks</u>

- These are formed when magma cools on the surface of the earth and have small crystals because they cool faster.

Examples of these rocks are

i. Obsidian
ii. Pumice
iii. Rhyolite
iv. Basalt etc

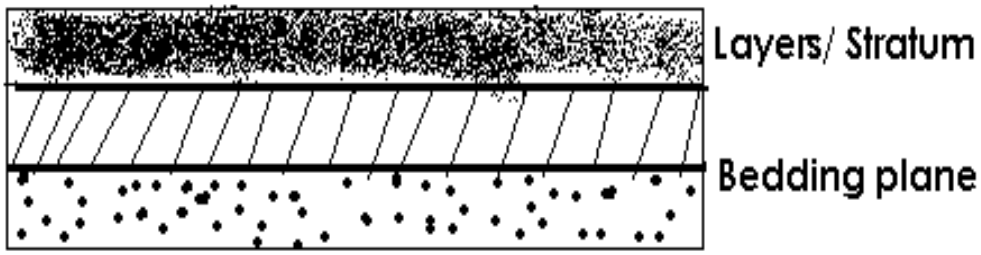
Igneous rocks in diagrams

ii. Sedimentary rocks

- These are rocks formed from accumulation and hardening of sediments of sand, silt and other materials.
- These are rocks that originate from rocks through sediments that come from the breaking of rocks.
- These rocks are formed from sediments that are transported and accumulated below water bodies or at any undisturbed place then become compressed to form layers of sedimentary rocks.

Characteristics of Sedimentary rock

- They are hot crystalline in nature
- They form in layers or they are stratified and each layer of sedimentary rock is known as **stratum**.



- They have fossils

Examples of these rocks are

i. Sandstones
ii. Gravel chalk
iii. Conglomerate

Formation of Sedimentary Rocks

Sedimentary rocks are formed in three ways;

a) Mechanically/physically b. Organically c. Chemically.

a. Mechanically formed sedimentary rocks

- These are formed by accumulation of both organic and inorganic materials collected together e.g. sandstone formed from sand grains
- The coarser sand stone is called **GRIT**
- Where pebbles are connected together the stone formed is called **CONGLOMERATE**
- Angular pebbles form a stone called **BRECCIA**

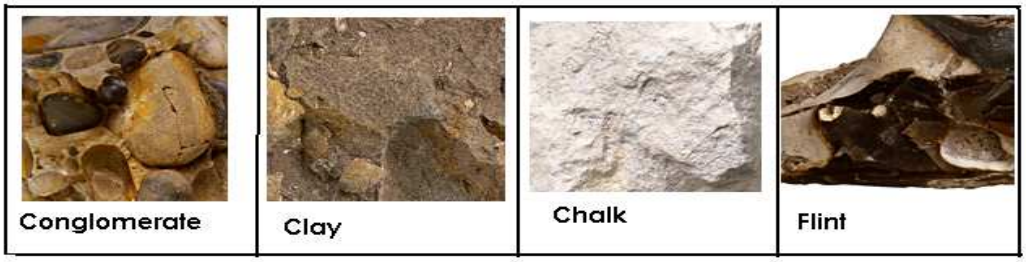
b. Organically formed sedimentary rocks

- These are formed from the remains of organic matter such as coral shells, fish whose fresh have decomposed leaving hard shells e.g. limestone, chalk, coal etc.

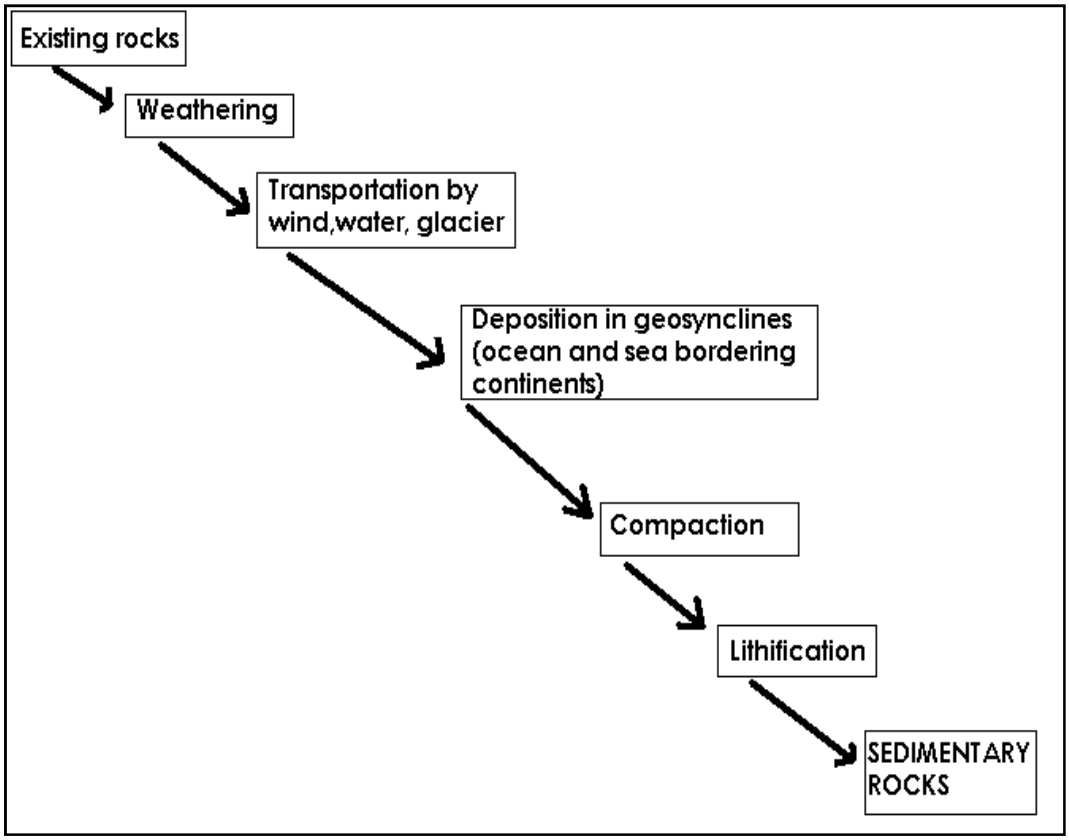
c. Chemically formed sedimentary rocks

- These are formed from evaporation of salt lakes with potash nitrate.

Sedimentary rocks in diagrams



Process Involved In Sedimentary Rock Formation



iii. Metamorphic rocks

- These are rock formed through the process of metamorphism.
- The existing rock change in the nature of original rock when subjected to environments or conditions that are different from those which they were formed by either of the following

a. By compression from the weight of overlying rock
b. Movements inside the earth's crust
c. By heat from pressure within the crust or nearness to flow of igneous rocks.
d. By chemical action i.e. water containing other minerals changes the form of the rock.
   - The type of rocks are commonly found in the following areas

   i. Shields ii. Eroded mountain ranges iii. Volcanic areas

Characteristics of metamorphic rocks

i. These rocks are not permanent because they are greatly altered by intense earth movement

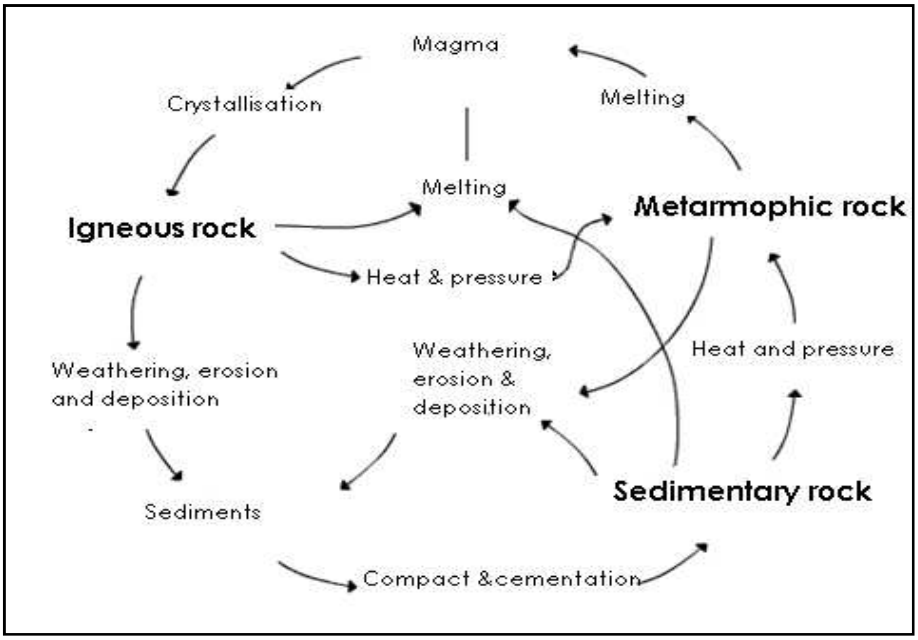
Examples of these rocks include;

- Slate which changed from clay
- Marble which changed from limestone.
- Quartzite which changed from sandstone
- Schist changed from shale
- Graphite changed from coal

Metamorphic rocks in diagrams

Rock Cycle

- The **rock cycle** represents the alteration of rock-forming minerals above and below the earth's surface.
- The rock cycle illustrates how rocks formed and altered by erosion, heat and pressure to form new rock types.

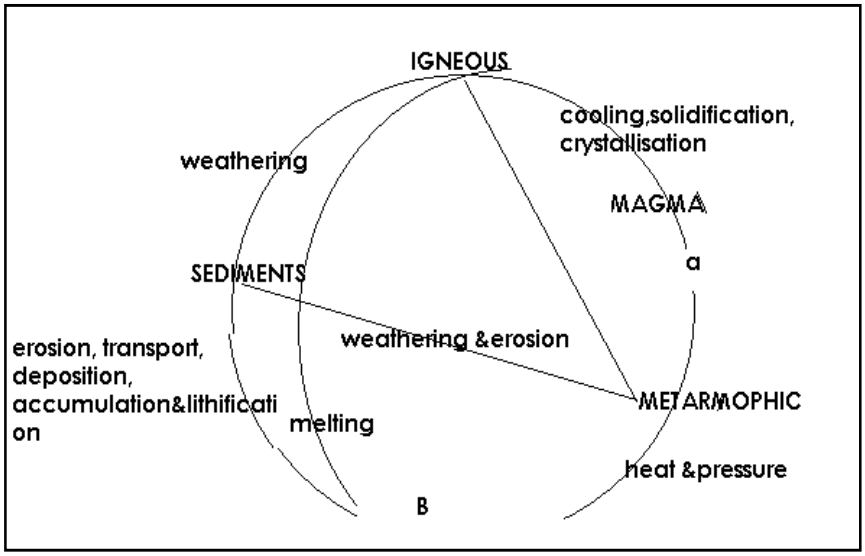


Economic Importance of Rocks

i. Rock helps in the formation of soil through the process of weathering
ii. Clay is used in brick making for building construction
iii. Limestone is used for cement making
iv. Rocks are also used for decorations
v. Some rocks are precious as such they are source of income after extraction e.g. gold.
vi. Source of energy e.g. coal

Sample Questions

1. Below is a diagram of a rock cycle, study it and answer the questions that follow;



i. Name the rock type labeled b
ii. Explain processes involved at a.

2. Give any **four** economic importance of rocks.

3. a. What is the difference between plutonic igneous rock and volcanic rocks?
b. Give **three** characteristics of sedimentary rocks.

WEATHERING

Objectives

- Define weathering
- Explain different types of weathering
- Explain different weathering processes.

- All rocks are vulnerable to weathering; this is "**the breakdown and decay of rocks in-situ related to elements of the weather (e.g. temperature, rainfall, frost etc.)**" (although biological weathering - does not directly involve elements of the weather, it is still classed as a weathering process).
- ***Do NOT confuse with erosion*** (erosion - involves the breakdown and removal of material - weathering occurs "in-situ")
- Weathering is the first stage in the denudation of the landscape. Rocks are weakened and loosened by weathering processes. This weakened material is then removed by agents of erosion (e.g. ice, water etc.)

Classification of Weathering

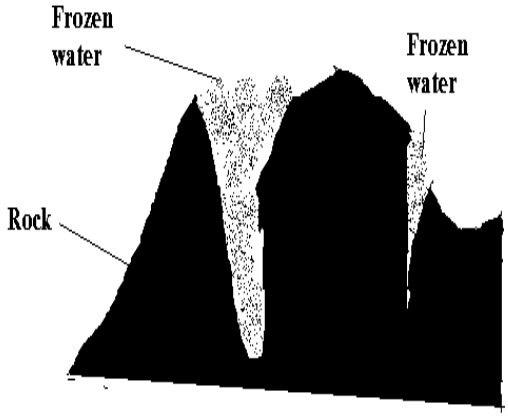
Weathering can be classified into Physical, Chemical and biological Weathering

Physical Weathering

- Physical weathering is also known as **mechanical weathering** and it involves the physical breakdown of rock - it does not involve chemical change.

Freeze Thaw

- This is the breakdown of rocks due to the expansion of water during freezing, a process common in upland Britain where evening temperatures often fluctuate around $0^{o}C$.



- Freeze thaw is most effective in jointed rock (e.g. granite). during freezing, water expands by 9% in volume.
- Water freezing in cracks in rocks, exerts pressure.
- Alternating freeze-thaw cycles gradually force the rock to split or cause rock fragments to break off.
- Where this process occurs on steep slopes, rock fragments collect at the base of the slope due to gravity in the form of a scree slope.

Pressure Release (also known as dilation)

- Rocks such as granite, formed as igneous intrusions are formed under pressure.
- When weathering and erosion removes overlying rocks, the pressure is released and the underlying rock expands.
- This expansion results in the fracturing of the rock, which weakens it by making it susceptible to other weathering agents.
- If cracks develop parallel to the surface, sheeting of rock layers may occur.

Thermal Expansion (insulation weathering)

- This process results from large diurnal temperature ranges which result in heating and cooling of the rock.
- When heated, expansion of the rock occurs, whilst during cooling the rock contracts. This expansion and contraction during cycles of temperature change results in stresses in the rock layers.
- Outer layers of rock heat and cool quicker than inner layers and over time the upper layers flake / peel off (exfoliation).

- It should be noted that the effectiveness of this process is heavily debated and some believe that it is only really effective when water is also present.

Salt Crystallisation

- Water passing through crevasses and joints in rocks, may be saline (carrying salts in solution).
- As the water evaporates, the dissolved salts precipitate and crystallize forming salt crystals.
- This may also take place where in rocks such as chalk, the rock is decomposed by solution to form salt solutions such as sodium carbonate which will then crystallize upon evaporation of the moisture.
- The salts may expand up to 3 times their original size, and therefore the crystals put stresses upon the rock as they grow, resulting in granular disintegration (gradually breaking off individual grains of rock).

Chemical Weathering

- Chemical weathering is where rocks are decomposed by chemical reaction between elements of the weather and rock minerals, resulting in either the alteration of a rock's internal mineral structure or the formation of new minerals (e.g. feldspar forming Kaolin in the process of hydrolysis).

- Weakened rock or the consequent deposits are then more easily removed by erosion processes.
- Water plays a key role in most chemical reactions and also provides a transport mechanism for other elements that carry out weathering.
- Chemical weathering is most dominant in hot and humid areas such as equatorial zones and least effective where there is little rain such as in desert or Polar Regions (where most water is held as ice).
- The susceptibility of rocks to chemical weathering is determined by the types of minerals they contain and their mineral structure. There are a number of different types of chemical weathering.

Oxidation

- The exposure of rocks to oxygen in air or water can result in a reaction between the oxygen and iron-based minerals in the rocks.
- Iron readily oxidises and during oxidation, blue grey ferrous iron (**Fe^{2+}**) is transformed to red ferric iron (**Fe^{3+}**).
- This causes a weakening of the rock structure enabling them to crumble easily and making them more susceptible to other weathering processes.

Carbonation

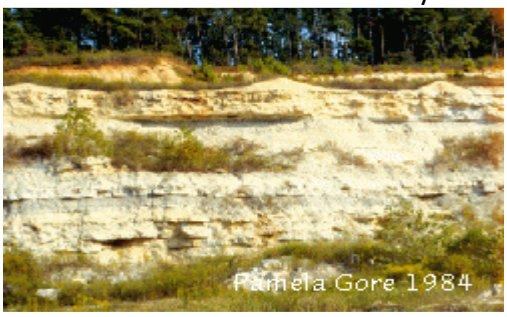
- Rainwater contains dissolved CO_2 which forms a weak carbonic acid (**$H_20 + C0_2 = H_2C0_3$**). Carbonic acid is able to react with calcium carbonate (common in rocks such as limestone and chalk) to form calcium bicarbonate which is then easily removed in solution in water.
- Limestone is gradually dissolved in this way as the calcium carbonate is converted to calcium bicarbonate and carried away in solution by running water.

Solution

- Water can act as a solvent by breaking down chemical bonds in minerals causing them to dissolve in a process known as **solution** - carbonation is therefore a form of solution although it is mineral specific in relation to calcium carbonate.
- Solution rates tend to increase with an increased acidity of water.

Hydrolysis

- This is where acidic water reacts with rock forming minerals such as feldspar.
- This is a common process in the weathering of granite.
- Hydrogen ions in the water displace potassium ions in the feldspar.
- This causes the **feldspar** to break down into a secondary mineral, **Kaolin (China Clay)**.



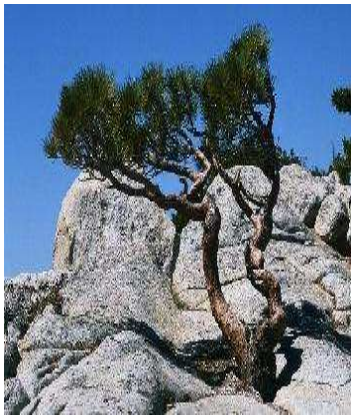
- Whilst the feldspar in granite decomposes, the quartz and mica remain relatively unaffected but the structure weakened.

Hydration

- This occurs as the addition of water causes minerals in rock to swell (by about 0.5%) due to a chemical reaction as the mineral absorbs water ('hydrates'), thus involving both chemical and physical (mechanical weathering).

- The formation of **gypsum** when water combines with **anhydrite** (**$CaS0_4$** (anhydrite) + **$2H_20$** (water) = **$CaS0_4.2H_20$** (gypsum)).
- Gypsum is fairly soluble and can then be fairly easily removed by solution.

Biological Weathering



- Usually consists of a combination of physical (growth of Roots into joints in rocks) and chemical (e.g. impact of organic acids) processes.

Tree Roots

- As roots of plants and trees grow downwards, they often enter and exploit cracks joints in rock.
- As they grow they are able to gradually wedge the joints further apart, eventually resulting in detachment of rock fragments (similar to freeze-thaw)

Organic Acids

- As roots as well as surface litter decays, organic acids are released into the ground. Percolating rainwater moves these acids further down and the organic acids may react with minerals in the rock through a process called chelation.
- The combination of rainwater and organic acids combines with aluminium and iron which are washed out of the soil.
- Respiration of bacteria and tree roots also releases $C0_2$ which when becomes dissolved in water forms a weak carbonic acid which can increase the chemical weathering process, carbonation.

Animal Activity

- Burrowing animals help to open up joints in rock and also help to bring rock fragments to the surface, where they are exposed to further weathering.
- At the coast, animals such as limpets increase the rate of chemical weathering through the acids secreted as they cling to rock surfaces.

Sample Questions

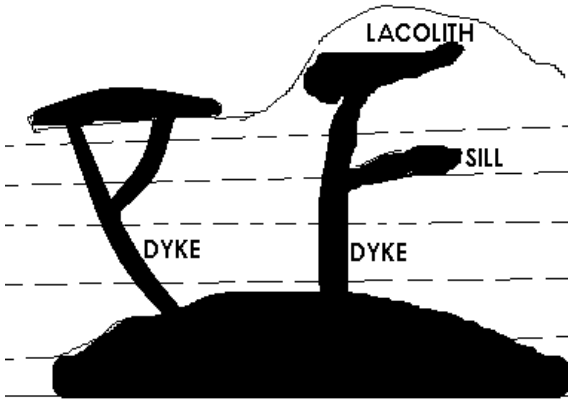
1. Define the following terms in weathering
   a. Exfoliation b. solution
2. Differentiate freezing thaw from crystallizations as physical processes of weathering.
3. With an aid of a diagram explain how plant roots contribute in weathering process.

VOLCANOES

Objectives

i. Explain formation of volcanoes
ii. Locate major areas of volcanic activity
iii. Assess effects of volcanism.

- Volcanoes are vents (openings) in the ground from which magma (molten rock), ash, gas, and rock fragments surge upwards, in an event called an eruption.
- They are often found at boundaries between the plates in Earth's crust. Volcanic eruptions produce volcanoes of different shapes, depending on the type of eruption and the region's geology. **HYDROTHERMAL ACTIVITY** occurs where underground water is heated by rising magma.
- Volcanic activity is closely connected with crustal disturbances particularly where there are zones of weakness due to folding and faulting.
- As the temperature increases with increasing depth below the earth crust, the interior of the earth is expected to be in a semi- acid state. This liquid is called MAGMA. The magma can force its way through the cracks/fault. Some of the magma can be erupted to surface of the crust by activities and from volcanoes or lava floor.
- Some of the magma may solidify within the crust and form different intrusive features as illustrated below;



- Crustal disturbance caused by deep faulting or rock folding due to collision of crustal plates permit magma to come out.
- Volcanic features formed in crust (Intrusive)
  - i. Batholith ii. Sill iii. Dyke

i. SILL- This is magma sheet lying along the bedding plain.
ii. Dyke – this is a wall like feature formed across the bedding plane and lie vertically or inclined. If exposed to the surface they may act as a ridge or an escarpment.
iii. Batholith – Large mass of magma which after removed of overlying rocks form a resistant upland region
iv. Lacolith – Dome shape mound with level bone fed by a pipe or conduit from below

- Features formed on the surface (extrusive)
  - i. Caldera lake iii. Lava plateau iii. Spine or plug

NOTE: Volcanoes are difficult to predict but scientists have done this by developing some warning systems. These detect possible volcanoes. This is done by looking possible conditions that precede volcanoes

The condition that precedes volcanic eruption is earthquakes or earth tremors. The do occur because magma beneath that rises to force its way out.

Types of Volcanic Lava

I. Basic Lava

Characteristics of basic lava

- They are very hot and highly fluid
- They are poor in silica
- They flow quietly affecting extensive area
- They give rise to lava plains and plateaus
- They are rich in iron and magnesium and are dark in colour.

II. Acid Lava

Characteristics of acid lava

- They are vicious (thick)
- They flow slowly
- They are explosive, often throwing out volcanic bomb or pyroclasts.
- They give rise to steep-sided cones.
- They are rich in silver and are light in colour.
- They produce fine dust, ash and fragments of rocks
- They produce rocks that are dense and lighter in colour.

Types of Volcanoes

a. Active Volcanoes

- These are volcanoes that are known to erupt frequently and are expected any time.
- Examples are: i. Stromboli (Italy) ii.Asama (Japan)
  iii. Nyiragongo and Nyamlagira (Congo/DRC)
  iv. Erte Ele (Ethiopia)

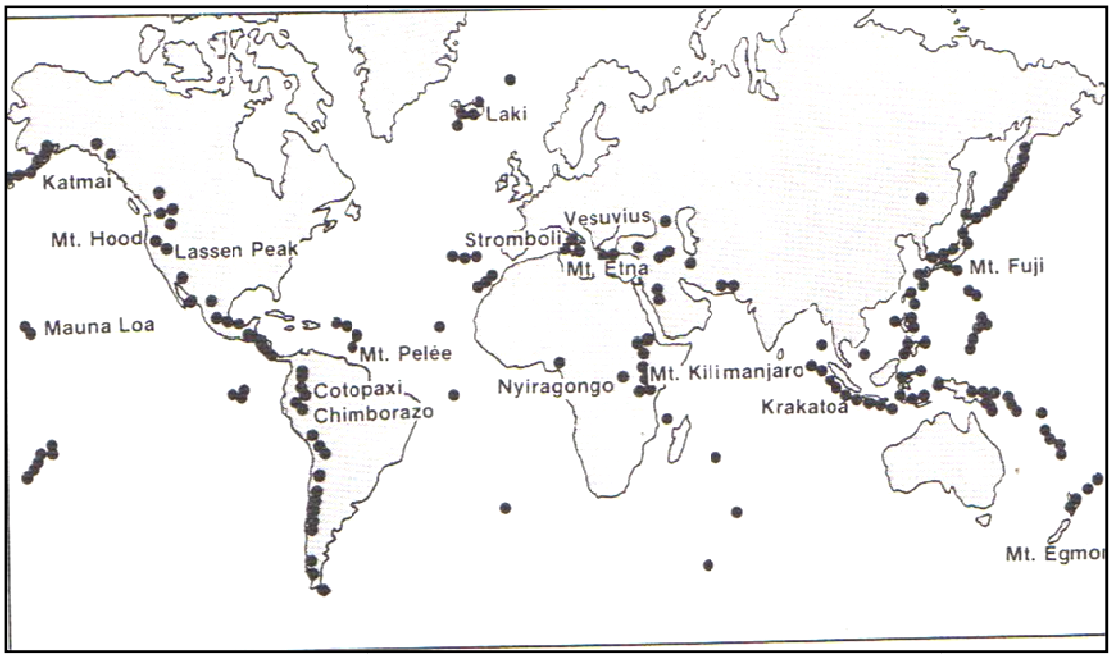
b. Dormant Volcanoes

- These are volcanoes that have not erupted in recent times but could erupt anytime.
- They are said to be sleeping
- Examples are: i. Lassen Peak (California) ii. Paricutin (Mexico)

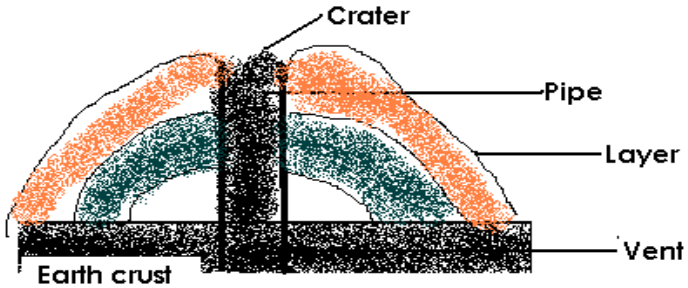
III. Dead or Extinct Volcanoes

- These refer to those volcanoes that stopped or cease to erupt.
- They may have features associated with volcanoes but never erupt.
- Examples are: i. Mount Kenya ii. Mount Elgon

World Map Showing Distribution of Volcanoes



Structure of a Volcanic Cone



Types of Volcanic Cone

1. **Ash/Cinder Cones**
   - These result from small volcanoes(minor eruption)
   - They form dust, ash and fragments(cinders) that accumulate after explosion and form a small- hill like structure (cone)
   - The cones formed are relatively small
   - The slopes are steep such that wind easily erode the dust that accumulates
   - Examples include Paricutin (Mexico)

2. **Composite cone / Strato volcanoes**
   - They are formed from big volcanoes
   - When they erupt there is steam, rock fragments (cinders), very big rocks (bombs), and ash and lava flow.
   - Sometimes they are built of layers of ash and lava
   - They are high and steep
   - Examples include: mount Kilimanjaro (Tanzania) and mount Kenya.

Features Formed From Volcanic Action

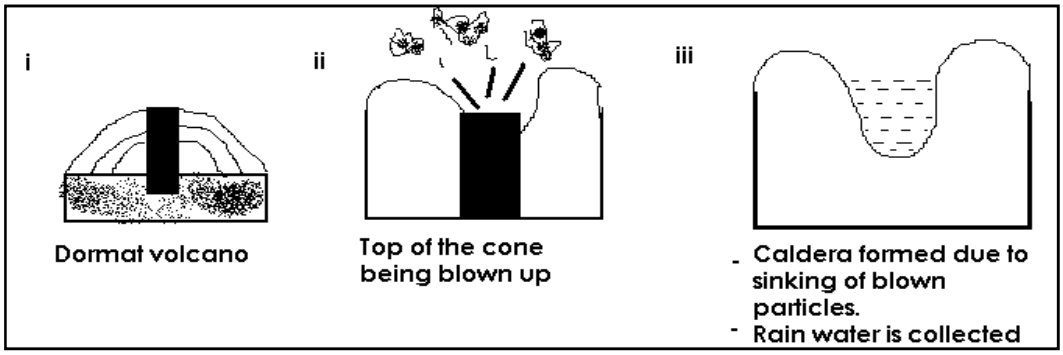
i. **Lava domes**

- These are formed from lava that flow without explosion and its fluid

- They are formed from lava issuing from extensive cracks
- Lava spreads extensively and form gentle slopes.

ii. Caldera lakes

- A caldera is a depression that forms on upper part of a pre-existing volcano.
- It is formed either by the top of the already existing cone blown off or if rocks that formed the pre-existing volcano are broken down and become part of the volcano as illustrated below;



- Example of this lake is Lake Toba in Sumatra.

iii. Lava Plateau

- Fluid lava give rise to lava plane or plateau
- They are rocky, high and steep with fairly flat tops
- They give rise to important rivers that flow with speed and ideal for Hydro-electric generation.
- Their tops are sometimes ideal for forestry
- Others contain valuable mineral e.g. bauxite
- Example is Deccan plateau.

iv. Lava domes/ Shield volcanoes

- These are formed from lava that flow without an explosion and is fluid.
- A shield is a large area of ancient rocks. These rocks are usually igneous and metamorphic which have been exposed.
- The rocks in a shield are resistant to erosion.
- Shields are found in area that have for a long time been un disturbed due to earth movement except for erosion.

v. Spines or Plug

- These result from vicious lava
- These are formed at the crater

vi. Hot Spring

- These are springs that ooze hot or warm water
- Water underneath the earth crust is heated and forced to rise to the surface quietly (without explosion)

vii. Geysers

- A Geyser is a hole in the earth's crust, spouting fountains of boiling water. Hot rock heats up water in an underground chamber and when the water boils, it sends out a fountain of boiling water, up to 500 metres.
- Water is usually ejected with an explosion

Social, Economic and Environmental Effects of Volcanoes

i. Good Effects

a. Ash that fall may change the soil to become fertile

b. They give rise to beautiful and attractive sceneries and these do attract tourists. E.g. mount Kenya and Mount Kilimanjaro
c. They bring about precious minerals that are of economic important e.g. Diamond.
d. Lakes (crater) that are formed provide water to people e.g. Ngorongoro and L.Ngozi (Tanzania), L. Shaka (Ethiopia).
e. Some volcanoes produce geothermal energy which can be used for in homes and industries e.g. geothermal energy is used to produce electricity in Mexico.
f. They produce hot water through spring which is used by people to heat homes.
g. They help scientists to know about the interior of the earth.

ii. Bad Effects

a. They cause destruction of villages, towns and cities
b. Eruption of volcanoes may causes large waves in oceans and seas called (Tsunami) which affects coastal areas.
c. Sometimes they give rise to un productive agricultural land.

Sample Questions

1. a. Define 'volcano'
   b. what are the three stages of a volcano
2. Give ant three constructive effects of a volcanic eruption
3. What is a difference between a spring and a geyser?
4. Explain any two differences between a basic lava and acid lava.

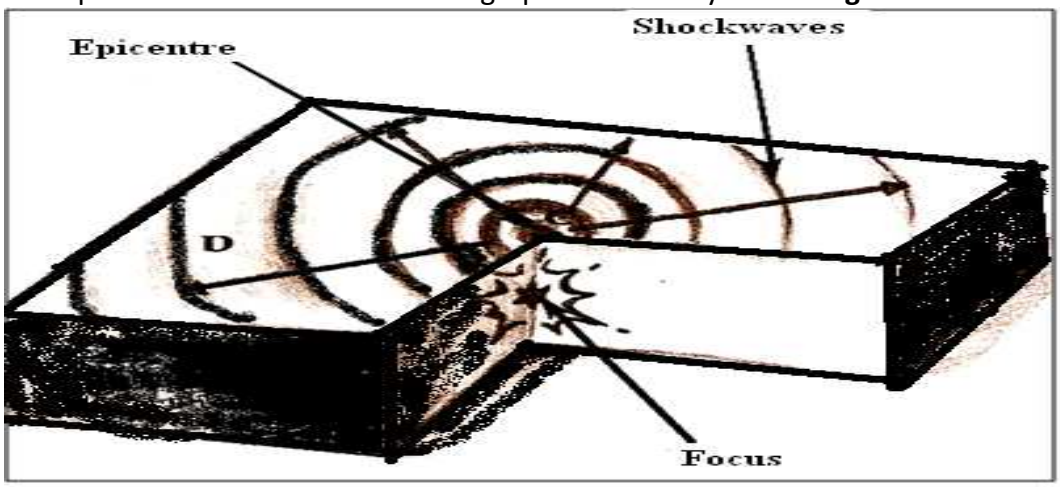
EARTHQUAKE

Objectives

i. Define earthquake
ii. Explain causes of earthquake
iii. Describe effects of earthquakes
iv. Locate areas where earthquakes occur
v. Explain relationships among fold mountains, earthquakes and volcanic zones

An Earthquake

- An earthquake is a vibration of the Earth produced by a rapid release of energy
- These are shaking or vibration of the ground that originate from the point known as FOCUS in the rocks of the earth.
- These are shaking of the ground caused by deep-seated disturbances, producing series of elastic shock waves spreading outwards from the EPICENTRE
- FOCUS is a point in the interior of the earth where an earthquake originate
- Epicentre is a point on the earth's surface which is directly above the focus and its where the impact of earthquake is felt first and it is great.
- Its impact is greater at the epicenter because this is the point which is nearest the focus from the earth's surface.
- Aftershocks are smaller earthquakes generated by adjustments following a major earthquake.
- Earthquakes are measured at Seismographic station by **seismologists**



Causes of earthquakes.

- The origin of earthquakes is ultimately the jostling between moving plates which produces the strain within the lithosphere that must be relieved by earthquakes.
- Pressure builds up along the fault lines and eventually slips, sending shock waves

i. Earthquakes are caused when tension is released from the rocks in the Earth's crust and upper mantle. This tension is due to friction between large 'plates' floating on magma on the Earth's surface.
ii. Sometimes earthquakes happen when the rocks in the earth's crust bend and break. This causes shock waves to travel on the earth's surface, resulting in widespread destruction.
iii. Human activities e.g. explosion – these cause earth tremors
iv. Volcanoes or earth movement
v. Extensive landslides may cause tremors.

Classification of earthquakes

- Earthquakes are classified according to the depth of their origin
- The Mercalli Scale (Ritcher scale) relies on how much damage is caused by an earthquake.

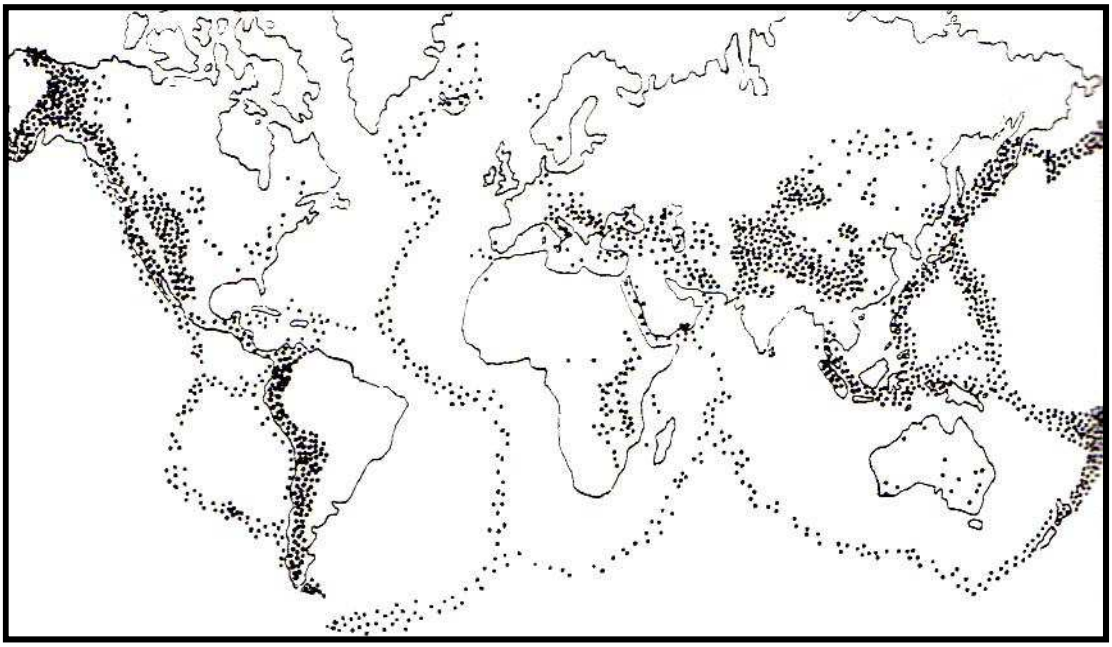
I	Only felt by instruments.	VII	Most people run outdoors. Damage to weakly constructed buildings. Felt by people in moving vehicles
II	Felt by people at rest, especially on upper floors. Suspended objects may swing.	VIII	Considerable damage to most buildings. Heavy furniture overturned. Some sand fluidised.
III	Felt indoors. Vibrations like passing traffic.	IX	Even well-designed and sturdy buildings badly damaged, moved from their foundations. Ground cracks. Pipes break
IV	Many people feel it indoors, a few outdoors. Crockery and windows rattle. Standing cars rock. Some sleepers awake.	X	Most masonry destroyed. Landslides occur. Water slops from reservoirs and lakes. Railway lines bend.
V	Felt by nearly everyone. Tall objects rock. Plaster cracks.	XI	Few structures remain upright. Bridges fall. Extensive fissures in the ground. Underground pipes totally out of action
VI	Most people run outdoors. Damage to weakly constructed buildings. Felt by people in moving vehicles.	XII	Total destruction. Ground thrown into waves. Objects flung into the air. You would be lucky to survive this one

- The shallow earthquakes cause a lot of damage because they occur near to the earth's surface.

Relationships among Fold Mountains, Earthquakes and Volcanic Zones

i. Areas where there is folding result into crustal disturbance which in turn cause sudden shaking of the earth called earthquake
ii. Where there is a volcanic eruption, there is a disturbance in the earth crust and this lead to earthquake and most of these occur along those zones

Map Showing Distribution of Epicentres of Major Earthquakes



Hazardous Effects of Earthquakes

i. They may cause buildings to collapse.
ii. They may mix power lines and cause short circuits that often cause fire.
iii. They induce landslides when they are highlands such as hills, mountains are shaken.
iv. They cause large waves in the oceans called TSUNAMI which sink ships and boats and cause damage to infrastructures along the coast.
v. People may loose their lives
vi. They make rivers to change direction

Measures to Avoid Disastrous Effects of Earthquakes

i. Complying to warning and orders by seismologist
ii. Buildings should be erected away from vulnerable areas e.g. along fault line or near dormant volcanoes.
iii. Building in areas that often experience earthquakes should be furnished with materials that can absorb the shock of the earthquake thereby sparing them collapsing.
iv. Buildings should be made from materials that can not easily get disintegrated e.g. wood materials, plastic or fiberglass.

Some terms on earthquakes

i. **Aftershocks**: smaller earthquakes following the main earthquake
ii. **Body waves**: seismic waves that propagate from earthquake focus to the surface; classified as primary (P) and secondary (S) waves
iii. **Elastic Rebound Model**: states that the sudden release of stored strain in rocks results from movement along a fault
iv. E**picenter**: location on Earth's surface that lies directly above the focus of an earthquake
v. F**ocus**: zone within Earth where rock displacement produces an earthquake
vi. **Lithosphere**: rigid outer layer of Earth, including the crust and upper mantle
vii. **Modified Mercalli Intensity Scale**: measures the intensity of an earthquake

viii. . **Richter scale**: measures the magnitude of an earthquake

ix. **Secondary effects**: no tectonic surface processes that are directly related to earthquake shaking

x. **Seismograph**: instrument that records earthquake waves, help locate the epicenter and focus of an earthquake

xi. **Surface waves**: seismic waves that travel along the outer layer of the Earth; classified as Love and Rayleigh waves

HYDROSPHERE

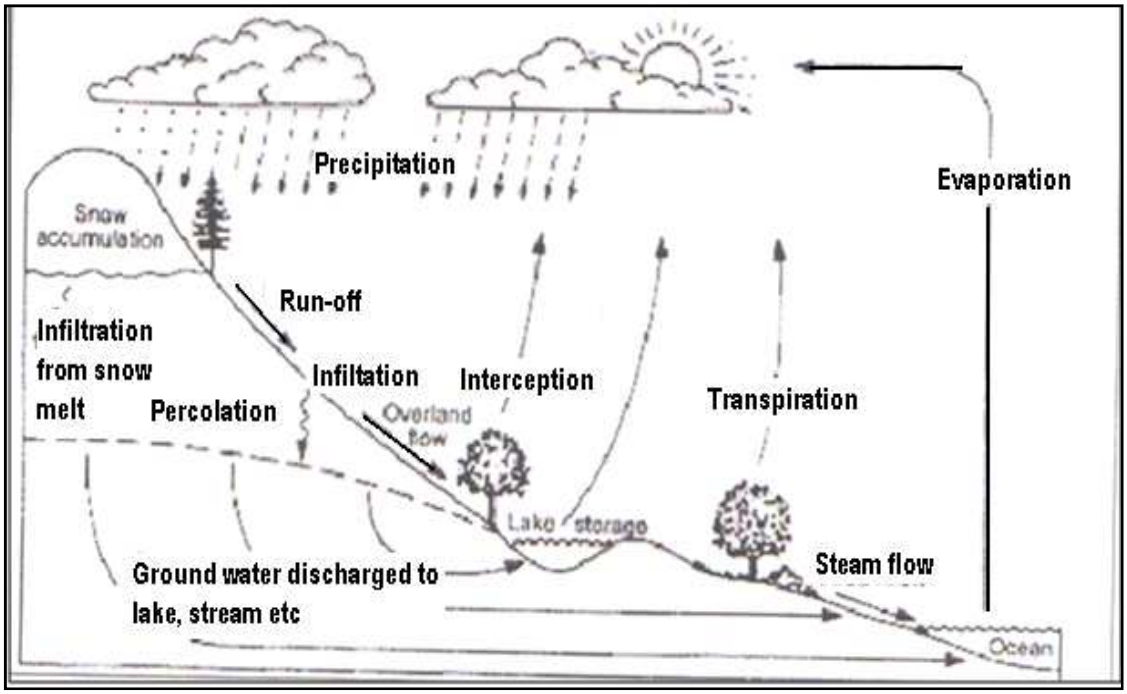
Objectives

i. Explain the composition of the hydrosphere in relation to the earth's surface.
ii. Describe the main features and processes of the hydrological cycle.
iii. Explain factors that can disturb hydrological cycle
iv. Explain importance of hydrological cycle,
v. Suggest ways of maintaining hydrological cycle.

- Hydrosphere refers to all free water on the earth's surface, in liquid, solid or gaseous form.
- This water is found in oceans, lakes, rivers, ice sheets, ground water and even as water vapour in the atmosphere.
- It covers nearly 70% of the earth's surface.

Hydrological cycle

- It is the movement of water from the water bodies to the atmosphere, from there to the land, and back to the water bodies.



- There are several basic processes in the hydrologic cycle. These can occur at the same time and, except for rainfall, happen continuously:

i. Condensation

- This refers to the changing of water vapour in the air to form droplets that eventually merge and fall as rain.

ii. Precipitation

- This refers to water droplets that fall from the atmosphere in form of rain, mist or snow.

iii. Runoff

- This is the water that does not soak into the ground or percolate into aquifers.

iv. Evapotranspiration

- Evaporation occurs when water is returned to the atmosphere in vapour form by the combined effects of solar radiation, the energy source, and wind.
- The evaporation process occurring in plant leaves is called transpiration, and together the processes are called evapotranspiration.

v. Infiltration

- This refers to diffusion of water into the earth surface.

vi. Percolation

- This is the downward movement of water in the earth after it have infiltrated in the soil

vii. Water table.

- This is the water found in the earth above the impervious rock.

Importance of hydrological cycle

i. It maintains the water supply that is water, which is lost from water bodies and plants, is brought back.
ii. It maintains life of living things such as plants and animals.
iii. Source of recreation, people tend to do sporting activities on some water bodies such as lakes e.g. boat riding.
iv. Source of natural beauty of the environment.

How can humans disturb hydrological cycle?

i. Cutting down trees carelessly, this will disturb hydrological cycle because trees contribute to the cycle then upon being cut down transpiration will be reduced.
ii. Setting of harmful bushfires, these bush fires will result into clearing all grass hence reducing transpiration.
iii. Dumping of industrial wastes in oceans, rivers and lakes result into water pollution which will lead to acid rains.
iv. Pollution through ozone destruction, some human activities such as factory fumes, smoke from cars will lead to ozone destruction
v. Overstocking, this is keeping of more number of animals than the area can accommodate. Too much animals will result into overgrazing which will reduce infiltration and also reduce transpiration since land will be bare. More cattle means more methane which is one of the green house gases.

How can man maintain hydrological cycle?

i. Avoid careless cutting down of trees
ii. Avoid harmful bushfires
iii. Avoid dumping wastes in water bodies
iv. Avoid overstocking.

Sample Questions

1. Define the following terms
   i. Evapotranspiration ii. Run- off iii. Percolation
2. With aid of well labeled diagram explain five processes involved in the hydrological cycle.
3. a. Discuss any **three** ways how human can disturb hydrological cycle.
   b. Give **two** importance of hydrological cycle.
   c. Explain any three ways how man can maintain hydrological cycle

OCEAN CURRENTS

Objectives

- Define the following terms
  i. Ocean currents ii. Continental drift(drift)
- Explain causes of ocean currents
- Name types of ocean currents
- Discuss factors that affect direction of 0cean currents.
- Explain the effect of ocean currents on the following
  i. Climate ii. Fishing iii. Shipping/water transport
- Locate warm and cold ocean currents on the World Map

Ocean Currents

- Is the large mass of continuously moving ocean water.
- Is a body of water, moving vertically or horizontally in a define direction
- Is the permanent or semi-permanent, horizontal movement of surface water of ocean.
- Are the moving masses of water in the ocean.

Drift

- Is the slow movement of surface waters in the ocean under the influence of prevailing wind.
- Refers to horizontal and vertical movements of ocean waters.

Importance of Ocean Currents to Man

i. Ocean currents permit countries and regions to trade with one another. Goods can be moved in very large quantities by ship more cheaply than by any other means.
ii. Some land margins would have colder winter if there were no warm currents in the nearby ocean. This would have an adverse effect upon agricultural activities.
iii. The ocean contains a valuable source of food such as fish found where warm and cold currents meet.

Causes of Ocean Currents

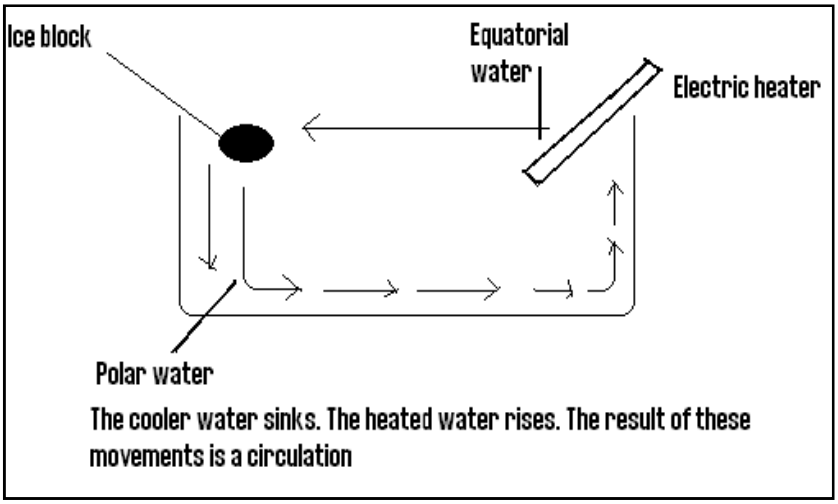
There two movements of water in the ocean and these are

i. Horizontal movements- Ocean currents
ii. Vertical movements- the rising of bottom water and sinking of surface water

- These movements are caused by the following factors
  a) Differences in temperature of Ocean water
  b) The World Wind belt/ Wind
  c) The Rotation of the earth/ Coriolis effect
  d) Shape of the land masses.
  e) Salinity

A. Difference in Temperature of Ocean Water

- Waters from the poles are cool (the temperature are lower) and this water is therefore cooled and descend and move towards the equator at the low depth in the ocean.
- Tropical waters, temperature are high and the water is heated then expand and move away toward the pole as illustrated in the diagram below:



- The sun heats the atmosphere creating winds and moving the sea surface through friction. This tends to drag water surface along as the wind blows over earth.
- Heat from the sun also alters the density of surface water directly by changing its temperature and or its salinity. If water is cooled or becomes Salter through evaporation it becomes denser. This can result in the water column becoming unstable, setting up density-dependent currents also known as **Thermohaline Circulation**.

B. Rotation of the Earth

- The rotation of the earth also affects the ocean currents through the Coriolis force (the effect of the force produced by the earth's rotation on a body e.g. water or air moving on its surface).
- Coriolis force causes water to move to the right in the Northern Hemisphere and to the left in the Southern Hemisphere.
- This exists because moving water is affected by friction with the earth only at the seafloor and become the eastward linear velocity of the earth decreases from maximum at the equator to zero at the poles. (the rotation, velocity however does not change.
- The Coriolis force increases away from the equator.

C. Shape of the Land Masses.

i. The angle of the coastline will affect the direction of moving mass of water directing it in a certain path e.g. The current coming up due south in north America will be turned to the north east by the coastline.
ii. Examples of the ocean currents whose direction have been influenced by shape of the continents include;
    i. North Atlantic Drift ii. Mozambique current

D. World Wind Belts.

- Global winds drag on the ocean's surface, causing the water to move in the direction that the wind is blowing and thus create surface **ocean currents**. Deflection of these **currents** by Earth's rotation produces spiral **currents** called ***gyres***.
- Trade winds cause water to move towards the equator from the north-east and south-east hence cause cold water to up well along the west coast of Africa.
- The examples of currents influenced by wind/world wind belts include the following;
    i. Canaries and Banguela currents in Africa
    ii. The California and Humboldt currents along the west coast of America.

E. Tidal Motion

- Tidal **currents** are most strongly influenced by motions of the moon.
  - When the moon is at full or new phases, the tidal current velocities are ***strong*** and are called ***spring currents***. When the moon is at first or third quarter phases, tidal current velocities are ***weak*** and are called ***neap currents***.

Types of Ocean Currents

There are two types of ocean currents namely;

a) Cold Ocean currents

- these are ocean currents that originate from the cool regions of the world such as polar region.

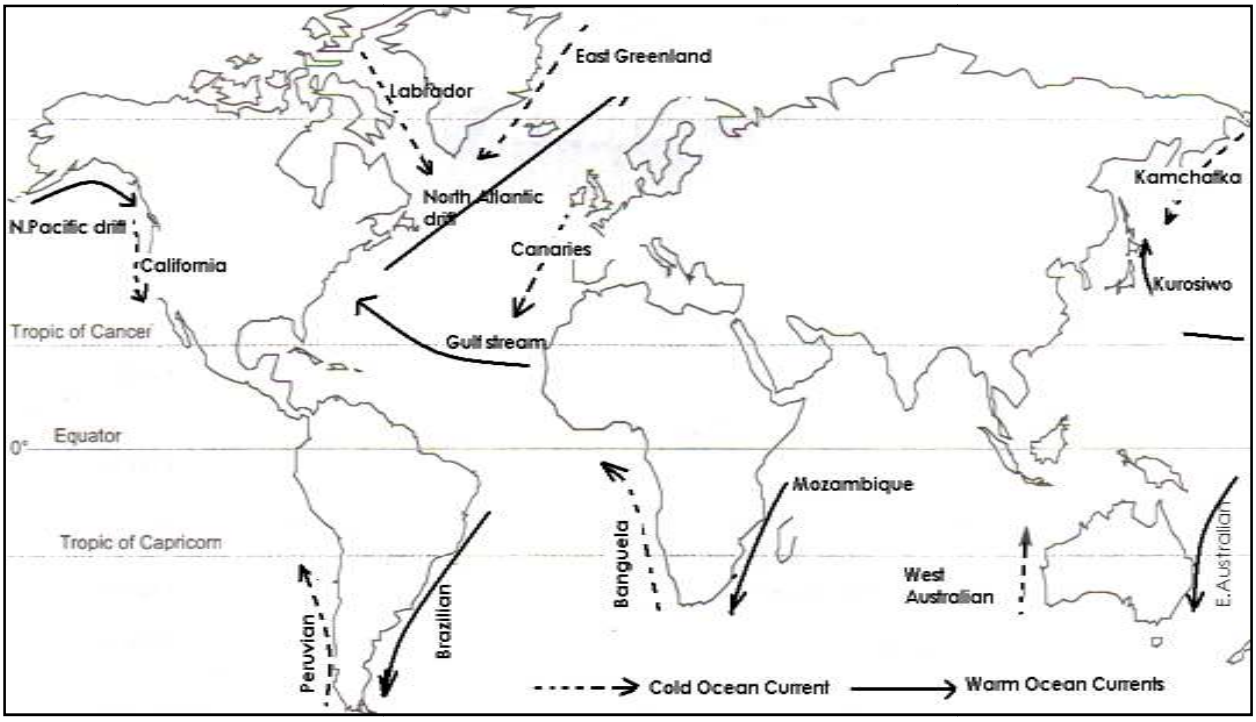
-Examples of such ocean currents

- Labrador current
- Canaries current
- Kamchatka current
- West Australian Current
- Banguela current
- California current

b) Warm Ocean currents

- these are ocean currents that originate from the warm regions of the world such as the tropical regions.
- Examples of such ocean currents include
  - Brazilian current
  - Kurosiwo current
  - North Atlantic drift
  - Mozambique Current
  - East Australian Current

Ocean Currents of The World



Effects of Ocean Currents

i. warm ocean currents
   - o They bring the rain to the coast
   - o They raise temperature of the coastal regions
   - o They provide warmth for the growth of the planktons

ii. Cold ocean currents
   - o They lower temperatures of the coastal regions
   - o The bring little or no rains
   - o Since they bring no rain as such they encourage desert development.

Factors Affecting Direction of Ocean Currents

1. **Wind**
   - o This will influence the direction in such a way that large masses of water will move according to the direction where wind is blowing to.

2. **Shape of continents**
   - o shape of continents will influence direction of ocean currents in such a way that one large masses of water heat the coast of the continents will be forced to take the shape of that continent.

3. **Temperature**
   - o Different place have places have different temperatures hence different pressure pattern that has an influence on direction of ocean current. e.g. from high pressure region to low pressure regions.

Effects of Ocean Currents On

A. Climate

- o Ocean currents consist of great masses of water as a result they act as major heat transfer hence affect climate of the region where the wind blow to.
- o Ocean currents carry large quantities of heat either hot or cold from one point to another.
- o They also influence precipitation as air passes warm currents, humidity increases and result into higher rainfall.

B. On Water Transport/Shipping

- o Cold water of Labrador Current carries many ice bergs which are dangerous to ship for example Titanic disaster in 1991. Because of this incident an International Ice control was set up.
- o Ship sailors also take advantage by following the direction of ocean currents as a result they find navigation easy and fuel consumption also becomes cheaper

C. On Marine Life

- o Large quantity of nutrients brought to the surface areas is rich in planktons due to upwelling of waters when two different ocean currents meet e.g. where warm and cold currents meet they create fishing ground e.g. Coast of Japan.

Sample Questions

1. What is the difference between a drift and an ocean current?

2. Discuss how the following factors can affect the direction of an ocean current, diagram can be used to illustrate your points;
   i. Temperature ii. Shape of the continents iii. Wind.
3. Using World map (figure 1) give on it insert any two warm ocean currents and any two colds ocean currents.
4. Explain any effects of ocean currents on the following
   i. Marine life ii. Climate iii. Shipping.
5. i. Explain why some currents are warm while others are cold
   ii. Explain any two beneficial effects of ocean currents on human activities.
6. With aid of diagram, explain how ocean currents are caused by temperature differences between Polar Regions and tropics.

THE ATMOSPHERE

Objectives

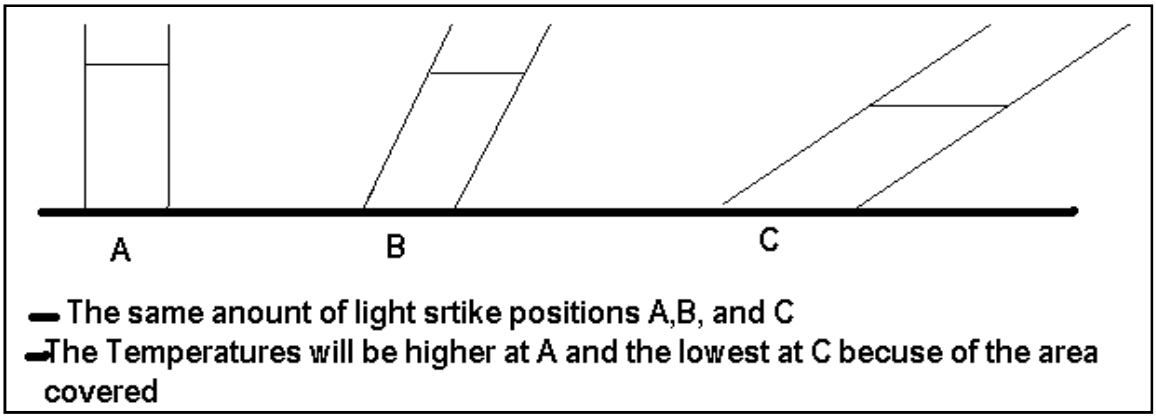
- Define season
- Explain causes of seasons
- Describe characteristics of seasons
- Explain factors which influence air pressure
- Locate the main pressure belts of the world
- Account for the distribution of pressure belts of the world
- Explain how air pressure influence wind
- Interpret isobars on pressure maps
- Locate prevailing winds on the map of the world
- Describe the pattern of prevailing winds
- Locate local winds on the map
- Describe characteristics of local winds
- Explain the occurrence of Land and Sea breeze on local weather
- Explain the effects of cyclones and anticyclones

Season

- This is the division of the year associated the duration of daylight, and or characteristics of climatic condition brought about by the sun.
- Division of the year according to weather conditions. These weather conditions are repeated in a set order every year.

What causes season?

- Seasons are caused by the following factors
  i. Change in the length of day and night:
  ii. Changes in temperature: these changes of temperature are influenced by Tilting of the earth towards and away from the sun.

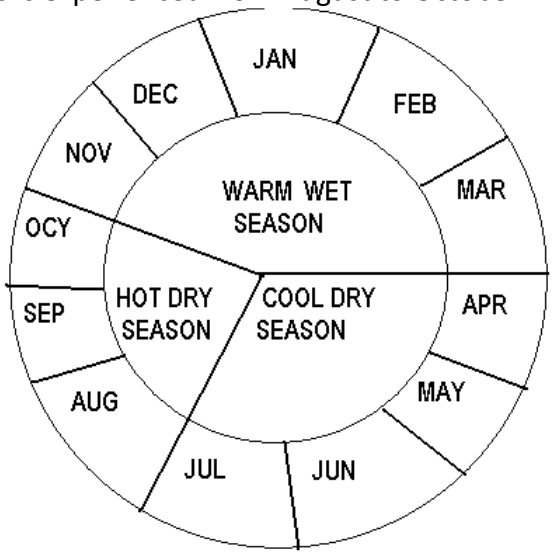


- Seasons are experienced at different points on the earth surface.
- There are four types of seasons experience and these are
  i. **SUMMER** – this is the hot season
  ii. **AUTUMN** - This is the warm to cool season
  iii. **WINTER** - This is a cool season
  iv. **SPRING** – This is a warm season

Cycle of Seasons

A. In The Tropical Zone (Malawi)

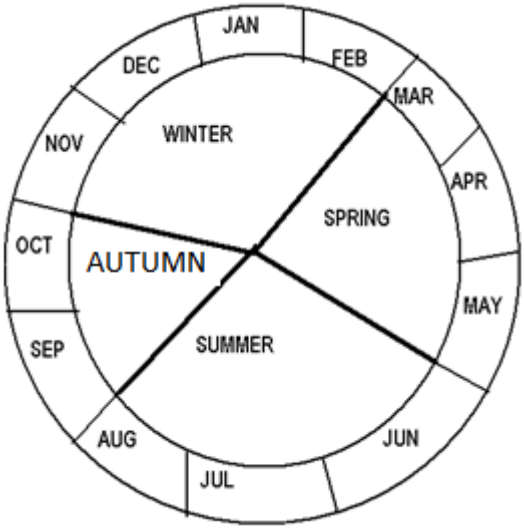
i. Warm Wet season : this is experience from November to March
ii. Cool Dry season : this is experience from April to July
It is characterized by showers under chiperoni conditions.
iii. Hot Dry season: this is experienced from August to October.



NOTE : In the tropical altitudes temperature changes do not differ so much, therefore there are no seasons in the way that they are in temperate regions
: there are only Wet and Dry seasons
: Human activities like agriculture depend greatly on the cycle of seasons.

B. **In the Temperate Zones (Britain**)

I. Winter season : experienced from November to February
II. Spring season : experienced from March to may
III. Summer : this season is experienced from September to October.



NOTE: In Temperate latitude the difference between seasonal changes occur because temperature changes are very large enough to divide the year into seasons.

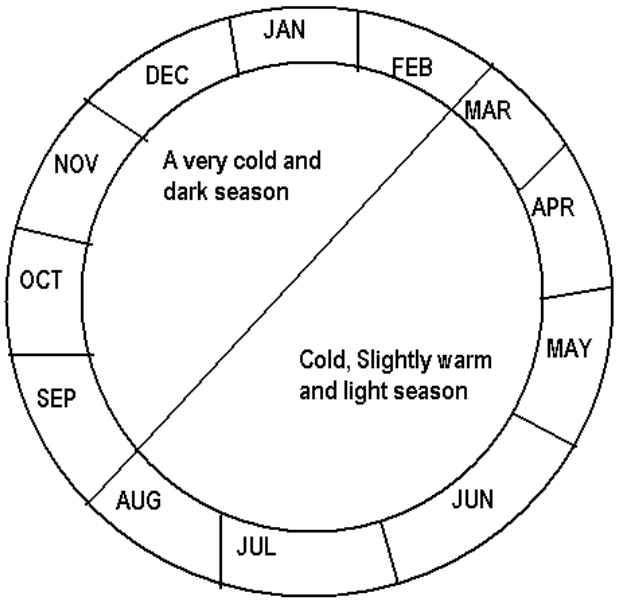
: Summer is the hottest season and Winter is the coldest

: Spring and Autumn are in between seasons.

C. **In the Polar Regions**

i. A very cold and dark season : from September to February

ii. Cold, slight warm and light seasons: from March to August and is characterized by sun shine all the six months.



NOTE: It has its own seasons

a. A Cold slight warm and light summer season.

- The sun shines all the time for six months, but not as it shines in the tropics because it stays very low on the horizon
- It is cold and occasionally warm.

b. A very Cold dark winter season

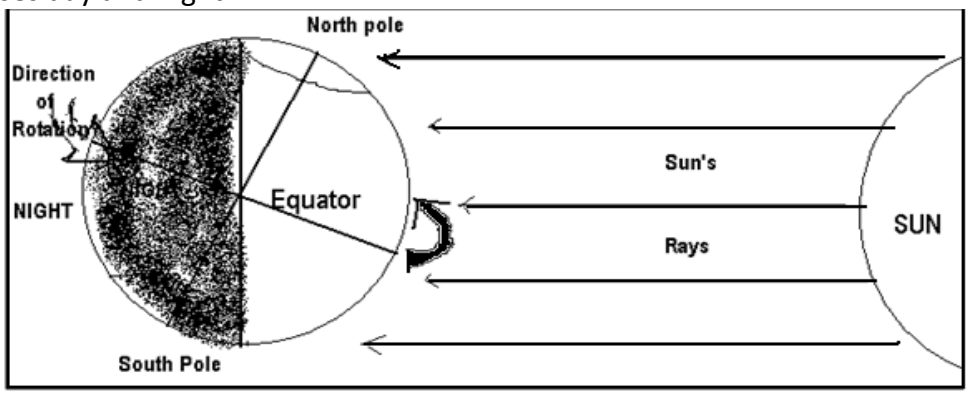
- It has no sunshine at all.
- It is very cold indeed.

Causes of Cycles of Seasons

- These seasons differ from place to place that is other areas experience the four seasons while others three (Britain experience four while Malawi experiences three). These are due to earths movements which are;
    a) Rotation: This refers to the spinning of the earth around central point.
    b) Revolution: This refers to the movement of the earth on its orbit around the sun.

a. Rotation of the Earth

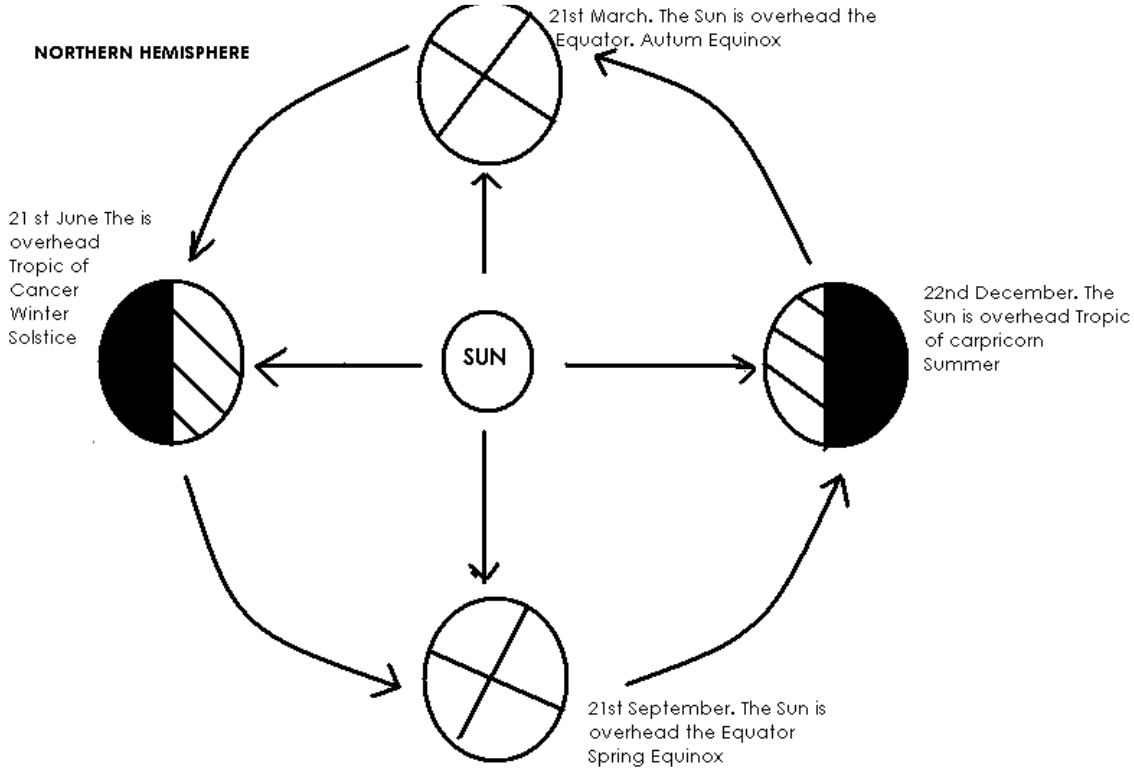
- The earth turns on its axis
- It rotates from west to east
- It takes twenty four (24) hours for the earth to make a complete turn 360°
- It causes day and night



- The side of the earth that faces the sun receives light hence **DAY** while the side that is away from that sun experience darkness hence **NIGHT.**

b. Revolution

- This is the movement of the earth around the sun on its orbit (the path that the sun follows as it is going a round the sun.
- It takes 365¼ days or 366 days to make a complete turn around the sun
- The earth does not stand upright, had it been it was so the there would be twelve hours of day and twelve hours of night every day and everywhere on earth.
- The earth is tilted at an angle of 66½°. This tilting of the earth result into;
    i. Changes in the altitude of the midday sun at different times of the year
    ii. Changes in length of day and night at different times of the year.
    iii. The four seasons as shown below;



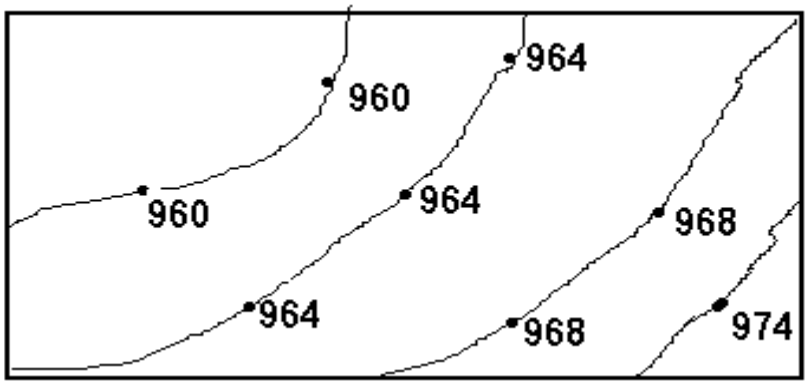
- The opposite of Northern Hemisphere is southern Hemisphere.

Atmospheric/Air Pressure

- This is the weight of air
- This is the measurement of how much weight there is at any given point on the earth or atmosphere.
- The atmosphere is composed of the following gases
  i. Nitrogen 78%
  ii. Oxygen 21%
  iii. Argon 0.93%
  iv. Carbon dioxide 0.03%
  v. Other rear gases 0.003%
- Because air has weight it presses down unto the surface of the earth.

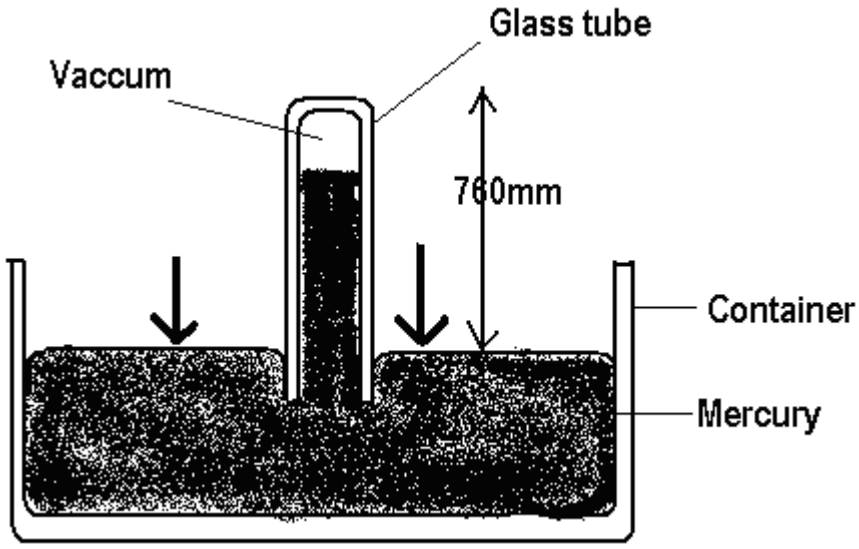
Measurement of Air Pressure

- Air pressure is measured with an instrument called **BAROMETER** and it is measured in **MILLIBARS**
- The lines that join places of equal amount of pressure on weather maps are called **ISOBARS** as shown below



- There are two types of Barometer
  i. Mercury barometer
  ii. An aneroid barometer

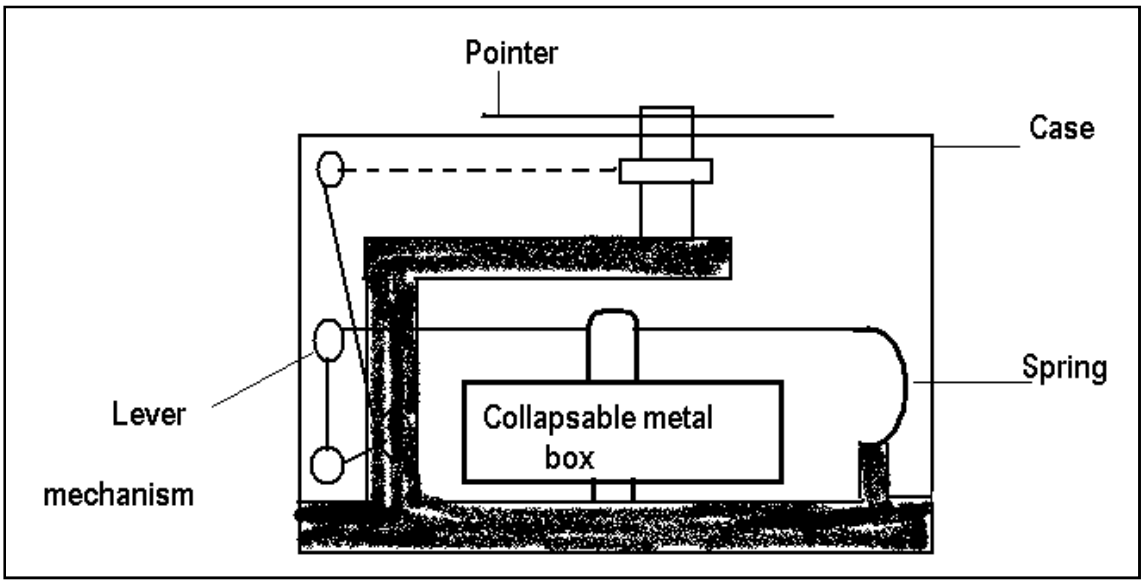
A. Mercury Barometer



How it works

- The pressure of air on the mercury in the container forces the mercury inside the glass tube to rise to a height of 760mm.
- A vacuum is produced in the glass tube due to falling of pressure on the mercury in the container
- When the level of mercury drops inside the glass tube it means that air pressure is low and when it rises above 760mm it means that air pressure is high.

B. An Aneroid Barometer



How it works

- Inside the instrument is metal box which contains a little air. The lid of this box is flexible so that it goes up and down slightly when there is any change in the atmospheric pressure.
- The movements are transferred by a system of levers to a pointer which moves across a scale on the top of the instrument
- When air pressure rises, the box lid bend inwards and when the pressure falls, the spring pushes the lid outwards.

Factors Influencing Air Pressure

- Atmospheric pressure is not the same in all regions and does not remain the same at all times. WHY?
  i. Temperature
  ii. Rotation of the earth
  iii. Altitude

1. Altitude

- This refers to height above the sea level.
- Air at the ground level is heavier than it is higher above the earth's surface.
- The amount of air pushing down at sea level is 1.034kg per square centimetre.
- Air density decreases with height, the higher one goes over the earths such the less air weighs and hence less air pressure.

NOTE:

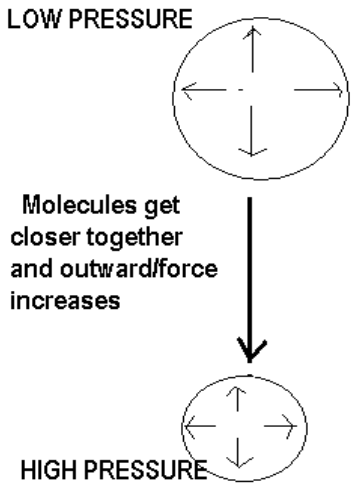
- When air sinks its pressure increases
- When air rises its pressure decreases

2. Temperature

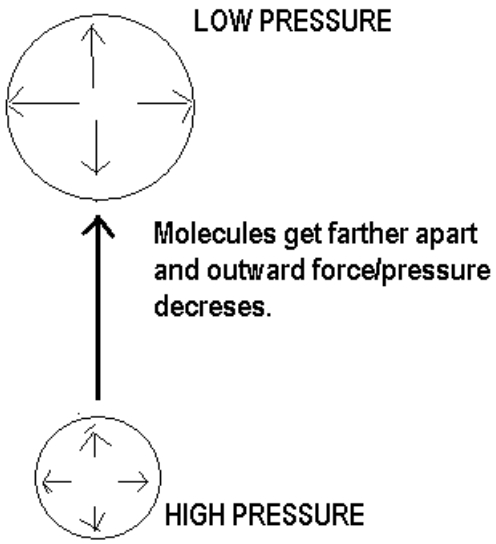
- This is the degree of sensible heat or cold in the atmosphere
- Temperature affects air pressure and air pressure affects temperature. **HOW?**
  i. When air sinks its pressure increases**. WHY**? It becomes compressed and when air is compressed its molecules move more quickly hence heat is produced
  ii. When air rises its pressure decreases. **WHY**? Because it expand and when air expands its molecules move more slowly and the heat is produced

iii. When air is heated it expands and when this happens the outward pressure of its molecules are spread over a larger area hence air pressure decreases.

iv. When air is cooled it contracts and when this happens the outward pressure of its molecules is spread over a smaller area hence pressure of air increases.



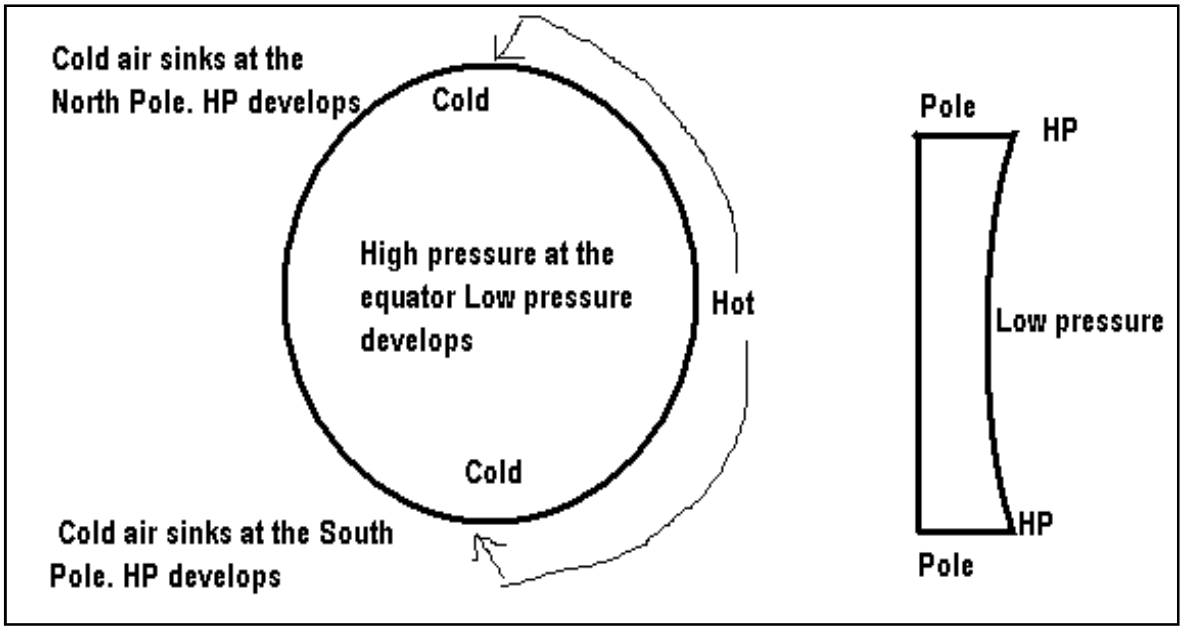
v. When air rises or sinks the air temperature changes. The sinking air becomes compresses by the air above it. Compression causes heat to be produced hence air temperature rises, when air pressure increase.



When air rises, air pressure decreases as the air expands. When air expands, air pressure increases and when it contracts that is it looses heat.

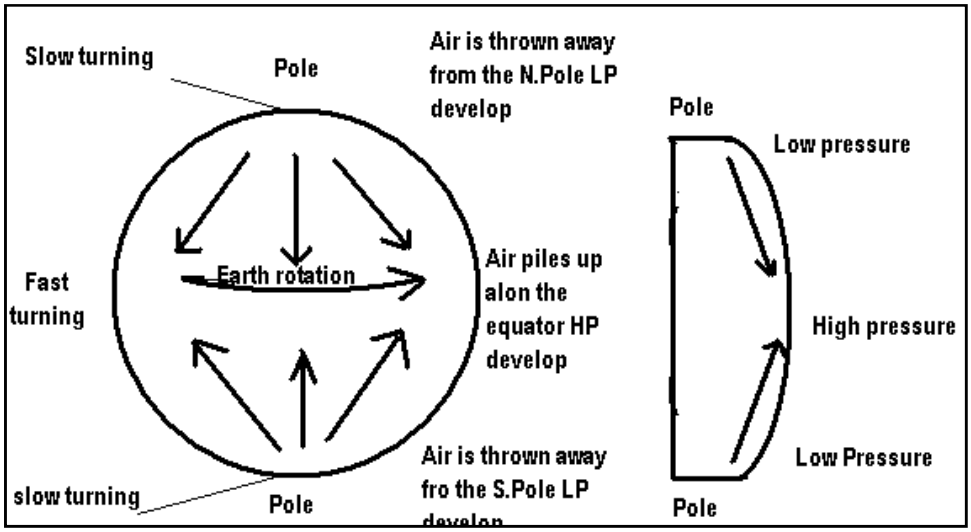
NOTE

- If pressure was only affected by temperature then there would be a belt of low pressure at the Equator and high pressure over the poles and on top of mountains.



3. Rotation of the Earth.

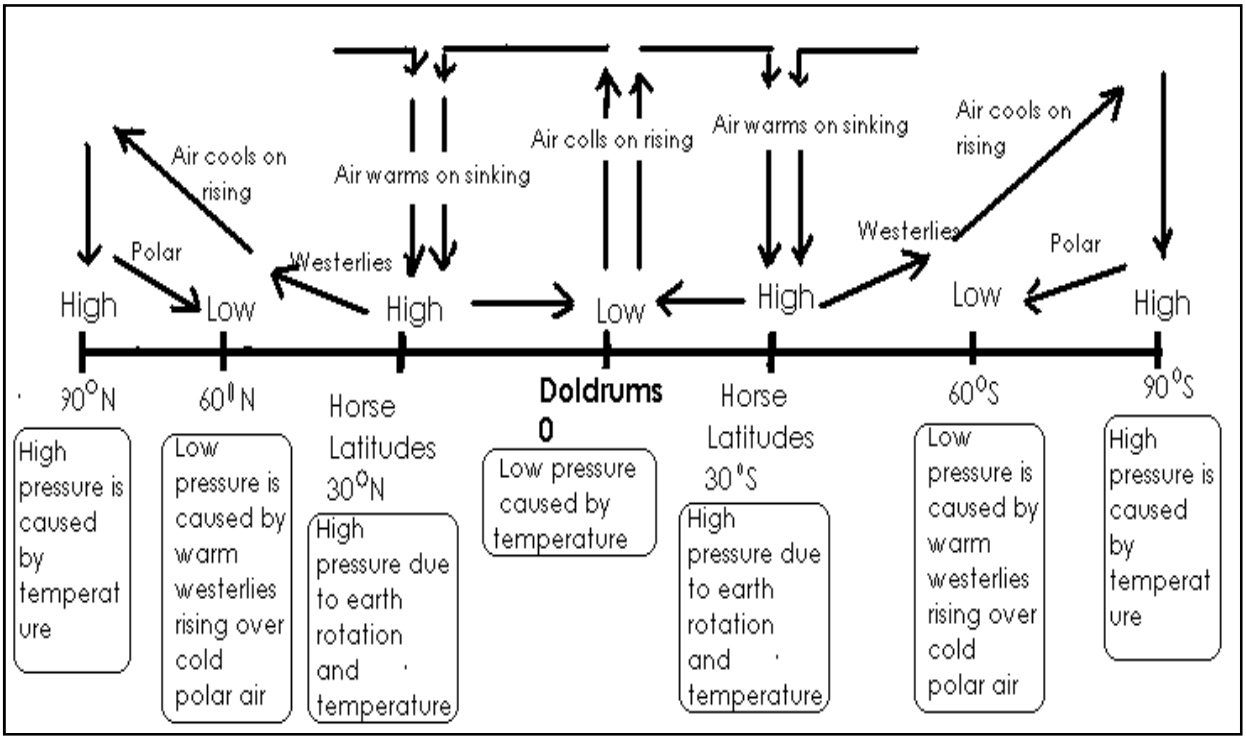
- Low pressure at the pole causes contraction of air and so high pressure develop.
- High pressures at the equator cause air to expand hence low pressure develop.
- The low pressure belt at the Equator is called the **DOLDRUM**

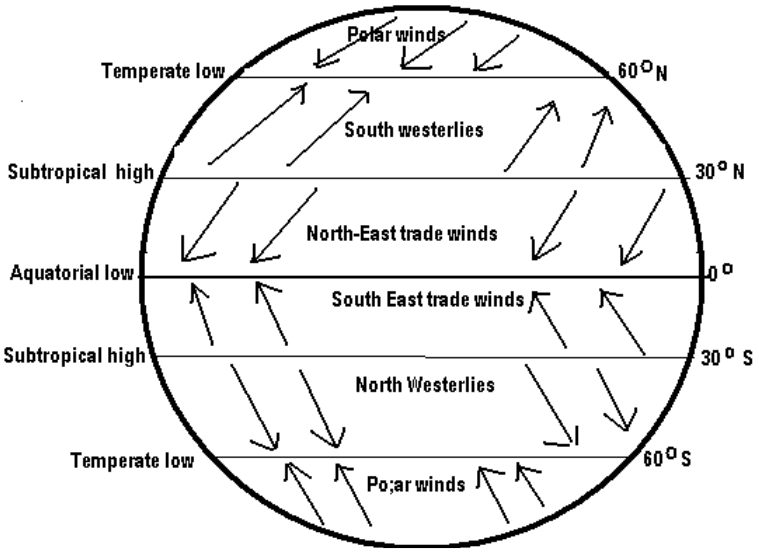


The effects of rotation of the earth on pressure

- Air from the poles moves across large areas and spreads out to occupy great spaces, thus it expands and pressure falls. Low pressure start along latitude 60° north and 60° south. As air moves away from the poles more air moves from higher levels to take its space.
- Air rising from the equator spreads out and moves towards poles. It crosses latitudes which decrease and therefore the air has less space to occupy.
- Air moving towards the equator replaces air which is rising there. When the air that is moving towards the poles reaches latitudes 60° North and 60° South, it replaces air that is rising there.

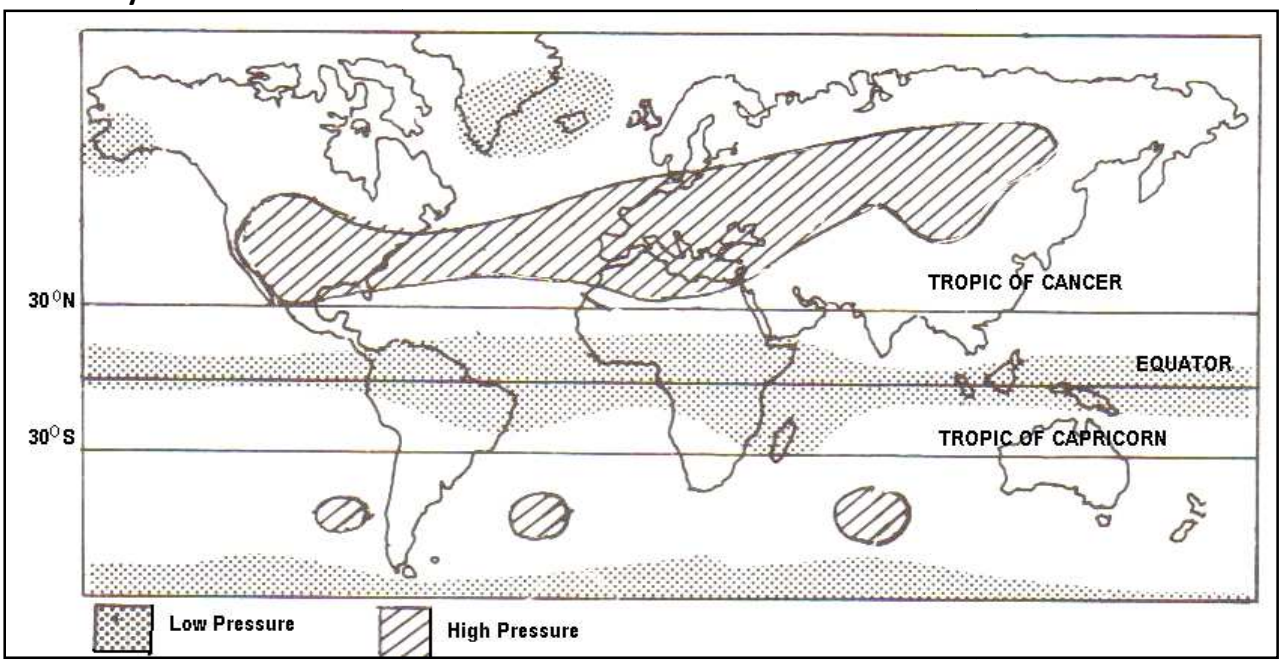
- The earth's surface consists of land and water and is tilted towards the sun. Land and Water heat and cool at different rates and the temperature outside the tropical regions differ very much from season to season. All these changes also contribute to the pressure system
- The diagram below illustrates how temperature and rotation affect pressure;





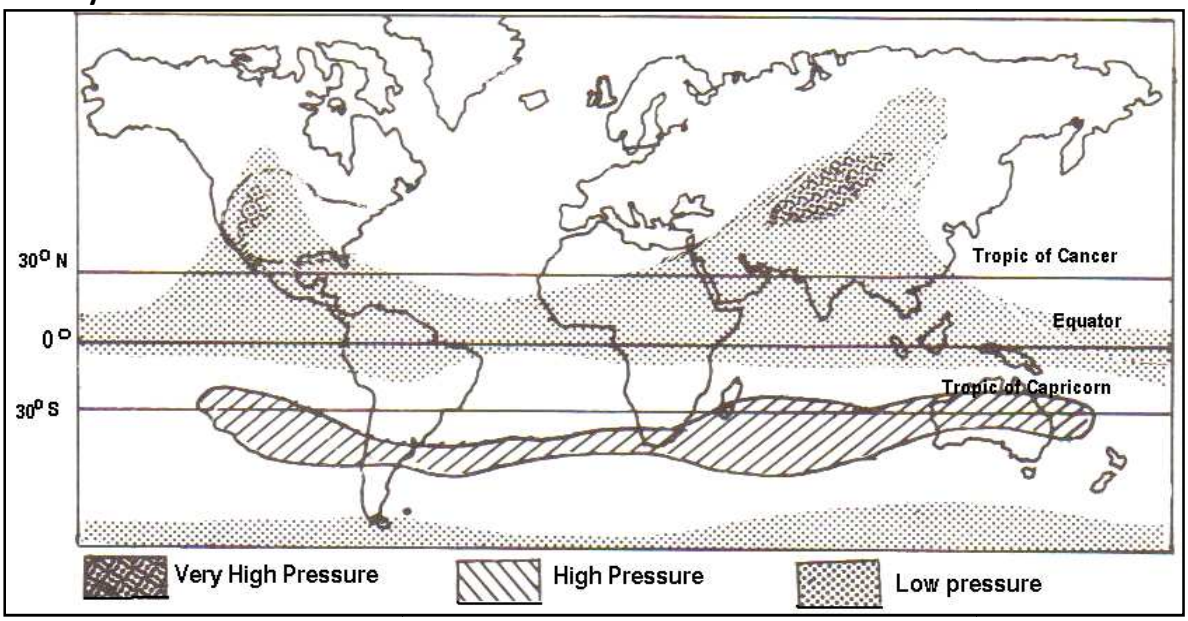
Pressure Maps

A. January Pressure



- The Equatorial Low Pressure Belt extends well into Southern Hemisphere where it is summer season.
- Low Pressure is well developed over Australia.
- There is low temperatures experienced over the parts of northern continents that produce high pressure system
- There is High Pressure in the Southern Hemisphere that forms only over oceans.
- Low pressure systems are well developed over the north Atlantic and northern Pacific oceans.

B. July Pressure



- The Pressure belts that develop at the Equator now expand well into the northern hemisphere where it is summer. This links up with very low pressure areas over North-West India and Pakistan and South-West USA.
- The high pressure belt in the northern hemisphere is no longer continuous; it extends in the oceans across the three continents.
- The low pressure belts in the northern Atlantic and north Pacific Oceans are poorly developed and move northwards.

NOTE:

- Seasonal pressure changes over the continents in the northern hemisphere are caused by seasonal temperature changes.
- Areas of Low pressure (**DOLDRUM**) are the key to pressure system and move north and south of the positions they occupy when the sun is overhead along the equator.
- Revolution of the earth and tilting on its axis result in the overhead sun 'shifting' between the tropics and this causes the Doldrums to move north and south of the equator.

WIND

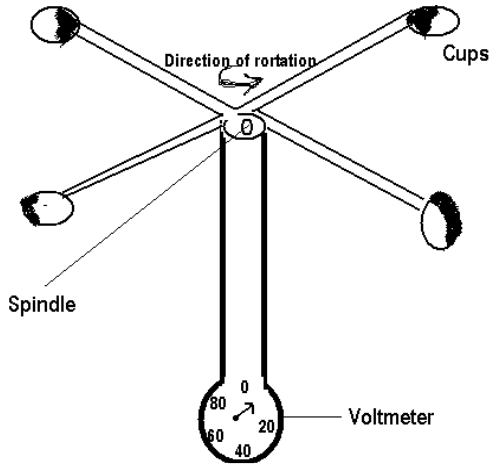
- Wind is air in motion or it is air that moves.
- This refers to sideways movements of the atmosphere
- Air moves from high pressure to low pressure area for instance from Horse latitude to Doldrums.
- Wind can be described as
  i. strong winds
  ii. very fierce/very strong (GALE)

Wind Speed

- The wind speed is measured by an instrument called **CUP ANEMOMETER**.

A Cup Anemometer

- It consists of there or four arms with cups fixed at the end pivoted on a shaft as shown below;



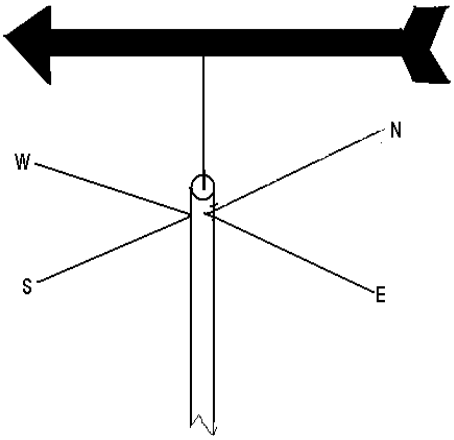
- When wind blows it forces the arms and cups to rotate.
- The rotating spindle generates the force that moves the **VOLTMETER**
- Wind speed is measured in kilometers per hour. That is 1-5km/h wind is regarded as light wind while 50-60km/h is gale and >121km/h is hurricane.
- The scale of wind forces and the effect of wind on objects and natural features is called

BEAUFORT SCALE

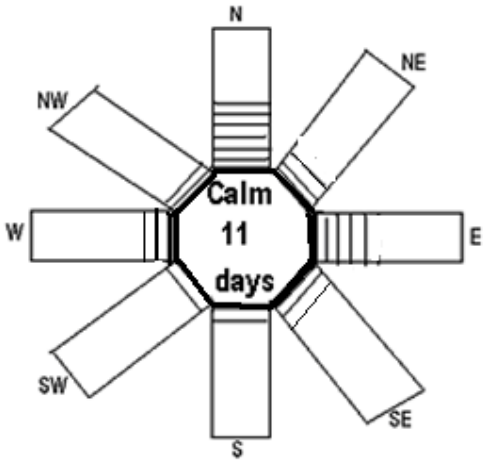
Kilometers per hour	Wind effect on land	Wind description
Less than 1	0. Calm: smoke rises vertically	Light air
1-5	1.Direction of wind shown by smoke but not by wind vanes	Light air
6-11	2. Wind felt on face; leaves rustle; wind vane moves	Light Breeze

Wind Direction

- Wind direction is measured by an instrument called **WIND VANE**
- Wind vane consists of rotating arm which is pivoted on vertical hollow shaft.
- The arrow of the wind vane always points towards the direction from which wind is blowing



- The frequency and direction of wind is recorded on a **WINDROSE**(chart on which is recorded the direction and frequency of wind)



- This shows from where and for how long the wind was blowing during a month.
- The wind rose above shows the following

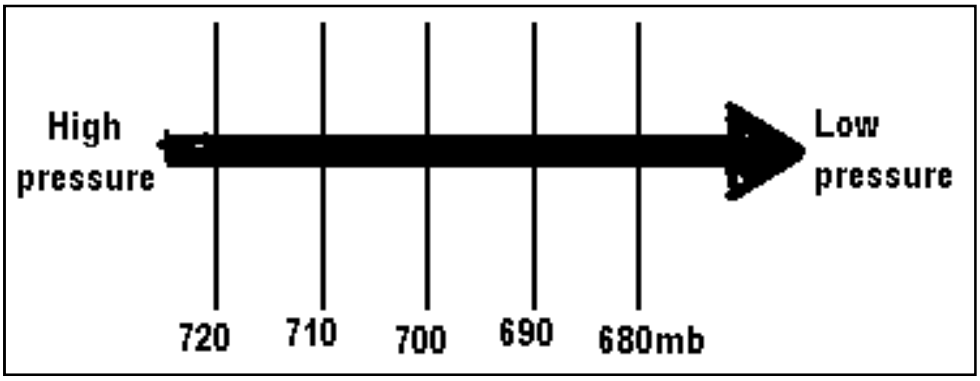
N	S	NE	SE	W	SW	NW	E	CALM
6	1	2	2	2	1	2	4	11

- The records show that the month had 31 days and most of the days during this month it was calm.

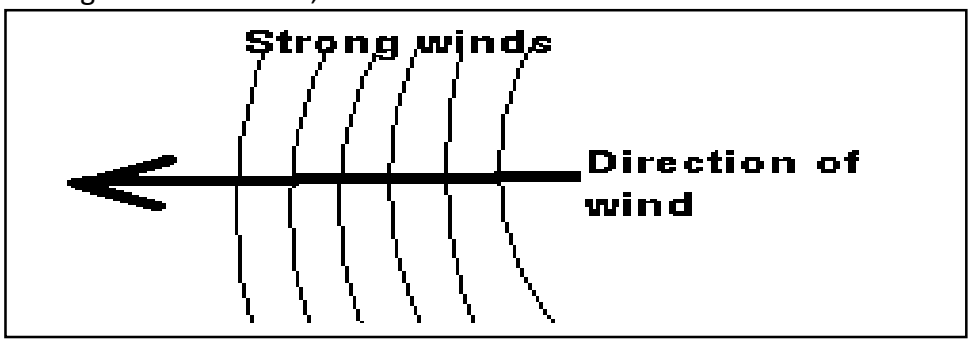
Factors Influencing Wind Direction and Speed

A. Pressure Gradient

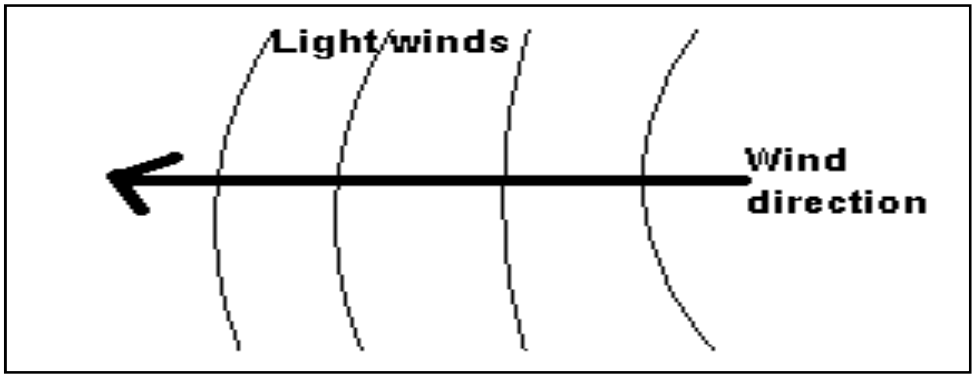
- This is the force caused by differences, which tend to move air from higher pressure areas to lower pressure areas.
- This is shown by isobars on the map



- When isobars are close together the pressure gradient is high and wind will be strong as shown below;

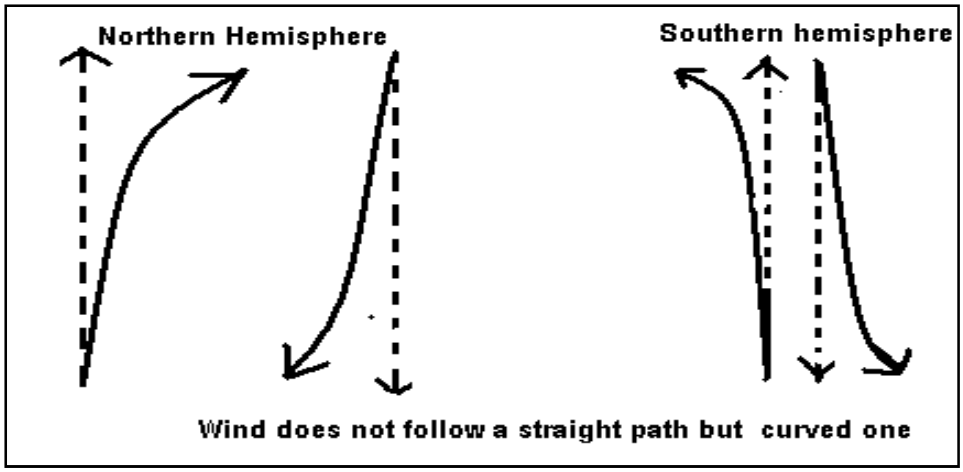


- When isobars are far apart the pressure gradient is light and wind will be light as shown below;



B. Rotation of the Earth

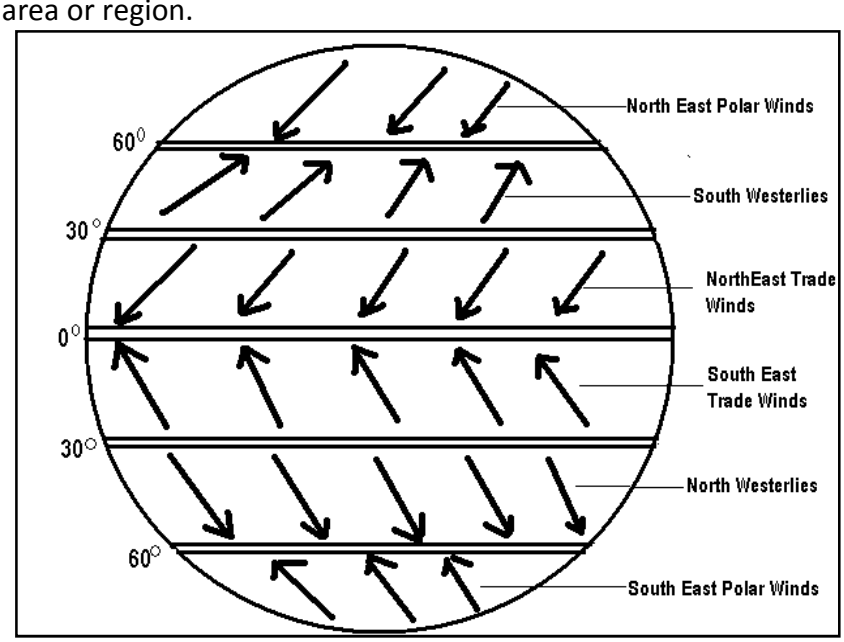
- According to Ferrell's Law it states that a freely moving bodies are deflected (turns aside) to the left in the Southern hemisphere and to the right in the Northern Hemisphere (Ferrell's Law states that LNS /RSH) as shown below;



- Wind as a freely moving body it will deflect to the West in the in the Southern Hemisphere and to the East in the Northern Hemisphere.
- As the earth rotates, it drags the atmosphere around with it.

1. Prevailing Winds

- These are winds that blow more frequently as compared to other winds that blow in a particular area or region.



- Air moves from areas of high pressure to areas of low pressure.
- There are three types of Prevailing winds

A. Trade Winds

- They are characterized by the following;
  1. They blow from high pressure areas (Horse latitude) to Low pressure area (doldrums).
  2. They deflect to the right in the Northern Hemisphere and become North East Trades and to the right in the Southern hemisphere and become South East Trades.
  3. They are constant in both strength and direction.
  4. They contain cyclones (a large system of air circulation centred on a region of low atmospheric pressure) and anticyclones (a large system of air circulation centred on a region of high atmospheric pressure where air descends)

B. Westerlies

- They are characterized by the following
  1. They blow from Horse Latitude to the temperate Low Pressures.
  2. They are deflected to the right to become S.Westerlies in the Northern hemisphere and to the left to become N. Westerlies in the Southern Hemisphere.
  3. They change from time to time in both strength and direction
  4. They contain depressions (area of low pressure) and cyclones.

C. Polar Winds

- They are characterized by the following;
  1. They blow from the Polar High Pressures to the Temperate Low Pressures.
  2. They are best developed in the Southern hemisphere because there is more water than land as compared to the Northern hemisphere.
  3. They deflect to the right in the Northern Hemisphere to become NE Polar winds and to the left and become S.E. Polar winds in the Northern Hemisphere.
  4. They change in terms of strength and direction in the Northern Hemisphere and Constant in the Southern Hemisphere.

2. Local Winds

- These are winds which affect a limited area and they only blow for a short period of time.
- There are of two types
  i. Depression winds
  ii. Descending winds

A. Depression Winds/Temperate Cyclones

- There are of two types of depression winds

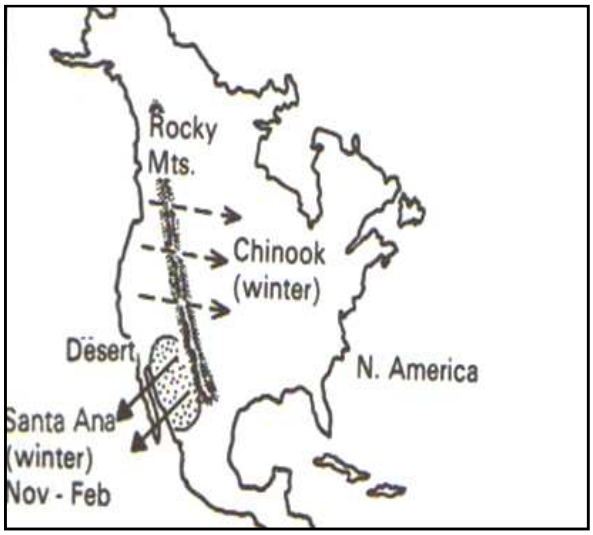
a) Hot winds

- ✓ They are characterized by the following
  - They are hot
  - They are dusty
  - They become humid after crossing the sea.

- Names of hot winds

i. In North America

- The Santa Ana- the blow from Mojave desert towards Mexico across Gulf of California.

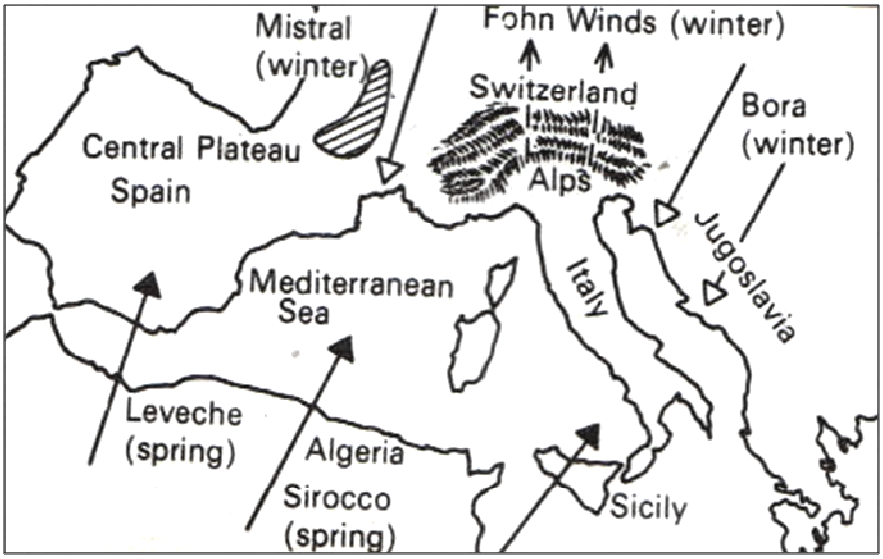


ii. In South America

- The Zonda – they blow from semi-desert of Patagonia and gran Chaco Of South America towards river plate estuary

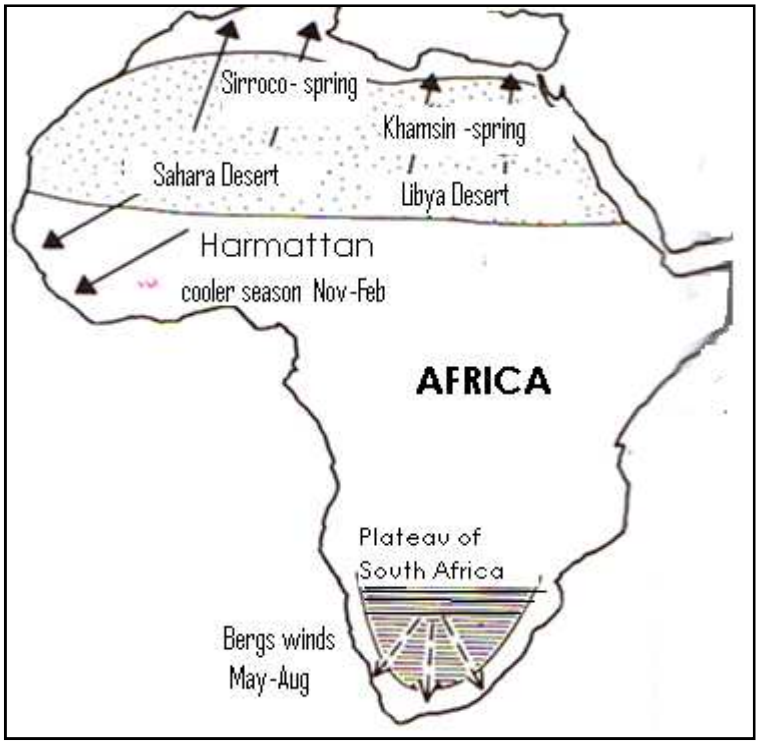
iii. **In Europe**

- The Laveche from Algeria through Mediterranean sea towards Spain
- Sirroco from Algeria through Mediterranean Sea toward Italy and Sicily.
- The Khamsin blow towards Turkey and Greece from Egypt part of Sahara.



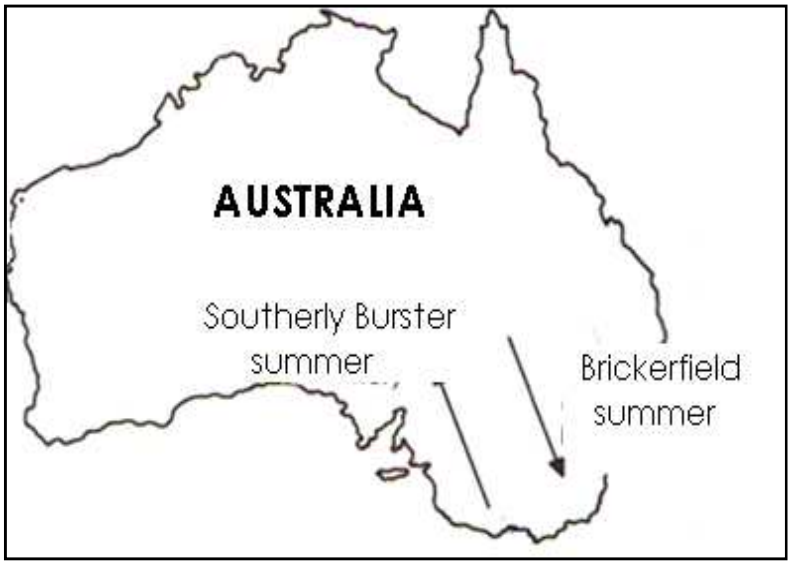
iv. In Africa

- The Harmattan from Sahara desert towards West Africa.



v. In Australia

- The Bricherfield from Australia desert towards Western Australia.



b) **Cold winds**

- They are characterized by
  i. Being strong
  ii. Being gusty
  iii. Being bitterly cold
- Example of colds winds

i**) In South America**

The Pampero- originates from South Pacific and blows across southern Chile.

ii) **Western Europe**

- The Mistral in France blows along the Rhine valley
- The Bora- experienced in Yugoslavia

iii) **Australia**

The Southerly Burster- originates from south Pacific and is influenced by the West wind drifts.

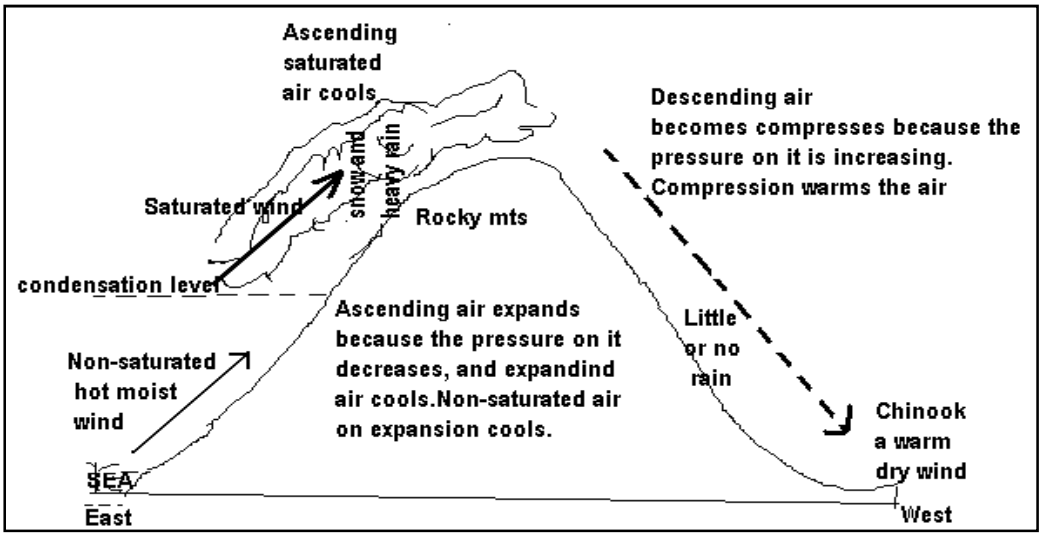
B. Descending Winds.

- These are winds which are warmed by compression when they descend on a leeward slope of a mountain.
- These are dry winds
- Examples are

i. In North America

- **Chinook winds**

- The wind descends the eastern slopes of the Rocky Mountains into the prairies, helping to melt the snow in winter.
- The Western slopes of the Rocky Mountains receive more rainfall because they lie on the windward side while the prairies receive no rain from the Chinook winds.
- The advantage received by the prairies is that it allows for the growth of winter wheat.



ii. In Europe

- The Fohn- these winds descend from Northern slopes of the Alps is Switzerland, where they help to melt the snow earlier in winter.

iii. **In Africa**

- Bergs of natal descends from Drankensberg mountain
- The Chiperoni originate from Chiperon Mountain in Mozambique and affects Malawi bringing drizzle and very low temperatures.
- Other descending winds include: the samun in Iraq ,Nevados in Equador, The Nor Wester of Southern Island, new Zealand

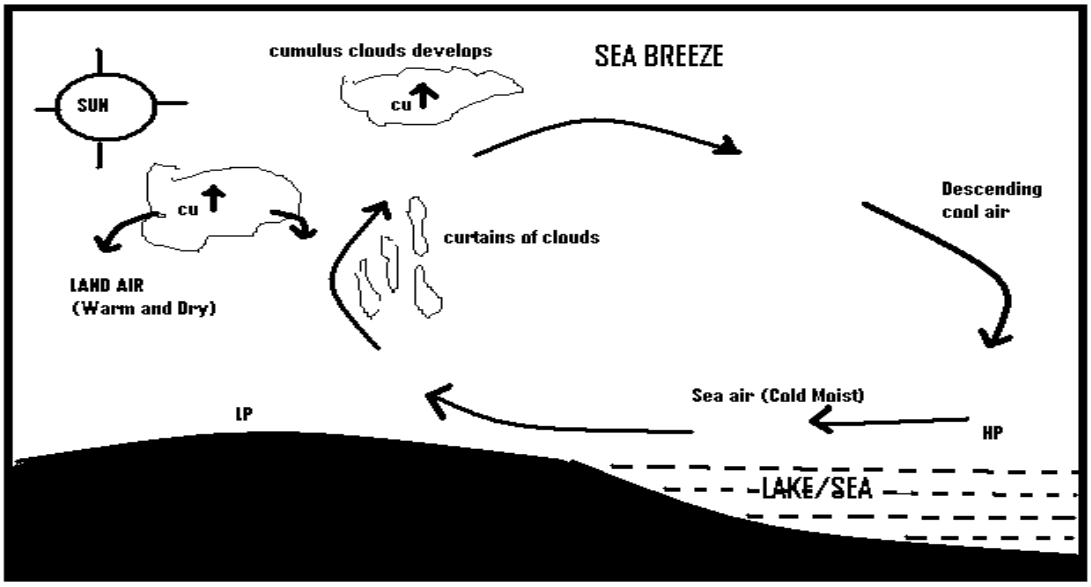
Land and Sea Breeze

- These are the local convectional currents along the sea or lake.
- They develop due to differences in temperature which result into pressure differences
- When an area is hotter than the neighboring area, air moves into hotter region, from the cooler regions to take place of hot air which has risen and expanded.
- Equal surface areas of land and water may receive the same amount of energy from the sun but the land surface reaches a higher temperature than water does

A. Sea Breeze

- This refers to the wind that blows from the sea towards land, usually during day.
- This refers to cool, gentle wind that flows from the water to land.

- They are caused because of the following
  i. During the day there is an onshore wind which occurs because land temperatures rise more rapidly during the day.
  ii. The warm air above the land rises and cool air from above the water moves in replace it.

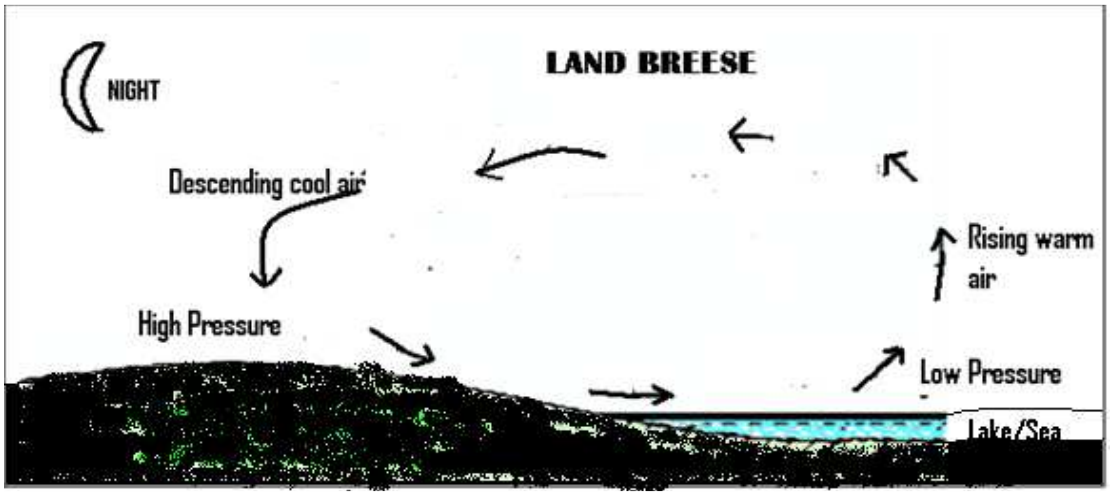


HP: High Pressure LP: Low Pressure

- Since the Sea breeze are cool they lower the temperature of coastal regions, but eventually, the temperature of the air will become the same with that over the land as such it will have no effect over the temperatures of the interior l land.

ii. Land Breeze

- A land breeze is a type of wind that blows from the land to the ocean. When there is a temperature difference between the land surface and the ocean, winds will move offshore. Although commonly associated with ocean shorelines, land breezes can also be experienced near any large body of water such as a lake.
- Land breezes usually occur at night. During the day, the sun will heat land surfaces, but only to a depth of a few inches. At night, water will retain more of its heat than land surfaces. Water has a high heat capacity.
- At night, the temperature of the land cools quickly without the insolation from the sun. Heat is rapidly re-radiated back to the surrounding air. The water along the shore will then be warmer than the coastal land creating a net movement of air from the land surfaces towards the ocean.
- **Why?** The movement of the wind is a result of differences in air pressure over the land and the ocean. Warm air is less dense and rises. Cool air is more dense and sinks. As the temperature of the land surfaces cool, the warm air rises and creates a small area of high pressure near the land surface. Since winds blow from areas of high to low pressure, the net movement of wind is from the shore to the water as shown in the image to the right.



In summary

1. Air temperatures decrease at night.
2. Rising air creates a *thermal low* at the ocean surface.
3. Cool air collects forming a high pressure zone above the surface of the ocean.
4. A low pressure zone forms above the land surface from the rapid loss of heat.
5. A high pressure zone forms as the cooler land cools the air immediately above the surface.
6. Winds aloft flow from the ocean to the land.
7. Winds at the surface flow from high to low pressure creating a land breeze.

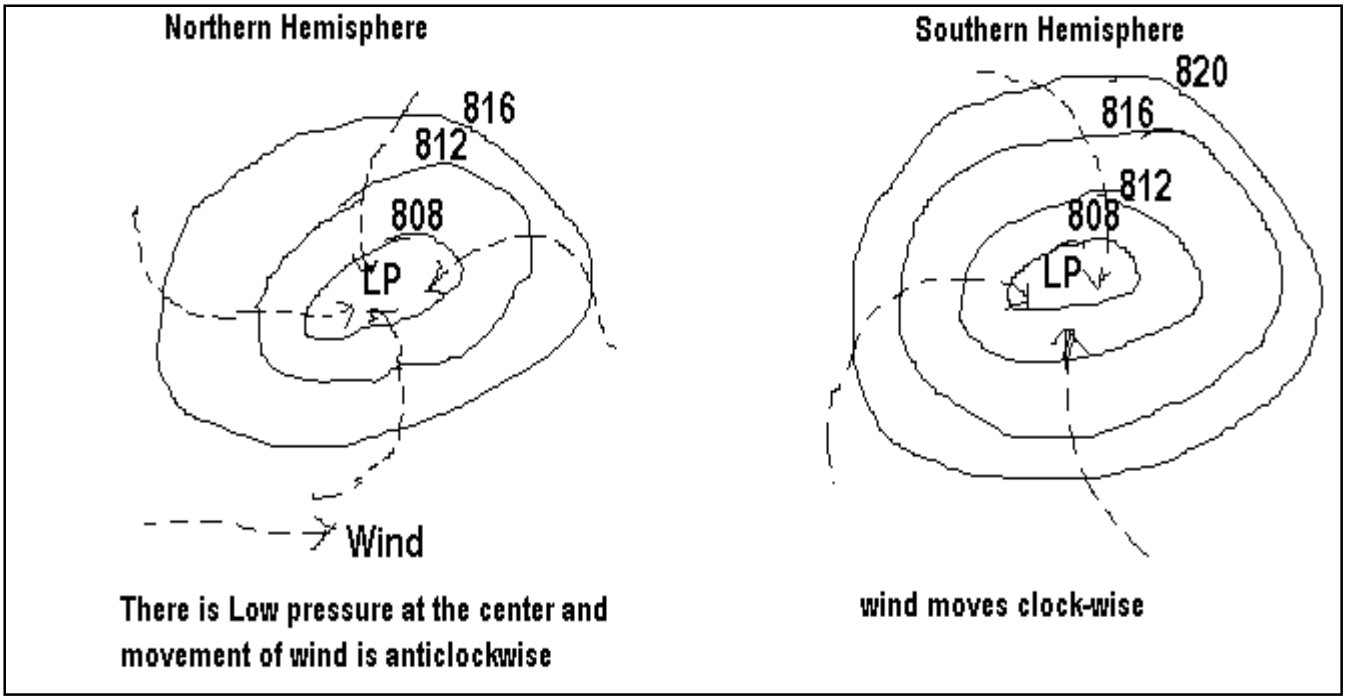
CYCLONES AND ANTICYCLONES

1. Cyclones

- This refers to a large system of air circulation centred on a region of low atmospheric pressure.
- These are depression which develop in the Westerlies and sometimes in the Trade winds and have low pressure at the center.

Cause:

- They are caused by the mixing of cold air from Polar Regions with Warm, humid air from the tropics.
- Air in cyclones rotates counter clock-wise in the northern hemisphere but clock-wise in the southern hemisphere. This is so because pressure is low at the center and high outside as such wind moves from outside towards the centre as illustrated below'



Types of Cyclones

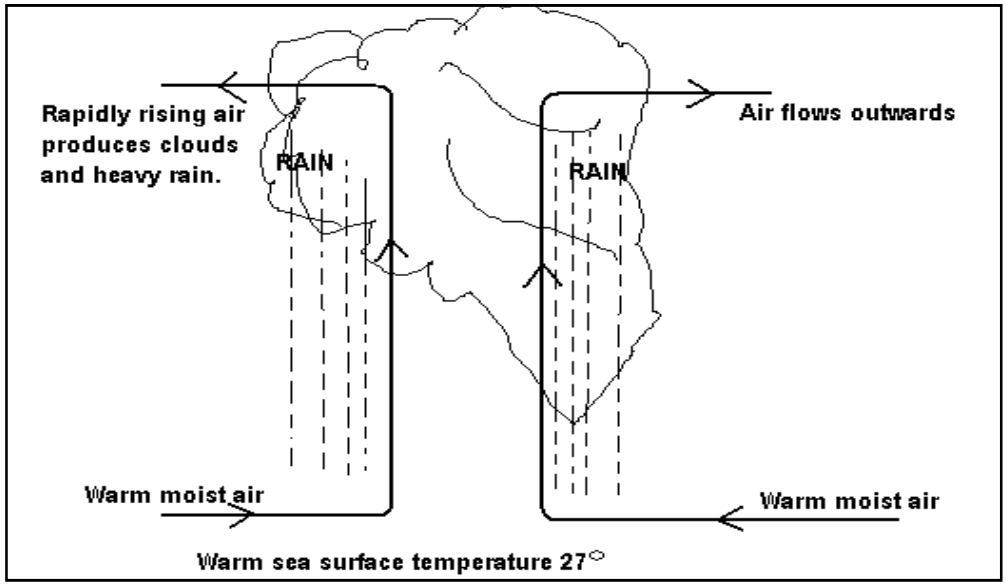
1. Tropical Cyclones

- These are system of intense low pressure known locally as hurricanes, typhoons and cyclones.
- They are characterized by the following
  i. They contain winds of extreme velocity and accompanied by torrential rainfall which causes wide spread of damages and loss of life.
  ii. They are regular and rarely stationary
  iii. They follow a definite track
  iv. They are mostly often found in maritime areas because they are weakened over land area.

Development of Tropical Cyclone

i. They develop over warm tropical oceans, where sea temperature exceeds 26°C and where there is considerable depth of warm water.

ii. They develop when north trade winds and south trade winds meet along Inter-tropical front between latitudes 5° and 20° North or South of the equator (near the equator the Coriolis force is insufficient to enable the features to spin.



iii. Tropical cyclones develop over ocean masses because air masses which have traveled over oceans have warm moist lower layer.

iv. Tropical cyclones die out when they reach the land because their supply of warm moist air is cut off.

v. Cyclones are called

a) Typhoons in Asia b).Hurricanes in West Indies

c).Willy Willies in Coast of Queens land d). Tornadoes in USA

e).Cyclone in USA

Weather Associated with Tropical Cyclones

i. Temperature and humidity are high

ii. It is associated with winds and thick clouds

iii. They are also associated with heavy rains

2. Temperate Cyclones/Depression

- They rise in the belt of Westerly winds

Development of Temperate Cyclones

i. They rise in the belt of westerly winds and caused by mixing of cold air from Polar Regions with warm, humid air from tropical regions.

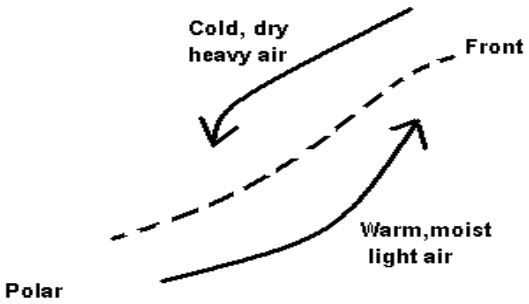
ii. They consist of swirling masses of air

iii. They bring prolonged rain to coastal regions and often very windy weather.

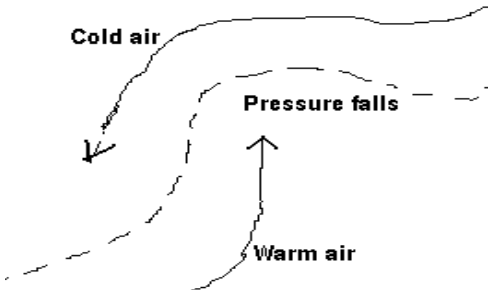
Stages in the development of Depressions

I. -Along the polar front, cold polar air moves in a general westerly direction and warm tropical air moves in general easterly.

-The frictional effect of the two air flows cause a wave to develop as shown below;



II. The wave bulges into colder air and gets larger.



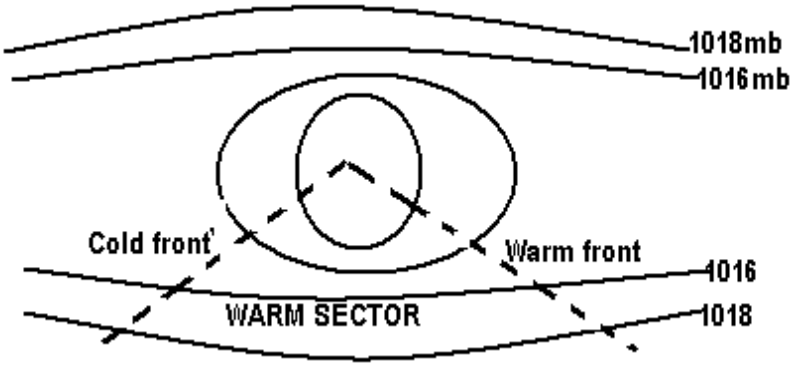
III. -As the bulge develops, the warm air rises up over the air at the front of the bulge.

- This front is called warm front
- The warm air between the two fronts is called **WARM SECTOR**.
- The warm front is much more greatly stopping than cold front

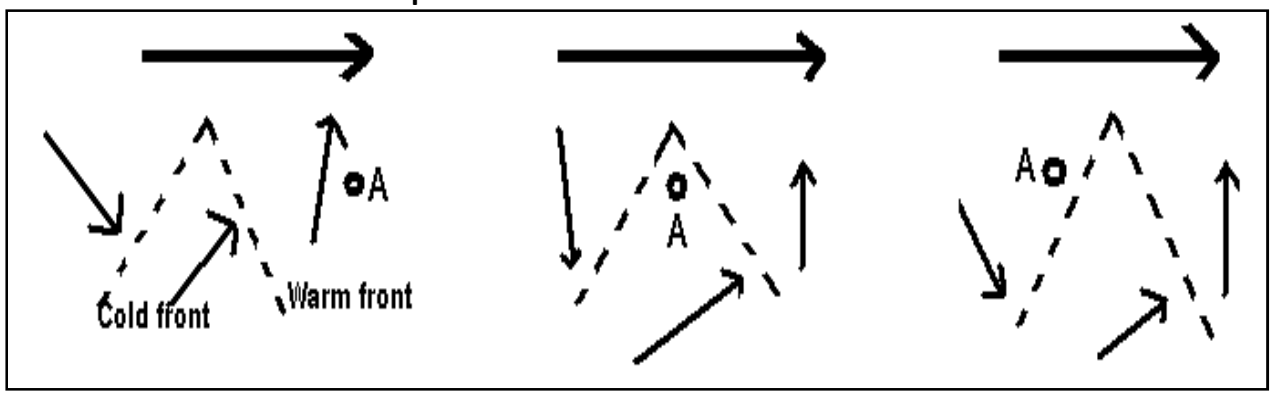
- As cold air catches up with warm front and lift it off the grounds and this then becomes **OCCLUDED FRONT** and it soon dies.

Occluded Front

- This is the contact area at the boundary between cold and warm air of depression with the warm air lifted off the earth surface. As shown below;



Weather Associated with Depression



- In the diagram above the depression is approaching point A and sequence of air at A will be as follows;
  - i. - Clear sky except for a little cirrus clouds.
    - Wind is from south-east
    - After a while definite cloud cover develops and light showers of rains occur
  - ii. – The rain stops and the wind changes direction from south-east to south-west.
  - iii. - As the cold front passes the weather changes very rapidly
    - Wind blows from north-east and temperature falls.

Front

- This is the boundary between warm and cold air masses.

Types of Fronts

1. **Warm Front**
   - This develops when warm air masses uplift the cold air masses.
   - On the weather map it is shown by the diagram shown below;

2. **Cold Front**
   - This develops when cold air masses uplift warm air masses.
   - There is a sharp drop in temperature
   - it is associated with scattered or occasionally showers.
   - it is illustrated on the weather map with the diagram shown below;

3. **Occluded Front**

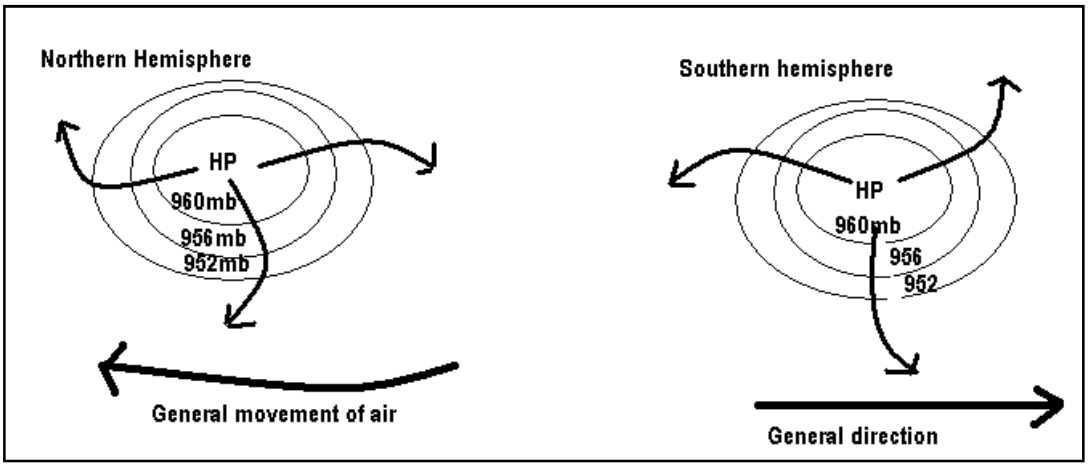
This develops when cold and warm air mass uplift each other as shown below

- The overtaking cold front elevates the warm tropical maritime air which result into
  1. mass lifting of humid tropic air
  2. gives rise to short, sharp showers
  3. thundery in summer

4. **Stationery Front**
   - this develops when warm air masses and cold air masses remain stationery where they meet because of opposing forces as illustrated below

Anticyclones

- These are areas of high pressure
- The are characterized by high pressure at the center and low pressure outside as shown below



- Air moves towards the poles from equatorial regions descending forming sub-tropical high pressure.
- Wind blows outwards from center in an a clockwise direction in the northern hemisphere (due to coriolis effect)
- Anticyclone is a uniform air mass which gives fair weather especially in summer.
- They remain stationery before gradually fading out.
- They usually affect the whole land.

WORLD CLIMATIC REGIONS

Objectives

- Locate local climatic regions
- Describe criteria used in classifying world climates
- Describe characteristics of each type of climate and its associated vegetation
- Outline the influence of climate and its associated vegetation on economic activities

Climate: This is the average weather condition throughout the season over fairly wide or very extensive area of the earth surface and considered over many years (30-35years)

- It is easy to predict climate

Weather: This refers to the condition of the atmosphere over short period of time and over a small area.

- Weather is un predictable
- It includes temperature, air pressure, wind, etc

CLIMATIC REGION

- This is part of the world which have similar climatic conditions
- It is the main area into which the earth is divided according to climate.

HOW ARE CLIMATIC REGIONS CLASSIFIED?

- There are a number of factors to consider when classifying world climate

I. Temperature: This refers to degree of hotness or coldness of air in the atmosphere. There is un even distribution of heat over space and this will result into different climatic regions

II. Rainfall : The type and amount of rainfall experienced in an area differ from Place to place. Other types of rainfall dominate in a specific area.

III. Vegetation : The type of vegetation experienced varies from one geographical area to another.

IV. Agricultural Development: The type of agricultural activities carried out in an area is nfluenced by weather elements which make up climate.

NOTE:

- Climate does the following

i. It determines where people can live, if the area is experiencing harsh climatic conditions people run away them.

ii. It controls the type of crop to be grown and type of animals to be raised.

iii. It controls the type of housing and type of clothing.

MAIN CLIMATIC REGIONS OF THE WORLD

- There are four main climatic regions namely
  a) Hot climatic region

b) Warm climatic region
c) Cool temperate climatic region
d) Cold climatic region

WHY DIFFERENT CLIMATIC REGIONS?

I. **LATITUDE**

- This refers to distance from the equator.
- Most of the warm regions are near the equator while cold areas are near the poles.
- Places across the equator may have different climate, for instance Andes mountain have very cold climate while Sahara, and 3000km north of the equator is the hottest and the driest. These are due to altitude.
- Equator is very hot throughout the year because the land receives much warmth everyday because is almost directly overhead.

II. **ALTITUDE**

- This refers to height above the sea level
- It determines the following.
  i. The height of the noon sun over and area.
  ii. The length of the day.
  iii. These determine the amount of heat received from the sun.
- The higher you go the cooler it becomes as such most hills and mountains are cooler than nearby lowlands.

III. **TERRAIN**

- This refers to things that constitutes natural surroundings e.g. soil, rocks and vegetation.
- Some surfaces for instance sand, rocks city pavements keep heat in turn the heat the air above them.
- Forests, water and grass retain less heat as such they warm the air but not as much as sand and rocks.
- It influences wind that is wind flows easily along the valleys hence bring warm or cold air in the same region.
- Mountains block the wind and force it to rise over the mountain.
- It may cause rainfall when moist air rises to pass over the mountains clouds develops and then rain falls.

V. OCEANS/WATER

- Availability of oceans/water has an influence of weather elements hence affect climate
- The coastal regions of the continents have mild climate.
- In Summer, the oceans do not become as warm as land because they absorb heat slowly.
- The oceans are source of rainfall because wind picks up moisture from oceans which turn into clouds and rain falls over land.

NOTE:

THINGS TO BE LOOKED INTO ON EACH CLIMATIC REGION

a. Location in terms of
   i. Latitude, which is how far, is the place from the equator.

ii. Places on the continents that is if it found in the Northern Hemisphere or Southern Hemisphere.

b. Climatic characteristics in terms of
   i. Monthly rainfall (graphs and tables)
   ii. Total annual rainfall
   iii. Annual temperature range
   iv. Other relevant climatic factors

c. Agricultural developments
   i. Type of vegetation
   ii. Crops grown and animals raised
   iii. Problems faced, that hinder agricultural development.

CLIMATIC REGIONS OF THE WORLD

A. Equatorial Climate

Location:

- It is found in lowlands between 5° North and 5° South of the equator
- It is experienced in Amazon and Zaire Basin, Guinea Coast, Malaya Peninsula, Indonesia and Philippines.
- Being closer to the equator the temperatures are high but in highlands this is not the case they experience low temperatures.

Characteristics of Equatorial Climate

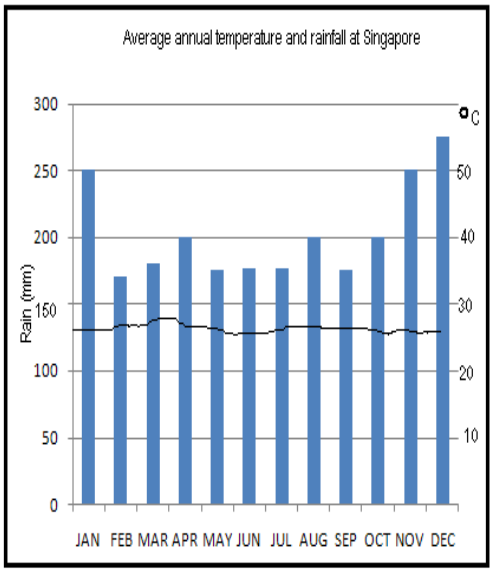
Temperature

- High temperature all year round of about 26°C and every day is like summer.
- Small annual temperature range of not more than 5 degrees Celsius
- Extensive clouds cover and heavy rainfall prevents temperature from rising over 26°C
- Diurnal range of temperature 5-15 degrees Celsius and it is higher than annual range
- It has no seasons because it lies along the doldrums where temperature constantly high throughout the year.

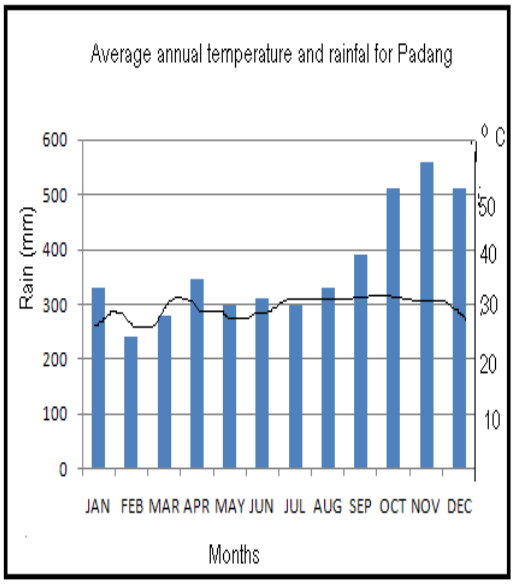
Rainfall

- It experiences heavy convectional rainfall all year round (2413mm/year) how ever some areas such as Guinea Coast of west Africa, Accra, receive low annual rainfall of about 700mm due to modified changes by monsoon winds.
- The rainfall comes every afternoon accompanied with lightening and thunder
- Rainfall has double maxima due to the over head of the sun at the Equator twice a year(April and October)
- Mount Cameroon receives about 10 000mm per annum.

Graphs below show rainfall and temperature of equatorial climate



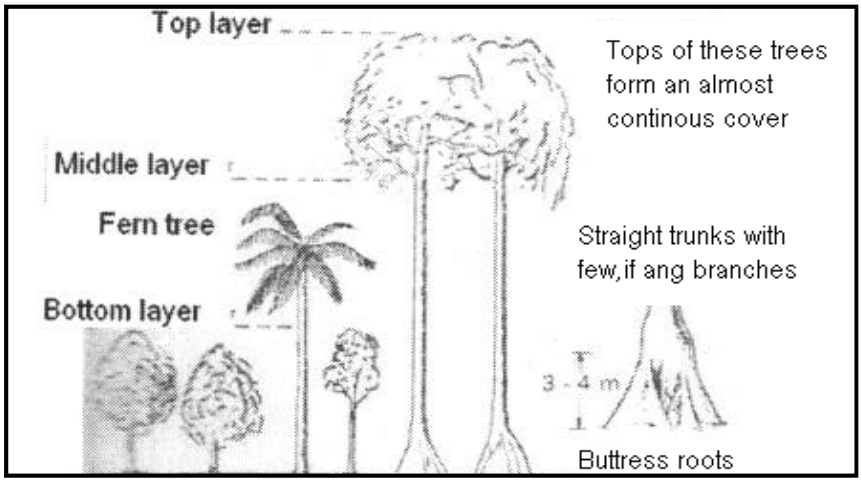
Average annual rainfall and Temperature in Singapore



Padang

Vegetation

- Vegetation is equatorial which is characterized by the following
- Vegetation is evergreen
- They are broad leaved to allow more transpiration
- They have canopy as shown below
- The typical vegetation are hard wood which include
- Mahogany, Ebony and chengal.green heart, iroko, sapele, okoume, teak and rubber.
- Trees grow in three distinctive layers with the upper layer 50m high and thunder canopy 30 m
- The trees are straight and have buttress roots for support
- There are a lot of creeping stems known as lianas which reach up to 200metres long.
- The bottoms of the thick forests are clear because light does not reach there.



Developments Activities

a) Growing of plantation crops i.e. cocoa, palm oil, rubber, bananas due to heavy rainfall.
b) Commercial cutting of trees (Lumbering)
c) Some area practice shifting cultivation.
d) Heavy rains experienced result into area being heavily forested hence sparse (scattered population e.g. Zaire basin)
e) Hunting and collection of fruits is practiced in this region

Problems faced

Initial Development is difficult in most areas because of the following reasons

i. There are many diseases and pests which attack human, animals and crops. If humans are sick they could not cultivate in their fields hence low development and on the other hand if crops are and animals are attacked by pests and diseases they will be of poor quality as a result there is low development.
ii. It is difficult to establish communication since the area is heavily forested.
iii. Soils are generally poor because thin layer of rich top soil are eroded very quickly by running water and heavy rains also result into a lot of leaching.
iv. There is excessive heat and high humidity.
v. Impassable rivers

B. Tropical Continental (Sudan) Climate/ Savanna

I. Location

- It is found between latitudes 5°- 15° North and 5°- 15°South of the equator.
- It best developed in Africa in countries such as Malawi, Zambia and Zimbabwe and also in Central part of South America.

II. Climatic characteristics

Temperatue

Hot summers of 32 $^{0}_{C}$ and cooler winter of 21°C

Annual range of 11°C.

Rainfall

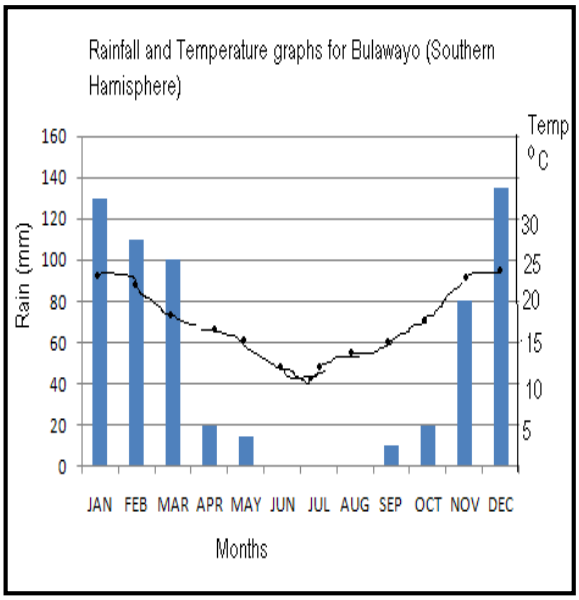
The total annual rainfall in the savanna climate in the Northern Hemisphere is about 850mm while in the Southern Hemisphere is about 610 mm.

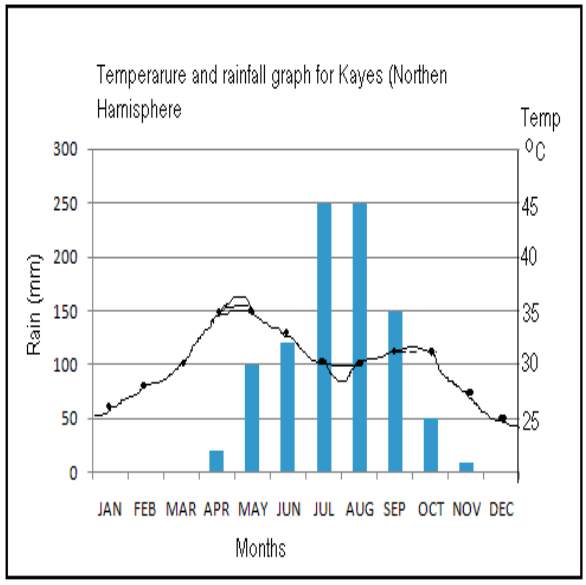
The climate experiences seasonal type of rainfall where by the Northern Hemisphere receives rainfall at a different time from the Northern Hemisphere

The area is affected by trade winds in winter and by doldrums in summer

The effects of trade winds are mainly felt in West Africa, South Africa and South America In West Coast Africa the winds blow from Sahara desert and are hot, dry and dusty (Hammatan), while in South Africa and America they blow from sea bringing rain to the coastal regions

Humidity is high in summer.





Lilongwe in SH **Kano in NH**

Vegetation and there adaptational features

a) Natural vegetation consists of scattered with tall grass and in Africa this type of vegetation is called **SAVANNA** while is South America is known as **LLANOS** (Guinea Highlands)/ **CAMPOS** (Brazil). Savanna is associated with clumps of trees and animals such as elephants, zebra, giraffe, antelope, lions and leopards.

b) The trees are deciduous,to prevent the water lose during the dry season to shed leaves during dry season and these include baobab and bottle trees that store water in their swollen trunks as such they are able to survive the dry season.

c) The trees have relatively small leaves to control the rate of transpiration.

d) Most trees are umbrella shaped to cover the toots from direct heat.

e) Trees have long roots to search for water.

f) Trees have thorny branches to reduce water loss.

Common examples of trees found in savanna climate include;

Acacia trees, Baobab, Eucalyptus, silk cotton, Gmelina, Shea butternut and Neem

Diagram depicting one of the trees in tropical grasslands.

A Baobab tree

Wiled life

Because of the scattered trees and availability of much grass, the savanna climate contains a wide range of wild life

- Carnivorous animals- Lions, leopards and hyenas.
- Herbivorous animals- Giraffe, elephants, zebras, monkeys, baboons, e.t.c.

Agricultural developments

- Growing of commercial and subsistence farming
  - They grow crops such as guinea corn, millet, maize, bananas, groundnuts and beans as food crops and non food crops include cotton and tobacco.
  - Commercial farming is also practiced in large scale using tractors, fertilizer in Malawi, Kenya, Uganda etc and crops include sugarcanes, tobacco, sisal and cotton.
- Agriculture is not fully developed in some areas but nomadic pastoralism is practiced. For example the Masai of East Africa herd large number of Zebu cattle, goats and sheep raised for milk and blood and rarely for meat.
- Well established Game Reserves and National Parks
- Integrated rural development programmer

Problems faced

The factors that prevent agricultural development includes

i. Drought occurs frequently as such is causes problem to farming
ii. Torrential down pour of heavy rains cause leaching which reduce the fertility of the soil.
iii. Most of the savanna areas have poor soils which are incapable of supporting good crops.
iv. Present of typical diseases and pests also affect agricultural in such a way that if attack animals they die or they are of poor quality.
v. There is poor communication from agricultural regions to the markets.
vi.

C. Monsoon Climate

LOCATION

This is well developed in South –Eastern and eastern Asia i.e. Pakistan,Burma, Vietnam, Kampuchea, Bangladesh

It is also found in Northern Australia.

Characheristics

Temperature

Temperature range beween 32$^{o}_{C}$ in hot season and 15 $^{o}_{C}$ in the cool season.

Rainfall

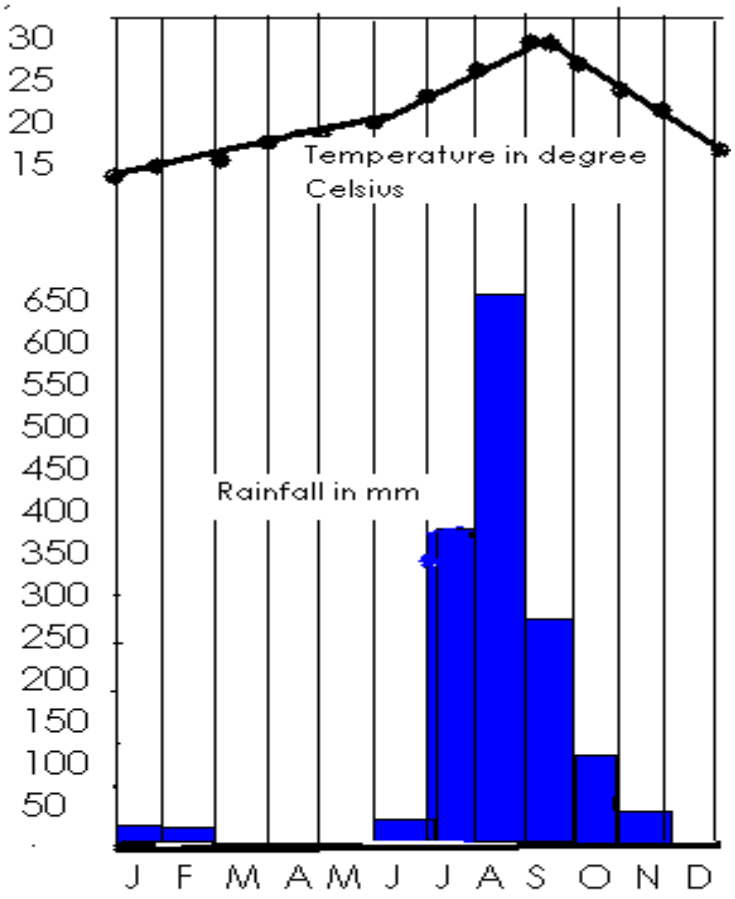
Monsoon climate receives very heavy but seasonal rainfall

The amount of rainfall varies depending on relief and the angle at which the on shore winds meet this.

South facing slopes receive over 12500mm annually while Delhi receives only 620mm annually.

The total annual rainfall for Monsoon climate is similar to that of Equatorial climate but in monsoon this amount is received only in five months not through out the year as is the case with Equatorial climate

Rainfall graph in monsoon climate



RAINFALL GRAPH FORDELHI IN INDIA

SEASONS

Monsoon climate experience three seasons

a. Hot dry season

March-February

Temperatures are high

Winds are absent

There is no rainfall

b. Cold dry season

November-February

Off-shore NE Monsoon winds blow and they bring no rainfall

c. Hot wet season

June-October

On-show winds SW Monsoon winds blow and these winds bring heavy rainfall

There is fall in temperature because of cloudy skies

Vegetation

- The vegetation in monsoon climate varies from evergreen forests in wettest
- places to deciduous forest in drier areas.
- In many drier monsoon areas vegetation is similar to that of Savanna

  Examples of trees in Monsoon climate include; Teak, coconut, bamboos, cashew, mangoes.

Economic Activities

- Intensive cultivation of food crops where soils are fertile e.g. padi (rice), wheat, maize, millet, sorghum.
- Plantation agriculture i.e.sugarcane, Jute, tea, coffee.
- Green revolution to provide more food for the higher population
- Tourism –due to the presence of Coral reefs, warm ocean currents etc.
- Lumbering .For example teak is the main export commodity for Burma.
- Shifting cultivation in remote rural areas

Problems

a) Over population
b) Widespread flooding due to due to heavy monsoon rainfall
c) Poor farming methods by indigenous farmers.
d) The practice of tenancy system retards development among tenants

D. Tropical Desert Climate

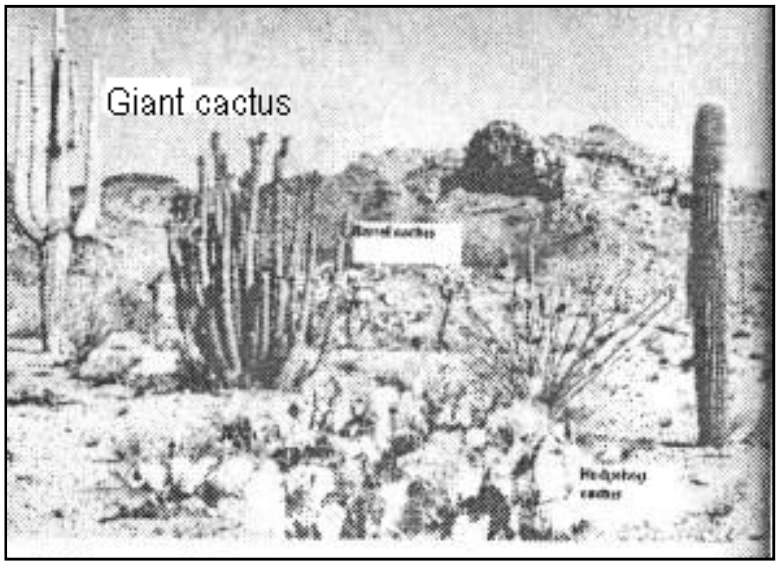
I. Location

- It includes the major hot deserts of the world.
- They are located on the Western coast of continents between 15°C and 30°C North and South of the equator. *WHY?*
  i. The Ocean water is cold, prevailing winds blow parallel to the coast line and due to the earth's rotation, and they tend to push surface water seaward at right angles to the wind direction
  ii. This is the zone of sub tropical high pressure where air is subsiding. The tropical air is forced to rise at equator, producing convectional rain, and later the air once cooled stripped its moisture descends at approximately 30° North and south of the Equator. As this air descends it is compressed, warmed and produces an area of permanent high pressure. If the is air is warmed it can hold an increasing amount of water vapour which causes the lower atmosphere to become very dry.
  iii. The rain shadow effect produced by high mountain ranges. As the prevailing winds in the subtropics are the trades, blowing from North east in the Northern Hemisphere and South east in the Southern hemisphere then any barrier such as the Andes, prevents moisture from reaching the western slopes hence the rain shadow effect create much large extent of desert. Aridity increases as trade winds blow towards the equator, becoming warmer and therefore drier.

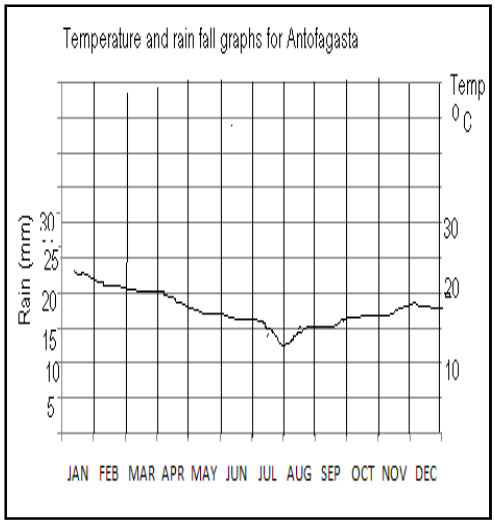
- These deserts include; Sahara, Great Australian, Arabian, Kalahari, Namibia, Movane and Atacama.

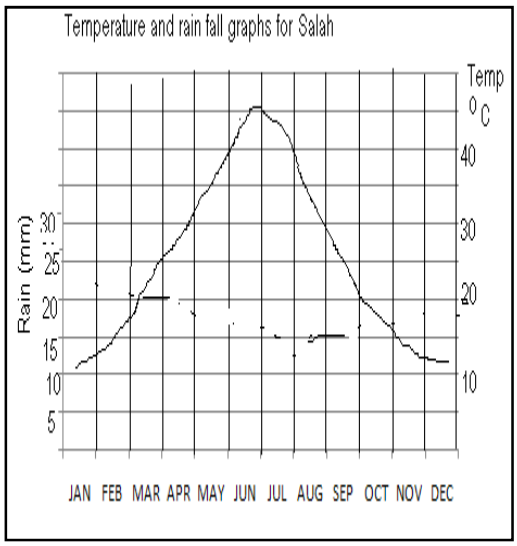
II. Climatic characteristics.

- The areas rarely experience rainfall and the average rainfall is 12mm and when it falls it is usually in form of heavy thunder-showers.
- Temperatures are high because of the following reasons
  i. Clear/cloudless sky.
  ii. Intense insolation (great exposure to heat).
  iii. Dry air
  iv. Rapid rate of evaporation
- The deserts have xerophic or drought resistance shrubs such as cactus, thorny bushes (these characters reduce rate of transpiration), long roots (absorb deep waters and plant foods) and dwarf scattered acacia. Beside is a diagram of cactus



- In the tropical desert climate there is little rainfall because most of winds blowing into the deserts begin in cooler regions and when they get hotter and this prevents condensation therefore very little or no rain falls.
- Because of clear skies it is often much hotter at the mid day at the equator, but at night great deserts are very cold. Temperature varies from 29^{o}C in hot season to 10^{o}C in cold season.
- Graphs below depicts temperature and rainfall graphs for this region;





IV. Agriculture development

- Through the use of irrigation canals in the valleys of the Nile, Tigris-Euphrates and the Indus valley are being cultivated.
- Other cultivations are done in Oasis (an area in a hot desert where the presence of water at suitable level permits sustained plant growth).
- Crops grown include dates. Wheat, vegetables and fruits
- Rearing of flocks of sheep and goats is practiced by the Nomads (the wandering tribesmen)

V. Problems faced.

- Problems faced prevents development in terms of agriculture
  i. Most water is found below the surface for instance in Sahara and this water is obtained through drilling aquifers.
  ii. Strong winds that blow across the desert areas cause chimney eyes and lots of dust and this is prevented by wearing long trousers.
  iii. Too much heat from the sun
  iv. Plenty of locusts which live on plants and migrate in swamps and these are controlled by spreading poisonous baits so that they eat and die.

E. Warm Temperate Western Margin/ Mediterranean Climate

I. Location

- It is experienced between 30° - 45° North and 30° - 45° South of the equator in the western sides of continents.
- Climate is best developed around the shores of Mediterranean Seas hence Mediterranean climate and in South-West Africa (Wavis Bay), Central Chile, Central California, South west Australia and Cape Province and Cape Town.

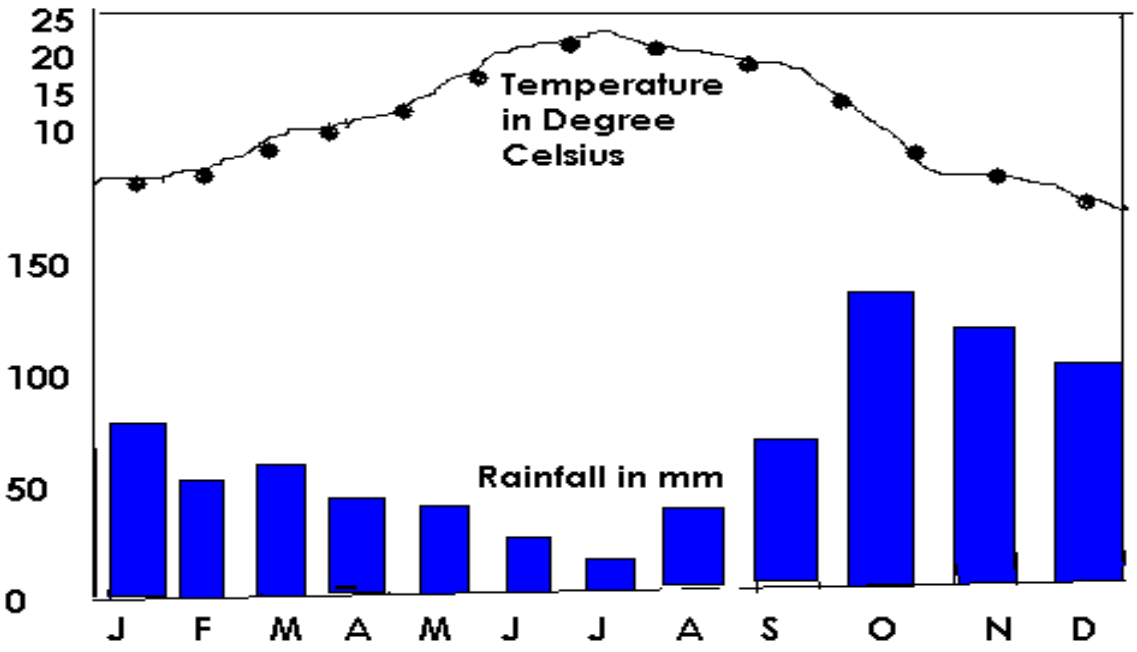
II. Climatic characteristics

- The temperature range from 21°C in summer to 10°C or below in winter.

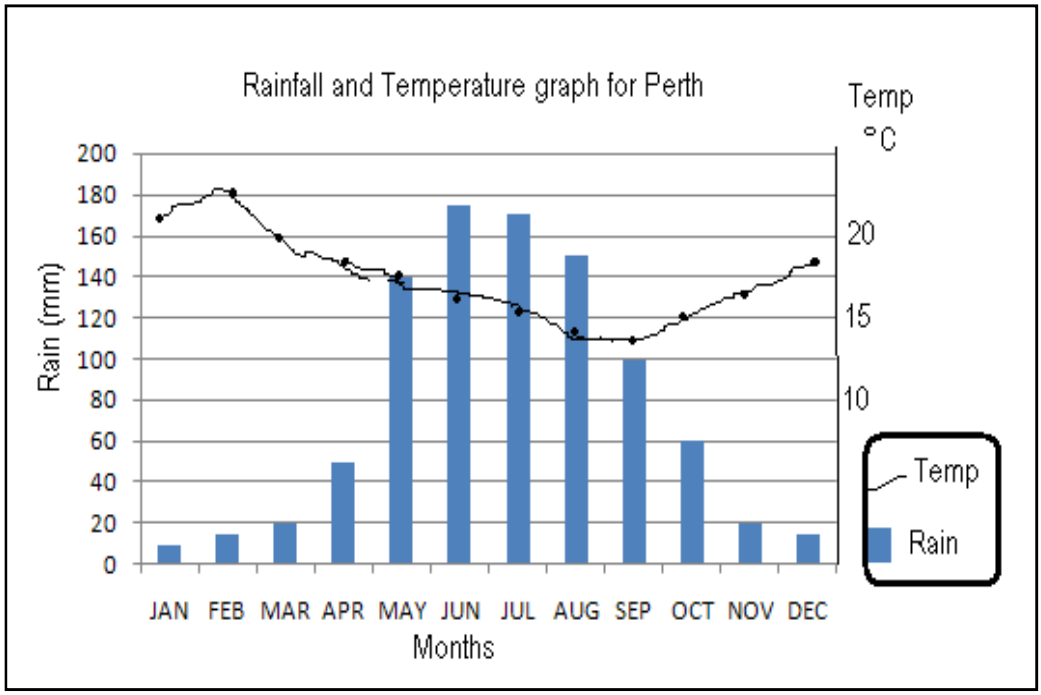
- The effect of on-shore and off-shore winds is very evident. In summer the winds blow off-shore and they are dry and they bring no rain while in winter they blow on-shore which brings cyclonic rain, sometimes up to 500mm
- The annual rainfall ranges from 500mm to 760mm
- There are series of hot and cold winds blowing over Mediterranean region and these winds include
    i. Sirocco winds: hot and dry winds which blow in summer and originate from Sahara desert.
    ii. Bora winds: winter cold wind that blows from Central Europe.
- The region experience bright, sunny, hot-dry summer and mild rainy winter.

Graphs below showing temperature and rainfall experienced in Mediterranean Climate

Northern Hemisphere



Northern Hemisphere: Rome -Italy



Southern Hemisphere-Australia

III. Natural vegetation.

i. Open woodland with evergreen oak trees in areas with relatively higher rain fall
ii. Evergreen coniferous trees e.g. pine, firs, cedar
iii. Mediterranean bushes and shrubs predominant in drier areas.
iv. Wiry and bunchy grasses

These have no deep root penetration and they are very short and grow very slowly because of winter condition.

IV. Economic Development

a. The climate is favourable for agriculture such as growing of citrus fruits (oranges, lemons grapes) and cereal crops (wheat and barley).
b. Olive trees are also grown and these are rich in oil used for cooking.
c. Production of these fruits gives rise to development of industries and engineering works such as fruit canning and food-processing.
d. The cultivation of Grapes is called Viticulture and large part of the fruit is used for making wine but some is dried to make sultan, currants and raisins.
e. Mining of petroleum
f. Irrigation agriculture
g. Fishing along the Mediterranean sea
h. Tourism encouraged by hot summers

v. Problems

- The failure of grass growing affects cattle rearing

- Strong cold winds and hot winds such as
- Mistral-strong cold wind
- Sirocco-strong hot wind
- Bora- cold wind
- Deforestation of soft coniferous wood
- Mass pollution from industrial wastes

F. Tundra Climate

I. Location

- These include Barrow points in Alaska and Bulon in the USSR
- The climate is best developed in the Northern Canada and Northern Asia.
- It occurs in the northern continents and north of the cold temperate continental climates.

II. Climatic characteristics

- In winter the nights are long and in summer the days are short.
- Winter temperatures range from -2°9C to -40°C while summer temperatures are about 10°C to -50°C.
- The total annual precipitation is about 250mm, some of which falls as rain in summer and some as shown in winter. Because of low temperatures humidity is always low as well.

III. Agricultural development

- There are no agricultural developments as sub soils are permanently frozen.

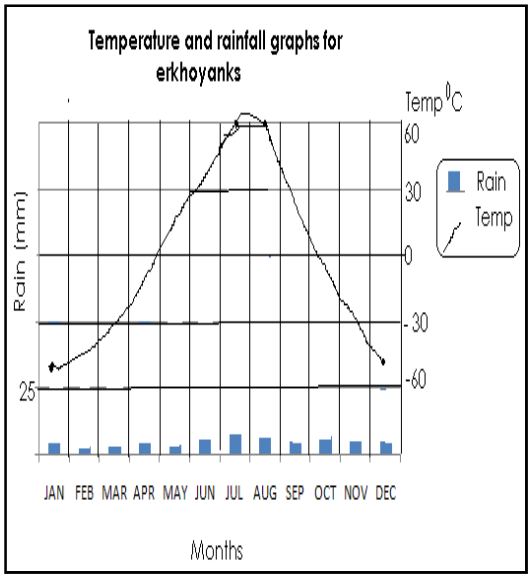
G. Cool Temperate Continental (Siberian) Climate

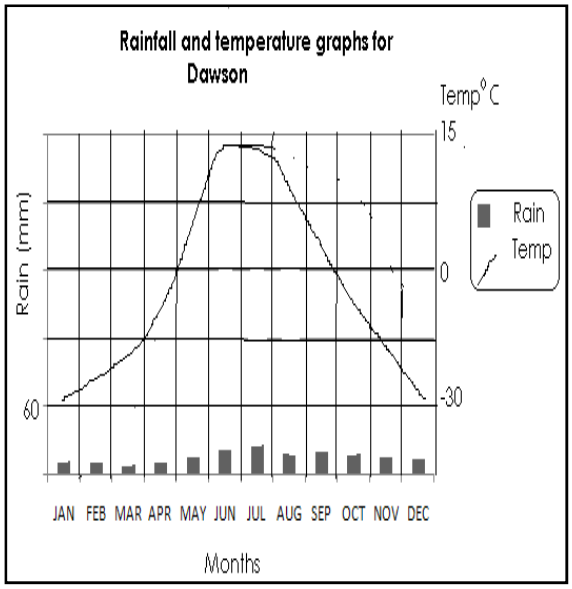
I. Location

- It is mainly found in Canada and the USSR.
- It is located between the cool interior climate and the Tundra in both North America and Eurasia.
- In Eurasia they are called the **Steppes** while in North America they are extensive and are called **Prairies** and lie between foot of Rockies and the Great lakes. In Argentina they are called **Pampas** while in South Africa they are called **Bush-veld and** in Australia they are known as the **Downs**.

II. Climatic characteristics

- Winter temperatures ranges from -34°C to -50°C and warmer temperatures averages about 21°C and the annual temperature range is over 70°C.
- Total annual rainfall rarely exceeds 380mm and most of it occurs in summer. These rains result from the entry of moist sea air.





III. Agricultural Development

- There is no cultivation of crops because the subsoil is frozen almost all year long.
- Wheat is being cultivated under extensive mechanization.
- Pastoral farming is practiced and cattle, sheep, pigs and horses are kept.

Sample Questions

1. Study the tables below and answer questions that follow;

STATION A.

Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temp ^{o}C	27	27	28	29	27	27	29	28	29	26	27	27
Rain (mm)	0	5	2	8	11	15	10	12	0	16	0	0

STATION B.

Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temp ^{o}C	27	27	28	28	28	29	29	28	29	28	29	28
Rain (mm)	200	250	300	350	300	280	300	300	350	300	290	300

a. i. Identify the climate for station A and B
ii. Which climate favors irrigation farming and why?
b. i. Name the type of vegetation associated with station B.
ii. In station A. what structures have vegetation development in order to survive such climatic condition?
iii. Draw a temperature and rainfall graph for station B.

2. a. i. define 'climatic region'
ii. Explain why climate vary from region to region.
b. Discuss any three problems of agricultural development in the equatorial.
c. Why is it that there is little rainfall in tropical desert climate?

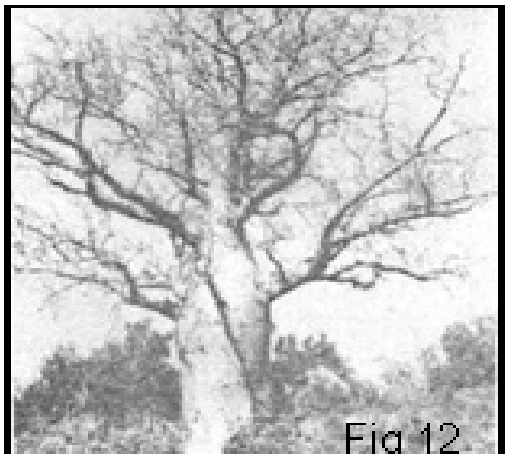
3. Explain and account for the following
   i. Hot deserts usually located on the western sides of continents
   ii. Desert plants are able to survive for long period without water.

4. a. Name the vegetation which is associated with each of the following

i. Tropical continental (Sudan) Climate

ii. Mediterranean climate

b. i. Identify the vegetation associated with the tree shown fig 12



ii. Explain how the vegetation type adapt to climatic conditions.

iii. Give one characteristic of this type of vegetation.

iv. Out line any two factors which hinder economic development in this region.

PART 2: HUMAN AND ECONOMIC GEOGRAPHY

THE ATMOSPHERE

ENVIRONMENT

Objectives

- Define the terms "***environment***", "***wetland***", "***Desertification***"
- Explain how human being endanger environment
- Explain the reasons for the conservation of the environment
- Describe the effects of desertification
- Explain the importance of wetlands
- State the causes of environmental pollution
- Describe the threats to wetlands
- State the causes of environmental pollution
- Describe the effects and control measures of pollution
- Explain the global warming and its effect.
- Explain causes off acid rains and its effects

Environment

o This is the sum total of conditions of the surroundings within which an organism, or group or an object exist.

Ecosystem

This is the interaction of all living organisms (plants, animals, bacteria etc) with each other and with their surroundings

Human Activities that Endanger the Environment

1. **Poor agriculture activities such as**
   i. Shifting cultivation
   ii. Pastoral nomadism
   iii. Making ridges along slopes

   The above practices encourage great run off and large scale erosion.
2. **Deforestation** , this is the clearing of forests for
   i. Timber
   ii. Building
   iii. Establishment of land for farming and settlements
   iv. Extraction of certain minerals like iron ore, bauxite, copper, uranium etc

   The above practices encourage great run off and large scale erosion leading to little water infiltrating the soil hence result into drought condition.
3. **Misuse of insecticides**

   These affect useful insects such as honey bees, praying mantises, so creating a gap in the ecosystem, such chemicals include DDT, Dieldrin etc.
4. **Pollution** : humans may pollute water, air as well as land
5. **Hunting-** Fire used by some hunters when hunting animals destroy all things in the ecosystem i.e. plants and other animals.
6. **Mining –** This depletes minerals resources and make open scars on the surface of the earth
   - The mining process my led to land subsidence

- Minerals that are mined produce poisonous substances which pollute the environment.

7. .**Industrialisation** – The need of manufactured medicine and improved technology has led to the release of some wastes into the water and atmosphere which endangers the environment i.e. smoke from the factories are emitted in the air and cause global warming.

Define the term Desertification.

- This is a process where desert conditions spread into the semi-arid areas as a result of human activities.
- This is the process that creates desert conditions by down grading the land surface.
- It is a steady process that turns good and fertile land into a barren one e.g. from forestry into grassland and then into barren and unproductive shrubs.
- Desertification has been created by human through misuse of lands

Levels of desertification

a) Slight desertification:
- These occur where desert already exist e.g. Sahara
- land cover is not affected by human activities

a) Moderate desertification:
- There is great change in plant cover.

c) Severe desertification
- This is where top soil is eroded and shrubs replace productive grassland.

d) Very severe
- This is where the land is totally destroyed by deep gullies and the desertification process is irreversible.

Identify the causes of desertification.

- Deforestation
- Laterisation.
- Overgrazing.
- Poor land management practices.

Describe the reason why desertification is fast in the developing countries like Malawi.

- Most people do not have alternatives for energy because of poverty as such they mostly use fire wood as the main source of their energy.
- Illiteracy level is high as such they fail to understand the long term impact of desertification.
- Over population i.e. the rate of their population increase does not match with the rate at which vegetation is replaced.

What are the effects of desertification?

- Soil erosion
- Soil degradation.
- Change of climate.
- Poor crop yield.
- Depletion of water table due to siltation.
- Destruction of wild life habitat.

Control of Desertification

- Afforestation- this is the process of planting of land, not formerly covered, with trees to make a forest for commercial or other purposes.
- Re-afforestation – This is the planting of trees on land previously forested by from which the trees have been removed by natural causes by cutting, burning or other means.
- Proper land husbandry- These include all processes that promote conservation of land e.g. practicing crop rotation and making ridges across the slope.
- Civic education campaigns- this is where people with knowledge on caring of trees and vegetation tell their colleagues on importance of vegetation conservation
- Controlling rapid population growth- if the population is high it means high demand for forestry resources and land for cultivation and settlement.
- Provision of alternative sources of energy- these alternative sources of energy include; solar, hydroelectricity, energy from wind, biogas, thermal energy, geothermal energy and nuclear energy

CLIMATE CHANGE

Describe human activities that cause climate change

- Deforestation due to high population growth
- Technological advancement e.g. fumes and other gases from factories and automobiles
- Urbanisation which induces urban islands

How can deforestation cause climate change?

- Bush fires emit gases e.g. Carbon dioxide into the atmosphere which form the green house effects
- Absence of vegetation makes the atmosphere to be full of Co2 which would have been absorbed by plants through the process of photosynthesis
- Deforestation results into soil erosion where the bare ground allows the high speed of surface run-off which eventually deposit the suspended solids in water bodies
- The deposited loads cause siltation of the water bodies and become shallow
- The shallow water bodies dry up easily situation which affect the hydrological cycle
- Disturbance of the hydrogical leads to climate change because rainfall is affected.

Discuss how technological advancement cause climatic change

- Technology has led to the establishment of factories which emit a lot of gases such as CFC's
- Nitrous oxides, sulphur oxide into the atmosphere and these gases affect the ozone layer and cause global warming.
- Some gases form acid rain in the atmosphere which also brings about climatic change.
- automobiles exhaust also release carbon monoxide into the atmosphere and leads to green house effect and eventually global warming.

Describe how global warming is caused

- The earth is warmed during the day by incoming
- short wave radiation
- From the earth, there is outgoing long wave infrared radiation
- The equilibrium between heat insolation and radiation makes either of the heat waves to cool down or warm up .The gases apart from 79% of nitrogen and 20% of oxygen form what is know as green house gases, Water vapour, methane from decayed vegetables, carbon dioxide from burning fossils, methane also from fermentation of animals dung, sewage disposal and growing rice are the other sources of the green house gases.

- While Nitrous oxide come from fertilizers and vehicles engines and CFC's from refrigerators and aerosols
- when gases increase in the atmosphere, they form a layer of gases which prevents the release of heat as a result the global becomes exceedingly warm. This is known as global warming.

Identify the effects of global warming

- Brings about the warming of sea water there by causing rise in the level of the leading to flooding of coastal areas.
- It leads to the warming of glaciers making polar areas warm which also lead to flooding.
- It affects the rainfall pattern such that some areas become wetter while others become drier.
- It causes desertification as hot areas become hotter
- It shifts climatic belts and vegetation type and in the process some animals become affected.
- It causes the spreading of tropical diseases to the temperate region
- Global warming also alters ecological balance as ecosystem changes.
- Shrinking of the Antarctic ice cap
- It leads to changes in ocean currents.

Describe the formation of acid rain

- Acid rains are formed when nitrogen oxide and nitrogen dioxide from car exhaust pass into the atmosphere.
- When these acids dissolve in air water, they form solution of nitrous and nitric acids
- These acids fall on the ground as acid rains.

Discuss the effects of acid rains

- They destroy plants leaves where by they turn yellow and in the process drop from branches prematurely.
- The nitrogen oxides cause leaching when they percolate into the soil and make it lose fertility.
- The acid rain weakens the capacity to resist disease in trees as such they are easily attacked by diseases.
- Acid rains erodes the statues and buildings

Suggest possible solution to the causes of climate change

- Reducing the use of carbon fuel i.e. avoid wild fires and advocate use of clean energy.
- Conservation of vegetative cover which help to absorb the accumulation of Carbon dioxide in the atmosphere.
- Intensify international conventions which among other things make policies on the enforcement of laws that produce chemicals that can pollute the air in the environment.
- Banning the use of funs and refrigerators that produce CFC gases.

Define Eutrophication

This is the process where by the shallow water loss all its oxygen due to the decaying of algae which use this oxygen as they decompose.

Describe how Eutrophication is caused.

- The process of Eutrophication starts with the draining of sewage and fertilizers in the water and these influence the fast growth of water plants called algae. When the algae die they fall to the sea bed where they use oxygen when decaying.

POLLUTION

There are three types of pollution

- Air pollution
- Water pollution
- Land pollution
- Noise pollution

Human Activities that Endanger the Environments

1. Poor agriculture activities such as
    a. Shifting cultivation
    b. Pastoral nomadism
    c. Making ridges along slopes

   The above practices encourage great run off and large scale erosion.
2. Deforestation , this is the clearing of forests for
    a. Timber
    b. Building
    c. Establishment of land for farming and settlements
    d. Extraction of certain minerals like iron ore, bauxite, copper, uranium etc

   The above practices encourage great run off and large scale erosion leading to little water infiltrating the soil hence result into drought condition.
3. Misuse of insecticides
    - These affect useful insects such as honey bees, praying mantises, so creating a gap in the ecosystem, such chemicals include DDT, Dieldrin etc.
4. Pollution : humans may pollute water, air as well as land

Water Pollution

- This is the process of making water unsafe for human consumption and hazardous for aquatic life.
- Man can pollute water through the following ways:

i. Farming:

- Fertilizer and pesticides are washed through the soil by heavy rains and make their way to rivers, lakes and seas.
- Phosphates and nitrates encourage the growth of algae and other water plants which use up oxygen and leave insufficient for fish to live.

ii. Domestic sewage :

- Untreated waste may pollute water intended for drinking purpose.
- These may also reduce oxygen and plant life.

iii. Industry :

- these do dump its waste into water e.g. Makata industrial area dumps waste in Mudi river (Blantyre)
- The water becomes unsafe for plants and animal life and for domestic consumption.

iv. Oil tankers:

- These are big vehicles that carry oil and they illegally wash their tanks at sea which in turn cause considerable environment.
- Accidents may also cause the same damage eg. Japan's major disaster in 1974 at mizushima

v. Erosion of soil

- Bare land which could be cause by human activities may lead to serious soil erosion, this cause silting of rivers and lakes hence making water unsafe for domestic purposes.

vi. Industry :

- These do dump its waste into water e.g. Makata industrial area dumps waste in Mudi river (Blantyre)
- The water becomes unsafe for plants and animal life and for domestic consumption.

Air Pollution

- This is the direct or indirect process by which air is affected in such a way that it is made potentially or actually unhealthy, unsafe, impure or hazardous to the welfare of organisms which live in it.
- Pollution usually occurs as a result of the presence of too much of some substance, or excessive occurrence of a process or action, in an appropriate place at an suitable time, such as oil spillage, sewage outfall, or industrial effluent in a river, lake or sea, e.g. mercury in the sea.
- Air may be polluted by burning fuels like coal, oil and natural gas, these increase carbon dioxide, nitrous oxide, chlorine, fluorine, carbon and methane. As these gases are increased heat is not send back into the atmosphere therefore a warming effect to the earth is created known as **GLOBAL WARMING**. This effect is known as **GREEN HOUSE EFFECT.**
- The gases which are responsible for global warming are called greenhouse gases.
- Results of global warming/greenhouse effect
  i. Altering of ecological balance as ecosystem change.
  ii. Shifting of rainfall patterns resulting in unusually heavy rains and floods, or serious droughts.
  iii. Rising of sea levels as icebergs melt leading to loss, of low-lying regions and increased soil erosion along the coastal areas.
  iv. Spreading of tropical diseases to the temperate regions
  v. Hot areas becoming hotter thus spreading deserts.
- Disruption of food chain – if any organism in the food chain is disrupted a lot of damage may result e.g. in an ecosystem where there are mice, snakes and maize. The crop is safe from mice because snakes catch them. The removal of snakes means multiplication of mice and more damage to mice
- Acid rains – car exhausts and fumes from industries may release nitrogen oxide and nitrogen dioxide to the atmosphere. When they dissolve in rain water they form solution of nitrous and nitric acids and these are components of acid rains and such rains
  ii. Erodes statues and building
  iii. Lower PH levels in the soil and water leading to death of aquatic animals and forests as well as damage to soil fertility.

Causes of air pollution

- Emission of gas e.g. methane CO_2, CFC into the air from industrial works.
- Bush fires release CO_2 into the atmosphere
- Automobile gases.
- Use of thermal energy e.g. coal for heating
- Burning of tyres. Release co_2 into the atmosphere.
- Removal of vegetative means that no oxygen is produced to the air to replace bad gases emitted into the air.

Solution to air pollution

- Planting trees to clean up the air through releasing O_2 and absorbing CO_2 from the atmosphere.
- Use of clean energy
- Avoid uncontrolled bush fires
- Burry old tyres and plastics other than burning them.
- Burry the dead animals.
- Treat the sewage with the disinfectants that destroy the bad smell.

Causes of water pollution?

- Soil erosion
- Disposal of industrial chemicals and garbage into the water
- Washing and bathing in water
- Defecating and urinating in water
- Sewage disposal and other dead animals
- oil spills from tankers

Solutions to water pollution

- Planting trees that will check soil erosion.
- Avoid disposal of industrial chemicals, untreated sewage and other garbage in water
- Avoid urinating and defecating in water.
- Encourage organic farming other than inorganic farming so that less fertilizers and chemicals are washed into the water.

Land Pollution

This is principally caused by poor waste management e.g. careless damping of litter; old clothes waste food plastics oil spillages e.t.c.

Solutions to land pollution

- Proper waste management e.g. digging of rubbish pits
- Legislation and enforcement of law which protect the environment.

Effects of pollution on human beings and the environment

- Respiratory problems due to air pollution.
- Produces odour
- Causes acid rain
- Death of aquatic life due to water pollution
- Out break of water born diseases and water contact diseases e.g. diarrhoea and dysentery due to water pollution
- Scarcity of portable and safe water
- Loss of biodiversity
- Loss of soil fertility
- Deduction of crop yield

Control of Pollution

i. Legislation and enforcement of laws that protect environment
ii. Conservation of the environment
iii. Proper waste disposal

iv. Use of clean energy such as hydroelectricity or solar energy.
v. Civic education

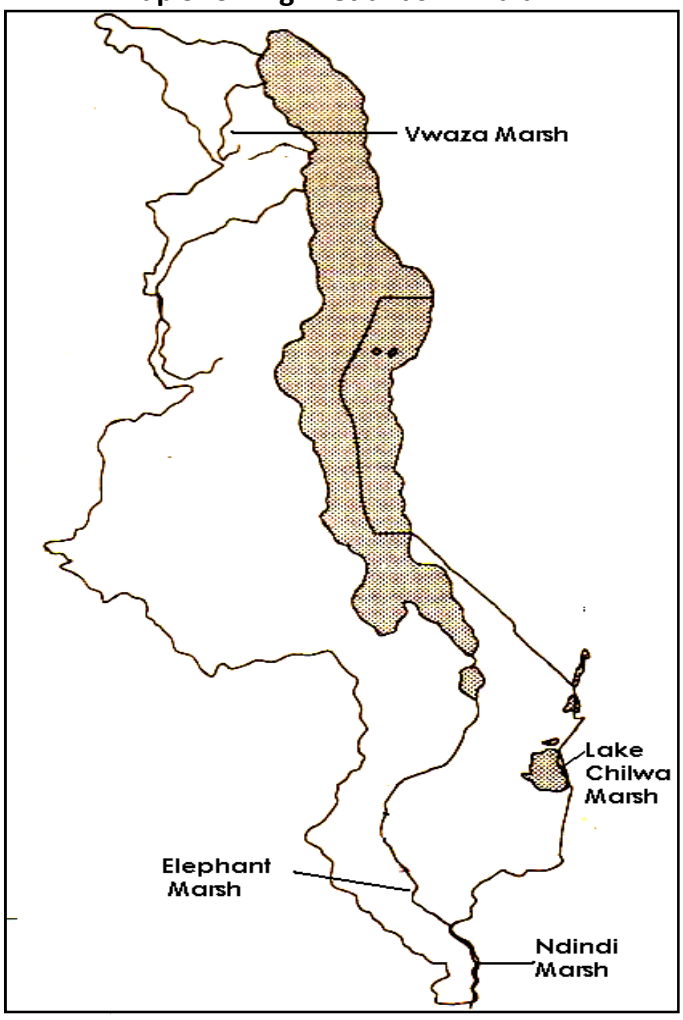
Wetlands

- This is the land which is covered occasionally, periodically or permanently by shallow fresh or salt water e.g., marsh, swamps and bogs.
- This is the aquatic, a natural or artificial landscape where the soil is waterlogged.

Location of the wet lands Malawi

- Vwaza Marsh-South Rukuru
- Ndindi Marsh -Nsanje
- Elephant Marsh –Chikhwawa and Nsanje
- Bana swamp

Map Showing Wetlands In Malawi



Explain the importance of wetlands

- They lock up plenty carbon in form of peat preventing it from entering the atmosphere as Carbon dioxide which is the main cause in global warming.
- Wet lands are habitat for birds, endangered and threatened plant and fish species
- Wet lands absorb and filter pollutants that would degrade rivers and lakes thus providing clean water.
- They buffer the impact of tides at the coast and in land wetlands absorb run-

off reducing flood waves down stream.
- They stabilise show lines and river banks
- Wetlands beautify the environment and produce ground where biological studies and recreational observations can take place.

Human activities that threaten wet lands

- Encroachment of people to the wetlands
  Because of high population growth in Malawi most people face scarcity of land for cultivation as a result most areas of wet lands are being drainedfor cultivation.
- The large population of people also keep alot of animals which overgraze the wet lands.

Effects of draining wet lands

- Draining of wetlands has an effect on utility of water because when solids are carried in suspension, the low speed of water through the removal of wetlands permits water to flow fast with suspended solids that end up into dams and lakes becoming silted and shallow.
- Draining of wetlands affects the utility of water because the water bodies dry up quickly
- Draining of wetlands has an effect on floods control as swamps hold back water or turn off such that removal of wetlands speeds up storms run off thus increasing flow of run-off down streams.
- Draining of wetlands has effects on ecology because there is delicate balance between wetlands and marsh plants as well as wild life such that once wetlands are drained, the balance is upset leading to the extinction of some plants and animals.

What strategies can be put in place for the management of wetlands?

- Civic education to the communities which live near the wetlands
- Putting in place stringent laws aimed at protecting wetlands
- Avoid farming and making settlements in wet lands

State any examples of endangered wild life

- Lions
- Elephants
- Hippos
- Birds
- Different species of fish

Outline the human activities that have endangered ;

a. Wildlife

- poaching
- Bush fires
- Deforestation
- Settlements/Development projects
- Air pollution

b. Aquatic life

- Water pollution
- Over fishing
- Draining of wetlands
- Siltation of the river banks

Ways in which wildlife and aquatic life can be conserved

- Environmental conservation in which the habitat is protected from destruction
- Environmental management where conservation areas such as forests are Reserved
- Putting in place policy measures that will help to enforce and monitor compliance on environmental conservation.
- Establishment of conservation area such as forest reserves, national parks and game reserves.
- Protection of endangered species e.g. elephants, rhinoceros.
- Relocating games where there are facing extinction or overpopulation.
- Civic education on conservation.

Reasons for conserving wild life and aquatic life

- For ethical values
  Just as human being plants and animals have the right to inhabit the earth
- For scientific research
  The environment with wildlife and aquatic life provide laboratory for research.
- For aesthetic values
  These provide natural beauty in the environment which is for human enjoyment.
- For preserving genetic diversity because if species are protected genetic diversity becomes preserved.
- For economic reasons as some plants are sources of medicine
- For recreation and environmental stability**.**

Importance of Conserving the Environment

i. Ethical reasons: this is where animals and plants have the right to live on earth.
ii. Scientific research: People need to find out more about environment and different organisms.
iii. Aesthetic reasons: This is where environment is preserved in order for people to appreciate the natural beauty and enjoyment
iv. Preservation of genetic diversity: This is where different species are preserved for reprocreation.
v. Sources of food, medicine and income
vi. Other reasons:
    - Environmental balance
    - Recreation
    - Preserving the quality of life

NATURAL RESOURCES

Identify the sources of energy

a- Renewable sources
- Hydroelectricity
- Solar energy
- Wind mill
- Biogas
- Wood energy

b. Non-Renewable.
- Thermal energy ie coal
- Oil energy
- Natural gas
- Nuclear energy

Which source of energy is mostly used in developing countries and why?

- **Fuel wood**
  a. Other alternatives are scientific in nature and poor people cannot produce them on their own.
  b. Other alternatives are expensive for rural people to afford.
  c. Fuel wood is locally found and easy to prepare.

NOTE: The dangerous part is that since it is the only source of energy that rural people rely upon; they do not sustainably use it as such it is leading to a lot of deforestation and other related environmental problems.

HYDRO ELECTRICITY

How it is produced

d. It needs a large head of water i.e. dams, deep rivers or lake.
e. Water from a good height flows fast through penstock to the turbine.
f. The turbine is turned rapidly by water and this rotates the generators to produce electricity.

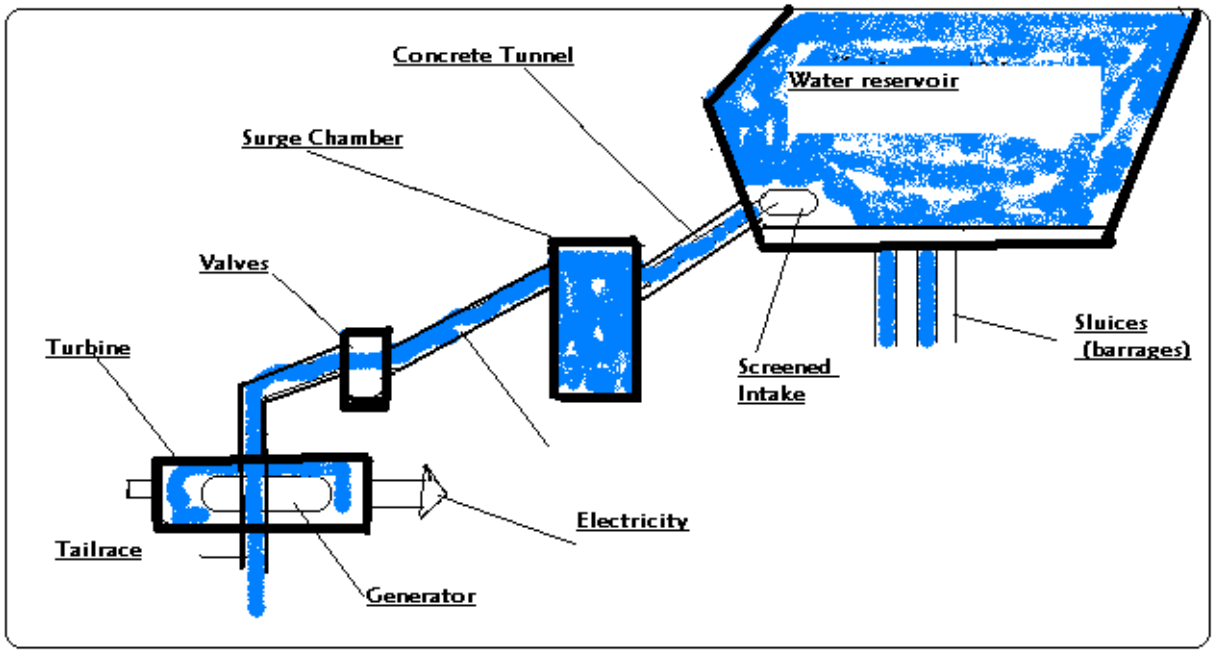
The advantages of hydro electricity

(i) Relatively cheap to produce
(ii) It causes little pollution
(iii) The water reservoirs may also be used for other purposes like irrigation and domestic use.
(iv) It can be transmitted over a long distance
(v) The dams may also be used for recreation.

The possible disadvantages that come along with the use of hydro electricity?

(vi) It is expensive to build dams
(vii) Damming rivers endanger the habitat of wild life.
(viii) Dams provide the breeding ground for diseases
(ix) Relocation or resettlement of the affected people is expensive.
(x) Electricity cannot be stored
(xi) May have little effect to local communities because of user fees.

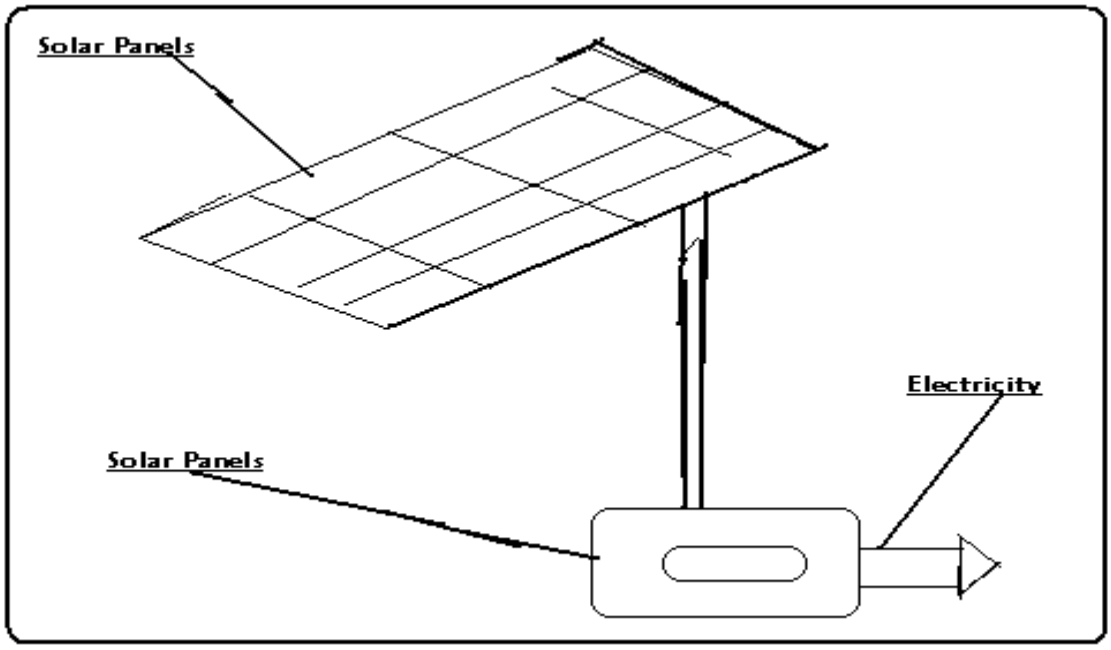
Production of Hydro electricity



SOLAR ENERGY

g. It depends on sunlight energy
h. The sunlight is harnessed by solar panels and directed to solar cells to produce electric energy.
i. Solar energy is also produced through the use of absorber pipes of using mirrors

DIAGRAM SHOWING GENERATION OF SOLAR ENERGY



Advantages and disadvantages of solar energy

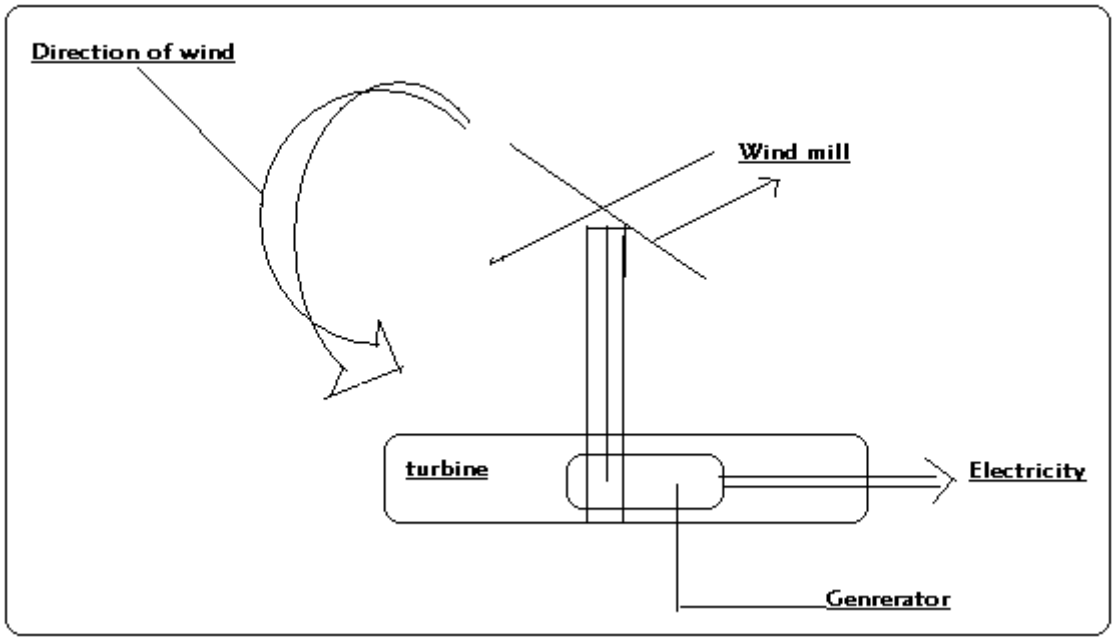
- **Advantage**
  j. It is environmentally friendly since it does not cause pollution
  k. It produces unlimited supply of energy

l. It is good for small – scale energy needs (ie rural areas0
m. It can be stored temporarily.

- **Disadvantages**
  n. very expensive to establish
  o. It is affected by weather ie relies on sunshine
  p. requires new technology
  q. The cells are in efficient for transfer; less than30% of the sun's energy to electricity.

WIND ENERGY

To produce enough energy from wind large numbers of wind mills are required.



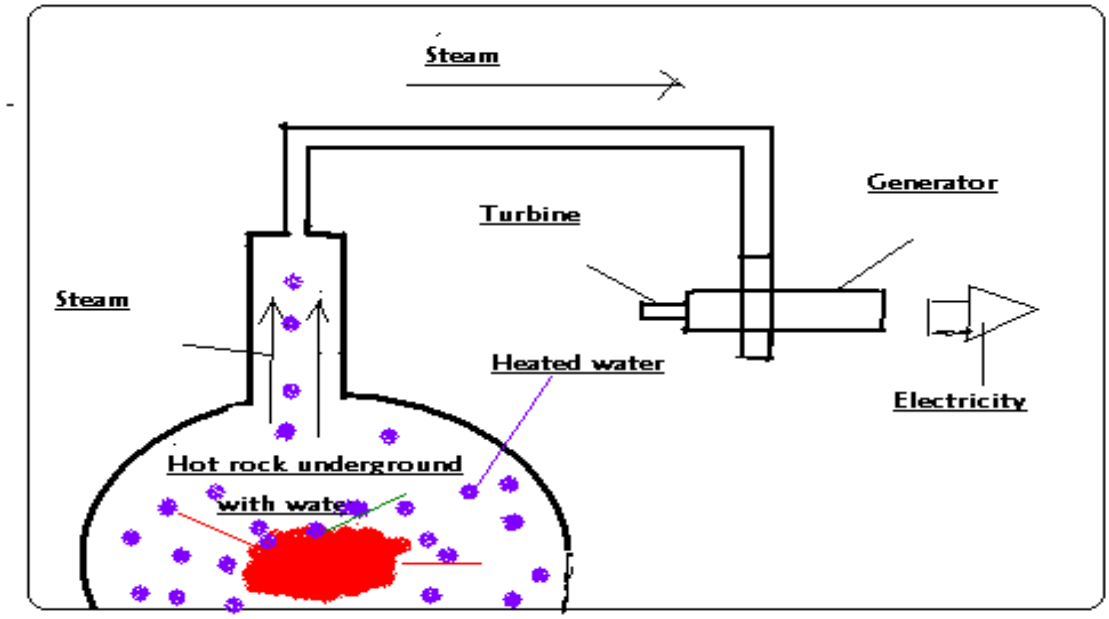
- **Advantages:**
  r. It is pollution free
  s. Does not contribute to global warming
  t. Wind farms can provide for farmers and create jobs for rural people.
  u. Low operating coast
  v. Wind farms provide tourist attraction
- **Disadvantages**
  w. it creates visual pollution and the rotation of wind mills cause noise pollution as many wind mills are required
  x. Wind does not blow at all times
  y. Not very easy in developing nation because of lack of expertise.
  z. Only possible in areas with regular and strong wind.

GEO THERMAL ENERGY

How it is produced

i. This is associated with hot springs inside the earth where hot rocks heat the water.
ii. The heated water comes out as hot springs or geyser.
iii. Hot springs may be used for heating homes and offices
iv. Hot springs or geysers are harnessed and directed to turbine connected to a generator to produce electricity

Production of Geo thermal electricity



- **Advantages**

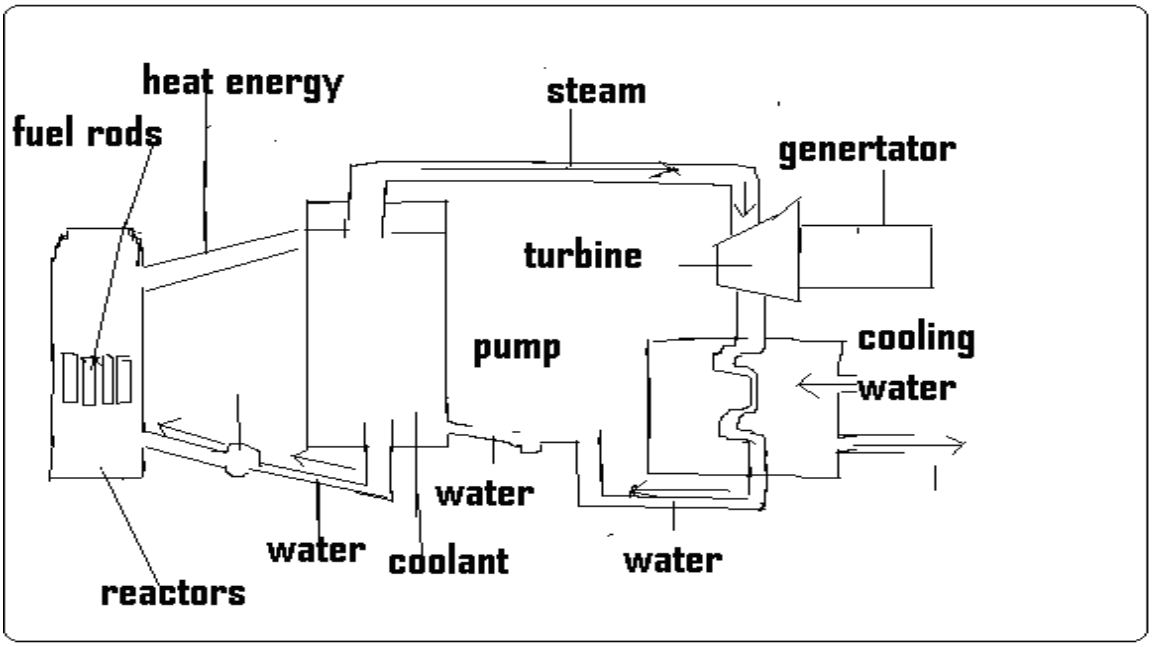
1. It is renewable and causes little pollution
2. It provides reliable source of energy
3. Besides heating it is used for generating electricity.

- **Disadvantages**

1. Suitable sites are limited
2. It emits sulphur into the atmosphere
3. Expensive to construct and maintain because it needs high technology.

NUCLEAR ENERGY

How is it produced?



Name the labelled parts in the diagram above

How Nuclear energy is produced

i. Nuclear energy uses uranium, radium, thorium and other mineral as reactors
ii. The atoms in the fuel roads split into smaller fragments releasing large amount of energy
iii. The energy then heats the coolant which in turn vaporises water into the steam to the turbine.
iv. The turbine and is connected to a generator.
v. The steam drives the turbine to rotate the generator.
vi. It is the rotation of the generator connected to the turbine that produces electricity.

What are the advantages of nuclear energy?

i. It causes little pollution
ii. limited raw materials are needed for its generation
iii. Accident risks are minimal because there many safeguard.

State the disadvantages of uranium energy

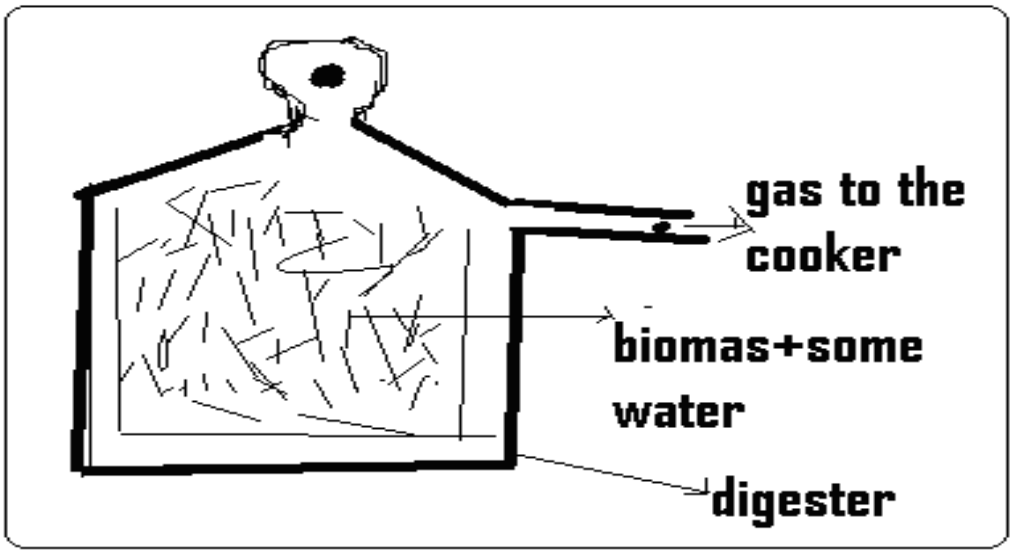
i. nuclear wastes are radioactive and dangerous for many years
ii. it is very expensive to set reactive plants
iii. Nuclear radiation is hazardous and can cause cancer and other related diseases for those living near the power stations.
iv. Accidents through rare like Chernobyl nuclear disaster have negative ecological effects.

BIOGAS ENERGY

How is biogas energy produced?

- It is produce by the use of wood grass and dung energy from biomass can be released by simple burning or use of digesters
- The dung is put in a digester and secured properly micro-organisms act on the biomass and in the process gas is produced. The gas is burned to produce heat for cooking and heating.

Diagram showing how biogas is produced



What are the advantages of biogas as a source of energy?

It is cheap because it does not need complicated equipment as the raw materials are obtained locally.

The disadvantages of biogas.

- It can not be easily used by local people because of its technicalogical skills

How is biomass produced?

- It is produced by the fermentation of starchy food e.g. Cassava and sweet potatoes.
- This produces ethanol which may be used to power cars.

Advantages

i. It is used locally available resources
ii. It is clean
iii. It does not pollute the environment

Disadvantages

i. it depends on scientific skills to produce ethanol
ii. Cassava or sweet potatoes are seasonally found and this can affect the production of biomass.

Importance of energy in development

- Any country that develops need energy for transport as well as the driving of machines that manufacture different items.
- A country with reliable sources of energy develops quickly because peoples' lives become comfortable when they use energy for lighting, heating and industrial activities.
- Energy is essential for communication

Examine energy crisis in.

a. Malawi

The energy reserves in Malawi of fuel wood are dwindling and this causes the increase of the cost price of fossil fuel. When the fossil fuel becomes expensive, many people cannot afford. This makes more people to venture into relaying on firewood for energy hence the rate of deforestation increases also.

b. World

Countries that have diversified energy sources export some of their energy for economic development while those countries with less energy resource tend to import power from the neighbouring countries for various works.

Suggest possible solution to energy crisis

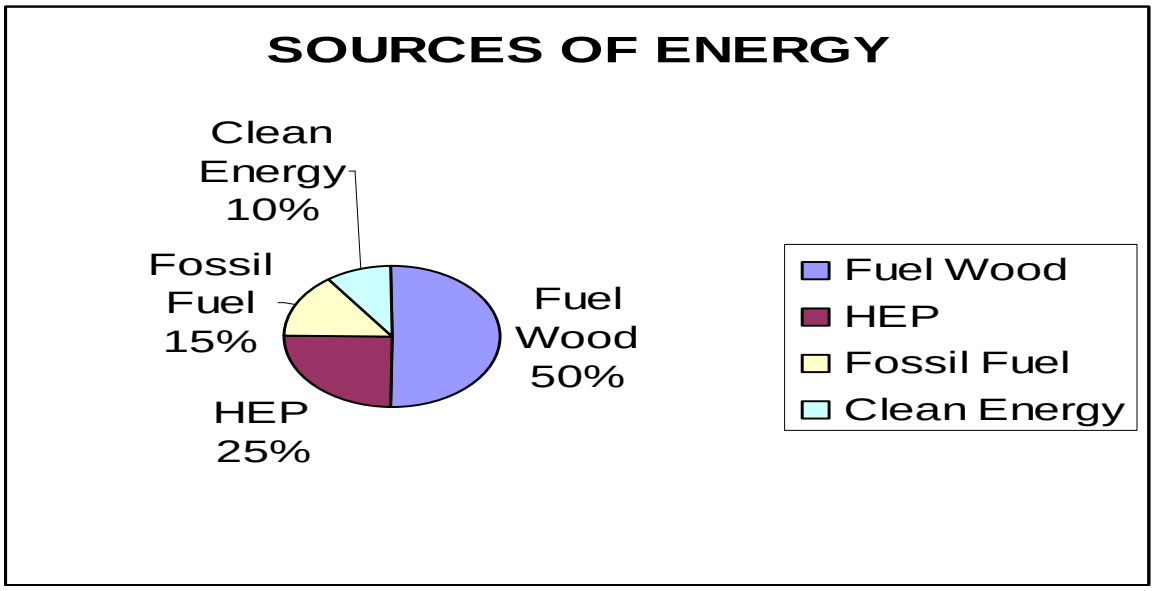
- Conducting international convention which put efforts from different nations together so that the problem of energy is seen as a global issue other than local issue because the problem caused by a single nation, can affect the whole globe.
- Encouragement of research that will help in finding more means of diversifying energy production.
- Reliance of renewable energy resources that can be sustainably used than non renewable resources.

How can the problem of energy crisis be solved in Malawi?

- Intensification of forestations programmes

- Encouragement of research that can help rural people to use alternative sources of energy e.g. Biogas and biomass.

The pie chart showing energy consumption in Africa.



From the pie chart which energy source in Africa

i. Most used energy is Fuel wood.
ii. Least used is clean energy (Biogas, Biomass)

What threat on development can such a scenario cause in Africa?

i. The high reliance on fuel wood can lead to deforestation and desertification
ii. The clearing of more fuel wood for charcoal and firewood would mean that more areas are left bare such that soil erosion leading to water pollution tend to be high.
iii. Developments that rely on large amount of electricity i.e. from HEP and fossil fuel can not improve because these sources of energy are produced in fewer amounts than fuel wood.
iv. The least amount of clean energy used would mean that there is less scientific know how as well as research to come up with more.

The data below shows energy consumption in developed countries

- Fossil fuel 40%
- Thermal energy 15%
- Hydro electric power 25%
- Nuclear power 10%
- Fuel wood 2%, Others 8%

Draw a bar graph of energy consumption

What two major problems can result from the type of energy consumption trend?

i. The more reliance on fossil fuel would mean more Co dioxide is released into the atmosphere that causes air pollution
ii. The more reliance of fossil fuel and thermal energy would mean that more carbon dioxide, carbon monoxide and sulphur are released into the leading climate change.
iii. Less reliance on fuel wood would mean that the developed nations experience less deforestation nor desertification.

MINERAL EXPLORATION

Identify the types of minerals and give their examples

a. fuel minerals i.e. coal, oil and natural gas
b. Metal mineral i.e.
   (i) Ferrous minerals- those which contain iron
   (ii) Non ferrous minerals- these contain aluminium, copper, manganese and tin
c. Non – Metal minerals?
   These contain phosphate, salt, limestone.

What is a mineral?

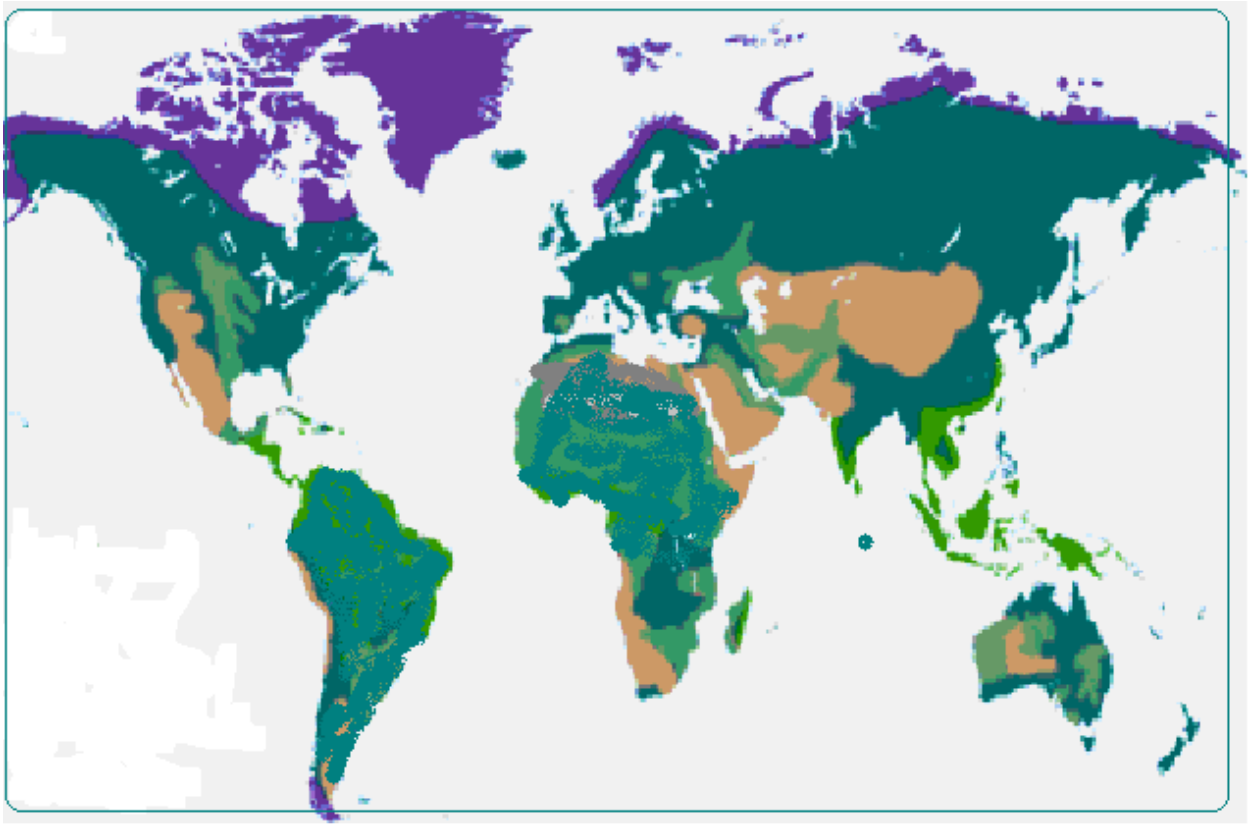
- This is a chemical compound which occurs in the earth's crust and form the basis of rocks.
- While a metal is a chemical element which can be separated from a mineral by special treatment-

Describe an ore:

An ore is a rock which has a metallic content sufficiently high to make it worth mining.

Locate the minerals on the world.

You may include the following



- Petroleum – Middle East, USA, USSR, Libya, S. America Far East, Europe.
- Bauxite- Australia- leading producer, Jamaica Guana, Iron ore.

MINERAL	PRODUCING COUNTRIES
Coal	USA – leading producer, Poland, UK, India, Germany
Gold	RSA- leading producer, USSR , Canada, Brazil, Australia, USA, Zimbabwe, Ghana
Diamond	DRC- leading producer, USSR, Ghana , Namibia, Seira-leone, Angola
Uranium	USA- leading producer, RSA, Canada, France , Niger, Germany, Australia and Gabon.
Copper	Zambia

Factors to Consider Before Mining Process Starts

1. Occurrence of the mineral that may determine the method of mining to be followed
2. Value of the mineral content
3. Value of an overhead cost
4. Demand of the mineral product
5. Source of power available
6. Market of the product

Methods of Mining

(a) Strip or Open-Cast Mining

The ores lie close to the surface of the earth. Open cast mining is cheap because it only needs the removal of over mass by picks. However, it has the following disadvantages to the environment:

- Land which would be used for agriculture is damaged.
- Causes deforestation
- Destroys habitat for wildlife
- Can also cause air pollution.

(b) Shaft Mining

- Ores are found deep.
- Ores are extracted by Derrick machines and it is expensive.

(c) Adit Mining/Drift Mining

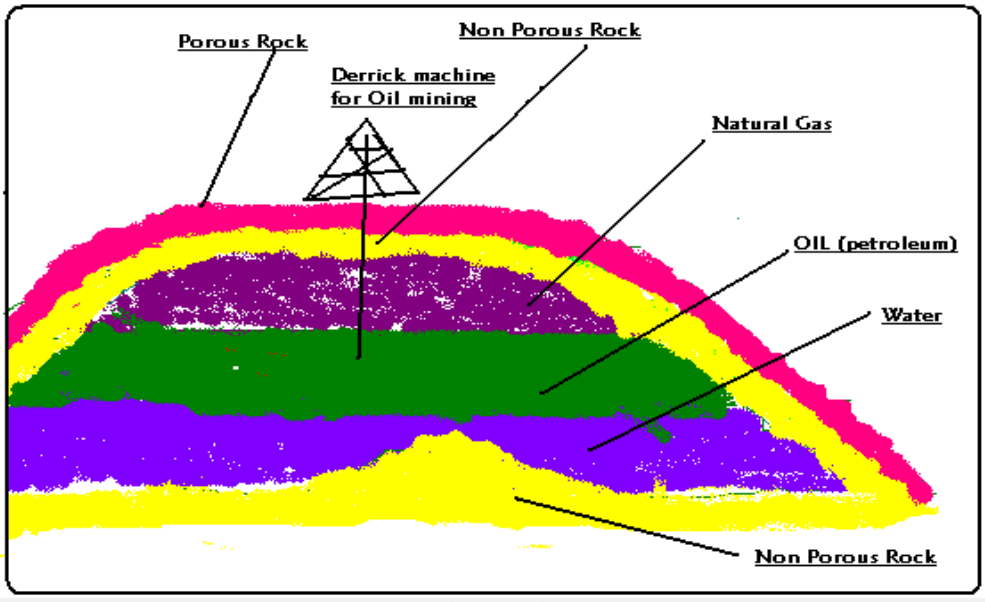
- This method is used to extract minerals from horizontal or gently slopping seams that outcrop along the valley

Petroleum

Origin and Occurrence of Petroleum

- Petroleum is a compound of hydrogen and carbon which is formed from decomposition of minute marine organisms which collected in the sediments on the floor of some seas.
- Earth movements forced the oil out of the sediments into porous sedimentary rocks during formation.
- Oil bearing layers were sandwiched between layers of impermeable rocks which prevented the oil from seeping away. The oil moved along the sedimentary rocks and collected in pools in anticlines or in traps.

Occurrence of Petroleum



Oil Extraction

There are three factors to consider before extraction:

- The mineral must e in high demand.
- The ore deposits must be sufficiently rich and large.
- There must be less problems or extraction, processing and transportation.

Methods of Extraction of Oil

- Before extraction of petroleum starts, a detailed survey of the geological structure of the rock is done.
- When the sedimentary rock containing the oil is underneath the ground, the machine called Derrick is elected where the drilling equipment is brought into the rock strata. Underneath the ground and when the ore is reached, oil gushes out through the borehole for weeks or years.

Refining of Petroleum

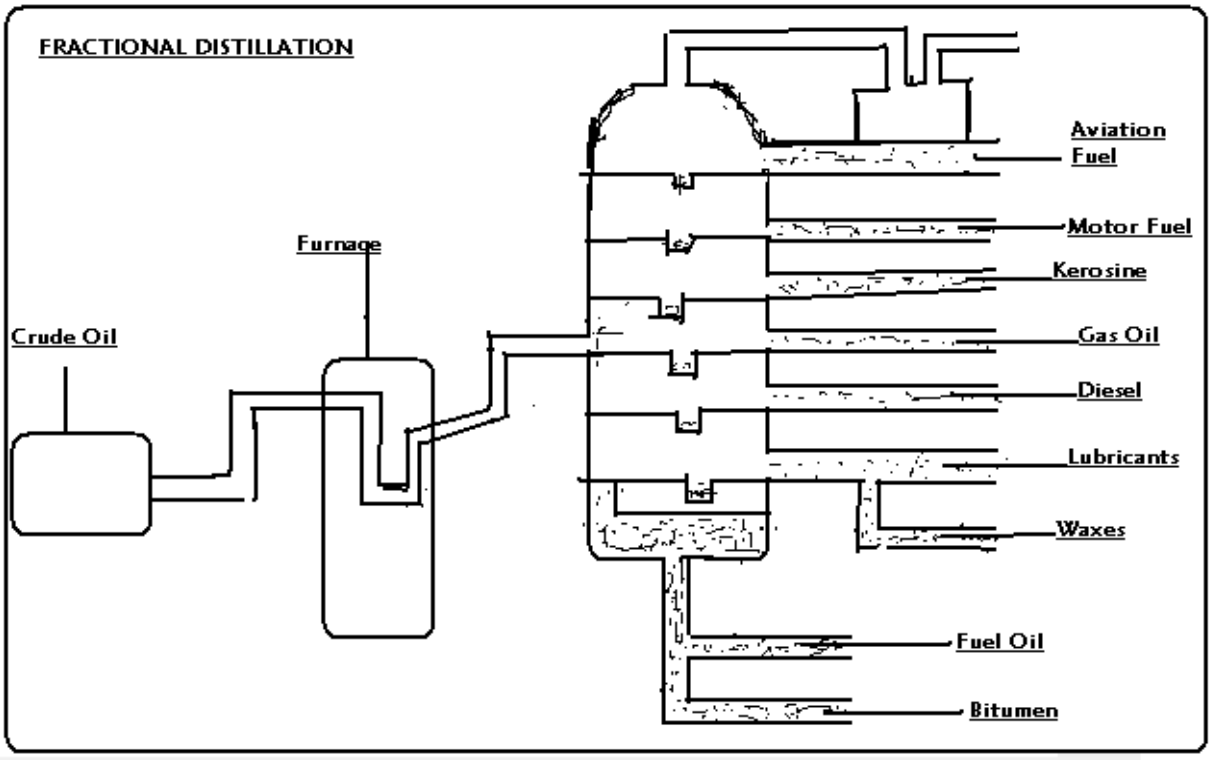
There are four ways of refining petroleum:

- Fractional Distillation
- Thermal Cracking
- Catalytic Cracking

Fractional Distillation

Crude oil has little use than refined oil. Through distillation process, oil is separated into various groups of hydrocarbons or fractions at very high temperatures. As each fraction boils at different temperatures, the various groups of hydrocarbons can be extracted at their own boiling points. The lighter fractions such as petrol, paraffin, or kerosene and benzene will evaporate and condense first at temperatures probably below 38 degrees Celsius.

The heavier fractions such as diesel, lubricating and fuel oils will condense later at temperatures between 38 degrees Celsius and 427 degrees Celsius. At the end, there are residues with heaviest fuel oils as well as wax, Vaseline and Asphalt.



Thermal Cracking

Fractional distillation produce only 15% of the motor fuel needed and because of the rise of automobile industry which demands large quantities of lighter oils, thermal cracking process is used to refine the oil. In this process, oils with heavier fractions are heated too much lighter temperatures until they break down or crack into lighter fractions such as petrol

Catalytic Cracking

This is the process of refining the oil by way of adding catalyst such as powdered platinum to crude oil to speed up the cracking process. In this way more and better motor fuels are extracted.

Uses of Petroleum Products

There are many used of petroleum products:

a. Used as indispensable motor fuel i.e. petrol, diesel
b. As a lubricant i.e. grease and lubricants are used to lubricate moving machines to prevent frictions.
c. Used as a source of power
d. Oils are being used daily in heaters, boilers and furnaces to provide power in factories and generate thermal electricity.
e. Kerosene is a domestic fuel used for cooking and heating. Asphalt or Bitumen is used for roofing, road surfacing and water proofing purposes. Paraffin and wax used as illuminants and lubricants and for manufacturing candles, seals and polishes.
f. By products are raw materials for plastic making, synthetic rubber, detergents, insecticides, pharmaceutical and organic chemical products such as drugs, vanishes, solvents diluents etc

g.

PRODUCT	**USE**
Petrol	Automobiles, bottled gas, chemical.
Kerosene	Jet fuel
Diesel	Automobile (buses) candles, ointments, polishes, chemicals
Bitumen	Ship, industry, road surfacing, roofing, water proofing

How Oil is transported

- Oil is transported using ships.
- Oil is also transported through pipelines.
- Oil is transported using road (Lorries) and railway.
- For military purposes oil is transported using aircraft.

The Role of OPEC in the Oil Industry

OPEC stands for Organization Petroleum Exporting Countries.

- OPEC controls the amount of oil produced by producing countries on daily basis.
- OPEC controls oil pricing world wide.
- OPEC controls competition of oil production between member states and increase profits.

BAUXITE MINING

Bauxite is a day like substance which contains a hydrated oxide of aluminum. It occurs in association with silica and limonite (an ore of iron). Bauxite is found ii the humid tropical as well as subtropical latitude where there are decomposed rocks.

Most bauxite contains 50% alumina. Bauxite deposits are commonly found in tropical humid regions because of leading and resulted in formation of aluminum concentrates in subsoil. This makes the bauxite to be found close to the surface hence open cast mining method has the following disadvantages to the environment:

- Causes land pollution/visual pollution
- Causes deforestation
- Destroys the habitat of wild life
- Causes air pollution

Processing of Bauxite

When bauxite is mined, it is crushed, washed and put into hot caustic soda solution. It dissolves leaving behind iron oxides undissolved. The iron oxide is removed by filtration. Aluminum hydroxide is then added to the solution to cause precipitation of this compound which is then heated to give alumina. Molten cryolite is added to the alumina then electroysed to form molten aluminum at the carbon cathode.

Properties of Bauxite

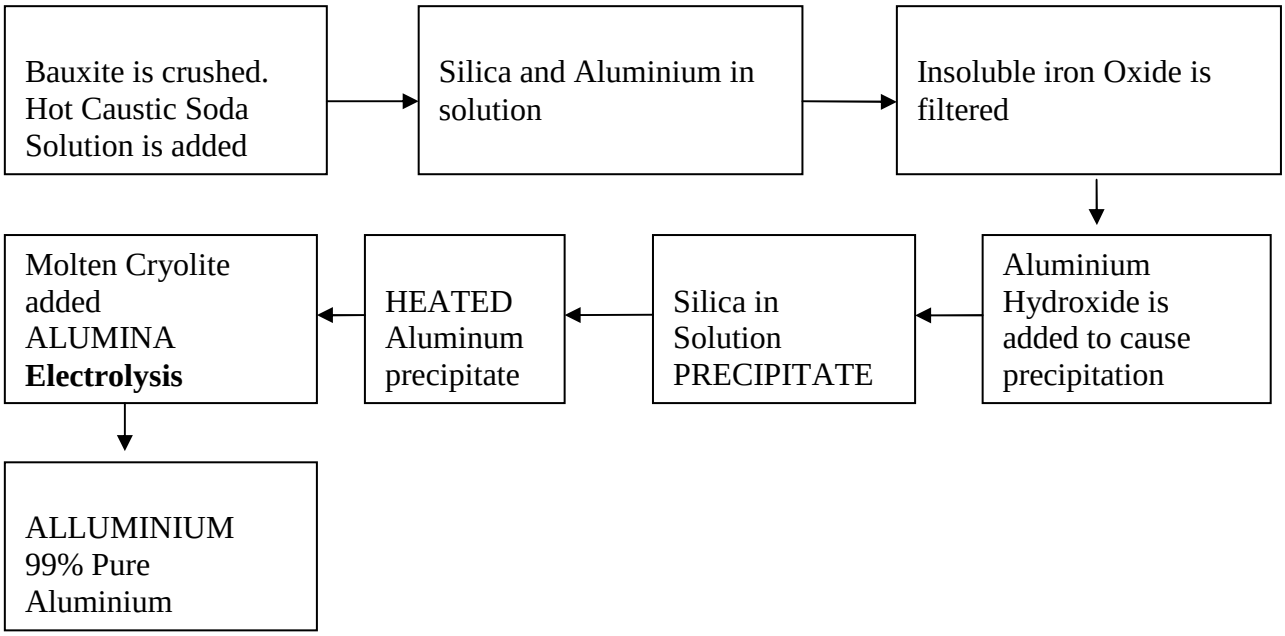
- It is light and strong.
- It is resistant to corrosion.
- High conductivity to electricity.
- It is malleable (easily rolled into sheets).
- It is ductile (can be molded into any shape).
- Has high melting point – 659 degrees Celsius.

Uses of Bauxite

- Used for manufacturing of air craft, railway carriages, buses and motor cars.
- Used in the manufacturing of electrical goods.
- Domestic utensils such as cooking utensils.
- Making of refrigerators, washing machines and cooking oven.
- It is used to produce hard alloy e. an alloy obtained by smelting copper with aluminum.

Production
Australia 29%, Jamaica 14%, Guinea 14%, S. America (Surina) 6%, USSR 5%
Guyana 4%, CIS 3.4%, France 3%, India 2%.

Flow Diagram of Bauxite Processing



Bauxite Mining In Malawi
There are some bauxite deposits on Mulanje Mountain and the size of the deposits is 28, 000,000 tones.
Despite the abundance of the metal, mining has never started yet for the following reasons:

- The mountain has igneous intrusions.
- The mountain has a lot of faults which make mining difficult.
- Power for processing the ore is inadequate. Unless electricity is imported from Mozambique, bauxite has to be exported in its raw form.
- Transporting the ore to the foot of the mountain cannot be cheap. Pipes or conveyor-belts may be used.
- Mulanje is a major tourist attraction but mining the bauxite may cause visual pollution.
- The wildlife may be affected by noise from mining machinery hence they may run away.
- Excavation of the area will destroy useful plant spices leading to ecological imbalance.

Benefits of Mining the Bauxite (Prospects)

- Malawi would benefit on export earnings from bauxite.
- Most Malawians would find employment.
- The economy of the country would increase as some manufacturing companies which use bauxite as raw materials.
- Import of bauxite would be reduce

AGRICULTURE GEOGRAPHY

AGRICULTURE AS A SYSTEM

1- How can farming be described as a system?

- When factors of production such as topography, climate, soil, ownership, Culture capital, market, mechanisation and chemical fertilizer are considered and processes are followed in order to come up with out put, farming can be considered as a system (input – process – output processes)

2- Describe how the following factors influence agriculture

Topography – Gentle topography allow mechanisation and soil erosion is controlled as water do not run very fast

Climate – Hostile climate e.g. drought, storms have negative impact on agriculture while good temperature and rainfall are required by each crop to increase production

Ownership- If land owned by the farmers, there will be no problem in deciding what to do with the land unlike when it is privately owned by individuals or government

Capital- Capital assists in the starting of agriculture for buying equipment e.g. lands, fertilizer, tractors, seeds, labour e.g. but without enough capital agriculture can not be successful.

Mechanisation – Mechanisation increases production because large areas of land are grown with crop how ever is only applicable to rich people and only for people with large farms this cause challenge to small scale farmers

Soil- Poor soils lower agriculture production because both crops and pastures of animals grow well where the soil is fertile.

Culture – Some cultures have negative impact on agriculture because they my not allow the growing of certain crops as well as the keeping of certain animals to preserve their culture.

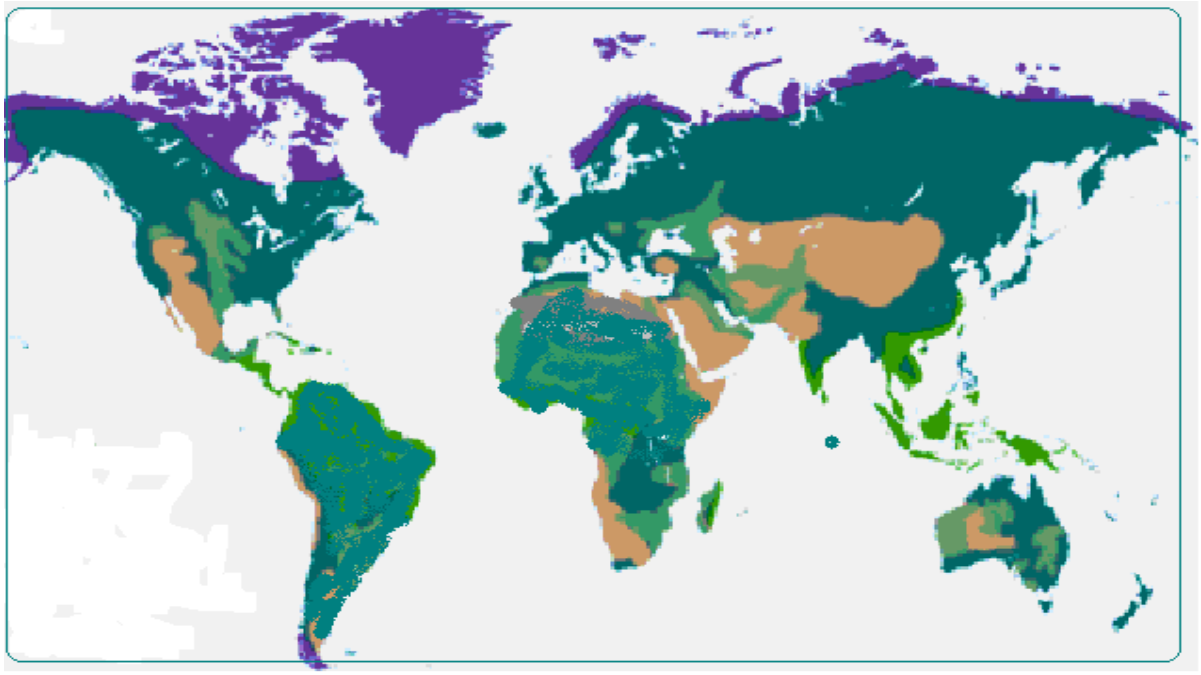
Market – availability of market has an influence on agriculture. Farmers are encouraged to produce commodities whose market is available otherwise lack of market hinder high agricultural production.

AGRICULTURE SYSTEMS

Identify the main systems of agriculture that are practiced by people world wide

- Intensive subsistence farming
- Extensive subsistence farming
- Intensive commercial farming
- Extensive commercial farming
- Nomadic farming
- Shifting cultivation

Locate on the world map the system of agriculture practiced in different regions of the world.



Distinguish subsistence farming from commercial farming and give examples for each type

- Subsistence farming is the growing of crops or raising animals for food only while commercial farming is the growing of crops and rearing of animals for sale

COMMERCIAL FARMING

- Intensive rice farming
- Extensive farming e.g. Cattle ranching in Argentina & Wheat farming in Canada and USA

Subsistence farming

- Mixed farming e.g. Wheat & cattle on the small farm
- Intensive rice farming
- Extensive wheat farming
- Shifting cultivation
- Nomadic pastoralism

Describe the characteristics of intensive farming

- Capital and labour applied to relatively small-sized farms
- Yield per unit area is high
- Small plot of land is with great intensive care to support the fast growing population
- Animal farming eg cattle is developed
- It is best practiced in Monsoon Asia
- Use animal and plant manure.
- Irrigation is used in time of dry weather.
- Double cropping is practiced during one year.

Outline the advantages and disadvantages of intensive farming

- High yield per hectare may be achieved
- -Several harvests per year are possible
- Land can be used continuously without losing fertility

Disadvantage

- Labour input is very high
- Farmers feel reluctant to integrate the land holdings into large farms which could be economically feasible for fear of losing their plots of land
- Under utilization of animals
- Land holdings are fragmented

NOMADIC PASTORALISM

What is nomadic pastoralism?

- This is an extensive subsistence system of rearing animals whereby animals are moved from place to place in search of pasture which involves the movement of the house since they depend on the herds of animals.

Diffenciate Horizontal Migration from vertical migration

- Horizontal migration is the movement of nomadic pastoralists to where rainfall and pastures are available on the other hand vertical migration is when herders and their animals migrate to higher places that temporarily contain pasture.

Identify the people who practice nomadic pastoralism and where they practice it.

- Fulani- Sahel in West Africa
- Masai – Eastern Africa
- Turegs – North Africa
- Bedouins- Saudi Arabia
- Lapps – Scandinavia
- Kirgiz – Central si kalmiks

Describe the characteristics of Nomadic Pastoralists

- Seasonal migration of the herders and their animals in search for pasture and water
- Poor animals because pasture and water are not sufficient and also the animals loose weight because of continuous movement over long distance
- Herders have no permanent houses and this leads to under development.
- Herders rely on the herds for milk, meat, wool and hides
- Large herds are kept.

Assess the reasons why pastoral Nomadists keep large herds of animals

- Animals are regarded as wealth and man's social position and prestige depend on them
- Nomadists use the animals for bride price
- Acts as an insurance against drought and famine such that during bad years many of them survive

Analyse the problems that are associated with Nomadic pastoralists

- Overgrazing which leads to ground being left bare which in turn leads to soil erosion
- Herds are affected by many diseases and insect pests because they move to
- different geographical region.
- The native breeds are kept and these produce insufficient milk and meat.
- Season and unreliable rainfall leads to poor utility of pasture.
- Loss of income because motor vehicles completes with traditional animal transport

- Loss of political control that the nomadic pastoralists were able to extend over the entire region
- Burning of grass during the dry season leaves the soil bare and exposes it to erosion

Differences and similarities between the Masai and the Fulani
Nomadic pastoralists.

- They only differ in their geographical location because the Fulani originate in Sahel region of West Africa while the Masai originate from the Eastern region of Africa i.e. Kenya & Tanzania
- They are all nomadic cattle herders
- They all keep large herds of cattle
- They all practice transhumance- where they migrate to the streams during the dry season for water and pasture of their animals while in the cool or rainy season they migrate to the upland.

Explain the main reason for the transhumance of the Fulani herds in West Africa

- During the dry season they move to the streams because these are the only places where pastures and water are available.
- During the dry seasons, the stream land, have fewer hyenas and less tsetse flies which attack animals during the wet seasons there for dry seasons are safe periods.
- They move to the North wards during the on set of wet seasons for fear of hyenas and tsetse flies.

Define shifting cultivation

- This is an agricultural system that involves alternating crops for few years on selected and cleared plots and once the land loses fertility it is abandoned and the new plot is opened.

Identify two system practiced in shifting cultivation

- Migratory system where there is movement of cropping
- Clearance system which depends on clearing of vegetation

Describe the characteristics of shifting cultivation

- Forests are cleared by fire and ash adds fertility to the soil
- The cultivated plots are usually very small
- Little attention is given to crops until they grow and ripe
- Few animals are raised.

Visoso is local name for shifting cultivation in Malawi; give the other names of this system of farming in

- Brazil – Roc
- India – Pador
- Sri-lank – Chen
- Thailand – Tama ran
- Ireland - Msone
- Zambia - Chitemene
- Zimbabwe –Milpa

What are the problems associated with shifting cultivation

- Difficulties in the introduction of innovation because most of the people who practice thus type are primitive and poor.
- It leads to massive forest lands being cleared and leaves the ground bare
- It leads to soil erosion and impoverishment.

INTENSIVE RICE FARMING SOUTH EAST ASIA

What is the main reason that encouraged intensive rice farming in South East Asia.

High population which leaves particular individual with small plots and fail to produce

Describe conditions for the rice growing

- Water supply where annual rainfall of over 2000mm is received
- Flooded condition during transplanting of seedlings
- The type of soil should be moisture retentive
- Rice growing favours level ground that enables the field to be flooded or irrigated
- More labour from preparation of the field to harvesting as machinery does not exist.

The main rice growing areas

- China
- India
- Thailand

Describe the annual cycle of activities at an intensive rice farm

- In July the fields are ploughed by buffaloes and manured
- In August transplanting seedlings to main fields from nursery beds.
- September weeding in the field is done
- October weeding continues and manure application
- November is the end of monsoon rains and this is the harvesting period for rice on higher grounds
- December- main harvesting of all the rice
- January -there is field ploughing and peas and beans are sown.
- February- weeding second rice crop
- March -harvesting the second rice crop
- April to May -no work is done on the field
- June is the beginning of Monsoon rain and this is the month of sowing the rice in the nursery beds.

Explain the operations systems of intensive rice farming

- Farmers do not have their own land but own it on tenancy basis
- Farmers get advance from their land owners
- The farmer does all the field work up to the processing of the rice.
- When the processing is finished the harvest is divided into half between the farmer and the land owner
- The farmer stores part of his share for food and seed for the next growing season and the remaining part is sold for income.
- The income is used for paying back the loans to the land owner and daily needs.
- The land owner pays revenue to the government for the land.

Assess the problems that are encountered by intensive rice farming in South east asia.

- The land holdings are small
- Lack of mechanisation leads to less improvement and increase of harvest from year to year by each farmer.
- The system of sharing the harvest by half is a disadvantage to farmers because the land owner is the one who benefit more from the proceeds

DIARY FARMING IN DENMARK

Locate on the map of Denmark the four main Islands and the main land.

State the factors that favour diary farming in Denmark

1. Favourable cool temperature which encourages the growth of polder crops and natural pasture.
   - Most dairy breeds favour cool temperature
2. Nutritious green and natural pasture that is available is favourable for dairy breeds
3. There is ready market of the products because almost every one in Europe use milk
4. Well developed transport network promotes dairy farming because milk is perishable and needs efficient transport to avoid loses of milk due to delay in transporting the product
5. There is high technology that makes the processing of the products easy.

Apart from rearing of dairy breeds, what other activities does a farmer do?

- Growing cereal crops such as wheat, barley
- Growing pastures i.e. grass
- Growing root crops i.e. sugar beet
- Poultry and pig farming

Describe the characteristics of dairy farming

- The farms are small
- Dairy farming is capital intensive
- Farming methods used are intensive in nature
- The main source of income is milk
- Milk products are processed right at the farm

Give examples of breeds reared at dairy farm in Denmark

- Milking short horn
- Guernsey
- Friesian
- Brown Swiss
- Jersey
- Alderney

Describe the activities that are done at atypical dairy farm in Denmark

- Nov-and January there is poor cool weather and the animals are stall fed this period
- Feb- April ploughing and sowing of seeds are done
- May- July weeding in the fields
- August is the period for harvesting cereals while in September root crops are harvested
- In October ploughing and sowing of some seeds is also done

What are cooperatives?

- These are organisations made up of a number of dairy farmers who pull their resources together and sell their products in groups.

Explain the functions of cooperatives in Denmark among Dairy farmers.

- They assist farmers in marketing their products because they collect, grade, store farm products and sell them.
- They help farmers in purchasing because they buy farm inputs in large quantities at lower price.
- Helps farmers by giving them loans so they serve as financing agencies.
- Assist in processing because they have facilities for processing which farmers could not own and as such farmers make profits
- Cooperatives provide advice and Research on dairy farming and this helps farmers to be guided on new technologies discovered and the problems facing the dairy farming so that farmers are well informed and improve their efficiency.

Describe the relationship between folk high school and the Dairy farming in Denmark

- The school provided lessons in agriculture to men while women learn home economics
- Men learn at least agriculture techniques which provide good foundation of cooperatives
- Women who learn home economics are provided necessary knowledge in the management of resources in the houses.

Mention the products from dairy farming

- Milk, Butter, Cheese, Condensed and sweetened milk, powdered milk, Skimmed milk, Yoghurt.

Analyse the importance of dairy farming to the economy of Denmark

- It assist in the employment sector because many people are employed who could otherwise be unemployed.
- Assists in the foreign earnings Denmark exports her butter and cheese to Germany, UK, and other countries

DAIRY FARMING IN MALAWI

Explain the underlining factors that hinder the development of dairy industry in Malawi.

- Un even distribution of rainfall makes the pasture to be of poor quality and quantity which does not support dairy farming
- High quality breeds do not stand the hot temperature of the tropical region very well as a result most of the animals that people raise are indigenous hence produce low milk.
- Most animals are attacked by diseases in the tropical region i.e. tsetse flies
- Most people in Malawi just like many tropical region keep animals traditionally and only for subsistence and do not aim at high production of milk products
- Low capital slows the development of dairy industry because exotic breeds are expensive.
- Poor communication, transport net work hinder dairy industry because milk is perishable product that need efficient transport to prevent loses due to delay in transport
- Lack of technology for the processing of milk into different dairy products
- Most people in the tropics do not use dairy products which my restrict production of more products.

Suggest the strategies that cn be put in place to boost the dairy industry in Malawi.

- Establishment of cooperatives that will assist farmers in research, financing farmers
- through loans, marketing the products and others
- Establishing farms that will introduce irrigation on pasture lands so that un-even
- distribution of rainfall will not affect the quality and quantity of pasture
- Introduction of cross breeds of cattle that will stand the hot climate of the tropical region
- Improvement in the infrastructure like roads that will facilitate quick transportation of dairy products.
- Intensification of research of the pastures and diseases of animals.

Differentiate the dairy industry in Denmark from that of Malawi

Denmark	**Malawi**
- Improved exotic pasture	- Local pastures
2- animals most kept for commercial purpose	2.Animals kept for subsistence
3. High technology used	3- No-or little technology used
4. Less prevalence of diseases	4- Animals highly attacked by diseases
5. Operates through cooperatives	5. Operates by individual farmers
6. Good transport network	6. Poor transport network
7. Schools for dairy farmers are established	7. No Special school for dairy farmers

POLDER CULTIVATION IN NETHERLANDS

Draw and label the map of Netherlands to show polder lands.

Define the following

a. **Polder:** This is the land that has been reclaimed from the sea

b. **Polderisation:** It is the process of draining the water from the water bodies or marshes to turn it into land for settlement or land for farming

Analyse any three reasons that have prompted for land reclamation in Netherlands

1. Netherlands is the most highly populated country in Europe
2. The good fraction of the area of Netherlands is covered by water and also people live below the sea level.
3. Most parts of the land have infertile soils except Holland which hold 60% of the total population.

Describe briefly how the process of land reclamation is done

- Firstly the dykes are constructed along the coast of rivers or across it using clay but concrete is used to construct dyke along the sea coast or across.
- The second step is pumping the water from the desired area using diesel pumps, electric engines or wind mills.
- The third step is planting the reeds that help in drying the water because pumping does not drain all the water and the absorb the salts
- Clearing the area after a few years to make the land ready for cultivation or settlement.

Mention two ways in which polderised land is used.

a. It is used for settlements

b. It is used for three types of farming i.e. arable farming where wheat, barley, oats, rye and pastures are grown.
   - Horticulture in which bulbs and vegetables are grown
   - Dairy farming as it is done in Denmark
   - Mixed farming

Assess the problems associated with land reclamation

- The soil has high salinity. This problem is solved through application of lime which makes the soil alkaline before plants grow.
- There is high probability of flooding to those low lying areas
- Pumping of water and construction of dykes is very expensive
- The reclaimed land takes long time before using it as draining of water takes long time.
- Land subsidence in the reclaimed land is a common problem
- Maintenance of dykes is very expensive

Identify potential areas for land reclamation in Malawi

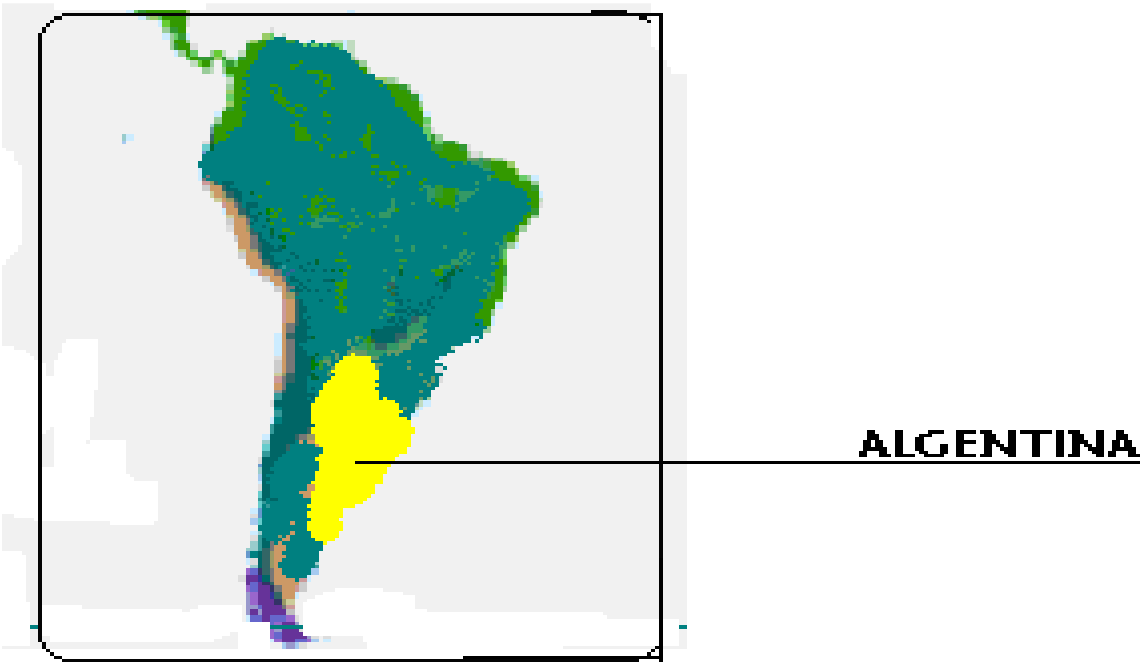
- Lake Chirwa
- Vwaza marsh
- Ndindi marsh
- Bana swamp
- Elephant marsh

Malawi has great potential areas for land reclamation. Suggest reasons why up to now land reclamation is not done.

- Land reclamation is expensive that Malawi as a poor country cannot sustain it.
- Malawi has many land that all what is needed is capacity building to use the available land to its productivity
- Land reclamation would disturb the wetlands there by affecting the habitats of birds and other wildlife
- Some of the potential areas for land reclamation like Lake Chirwa have a lot of fish on which many Malawians rely on for protein.
- The reclaimed land would have a lot of salinity which would need another project of lime application to neutralise the salts
- Some areas that are potential areas like Vwaza, Elephant and Ndindi marshes have animals that provide tourism and vegetation is also conserved in such areas.

CATTLE RANCHING IN ARGENTINA

Locate Argentina on South America Map



MAP OF S.AMERICA SHOWING CATTLE RANCHING

What is an Estancia?

- This is a cattle Estate in the pampas temperate grass lands in Argentina but small estate is chacras

Identify the differences between Ranching and Pastoral Nomadism.

Ranching	Pastoral Nomadism
-Vegetation cover is continuous -There is little or no migration of animals	- Vegetative cover is seasonal -There is continuous migration of animals
-The cattle farms are scientifically manned	-Animals are traditionally kept without scientific management
-Animals are raised for sale	- Animals are raised for subsistence & prestige
- There is low stocking ratio	- very high in stocking ratio
- Development oriented	- No development conscious

Describe the characteristics of ranching

- In most cases only one type of animals is kept in large numbers
- It is practiced in marginal areas where desertification is not commercially worth while.
- Ranching is done at large scale
- Depends on natural vegetation for pasture
- Animals are kept either through open grazing system where animals are always looked after by herdsmen or through paddock system in which animals are fenced.

Explain the favourable conditions for cattle ranching in Argentina

- There is low population density that gives room for the establishment of large farms in grasslands.
- Pasture grows throughout the year because temperature does not fall below freezing point
- There is efficient railway net works for transporting the animals to frigorificos centres
- Access to internal and international market for meat products.

Explain how ranching operations are carried out from the period animals are born to when the products are exported or used locally

- The young ones are weaned when they are born in order to fatten them.
- After 6 months the animals are rounded up to frigorificos centres while already
- branded with hot iron for easy identification
- Animals are weighed cleaned, shocked and killed
- The skins, hooves, heads and wofoes are removed
- The carcases are chilled, frozen or corned
- The chilled meat is exported to shorter distances while the frozen meat is exported internationally to places like W. Germany, Arab States, U.S.A., Canada, France, Spain and Israel.
- The corned meat (salted) is used locally
- Corning of meat is done at Saldero (meat factory)
- Beef is exported through the ports of Rosario and Buenos Aires.

State the other products that are made from cattle ranching

- Ox
- Bovril
- Leather
- Glue
- Fertilizer
- Fat

Assess the problems that area faced by cattle ranching in Argentina

- The pampas grasslands area sometimes affected by pampero winds which affects animals as well as pastures.
- Argentina experiences un reliable rainfall quite often that sometimes results into pasture problems in the pampas grasslands.

Suggest the problems that affect cattle ranching in Malawi.

- Lack of enough grazing land like the pampas grasslands of Argentina
- Lack of technology for the processing of the products
- The Malawi Zebu produces little amount of beef
- Market for the beef is limited as many people are poor that they cannot afford to buy beef.

COMMERCIAL WHEAT FARMING IN THE PRAIRIES

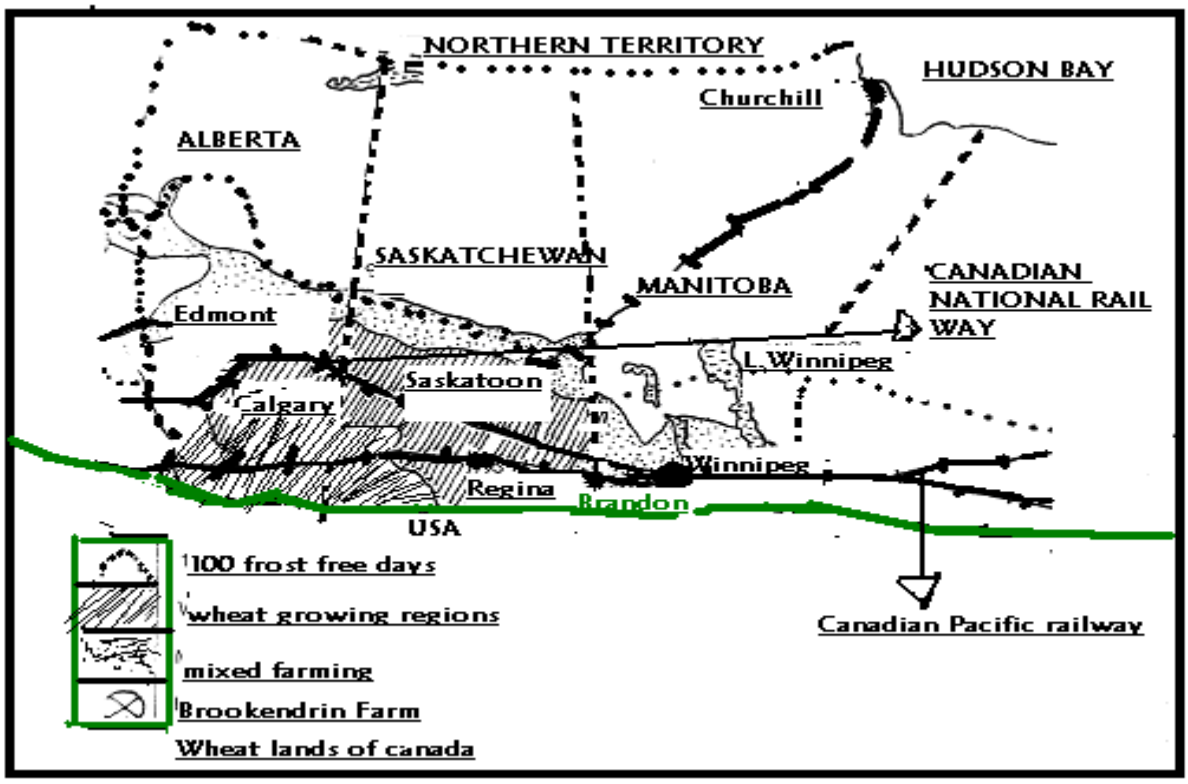
What are the characteristics commercial wheat farming in the prairies

- It is practised in areas where population is sparse
- It has very large farms up to 60 sq km
- Cultivation is highly mechanised
- It is monoculture type of cropping
- Low yield per hectare but high per man
- Farms are generally owned by farmers

Mention the main wheat growing areas world wide

- USA
- Canada
- China
- France
- CIS (Common Wealth of Independent States)

Map Showing Wheat Growing Areas in Canada



Describe the favourable conditions for wheat growing

- It needs rainfall of between 305 and 405mm
- It does well with frost free period of 100 days
- It needs temperature of bout 18 degrees Celsius.
- Heavy loam soils called chernozem of the steppes
- Well drained undulating topography that enables mechanisation.

Describe the farm activities on wheat farm that is commercially manned.

- In April – May there is sowing of wheat and growing of potatoes
- In June – July there is weeding and spraying of chemicals in the wheat field.

- In August- harvesting wheat is done by combine harvesters and transported it to elevators (storage) houses by railways
- In September harvesting of potatoes is done
- In October the fields re ploughed and lime or fertilizer is applied
- In November-March There is no work done in the wheat field because of snow instead repairs and general maintenance of farm structures and equipment is done.

Explain how the wheat is processed before exports

When the wheat shows golden straws, it shows that it is ready for harvest and harvested by combine harvesters

- The combine harvester threshes the straws once
- The wheat is then milled to obtain wheat floor.
- Most farmers take their wheat after threshing to the country elevators
- The wheat is dried and cleaned by the country elevators
- The wheat is also graded and weighed.
- Wheat for export is transported by trucks and railways to terminals.
- High ships are loaded with the wheat from terminals ready for export.

Assess how the wheat is exported to Europe is and the far east- from Canada.

- The wheat to Europe is exported through the ports of Winnipeg, Port Arthur and Port William on Lake Superior and the great Lakes.
- The wheat reaches Europe through Halifax, Montreal and St. Johns Ports.
- The wheat to the Far East is exported through west wards route to pacific ports of Vancouver, Churchill and Seattle to Japan, Korea and Indonesia.

Identify the products that are from wheat farming

- Bread flour
- Semolina (for making spaghetti, Macron and vermicelli)
- Cakes, biscuits, breakfast cereals, pie crust and ice cream corn.
- Live stock feeds i.e. bran
- Distillation of alcohol
- Preparation of glue and adhesives
- Straws for paper making
- Gluten flour for diabetic patients
- Cow beddings in sheds.

Account for the importance of extensive wheat farming in Canada.

- Wheat is the major commodity for export as such it helps in the earning of foreign currency.
- Wheat farming has influenced the construction of railways and elevators hence help in the development of the country.
- Wheat farming has created a lot of job opportunities to people who are involved in different activities at different levels.

Discuss the problems faced by Extensive wheat farming

- Wheat farming is often hit by fluctuation of price on International markets.
- Crops are affected by natural disasters of drought, hail, winds and frost.
- Closing of the exporting routes because of freezing conditions is another challenge.
- Wheat is attacked by pests like grasshoppers and some diseases.

PLANTATION AGRICULTURE

This is the growing of a single stand of crops on a large piece of land commercially. Plantation agriculture in most cases is practised with perennial crops that take along time to give proceeds after establishment but also takes along time harvesting the same crop e.g. coffee, and tea.

Characteristics of plantation Agriculture

- Estate farming, but sometimes small holder farming is also possible.
- Foreign ownership but local labour
- Scientific management in order to achieve required standards.
- Heavy capital out ray.

Advantages of plantation agriculture

1. Farmers can choose the best seeds from the nursery
2. Weeding is easy because crops are planted in rows.
3. Crops provide waste materials which decompose into good manure for the crops.
4. Crops shade the trees and at the same time act as wind break.
5. Plantations provide employment for local workers.

Disadvantages

1. Setting a plantation is very expensive because it needs heavy capital out ray
2. Little produce in the first years of establishment hence little money.
3. Many plantation crops such as oil palms, sugar cane need to be processed soon after harvesting and any delay will lead to great loss.
4. It is vulnerable to price fluctuation
5. Disease out break is very fast in a plantation and could wipe out the entire plantation.
6. Poor conditions in a plantation find it difficult to attract enough labourers to work in the farms.
7. Plantation workers need to learn different types of skills for working in a plantation.
8. Rapid deterioration of tropical soils difficulties of clearing and maintenance.

COCOA GROWING IN GHANA

Cocoa is one of the plantation crops. Apart from Ghana, cocoa is grown in Brazil, Nigeria, Ecuador, Gabon, Ivory Coast, Mexico and Columbia.

Factors Which Favour the Growing of Cocoa

- Well drained porous soil rich in potash.
- Hot climate with temperature over 24 degrees Celsius.
- Heavy rainfall of 2000mm-3500mm per annum without long drought.
- Availability trees to provide wind break.

Cocoa Growing Areas in Ghana

- Agogo
- Kumasi
- Awaso
- Bibiani
- Sunyani

Cocoa Cultivation at Agogo

- The forests are cleared with some trees left to act as wind break.

- Small holder farmers use primitive tools for farming.
- The plants are planted and the fields are weeded.
- The plants take some time before they start bearing pods (about 5 years).

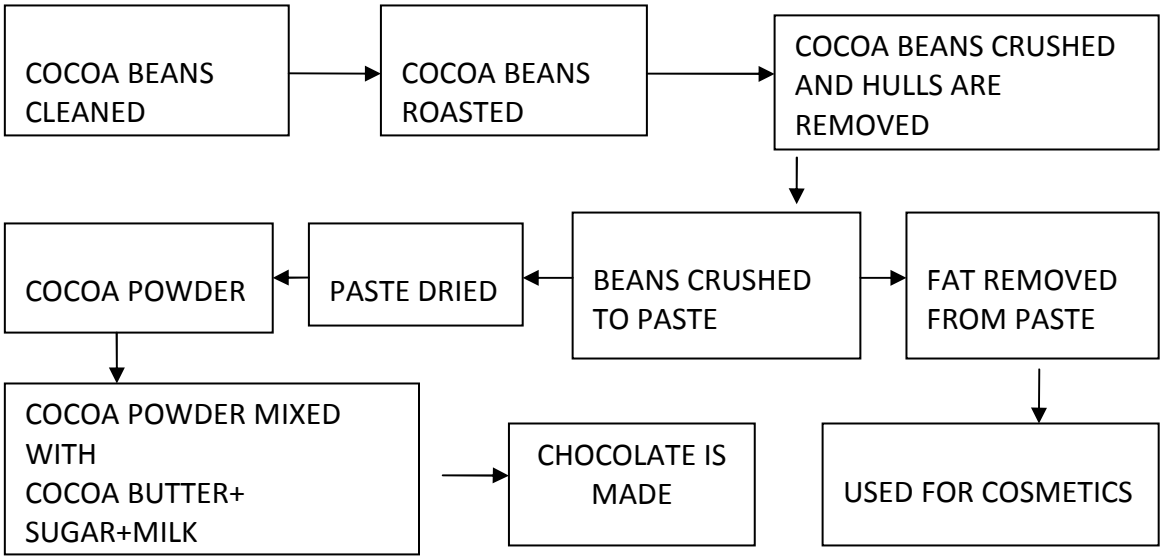
Processing of Cocoa

- The pods are harvested with knives then pods are split open with knives. The beans are separated from the pulp. The beans are then fermented for a week. After fermenting, the beans are dried for a week and packed in bas after drying ready to the market.
- Cocoa is transported to Agogo where there are intermediate buyers.
- Cocoa is transported to the buyers by bicycles and ox-carts.
- From Ago go, cocoa is transported by railway or lorry to ports Tema and Sekondi. Cocoa is shipped to overseas where there are chocolate making factories. Processing of the cocoa continues in the importing country.

When the processing companies buy the cocoa from the intermediate sellers

- The beans are cleaned and roasted.
- The husks are removed after roasting in order to produce cocoa nibs.
- The nibs are then ground into powder with machines where the fatty cocoa butter is removed.
- The powder is finely ground and mixed with mild to make cocoa drink. For making chocolate, the powder is ground to great fineness. Sugar, nuts and flavouring ingredients are added to improve the taste and appearance.

Flow Diagram of Chocolate Making



Other Crops Grown at a Cocoa Farm

- Yams
- Groundnuts
- Beans

Products from Cocoa Farming

- Chocolate
- Cocoa butter lotion (Cosmetics)
- Cocoa butter powder
- Drugs

Factors that have led to the Decline of Cocoa Growing in Ghana

- Falling of prices at international markets discourages farmers.
- Lack of labour as young people migrate to towns leaving old people to work in farms.
- Smuggling of cocoa to neighboring countries where cocoa prices are better.
- Viral disease called swollen shoots continues to reduce harvest.
- Uncontrolled bushfires
- Diminishing of trees that prevent wind from destroying the crops.
- Lack of good roads in the borders.
- Credit is difficult to obtain.
- Mechanisation is absent.

Importance of Cocoa Industry in Ghana

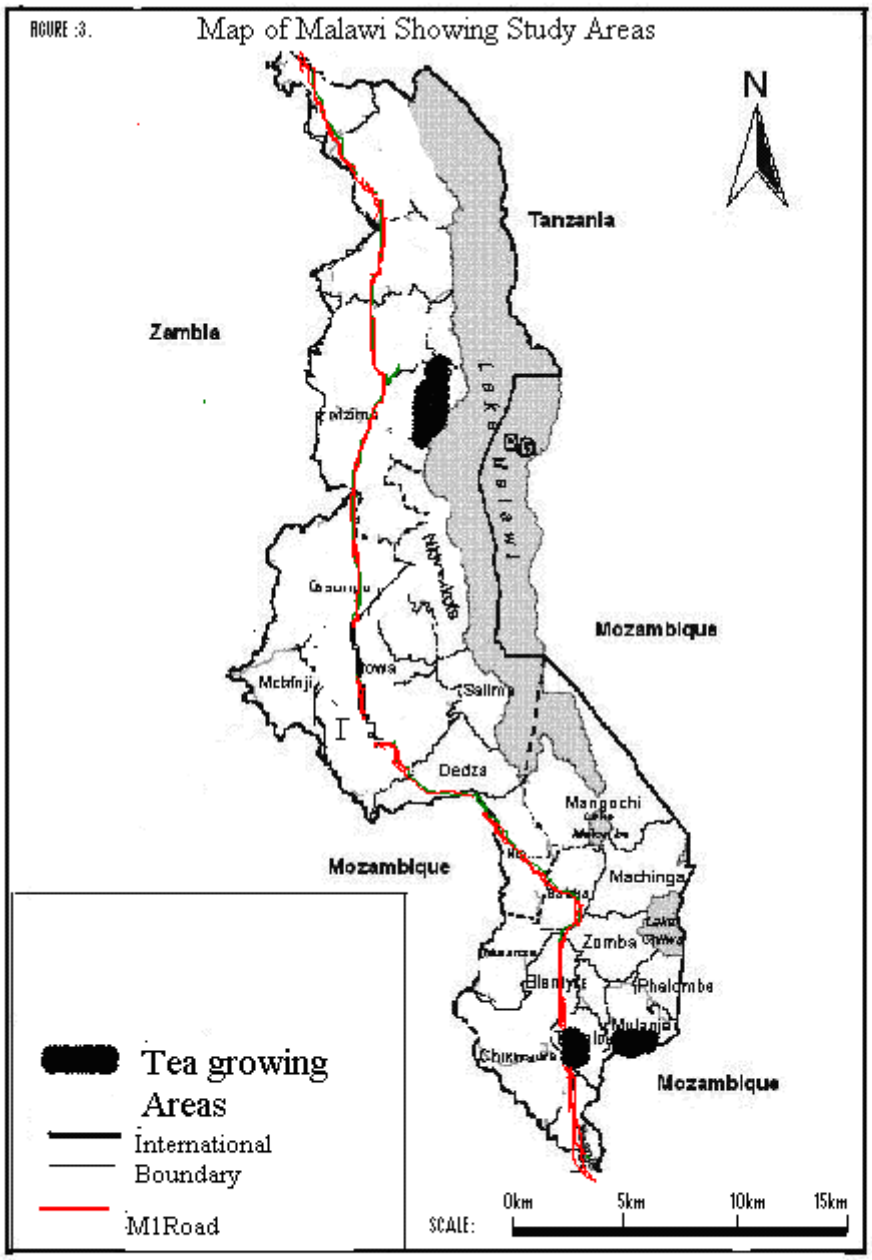
- Source of employment since 500,000 people are employed.
- Source of foreign exchange since 65% of Ghana's economy comes from cocoa export.

Marketing of Cocoa

- Local farmers sell their cocoa to the United Farmers Council which is a state cocoa marketing board responsible for the export of cocoa.
- At the overseas, cocoa is exported to Great Britain, USA, Germany, France, Sweden, Netherlands, CIA and Italy.

TEA GROWING IN MALAWI

Tea was introduced to Malawi in 1878 by British missionaries. Currently tea is grown in Mulanje, Thyolo and Nkhata Bay.



Conditions Favouring Tea Growing

- Heavy rainfall of about 1600-2000mm per annum
- Moderate temperatures of 18-20 degrees Celsius with little or no chance of frost.
- Well drained loam soils which are acidic on gentle slopes.
- Large labour force especially during picking period

Activities that Are Done During the Tea Growing Process

- Germinating, Pruning, Plucking,
- Processing i.e. Withering, Rolling, Fermenting, Firing, Sorting, Grading, Packing, blending.

Flow Diagram of Tea Processing

1. Withering:

- Warm air is brown on the green leaves to reduce the moisture content.

2. Rolling:

- The leaves are crushed into small pieces by machines (rollers)

3. Fermenting:

- Fermenting is the breaking down of chemical parts of a substance to change it into another product. It takes 3-$3^{1}/_{2}$ hours. In tea processing this is the important process because it determines the quality of the tea.
- The tea is kept at humid temperature of 24 degrees Celsius to ensure a clear colour with sweet smell

4. Firing:

- Hot air is passed over the fermented tea to dry it a little more after fermentation.

5. Sorting:

- Tea is sorted into different sizes and quality by machines.

6. Grading:

- This is the ranking of the product by quality or value using machines or tea experts.

7. Packing:

- This process puts tea in wooden boxes or chests ready for export.

8. Blending:

- This ids the mixing of different grades of a product together and it helps to determine the final price of the product..

Growing of Tea at Makwasa Estate

- Tea growers take cuttings from the best tea trees
- They germinate these cuttings in wet sand.
- They later transplant the sprouts (cuttings) into the nursery beds.
- After1-2 years these plants are ready to be transplanted in the open field.
- They are planted 60cm apart in rows which are 150 cm.
- After four years the plants are pruned (cutting off the tops of plants)
- The tea trees form a hedge which allows the leaves to be plucked easily.

Shade trees are planted among the hedges for the following reasons

- Adequate shade helps tea leaves to grow and prevent withering (drying up of leaves)
- The shade trees planted are usually leguminous that put nitrogen back into the soil
- leaves falling from the trees conserve moisture in the ground and once
- decomposed they provide food for the plants.
- The trees also provide shade for the pickers.

Small Holder Tea Authority

To encourage the growing of tea by small farmers who could not afford to grow tea on a large scale, the government of Malawi in 1967 introduced the Small holder Tea Authority

This was established in Mulanje, Thyolo and Nkhata Bay region because of the following reasons

- These were already tea growing districts.
- Tea does not need a lot of land for high yield therefore a small holder does not need a lot of land to grow tea.
- Tea can offer additional income to small holder farmers in addition to the income they receive from selling bananas pineapples which is the main cash crop in these districts.

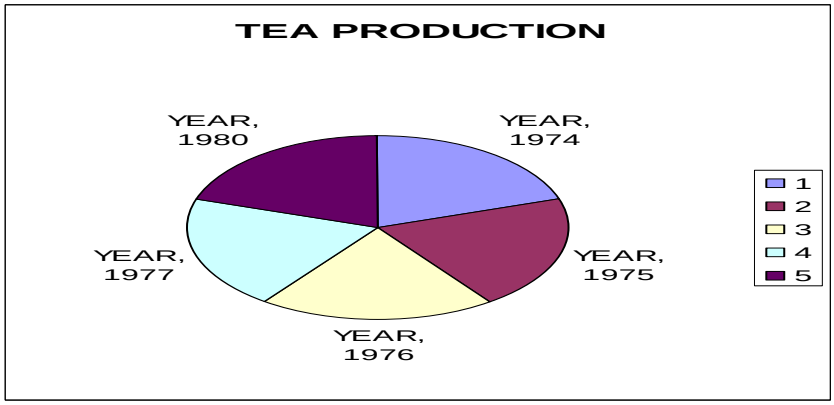
- A lot of people work on tea estates know how tea is grown and cared for.

The tea authority is responsible for the distribution of tea plants to the small holder farmers on long term basis.

From 1967 the number of small holder farmers has increased steadily and the production of tea has also been increasing.

Tea Production

Year	Amount
1974	23.2
1975	26.2
1976	28.2
1977	31.6
1980	34.5



From the pie chart and table above the increase in tea export yearly is due to the following factors

- Establishment of Mimosa Tea Research station who research improves the quality and the yield of tea
- The establishment of the small holder tea authority which helps and encourages the small holder farmers to grow more tea

Problems of Tea Growing

1. Fluctuation of prices on international markets.
2. High competition with other countries that produce tea
3. Luck of government subsidy to improve the amount of tea grown by small holder farmers.

IRRIGATION FARMING

Define the word Irrigation

This is the supplying of water on the land to enable crops to grow to reduce the length of period in which lack of Moisture retards plant growth.

On the world Map locate the following areas where irrigation farming is practised at large **scale.**

-On that map the following areas should be labelled.

- Nile Valley – Egypt
- Murray basin – Australia
- Indus Valley – India
- Negev desert -Israel
- Gezira in Sudan
- Nchalo in Malawi.

World Map Showing Areas of Irrigation Farming

Describe the favourable conditions that encourage Irrigation farming

- Dry climate or prolonged drought
- More reliable water supplies
- Flatness of the land that will not allow water to flow away (back).
- Impervious clay soils to prevent percolation of water.
- Scarcity of land and high population density which will encourage double cropping in one year.

Differentiate traditional and modern methods of irrigation farming.

- In traditional method, water is made available to crops through basin, perennial and tank systems while in Morden method, water is supplied to crops through sprinklers (overhead) furrow and trickle or drip methods.

Describe the characteristics that make irrigation farming intensive

- Yield fluctuation from year to year is reduced.
- Continuous cultivation becomes possible
- In most cases the land holdings are small.
- Double or treble harvests may be realised
- Higher yield per hectare of given crop.

Identify the problems associated with Irrigation farming.

- Loss of soil fertility caused by leaching
- Spread of water borne diseases because most of the water supplied to crops is taken from stagnant sources e.g. dams and tanks.
- High costs of pumping the water
- It causes dam siltation.
- Salinity which encourages formation of hard pans

IRRIGATION IN ISRAEL

- The country of Israel covers 20,440sq kilometres and half of this is a desert while a 440sq kilometre is water.

Israel Is Divided into Three Main Regions

- **The Mediterranean Coastal Plains:** This area is flat and the soils are fertile
- **The Hilly Country:** This region is highly eroded. It is bounded by Galilee in the north, Judea in the centre and Jordan valley to the East.
- **Negev desert in the South:** This area is very hot and dry with no rainfall from May to October. It is this area where irrigation is needed in order to grow crops.
  - The desert area is close to the Dead Sea but the water for irrigation is not taken from this sea because the water is salty.

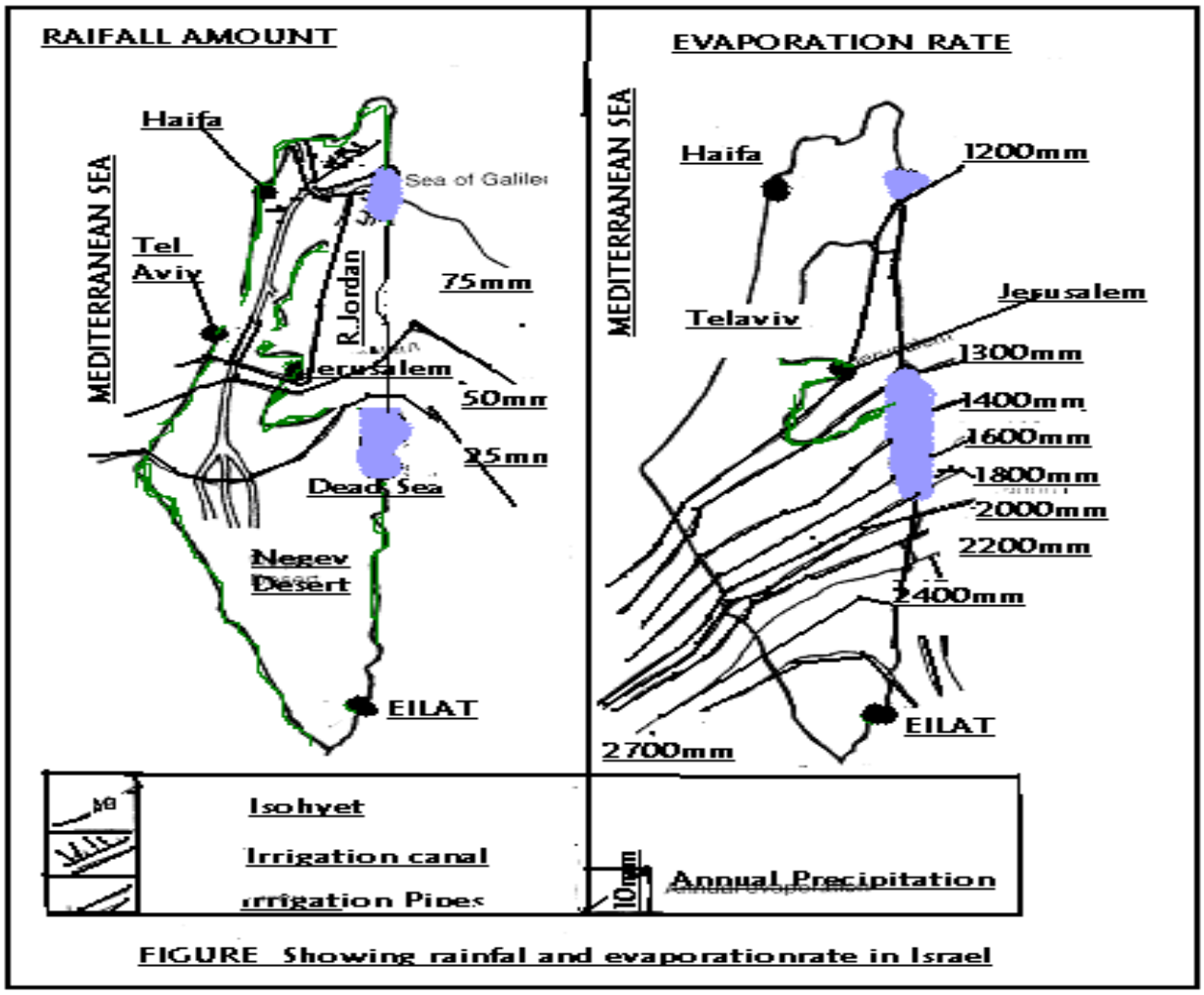


FIGURE Showing rainfal and evaporationrate in Israel

Sources of Water for Irrigation in Israel

The water for irrigation is obtained from

- Lake Tiberius (Sea of Galilee), or Lake Kineret.
- Yarkon river

How Water for Irrigation is Transported

Water grids of canals and pipes are constructed to transfer water from the northern part to the Negev desert in the southern part.

Along the desert area the water is mainly taken through pipe lines because it is very hot and evaporation is very high such that without pipelines much of the water will be evaporated.

Methods of Irrigation

- Sprinkler irrigation but it is wasteful.
- Drip or trickle irrigation-This saves water hence widely used.

Examples of Crops Grown Under Irrigation

- Tomatoes, sunflower, sugar beet, citrus fruits, apples, cotton, pears and spring potatoes.
- Despite the water taken from the rivers and the lake, water for irrigation in Israel is still not enough as such the government has embarked on an ambitious project of water desalination. Desalination plants have been constructed at Haifa and Eilat.

What is desalination?

- Water desalination is the process of removing the salts from the water through the use of electricity.
- There are different methods that are used to desalinate the water.

1. Vacuum Freezing

- In this process sea water is cooled and then introduced into a freezing chamber where the water forms a thin mixture of liquid water and ice particles.
- The mixture is separated and ice particles are finally washed to remove the brine (salt).
- The ice particles are melted down to give fresh water.
- This method is cheaper than other methods.

2. Evaporation Method

- The water is heated up to the boiling point. When it changes into gas (water vapour), the vapour is cooled and fresh water is collected leaving behind salts in the evaporating chamber.
- This method is slightly expensive as it uses more electricity. This method is used at Eilat.

3. Electrolysis

- This method removes the salts from the water through electroplating process as the electricity passes through the salty water. (***Check with Physics to know this process more)***

Problems Associated with Irrigation in Israel

1. Insufficient source of water
2. Hostile Arabs who would not like to sea Israel use Jordan River
3. It is very costly to pump water from lake Tiberius 210m below sea level
4. Evaporation rate is very high in the Negev region
5. Desalinating the water is very expensive.

NCHALO SUGAR IRRIGATION SCHEME

- It is located in Chikhwawa District to the western bank of Shire River.

General Necessary Conditions for Sugar Cane Growing

1. Temperature of 21-27 degrees Celsius throughout the year
2. A sunny dry season close to harvesting period to promote concentration of sugar in the cane.
3. Rainfall of about 1270 mm (rain fed) but too much rain dilutes the sugar and leads to poor quality.
4. Water-retentive deep fertile soils
5. A flat topography to facilitate mechanisation and proper usage of irrigated water

6. A large supply of labour during harvesting time

However Nchalo sugar cane scheme has the following conditions that favour the growing of sugar cane

1. Temperature of 20-32 degrees Celsius
2. Rainfall below 800mm per annum .this low rain fall encourages the use of canal and sprinkler irrigation to supply rain water.
3. Flat topography
4. Have calcimorphic soils (gray to dark brown alluvial soils) and Hydromorphic soils (strongly developed course structured clay soils).
5. Abundant labour force

Harvesting of Sugar Cane

Before harvesting the cane field is set on fire in order to

- Burn off the dead foliage
- For easy harvesting
- Get rid of pests and dangerous animals.

The canes are cut with long knives and carried by tractors to the factory

Processing Of Sugar Cane into Sugar

- The canes are cut into pieces in a factory and crushed by the rollers to extract the juice.
- The juice is then boiled and lime is added to prevent fermentation
- The Syrup is partly evaporated and the rest is crystallised into raw (brown sugar) .This process leaves behind molasses as by –product.
- In order to come up with white sugar, the syrup if filtered to remove the solid impurities and then run into Char or bone charcoal packed cylinder.
- The function of the char is to absorb the brown colour.
- The sugar is then evaporated and condensed into white sugar .This process leaves behind the by-product known as **golden syrup** which is used to smear on the bread

Other Product from Sugar Processing

1. **Golden syrup**: used on bread
2. **Biogases**: used as fuel for mills
3. **Cattle fodder**
4. **Fibre board** and synthetic textile industries
5. **Molasses:** Used for
   - Making rum and treacle
   - Making industrial alcohol
   - Mixing with silage to improve the palatability

Marketing of Sugar from Nchalo Scheme

- It is marketed locally
- It is exported to other SADC countries e.g.
  Malawi, Zambia, Zimbabwe, Tanzania, Angola, S. Africa, DRC, Swaziland, Congo, Lesotho, Seychelles, Mauritius and to Europe.

Economic Importance of Nchalo Scheme

1. It provides employment to the neighbouring villagers and other experienced people like engineers.
2. Source of foreign currency through export.
3. Source of income to small holder farmers.

FISHING INDUSTRY

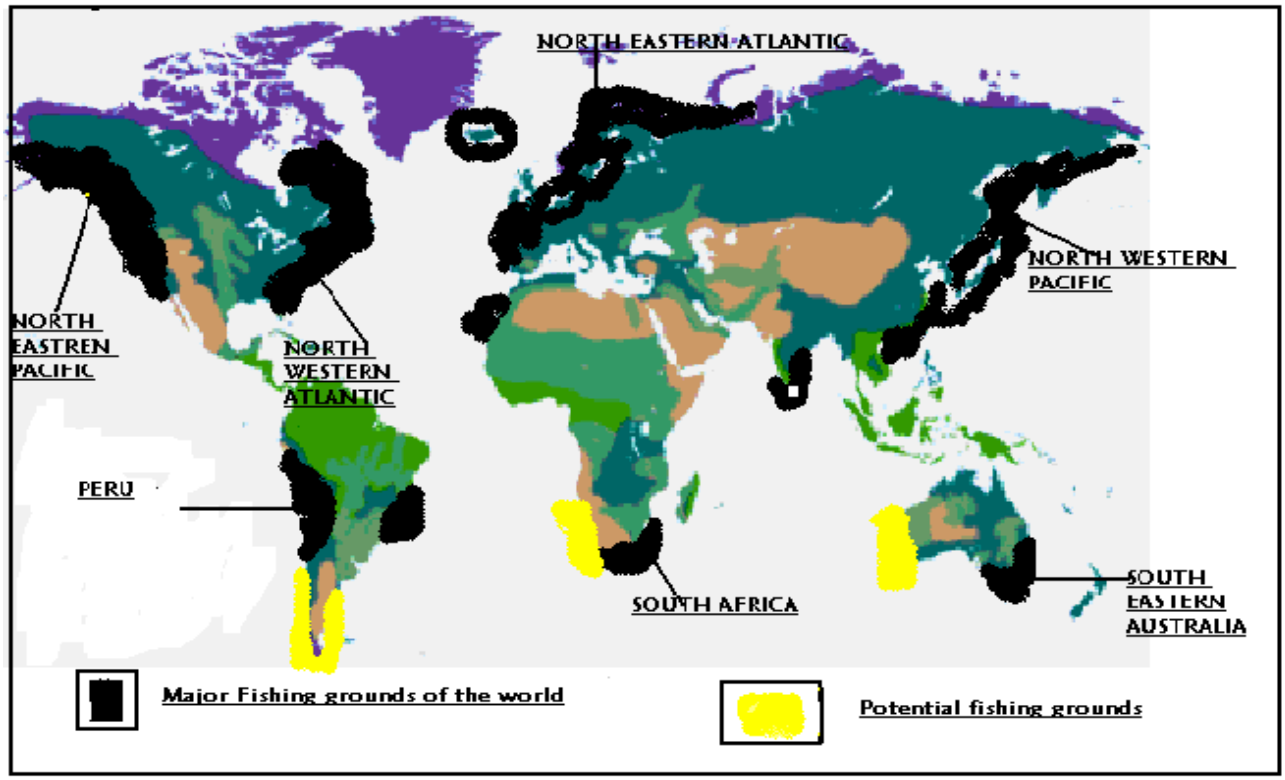
WORLD FISHING

Fishing is defined as all aspects of man's pursuit of all the marine animals in the seas and the inland waters.

Factors that Encourage Fishing

1. Presence of continental shelves or shallow waters that allow penetration of sunlight to stimulate `growth of abundant planktons.
2. Cool climate with temperature lower than 20 Degrees Celsius.
3. Indented coastal lines for natural harbours.
4. Meeting of warm and cold ocean currents which encourage precipitation of mineral such as nitrates hence the growth of planktons.
5. Moderate or large population because fishing requires more labour.
6. Scarcity of cultivated land in the coastal lands which may force the people to resort to fishing in order to survive

Major Fishing Grounds of The World



Major fishing grounds are confined in the Northern Hemisphere because:

1. It is land hemisphere with large population.
2. Great length of indented coastlines for harbours.

1. North East Atlantic

- This is influenced by the North Atlantic Drift warm current. The most popular area is Doggar Bank where fishing is mostly done in spring season using high mechanisation.

Fishing is done using the following methods:

Method	**Fish Caught**
Tawling	Demersal

Haul Seine-netting	Deep herring Water Fish
Drift netting	Herring

Important Fish Caught Include:

- Mackerel, cod, herring, haddock, plaice, halibut, sole, hake and skate.

The North East Atlantic is the greatest fish exporting region of the world. The important areas in the area are Norway, Denmark, Spain, Iceland, UK, France, Germany and Portugal.

2. North West Atlantic

- Fishing is centered on the sand banks off the coast of New Found land. This area has a problem of overfishing.

Fish Caught Include:

- Cod, herring, haddock, sardines, mackerel, halibut, hake, flounder.

Methods of Catching Fish in North West Atlantic include:

(a) Trawl netting
(b) Drift netting
(c) Haul Seine netting

Fishing in this area is very important because it provides employment to many people more especially New Foundland. Fish from this area are exported to A. Africa, Southern Europe, North Africa, USA and Canada.

Fishing in North West Atlantic is mostly influenced by

(a) Vast N.W Atlantic continental shelf with abundant planktons.
(b) Meeting of North Atlantic Drift and Labrador ocean currents encourage growth of planktons.
(c) Lack of natural resources on the land and harsh climate force people to concentrate on fishing hence overfishing.
(d) Coastal indented coast with good natural harbours.
(e) Cool temperature climate.

3. North East Pacific

- This ground runs from Alaska to California.

Common fish caught include

- Salmon, Hake, Halibut, Cod, Herring, tuna, sardines, Alaska Pollack and menhaden.

Methods of catching fish

- Trawl-netting
- Drift-netting or purse seine nets

4. North West Pacific

- This extends from Bering Sea to East China Sea. This is the world's greatest fishing region. Japan is the leading fishing nation in the region.

Important types of fish caught are

- Cod, halibut and salmon, sardines, tuna, herring and mackerel (mullet, gallup and carp – in China.

5. South Africa

- In this region, fishing is important over the Agulhas Bank. Important fish caught include cape hake, S. African Pilchad, Cape anchory.

Methods of fishing

- Trawling
- Drift netting

Important Fishing Ports Include:

- Cape Town
- Port Nolloth
- Durban
- Saldana Bay
- Port Elizabeth

Fish from here are exported while canned. Fish meal and fish oil are also produced here

6. PERU

This is due to the upwelling cold water of the Humbott current and narrow continental shelf. Most of fish caught here are used for fertilizer making examples of fish caught include anchovies by drift-netting.

Development of the Fishing Industry

Countries that are closer to the fishing grounds have advanced in fishing grounds have advanced in fishing industry.

They are involved in fishing industry of other products. Therefore, where commercial fishing is concerned, other industries have also been started e.g

a. Fertilizer making
b. Fish meal and fish oil production
c. Soap and margarine manufacturing factory.
d. Perfume making etc
e. Glue making

Main types of fish caught include

(a) Pelagic Fish

There are found near the surface of the water. Examples of fish include Herring, Mackerel, tuna, and pilchard, Sardines, Anchovies and Menhaden.

(b) Demersal Fish

These are found very deep almost near the sea bed of the continental shelf.

Examples of demersal fish are: Sole, Cod, Haddock, Halibut, and garoup, Plaice, Hake and Skate.

(c) Anadromous Fish

These are the fish that spend part of their life in fresh water rivers and lakes while young and in saltwater of the sea when they are old. They go back to the fresh water for spawning.

Fish Examples: Salmons

Main Fishing Methods

The method of fishing is determined by whether the fish are pelagic or demersal, whether fishing is for commercial or subsistence. The following are the different fishing methods:

(a) Drift Netting

This is put vertically in the sea and it is fitted with floats on the upper edge and weights below. This method is efficient in catching pelagic fish e.g. herring. It is drifted by an engine boat called drifter.

(b) Trawling Methods

The trawl net is a bag shaped net whose mouth is kept open head beams.
The net is dragged along the sea bottom.
This method is efficient for catching demersal fish e. cod. The problem with this method is that it only need smooth sea bed because irregular surfaces may tear the net. Another problem is it needs large amount of labour.

(c) Haul Seine Netting

This resembles trawl netting only that this one is drifted by two small boats. This also is used for catching demersal fish.

(d) Purse Seine Netting

This is similar to drift nets but instead of hanging in the water, the nets are pulled by their ends to surround a school (group) of fish. The net is sometimes stretched between two boats. This is used for catching pelagic fish.

(e) Line Method

These are of two types:

- Hand lines – These have a single baited hook. This is not economically reliable as it is too slow.
- Long lines – These may have 500 – 5 000 hooks attached. A few metres apart to a single main line which is several kilometers long.

The hooks are drawn are drawn up by a steam boat. This method is used for catching demersal fish.

Importance of Fishing Industry

1. Provide raw materials to other important products e.g. fertilizer, margarine, perfume, glue etc.
2. Promote foreign earning to those countries that export fish and fish products.
3. Source of employment.
4. Source of vitamins.
5. Influence the establishment of other manufacturing industries.

Problems of the Fishing Industry

-Overfishing
-Indiscriminate fishing of the immature fish.
-Pollution of water by chemical plants and factories.
-Ignorance of fish management

Solution to the Problems Faced

(a) Controlling types of fishing nets here only those nets with recommended mesh will be allowed. All nets with small holes will be confiscated and destroyed.
(b) Prohibiting fishing during the breeding season. In Malawi, lakes are closed to fishing in November and December to give fish enough time to breed.
(c) Restocking of overfished waters by transferring small fish from areas well populated with fish or by introducing new species. Forbid indiscriminate fishing by checking the size of fish brought into port by punishing the offenders.

International agreements on fisheries research on which understanding on the available species, habits, habitats, food and movement of fish will be made.

Other Resources from the Sea

(a) Prawns
(b) Shells
(c) Salt (desalinated)
(d) Sand and gravel
(e) Oil
(f) Natural gas, metals i.e. tin, iron, gold, seaweed which is used for making ice cream, malted milk, pudding, mayonnaise, salad dressing, jellies. Other minerals i.e. sodium chloride, magnesium, potassium etc

FISHING IN MALAWI

Malawi is a landlocked country. It does not have sea ports. Despite this, Malawi catches more fish than Mozambique because she has short supply of meat such that fish remains the main source of proteins.

Fishing Grounds in Malawi

(a) Lake Malawi
(b) Other lakes: L. Chilwa, L. Chiuta, L. Kazuni, L. Malombe
(c) Rivers i.e. Shire, Domasi, Bua, Rusa e.t.c
(d) Dams
(e) Wetlands e.g. Elephant Marsh

Types of Fish Caught in Malawi

(a) Chambo
(b) Kambuzi
(c) Kampango
(d) Matemba
(e) Utaka
(f) Mlamba
(g) Micheni
(h) Bakayawo
(i) Mphutha
(j) Mbaba
(k) Ntchira
(l) Bombe etc

Methods of Catching Fish in Malawi

(a) Traditional Methods: This uses arrows, spears, stones and fish traps.
(b) Modern Methods: Mostly used for commercial purposes and these are
- Seine Netting
- Travel Netting
- Drift Netting

(c) Hooks and Lines

NOTE: Commercially the fish finders, radar and position finder equipment are used to track the fish both night and day.

Processing and Preservation of Fish

There are two main methods of processing and preserving fish

(a) Traditional Method
(b) Modern Method

Traditional Method

(a) Sun Drying

The sun are caught then washed and spread on rocks for quick drying on the drying platform.

(b) Smoking

Smoke is the main agent that preserves fish. Small and medium fish are preserved using smoke. The fish are gutted (dissected) washd and spread over a platform and below there is fire i.e chambo, mlamba

(c) Salting

Salt is applied to the fish to remove the water and denature the growth of bacteria that spoil the fish.

(d) Para Boiling Method

Fish are boiled and then later dried i.e usipa. Mostly the traditional methods of drying fish are used in less developing countries like Malawi because:

- There is lack of modern facilities.
- Low technological level
- Fishing is done at a small scale.
- Lack of enough capital for modern facilities.

Modern Methods

In the modern method, deep freezers are generally used. Once fish are caught are washed and graded and stored in to be sold locally. They are sometimes frozen in blast plants for exports outside the country. MALDECO Fisheries is responsible for this in Malawi.

NOTE: In Malawi, canning, tinning are not done.

Problems of Fishing in Malawi

1. Use of poor fishing methods i.e.

- Nets with small mesh
- Use of poisonous herbs

2. Pollution

In Malawi, some fish species have died from the effluents from Dwangwa Ethanol Company. In other seas pollution is done through the oil spillages from broken tankers

3. Over Fishing

4. In controlled fishing period i.e without observing closed season.

5. Inability of following quota.

6. Failure of stakeholders to enforce the law on controlled fishing.

7. Preservation problems due to lack of enough modern facilities for preservation.

8. Transport problems

There are poor transport networks which affect fish distribution.

Solution to the Problems in Malawi

(a) Controlling types of fishing nets where by all nets with small mesh should be confiscated and destroyed.
(b) Prohibiting fishing during the breeding season i.e. November to December in Malawi.
(c) Mandating the Traditional Authority (society) to deal with the culprits during the closed season.
(d) Introducing quota to commercial fishermen and agencies in order to check overfishing.

(e) Establishment of research centre and training institutions i.e Mpwepwe, Kachulu, Salima and Monkey-Bay.

Research centers have the following duties:

- Providing training in better fishing methods.
- Experiments on breeding fish breeds.

(a) Introduction of fish farms which involves rearing of fish in fresh water ponds. This is called Aquaculture. Fish farms in Malawi are in:

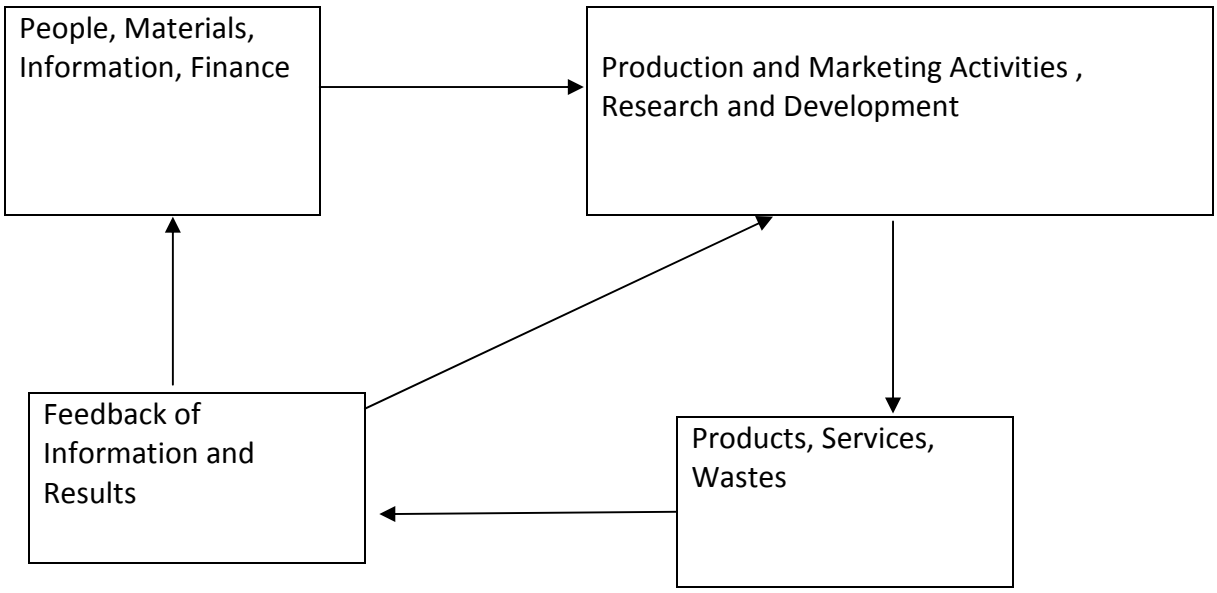
Domasi in Zomba
Kasinthula in Chikwawa

Fish farms are established to:

- Reserve stocks of fish.
- Stock local as well as exotic breeds of fish.

The attempts that have been made to solve problems facing the fishing industry in Malawi fishing is a Robber Industry because man can not replace the fish once caught.

INDUSTRIES



Types of Industries

1. Primary Industries

This is concerned with the exploitation of natural resources and raw materials e.g. fishing, mining, crop cultivation

2. Secondary Industry

This is concerned with the conversion of raw materials into new manufactured products.e.g.soap making, oil making, beer brewing, cement making.

3. Tertiary Industry

This is concerned with the distribution of products from the secondary industry. This does not involve manufacturing any thing.e.g.teaching, transporting goods, policing, banking, Hotels, hair dressing salon, post office,

4. Quaternary Industry

This is involved with the collect provision of information and expert valuation. This is a service industry.e.g.banking-uses computerized service, money card, western union money transfer. Health sector-scanning services, x-rays. Communication-Electronic, email, internet, fax, ladder.

Major Industrial Areas of The World

1. Western Europe

This is the greatest world industrial area and the first to develop. It has developed because of the following factors;

- High level of technological advancement in engineering, chemicals, textiles and electronics
- Abundance of coal, nuclear and HEP.
- The region has high population which provide readily available for the products.
- They have the ability to produce their own raw materials, e.g. iron, steel and coal.

2. North America.

Factors

- This region has rich mineral resources
- There are a lot of markets
- There is cheap transport for the raw materials. E,g. the Great lakes

3. Japan

Factors

- Has large market in main land Asia.
- This has developed HEP resources
- Has large port s for the importation of raw materials

4. Other areas include: South Africa, Argentina, South Korea and Brazil.

Factors Affecting the Location of an Industry

1. **RAW MATERIALS**
   Industries can only be located closer to where raw materials are produced in order to make profits.
   Materials that are light to transport and do not get bad easily can be transported to an industry than heavy and perishable materials which may need short transport distance and go bad easily respectively.

2. **TRANSPORT**
   Industries can economically be located along areas with good transport net work.

3. **SOURCE OF POWER**
   Most industries need enough power supply there fore it is advisable to locate the industry close to the power supply.

4. **AVAILABILITY OF MARKET**
   Market is a pull factor for the establishment of an industry. Places with high population are highly industrialized because the large population provides large market.

5. **POLITICAL FACTORS**
   Favourable political climate influences the establishment of industries while hostile political condition discourages investors.

CEMENT INDUSTRY IN MALAWI

- Cement Industry is located in Blantyre for the following reasons
- There is availability of large market
- There are storage facilities (ware houses)
- Blantyre is more accessible than Changalume

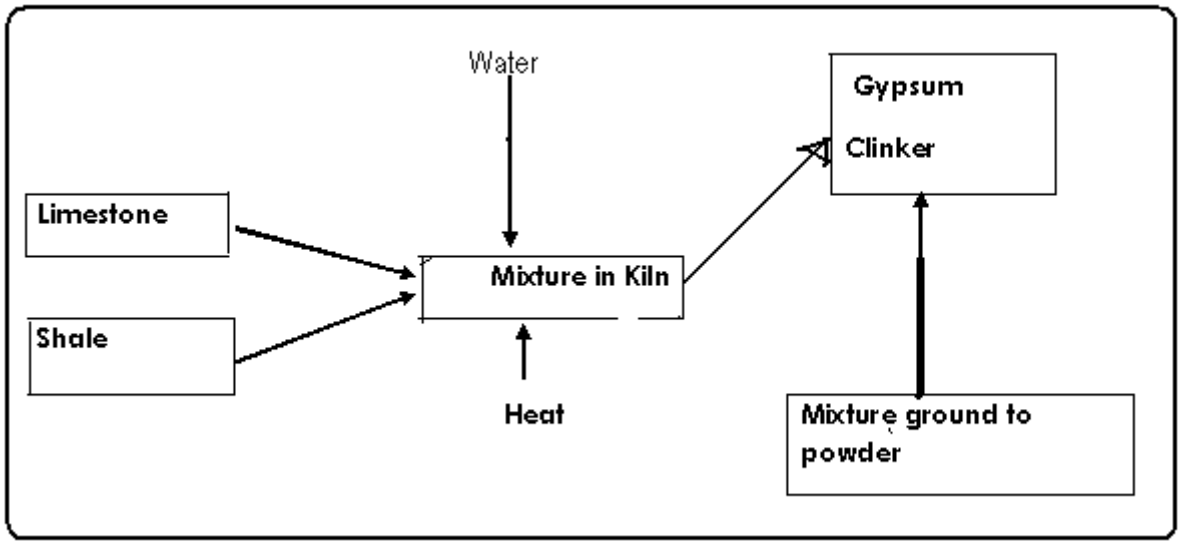
Importance of cement industry in Malawi

- Source of employment to Malawians
- Source of revenue to the government through taxes.
- It reduces import rate of cement and acts as a back borne of construction sector.

How Cement is Manufactured

Limestone is mined at Changalume-(now Balaka) with a lot of impurities. The limestone is broken up and crushed .The crushed substances are mixed with water and thrown into kiln and heated to 1500 degrees Celsius to evaporate the water. The result is called **CLINKER .**The clinker is transported to Blantyre where Cement is produced.

Flow Diagram of Cement Making



Impact of Cement Making to the Environment

It uses land which could otherwise be used for agriculture
It causes air pollution
It causes deforestation and disturbs ecological balance

Some of the problems can be solved by:

- Refilling the pits
- Planting vegetation on the refilled areas.

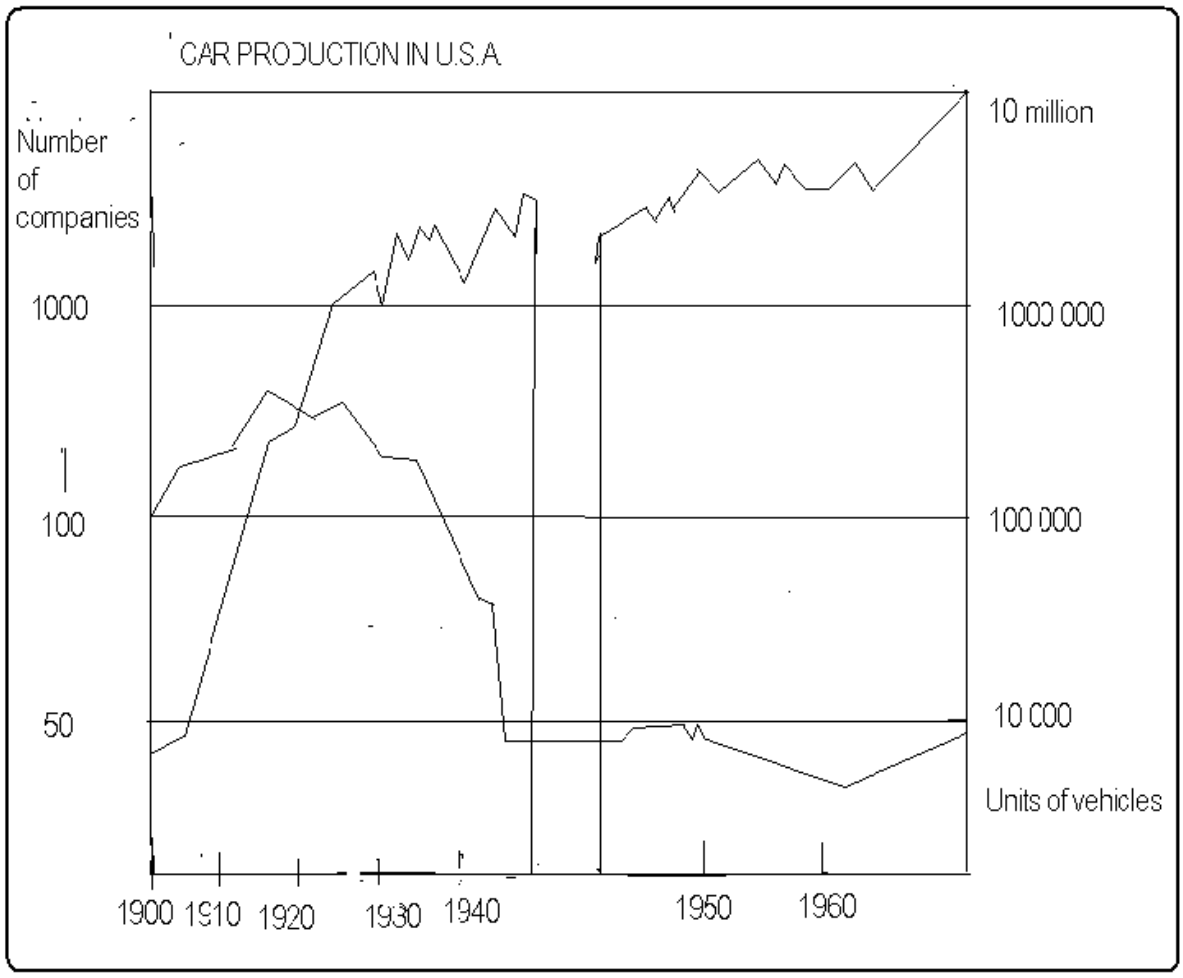
Motor Vehicle Industry in USA and Japan

Motor vehicle industries has developed because it requires iron and steel which are readily availabe.Iron and steel are found in the following areas;
Pittsburg: main centers are Young town and Pittsburg
The Great Lakes Region: Detroit, Cleveland, Buffalo, Gary and Chicago.
Atlantic Coast: Sparrows point and Bethlehem.

Motor vehicle industry in USA dropped between 1919-1919 because this was the period when United States experienced great economic Recession. Due to this the following resulted;

- Many companies were closed from 108 to 44.
- Great unemployment as many workers were laid off.
- Shrinkage of economic activities

During the Second World War there was also a drop in manufacturing of motor vehicles because production switched to manufacturing of war materials. See the figure below.



Original Factors that Favoured Detroit as a Car Leading Producer in USA

- Historical factor because hennery Fold lived there
- Availability of raw materials such as tyres, paint, spring and others.
- Flat land because first cars had little power and brakes.
- Nearness to Ohio-Indiana Coal Field, Appalachians.
- Skilled labour force from Europe

How ever the present factors include the following

- Nearness to iron and steel industry
- Market provided by the eastern industrial and populated eastern North America. Cheap transport provided by the Great lakes.
- Availability of abundant power supply.

Reasons for Scattering Regional Assembly Plants in Parts of USA

- It is expensive to transport assembled cars than car parts.

- To serve scattered markets
- To exploit less militant labour than the ones in Michigan.
- To take advantage of cheap land in those scattered places.
- Each factory has out put size and assembly lines do increase production

Problems and challenges facing the car industry and led to the decline

1. Great competition with other car making industries outside USA.
2. Other companies make smaller and economical cars that those from USA which consume a lot of fuel.

Importance of motor vehicle Industry in USA.

1. Increased job opportunities
2. Expanded housing location and alternatives
3. Expanded opportunities for leisure time
4. Has provided convenient, comfortable and cheap personal transport over both long and short distances.

Effects of the development of Motor vehicle Industries.

1. They have increased emission of gases into the atmosphere and has caused air pollution greatly.
2. Noise pollution
3. Increased the injuries and death toll through car accidents
4. Decline in public transport.

TOURISM INDUSTRY

This is defined as the total sum of economic activities generated in a national economy through travel or visits of people.
A tourist is a person who spends at least one night away from home on vacation.

Growth of Tourism

At first, tourism was not as developed as in these recent days. During the 19^{th} – 20^{th} century, more people began to spend their time in the sea shores. Modern tourism has grown due to the industrial revolution.
There are several developments as a result of industrial revolution:

(a) Improved transport networks.
(b) Invention and proliferation motorbiles
(c) Birth of air transport which is comfortable and fast.
(d) Increased income – the wages of workers have been growing steadily overtime and also increases the spending power of which leads to more people to spend for tourism.
(e) Improved working conditions which allowed the reduction of working hours due to the introduction of machinery such that there was more time for tourism.
(f) Introduction of paid holidays.
(g) Changes in life styles where necessity rather than a luxury.
(h) Politically many govt. have allocated more money in tourism because it appears as an invisible export.
(i) Socially, there has been the birth of education where individuals have acquired interest of visiting some areas.

Factors that Promote Tourism in Africa

(a) Physical Factors

- Pleasant climate that attract temperate people.
- Impressive scenery, lakes, mountains, forests e.t.c

(b) Cultural Factors

- Places of historical interest e.g. churches, mosques, places, pyramids.

(c) Economic Factors

- Accessibility to good transport network.
- Availability of social facilities e.g. good accommodation facilities, catering facilities, presence of tourist guides.

Impact of Tourism

Tourism is an important economic activity in the country that brings economic, physical and cultural impact for good and bad effects.

Economic Impact of Tourism

(a) Source of employment.
(b) Most people are employed in hotel or transport sector.
(c) Boosts other economic activities e.g agriculture. Some farmers are encouraged to grow some crops for tourists feed.
(d) Manufacturing of blankets
(e) Making of curios and hats
(f) Invisible export as countries obtains foreign currencies when visitors pay for accommodation.

Economic Problems Caused by Tourism

(a) Inflation of prices of commodities.
(b) Some foreign investors may also drain the benefits from tourism industry e.g. protea.

Physical Impact of Tourism

The tourism industry assists in boosting of infrastructure e.g roads, hotels are constructed close to tourist resorts.

The negative physical impact is that tourism:

- May encourage pollution
- Areas which do not have adequate facilities along the lake shore areas, the low sewage may be pumped into the seas and oceans.
- Air pollution due to excessive use of automobiles and industrial chemicals during the food manufacturing for tourists.

Social Impact of Tourism

- It hard to measure the social benefits of tourism because they are abstract. However the lives of people in some families improve as some family members work for the industry associated with tourism.
- The negative impact of tourism is rise in crime and violence.

Cultural Impact of Tourism

(a) Brings about a mutual understanding of different cultures.
(b) Boosts up bilateral relations.

The negative cultural impacts of tourism include:

(a) The interaction may erode the native cultural norms.

(b) Spread of diseases e.g HIV/AIDS, bird flue e.t.c
(c) Unfavorable political developments.

Tourism is well developed in Europe, North America and Canada because of the following reasons:

(a) Most tourists come from these regions
(b) There is concentration of historical and cultural resources in these region

TOURISM IN MALAWI

Factors for Tourism Development in Malawi

(a) Physical environment has contributed to tourism development due to the presence of features of great scenic beauty e.g. Lake Malawi, Zomba Plateau, Nyika Plateau, and Mulanje Mountain.
(b) Good climate - The country has warm, sunshine weather that attract people from the European world.
(c) Hospitality of Malawian to foreigners also attracts visitors.
(d) Improvements in transport especially air transport i.e. it may take three days to travel from America to Malawi or a day from U.K

Tourist Attraction

They are physical as well as cultural

(a) Lake Malawi attracts people from the rest of the world because of its fresh waters.
(b) Natural parks e.g. Nyika, Kasungu attract the tourists because of great diversity of wild life and the scene are very attractive.
(c) Highlands i.e. Zomba, Mulanje attract tourist from far and beyond.
(d) Local crafts e.g beads, curios of wood, clay and stones.

Cultural and Historical Sites that Attract Tourists Include:

(a) PIM in Chiradzulu – state people
(b) Blantyre Mission
(c) Great mystery i.e. Mwala wa mtunzi, Mwala wa mphini.

Importance of Tourism in Malawi

(a) Source of employment.
(b) Source of foreign exchange i.e. in 1999 Malawi realised 7 million US dollars from tourism.
(c) Stimulation of tertiary industry e.g. hotels, air transport as well as road transport.
(d) Infrastructural development e.g. roads that lead to resorts are often taken care of from time to time.
(e) Promotes small scale industries such as the development of arts and craft (mats, baskets and carvings).
(f) Promotes international understanding and public relations.

Problems Facing Tourism Industry in Malawi

(a) Insufficient tourist accommodation
(b) Relatively high costs of visiting Malawi. The distance from Europe and America is prohibitive.
(c) In addition, the regional fares including ground costs are higher than in many parts of the world.
(d) Hotel rates are very high as compared to rates in this region of Africa.

(e) Inadequate air transportation services both to and within Malawi.
(f) Lack of enough entertainment facilities.
(g) Theft by some tourist guides.

Types and Forms of Tourism

(a) Common Interest Tourism

A group travel by people with cultural interests.

(b) Domestic Tourism

Travel by indigenous population of a country.

(c) Health Tourism

They travel by medical or non –medical personnel health resorts and establishments.

(d) Incentive Tourism

This is travel rewarded by commissions.

(e) Mass Tourism

This refers to tourism in which large numbers of tourists take part.

(f) Eco Tourism

This is the form of tourism which seeks to avoid adverse and enhance positive impact. This form of tourism promotes environmental conservation and sustains the ecology. In other areas, ecotourism is known by the following names:

- Green Tourism
- Soft Tourism
- Responsible Tourism
- Appropriate Tourism
- Alternative Tourism

When people interact (indigenous and tourists) there is mixing of two different cultures. The result of interaction between people of different cultures is known as **assimilation**. Another term for assimilation is acculturation or accommodation. The tendency of imitating the behavior of other and assimilate it as one' own is called **demonstration effect.**

Take note of the following:

(a) Infrastructural overload
(b) Environmental Audit
(c) Tourism is a catalyst to development
(d) Tourism can be a lever for social change

POPULATION

(a) Population is the total number of people in the country or region.

(b) Population of an area can be composed of

- Sex i.e. male and female
- Age groups i.e. 0-5, 6-10, 11-15 e.t.c
- Races i.e. Europeans, Africans, Asians or Indians
- Ethnic groups i.e. Chewa, Tonga, Lomwe e.t.c

World Population Distribution

Population is not evenly distributed at different places in the world. Initially the world is divided into three divisions basing of the population distribution.

(A) Highly or Densely Populated

1. Monsoon Asia: China, Japan, India, Bangladesh, Java, Srilanka. Burma, Thailands
These areas are densely populated because of favourable agricultural conditions, fertile development,
2.European Peninsula: U.K, France, Holand, Italy, Germany, Spain.
The factors for high population are:

- Favourable climate for farming
- Development of trade
- Rich mineral base of industrialization.

3. **Eastern U.S.A, Canada:** Shores of the Great Lakes regions, St Lawrence Seaway and Hob erg region.
The reasons in these areas are:

- Industries
- Trade

4. In Africa: Egypt, Nigeria, the Great lakes Region, south Africa.
The factors include:

- Agriculture
- Industrial Development
- Religion
- Good water supply
- Contact with early traders

(B) MODERATE DENSITY AREA

- South Eastern Australia
- South Eastern South America.
- Some regions of U.S.A and Canada e.g. California

(C) SPARSELY POPULATED AREAS

(i) Tundra Region

- Northern Canada
- N. Asia
- Greenland

The reason is hostile cold climate, short crop growing period, poor soil, difficult in transport.

(ii)Hot Desert Areas

- Sahara
- Namibia (Karahari)
- Gobi
- Fur
- No contact with outside world because of hostile climate.

(iii) The Tropical Rainforests

- Amazon Basin
- Dangerous animals
- Congo basin

The factors for this here are:

- Poor soils
- They are inaccessible
- They are prone to diseases

(iv) High Altitude Area

- Andes, Rockies, Himalaya

Reasons include:

- They are very cold and steep
- Soils are very thin
- There is poor communication

Population Distribution in Malawi

Patterns

A. High Density Areas: Blantyre, Mulanje, Mzuzu, Phalombe, Lilongwe, Karonga, Chiradzulu, along the shores of L. Malawi
B. Moderate Density Areas: Kasungu, Zomba, Mchinji, Dedza, Salima
C. Low Density Areas: Plateau area, Marsh areas, forested areas, hilly areas escarpment areas.

Factors Influencing the Pattern of Population

A. World Distribution of Population is affected by:

(a) **Geographical Factors**

- Climate: Degrees of temperature and rainfall
- Relief and soils.

(b) Economic Factors

- Trade
- Industries
- Mining

(b) Social Political Factors

- Stability – in countries where there are wars people are not stable.
- Deliberate government policies

B. In Malawi Population is affected by:

- Relief
- Climate
- Economic development i.e. trade, industries, transport, facilities, social-cultural centers, fishing

- Soil fertility
- Job opportunity
- Availability of social amenities and essential natural resources.

Population Growth

- This is the increase or decrease in the number of the total population of a country. In different countries of the world, the population growth rate differs. In other countries more especially developed countries like Sweden, UK, Germany; the population growth rate is low while in the developing countries like Mozambique, Lesotho and Malawi, the growth rate is very high.
- The population initially grows when birth rate exceeds the number of death rate or when the birth rate is constant but the death rate is increasing. Birth rate is the total number of births per year per 1000 people.
- Another way in which population of a country increase is through permanent international migration.
- Since population growth between developed and developing countries differ, their population structures are also different.
- Population structure is how the population of a country is spread basing on age groups.
- In developing countries like Malawi, the population growth rate is high such that there are more people in the lower age groups. There are more people (children) at the base of the population pyramid.
- There are also more females than males but more males are bone than females. More males also die than females. More males migrate to urban areas to work than females.

Reasons for the shape of the Population Pyramid for Developing Countries (Malawi)

There are more children because:

(a) Low education levels of women.
(b) Low employment opportunities for women as a result they tend to concentrate on their traditional child-bearing activities.
(c) High mortality rates which force couples to continue bearing children in hope those others may survive.
(d) Lack of family planning services.
(e) Children are regarded as a source of labour.
(f) Lack of old age and other security systems force couples to have more children as security in their old age.

In the structure for developed countries, there is a narrow base meaning that the birth rate is low. The reasons for this trend could be:

(a) High cost of living
(b) Government policies
(c) Cultural values
(d) High technological level
(e) Female emancipation
(f) Better economic status
(g) High levels of education among women
(h) Availability of family planning services.

General Factors that Affect Birth Rate

(a) **Urbanisation**

- Generally people who live in town are faced with high costs of living in terms of food, accommodation and transport.
- It is assumed that due to this many couples are influenced to have smaller families.

(b) **Economic Status**

- The income of the family has a bearing on its size. Less income families tend to have more children because children are regarded as a source of labour. Children are seen as insurance for old age person.

(c) **Education Literacy**

- This affects the age at marriage. The longer one stays in school (females) the bigger their age at marriage. As individuals are schooling most of their child bearing period is spent at school as such they may not bear as many children as they would do when otherwise.
- Education makes people more receptive to ideas than otherwise.
- Education may cultivate certain values, attitudes and aspiration.

(d) **Religion/Culture**

- Certain religious or cultural settings encourage large families e.g. Hindu. They have their culture where males inherit the father's worth such that if the family has only daughters, they still try for a boy. In Islam, polygamy is advocated where a man is allowed to marry not more than 4 wives. The Roman Catholics do not advocate the use of contraceptives in family planning.

(e) **Status of Women**

- In societies where women take part in many social-economic activities and not spend much time in the home, dislike large families. They adopt family planning methods.

(f) **Availability of Health Facilities**

- Better health facilities cut down mortality rate and later reduces birth rate.

Implication of Various Population Structure on Development

Effects of Rapid Population on Development

A. The population structure with wider base (more children) may have the following implication on development:
    - Levels of Living Standards will be Low
        (i) Less attention to cultural values.
        (ii) There will be less job opportunities.
        (iii) Education levels will be low
    - Economic and Social Choices May Not be Expanded:
        (i) There will be high dependency ratio
        (ii) People may not be free from forces of ignorance and human misery.
    - No increased Distribution of Basic Life Sustaining Goods
        (i) Poor and inadequate food
        (ii) Poor accommodation
        (iii) Inadequate health services
B. Development is the process which involves changes in structures, attitudes and institutions as well as acceleration of economic growth, reduction of inequality and eradication of poverty. This is possible when the population growth (structure) is like that of developed countries where there are low birth rates. Under this circumstance development ought to:

- Raise levels of living by providing higher incomes, more jobs, better education and more attention to cultural values.
- Expand the range of economic and social choices to individuals by freeing them from dependence on others
- Increase the distribution of basic life-sustaining goods such as food, shelter, health and security to people

Strategies for Controlling Rapid Population Growth

(a) Establishing family planning programs to provide health and contraceptive services.

(b) Manipulating economic incentives and disincentives to have children by:
- Imposing minimum age child labour laws.
- Reducing or eliminating maternity leaves and benefits.
- Establishing old age social security provision e.g pension
- Raising school fees to eliminate heavy public subsidies for secondary and tertiary education.
- Subsidising smaller families through direct money payments. Taiwan and India have done this already.

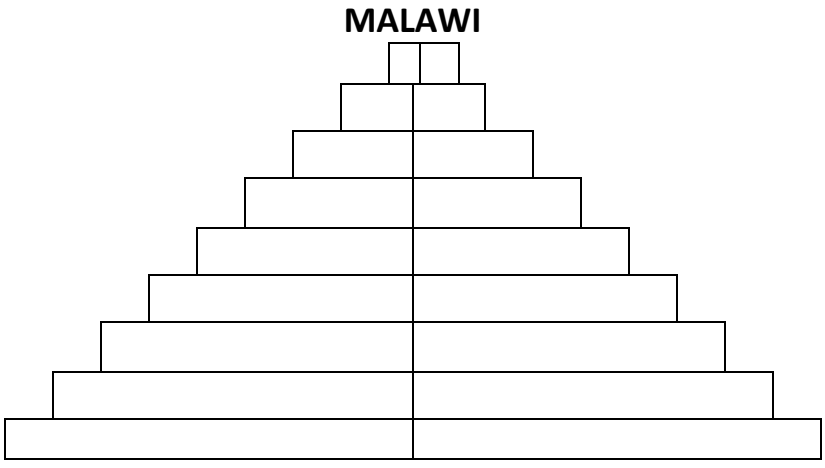
(c) Persuading the people to have smaller families through mass communication media (TV, Newspaper, radio, adult education.

(d) Forcing people to have smaller families through legislation and penalties. In India where men having three or more children undergo sterilization or face severe fines and prison sentences. In Britain, it is an offence or dismissed to get married under 18 years old.

(e) Relocating population away from rapidly growing areas by eliminating the imbalance in economic and social opportunities between regions within a country

Possible Strategies
- Eliminating maternity leave and benefit.
- Raising school fees in tertiary education.
- Persuading people to have smaller families.

Indicators of Development
- High levels of living standards.
- Increase in the economic levels among women
- Even distribution of social amities
- Availability of portable water



Population Policies

India

India is the second highly populated country. To reduce population growth, India has the following population policy:

- Family planning campaigns
- Where contraceptive methods fail, stelirisation is used
- Gifts and money are given to people who volunteer to be sterile of dismissing those who do not volunteer to sterilize.

Taiwan

- Family planning campaigns
- Subsidising smaller families through direct money payments.

Great Britain

- Family planning campaigns
- Limiting marriageable age for girls. It is an offence for a girl to marry under 18 years.
- Provision of old age social security

Egypt

- Has government backed up family planning schemes throughout the country although religious establishment encourage early marriage and do not advocate the use of contraceptives.

China

Has the largest population in the world where almost one in every four people you meet is a Chinese. To reduce such a population, high growth rate the following is done:

- Wide spread and active family planning campaigns
- Encouraging late marriages. Legally 2-3 children are allowed.
- Contraceptives, sterilization and abortion are used in rural areas.

Nigeria

- Has a population of 120 million, highest in Africa. To curb rapid population growth there are country-wide and government-backed up family planning campaigns which provide contraceptives and encourage smaller families.

Malawi

- Family planning programs
- Late marriage advocacy
- Women empowerment
- Girl child education, NGO involvement in civic education campaign
- Use of electric and print media for mass communication
- The population graph above is showing a J curve growth pattern.
- Population growth was slow between 1700-1850 because of
    - (i) High death rates
    - (ii) Poor health facilities
    - (iii) Poor living standard
    - (iv) Poor maternal care

Between 1950 – 2000 there is population boom as exponential growth.

SETTLEMENTS

A settlement is a place where people live and have built homes or a grouping of people, their activities, building structures and transport links that function as an entity.

Types of Settlements

There are two types of settlements which differ in their functions:

- Rural settlement
- Urban settlement

Rural settlements are unifunctional and are concerned with primary activities such as agriculture.

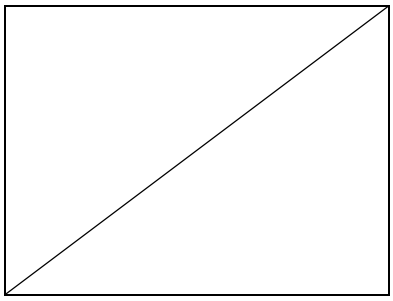
Urban settlements multifunctional and concerned with secondary activities such as manufacturing and tertiary activities.

Settlement Patterns

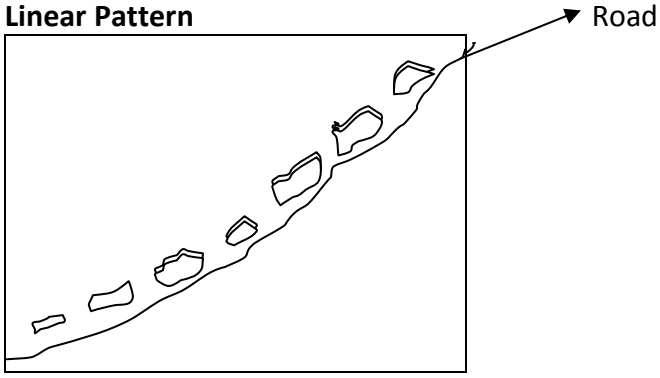
There are three main types of settlement patterns

i. Linear
ii. Clustered/Nucleated
iii. Dispersed/Random

Clustered or Nucleated Pattern



Linear Pattern



Factors that Influence Settlement Pattern

(a) Human Factors

- Location of employment opportunities
- Growth or loss of population
- Availability of leisure facilities
- Planning policy and control

(b) Level of Technology

- It affects population mobility
- Differing source of employment
- Transport network
- Type of building
-

(c) Historical Influences

- Attraction and constants of earlier settlements
- Route network as well as current network

(d) Physical Environment

Effects of terrain, drainage, water supply, accessibility, soil fertility.

Relief

- Plain areas tend to have nucleated settlement than high areas which have no arable land.

Water Points

- Have nucleated settlements than dry areas which have scattered settlements.

Soil Condition

- Fertile soils encourage nucleated settlement while unproductive soil scattered settlements.

Functions of Settlements

Settlements have many functions ranging from social, economic to physical

a. Agricultural Links

- Rural settlements provide agricultural products to the urban areas of fruits, maize, vegetables on the other hand towns act as the markets

b. Industrial Purposes

- The urban based factories process the raw materials from the rural areas while the rural areas use the products from the urban areas.

c. Trade Linkage

- The rural areas provide customers for the town retail shops on the other hand the urban areas provide specialized facilities to the rural areas e.g health, banking, tertiary education e.t.c.

d. Social Linkage

- Rural people travel into town to enjoy some entertainment and other cultural facilities while the urban dwellers travel to rural settlements to enjoy the scenery or seeing folks.

e. Community Linkage

- Rural people may travel to town for work vice versa.

URBANISATION

- This is the process by which an ever-increasing percentage of the total population of a country is accommodated in urban rather than rural settlements. There is a difference between urbanization, urban growth and urban expansion.
- Urban growth is the increase in the number of urban dwellers. This can take place without urbanization taking place.
- Urban expansion is the physical or area growth as urban population increases. This is also called physical urbanization.

Factors Responsible for Urbanisation

- Rural-Urban migration
- High rate of natural increase in urban areas through births.

Reasons Why People Migrate to Urban Settlements

a. Social Factors

- To break away from traditional constraints of social set-up

b. Demographic Factors

- High rural population growth rates force people to try their luck in urban areas

c. Physical Factors

- Climate and meteorological disasters such as droughts, floods force people to abandon their homes and move to the urban.

d. Economic Factors

- This is the main factor where people would like to find employment in the urban area.

e. Cultural Factors

- People are attracted with the city life e.g. education, bright lights, entertainment e.t.c.

Initially the following factors may be the pull factors in the urban setting attracting people from the rural areas.

- Industrialisation
- Market potential
- Increased education
- Perception
- Increased service activity transport improvement.
- Social and cultural attraction.

Factors that have led to the Growth of the Cities in Malawi

Blantyre

- It is a base for missionary expansion.
- Presence of teas estates in Mulanje and Thyolo
- Industries and commerce
- Accessible due to good transport networks e.g. road, rail and air
- It is an administrative centre.
- It is an education centre e.g. Polytechnic and College of Medicine

Lilongwe

- It is a capital city - many administrative functions are done here

- Has rich agricultural land
- It is most accessible hence a route focus
- Some industries which were in Blantyre have been opened in Lilongwe
- Industry and commerce

Reasons for Shifting the Capital from Zomba to Lilongwe

- Lilongwe is the central point of Malawi
- Lilongwe is more connected to other areas than Zomba
- Many agricultural works take place there hence more products for industrial works.
- Lilongwe is an administrative centre.

Mzuzu

- Mzuzu is a commercial as well as industrial city.
- Mzuzu is an administrative centre for both government as well as private sectors.
- Establishment of Tung estates in the Vipya area.

CITY	1977	1987	GROWTH RATE
Blantyre	229, 000	333, 120	3.8%
Lilongwe	102, 000	223, 318	8.1%
Mzuzu	16, 108	44,217	10.6%

Problems Created by Rural Urban-Migration

Urban-migration creates problems in both the rural and urban areas.
Problems in the rural will be rural depopulation which results into:

- Economic stagnation
- Decrease in food production
- Insecurity
- Abandoned and neglected houses
- Many elderly but less young people
- Poor services
- Unmaintained roads and schools.

In the urban areas the problems created will be as follows:

- Housing shortages
- Loss of agricultural land as physical urbanization progresses
- Congestion
- Pollution
- Squatting
- Crime increase
- Drug and alcohol abuse
- High rate of prostitution
- Environmental despoliation

Effects of Urbanisation

There are positive and negative effects urbanization

Positive Effects of Urbanisation

- Provide plenty employment opportunities
- There is high order social and cultural amenities
- Better and easy transport networks.
- High standard of living
- Lessen pressure on resources in the rural areas
- Reduces environmental degradation in the rural areas as more people rush to the urban area.

Negative Effects of Urbanisation

- Effective administration becomes difficult traffic congestion which becomes out of control
- Worsening on slum conditions
- Reduction in the quality of urban life because of pollution and environmental despoliation

Problems Created by Urbanisation

a. Centralisation
b. Congestion
c. Urban decay
d. Urban sprawl
e. Excessive congestion of people in cities
f. Causes regional imbalance of the development and prosperity level

Solution to Problems Associated with Urbanisation

- Providing parking areas
- Accelerating traffic flow by providing freeway, one way streets and traffic lights
- Discouraging cars from coming to the CDB by introducing parking meters and imposing fees for entry into the CBD.
- Building satellite towns e.g. Matawale, Gulliver e.t.c which reduce overcrowding and pollution.
- Demolishing and redevelopments.
- Building skyscrapers to create space and reduce over crowdness
- Creation of rural growth centers.
- Creation of rural growth centers.
- Expanding existing commercial and industrial activities and creating new ones to provide employment.

NOTE

Since these solutions are temporary and may cause urban sprawl (uncontrolled physical urbanisation) proper policies can be long lasting solution to urbanization problems.

Policies that can Reduce Rural-Urban Migration and the Effects

- Reduction of imbalance between the economic opportunities in the rural and urban sectors.
- While creating jobs for urban unemployed, the rural areas should be improved in terms of income and employment opportunities.
- Encouraging integrated rural development problems.
- Creating and expanding small-scale labour intensive industries.

- Modifying direct linkage between education and employment.
- Elimination of factor price distortions between the rural and urban areas.

Types of Cities

A city is an urban area with population ranging from 1, 000, 001 – 1, 000, 000. This has considerable diversified functions.

a. Conurbation

This is a large city that has been formed as a result of merging of originality separated towns or cities e.g London, Malchester, Chicago, Tokyo

b. Megalopolis

This is a city that is bigger than a cornubation formed by merging of cornubations or large cities (vast urban zone).

c. Primate Cities

This is a very large city formed from merging of megapolicies.

A single primate city can dominate the whole country e.g Buenos Airs, Kinshasa, Lagos.

Differences between Rural and Urban Settlements

RURAL	URBAN
• They are conservative	• Highly and closely packed buildings
• Rigidity	• A lot of human mobility
• Slow in things	• Non agricultural functions
• They are calm	• A lot of individualism
• Life is less stressful	• Numerous and diverse groups of people
• Quieter settlements	• Share some social and economic facilities yet lacking strong social contact
• Introversions	• Complex class structure
• Homogenous way of life	• Heterogeneous ways of life
	• Wide variation of human health

Green Belt

This is a stretch of land round a town of city where building is not allowed

Reasons for the Presence of Green Belts

- To restrict new buildings in an area around the town or city.
- To prevent urban sprawl.
- To protect agriculture land around the city from being belt with houses.
- To prevent squatter around the city which usually have poor conditions. Squatter do not pay rents and does not contribute to development.

Site

This is an actual piece of land on which a settlement is built

Situation
This is the relationship of a settlement with its immediate environment.

Factors that Encourage Dispersed Settlement and Nucleated Settlement

a. Relief
Hilly areas have scattered settlement while plain areas have nucleated settlement.

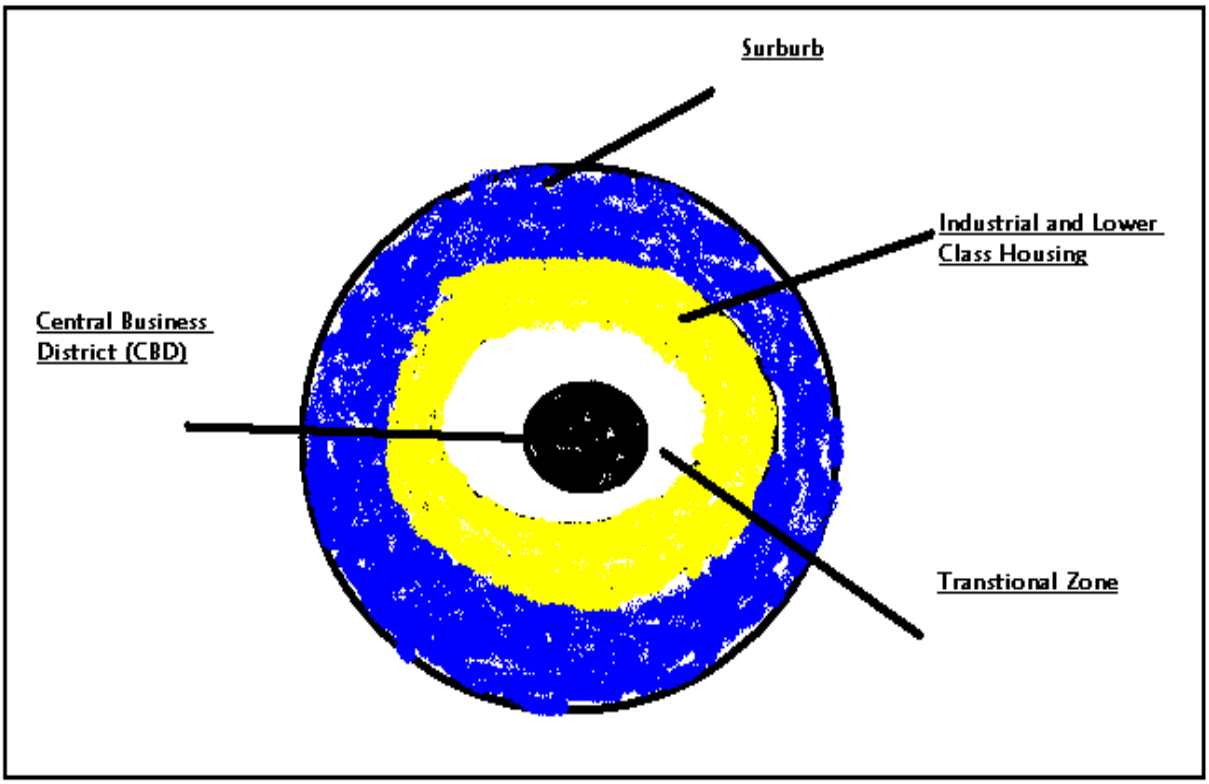
b. Water
When water is available, every where settlements are dispersed but where water is scarce settlements are nucleated.

c. Agronomic Factors
Private land ownership leads to scattered settlement. Extensive type of agriculture system influence dispersed settlements.

d. Social Conditions
Fertile soils encourage nucleated settlements and unproductive soils scatter the settlements.

e. Social and Cultural Factors
Safety considerations land holding traditions and policies have varying degrees of influences on settlements.

City Zoning



The city is divided into zones based on the functions:

Central Business District

- This is the heart of the city.
- High-order functions are founding e.g
    (a) Professional services
    (b) Retail shops
    (c) Administrative services
    (d) Entertainment establishments
    (e) Financial institutions
    (f) Hotels and good restaurants
    (g) Concentration of tall buildings which means great intensity of land use.

Characteristics of the CBD

- Very high accessibility
- Absence of residential activities
- Absence of manufacturing activities
- Internal specialization of activities of hotels, banks, shops, travel agents.
- High land value
- Reduced accessibility during day but depopulated at night

Transitional Zones

- There are commercial establishments that require large space.
- Some hotels
- Supermarkets
- Public buildings
- Little residential use

Industrial and Lower Class Housing

- Narrow streets and crowded
- High population density
- Land value is relatively low

Suburb Zone

- This marks the outskirts of the city
- There are wider streets
- Housing is better
- There is low noise level
- The land value is high

TRANSPORT AND COMMUNICATION

The increase in trade, manufacturing and travel to foreign land has posed a great need for better, affordable and fast need of transport. Before technology man depended on animals such as the yaks, reindeers camels and huskies among others for transport. These days many people no longer relay on animals as their main means of transport. There are three main categories of transport used by people basing on their convenience. Each of them has advantages and disadvantages.

Factors that influence the type of transport to be used

- The nature of transport to be used
- The cost of transporting the Items
- The speed at which the items are to be transported

Land Transport

This is categorized into

1. Road transport

This is perceived as the main means of transport in many countries. Lorries trucks busses and other small cars carrying different amount of good pass along these roads.
Roads exist in different sizes and are also known by different names in different countries

- High ways in USA and Malawi
- Motor ways in UK
- Autstrada in Italy
- Autobahn in Germany

Advantages

- They are more convenient because they form direct links between producers and consumers
- Roads can be constructed almost every where on earth.
- It is good for shorter distances.
- It is relatively faster as compared to water transport

Disadvantages

- They are expensive to construct and maintain.
- Maintenance cost is also expensive
- They cause a lot deforestation and destruction of valuable farming lands
- They lead to relocation of people especially when the road passes through people's settlements.

2. Railway Transport

This is quite significant in industrial regions and areas where great production of agriculture commodities is done.

Advantages

- They carry large and bulk amount of goods
- They are convenient for longer distances
- Fares for transporting the goods are lower as compared to the other means of transport.
- They are fairly adaptable to the terrain of the area.

Disadvantages

- Difficult to reach the destination and needs another means of transport to reach the destination
- The overhead costs for establishing railways are very high
- Railways in most cases pass through the remote areas as such not preferred by many people
- It is slower means of transport
- Some times it has traveling schedules.

Water Transport

They are in two categories:

- In land water transport
- Ocean Transport.

A. Inland Water Transport

This uses rivers, lakes, dams and canals.

This means of transport is mostly used by densely populated regions of Europe and north America for transporting their raw materials e.g. Coal iron ore, rubber timber; finished products e.g. machinery.

In USA the Great lakes joined by the Welland and Soo canals and the St Lawrence Sea way constitute the most important water way world wide.

Advantages

- They are very cheap than any other means of transport
- They use natural water which means that there is no need of constructing artificial routes.
- They transport large amount of goods at once over long distances
- It is ideal for fragile goods.

Disadvantages

- Natural courses of rivers are not flexible hence cannot be altered.
- The river floors have no uniform depth which needs improvement through dams and locks.
- Some rivers like the Zaire and Amazon flow through dense impassable forests which are sparsely populated.
- Water falls and rapids present in some rivers obstruct the smooth navigation of rivers
- Some inland routes are seasonal such as the Lena, Ob and Yenisei rivers in Russia because during a certain period of the year they become frozen as such ships cannot operate.
- Some rivers experience a lot of siltation due to alluvial and sand bars deposition during the rain season especially in areas where deforestation is very high.
- Dredging of silts to maintain uniform depth is also expensive.
- Some rivers are so winding that their commercial navigation is much reduced because they lengthen the distance and the journey becomes much slowed.
- Seasonal fluctuation in the volume of water levels due to changes of rainfall amount received from one year to another affects the navigability of the rivers.

B. OCEAN TRANSPORT
This provide link between one continent to another.

Different vessels operate along the oceans for various purposes.
1. Passenger Liner: carries passengers, express mail and high valued freight

2. Cargo liner: This combines passengers with freight. They contain refrigerated containers for keeping perishable fruits and meet.

3. Packets: These are used for crossing narrow straits or seas. They are also called ferry boats

4. Independent Cargo Boats
These include all kinds of tramps that carry goods of between 2000-10 000 tonnes. These do not have specific time schedules of travel.

5. Industrial Carriers:
These include oil tankers, colliers (take coal), banana and grain carriers. Note that oil tankers are the larges t ships afloat.

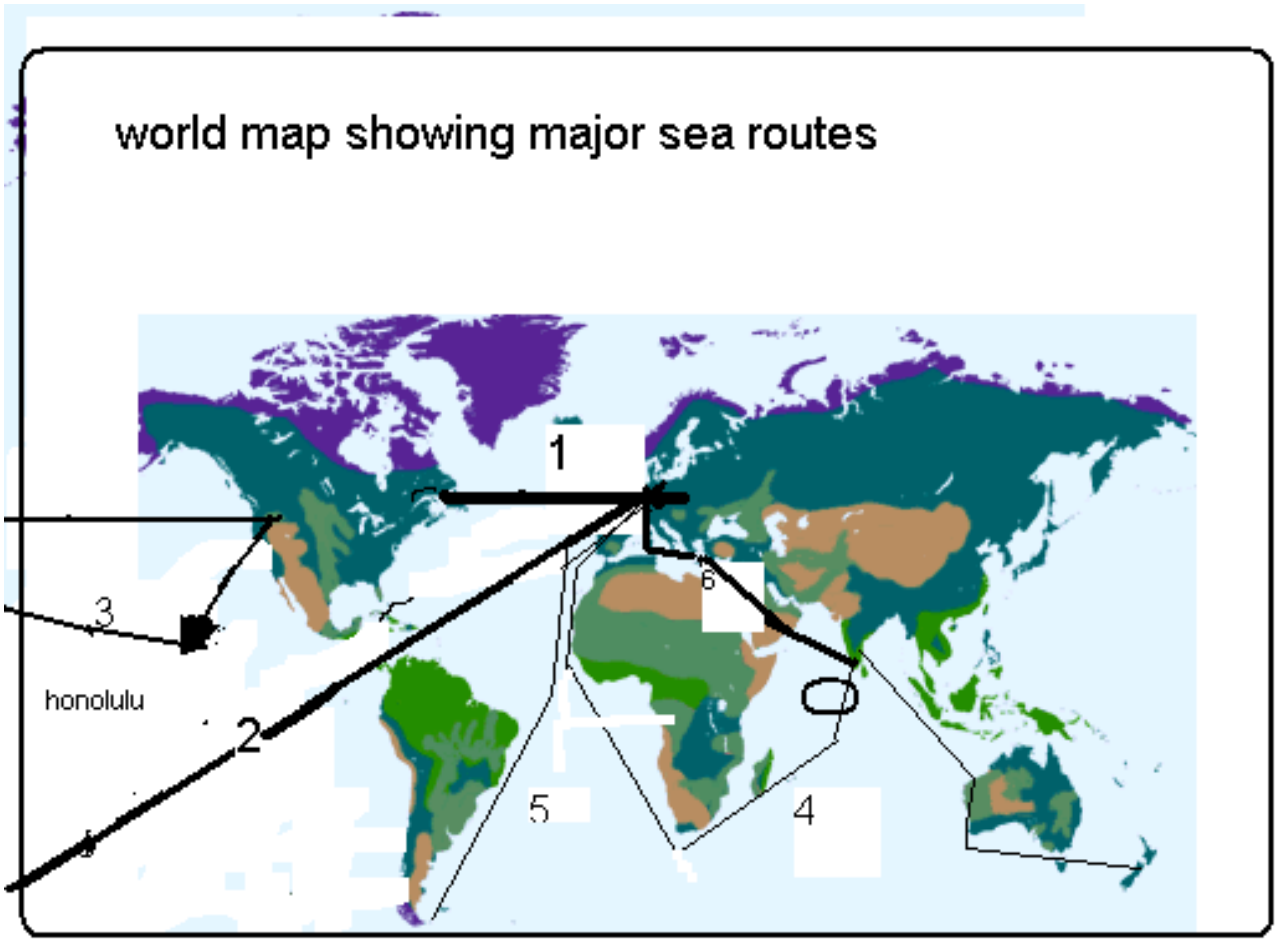
6. Containerization. This is the latest development. There are special ships designed to carry containers.

The advantages of containerization are;
- Breakage and theft are minimized
- Minimises labour costs because goods can be palletized or parked in cartons
- Handling of goods is easier
- Transfer of goods to land transport by rail or road transport is easier.

However containerization has the following limitations:
1. Specially designed Lorries, train or ships
2. Specially designed crane equipment and port storage goods.

7. Coastal Shipping vessels.
- These carry more bulky goods which are not sent by rail.
- They compete with the inland roads and railways for carriage of the local products.
- They move irregularly hence have little passenger traffic.

WORLD SEA ROUTES
Factors that influence Ocean Sea Routes
- Supply and Demand: There must be goods to be carried and a market for them
- Availability of ocean terminals
- Absence of physical barriers such as ice burgs and strong winds
- Nature of cargos



There are six main water routes

1. The North Atlantic Route

This is the busiest and most important sea route.It joins Europe and North America which are the world's most industrialized continents .These areas are highly developed and people have high living standards. Major sea ports lie within this route such as London, Southampton, Humburg, Liverpool, Glassgow, Rotterdam, Boston, Montreal, Philadephia, Quebec. Goods carried along this route include Wheat, cotton, paper, wood pulp, iron, timber, copper, steel and transport equipment from America.

2. The Panama Canal route-Indian Central American route.

This route started as a result of completion of the Panama Canal which forms a gate way to the pacific ocean. It eliminates the long and hazardous voyage round the stormy Cape Horn.Goods carried along this route are:

From the Far East and pacific States: oil, gold, copper, tin, nitrates, sugar, coffee, timber, wheat dairy products, wood and meat.

From Europe and atlantic states are: machinery, mining equipment, cars, drugs, textile , nes print, and chemicals.

3. The Trans –Pacific Route

Trade across the vast North Pacific Ocean goes by several routes at **Honolulu** for refueling and servicing. This route joins Vancouver and Yokohama in Japan and reduces the distance by half. The ocean terminals that serve this route include; Vancouver, Seattle, San Francisco, Los-Angeles

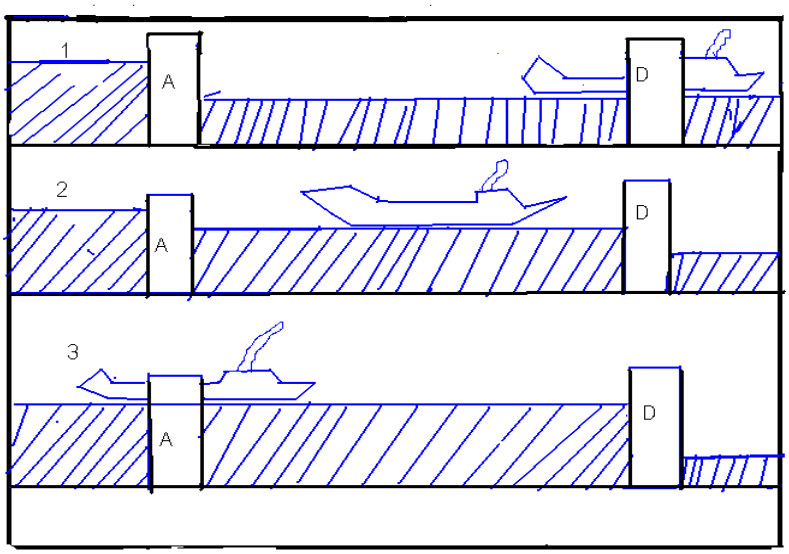
on American side. Goods passing through this route are wheat, wood, paper and pulp, timber, fish, and dairy products
From the eastern continent (Asia) Manufactured goods e.g. textiles, electrical equipment, rubber, palm oil, teak, tea and tin.

4. The Cape of Good Hope Route
This route became more operational when the Suez Canal was closed in between 1965 -1975due to the Arab-Israel conflicts. How ever it is the oldest route sailed and named by Vasco d agama. Many shipping companies do not use it because it is very long hence not economical. It links western part of Africa, eastern part of South America with Asian Sub continent-India.
Goods transported through this route include: meat, oil, copper, diamonds, and manufactured goods from the west. Cotton, oil, fruits, coffee, tea, tin, groundnuts, tobacco, diamond and manganese fro the eastern world.

5. The South Atlantic Route
This connects regions of sparse population and more limited economic development
There is also little trade on the east-west route between Rio de Janeiro and Cape Town because South America and South Africa produce the similar type of products and resources.
A fair volume of traffic also passes between the eastern South American countries, North America and Europe.
Goods passing through this routes include; wheat, meat, wool, flax, and other products from Argentina. Coffee and cocoa from Brazil.

6. The Suez Canal Route
This route links the Far East with Europe and it became operational with the opening of the Suez Canal.
Goods carried through this route; from Europe to Asia they include: manufactured goods, textile, chemicals paper, machinery, fertilizers.
From the Far East to Europe: petroleum, cotton, tea, coffee, sugar, meat, fruits, hides, rubber and cars.

How Locks Operate to Raise or Lower Ship from Low Altitude to High Altitude or from Higher Altitude to Lower Altitude along the St Lawrence Sea Way



Lock Operation

Locks help to raise the ship when it coming from area of low altitude to areas of higher altitude. They also help to lower ships as they move from higher altitude to areas of lower altitude.
Locks are common along the St. Lawrence Sea Way. For example, Port Montreal is at 7m above the sea level while Duluth port in Lake Superior is 183m above the sea level.
In 1 the ship approaches lock D and the gate sluices open so that the water level between A and D beyond becomes the same, the ship passes through.
In 2 lock D is now closed and A is opened. The ship rises as the water level rises between A and D.
In 3 the ship is passing through lock A as the sluices are opened and the water level between D and A beyond becomes the same.
In the same way when the ship goes to the opposite direction from A to D ,A starts to open .The ship passes as the water level lowers so the ship lowers down as it passes through to D while D remains closed. Lock D opens when the ship approaches it so that the water level between A and D beyond is the same and the ship passes through D and sails on.

Canals
There are many canals all over the world but the commonly used are the Panama Canal and the Suez Canal.
Panama Canal connects the Caribbean Sea and the Pacific Ocean.
It was opened in 1914.It is 80 kilometres long and has got locks
The Suez Canal connects the Mediterranean Sea and the Red Sea. It is 160 kms long. Suez Canal has an advantage over Panama Canal because it has no locks.

Air Transport
This mode of transport carries people and goods of high value.

Advantages of Air Transport
- It is very fast and reduces transit time
- It uses direct routes which are easily followed.
- It is relatively independent of physical barriers such as mountains because aeroplanes fly over them.

Disadvantages of Air Transport
- It has limited carrying capacity
- Freedom of the air space is not automatic as permission has always to be obtained in order to fly over each country.(political factors)
- The increase of air transport and increase in the sizes of planes many air terminals are not adequately equipped.
- Air transport is much expensive than any other means of transport.
- It is always dependent on good communication and good weather conditions in the atmosphere.

Note: USA commands 50% of the world's total air traffic while Europe becomes second with 20%.

Railway Distribution in Africa
Railway construction is affected by a number of factors
- Relief of the region in which the railway passes.
- The productivity of the region to be served by the railway.
- The availability to be used by the trains

- The degree of economic development of the region in which the rail way is operating.
- The frequency of thunderstorms, sandstorms, and land slides in the region served by the railway.

The factors above affect distribution of railways such that in some areas there are more railways while in other areas there are few or none.

1. NORTH AFRICA

This region has lowest railway distribution because it is un productive and there are a lot of sand bars which cover the railways available.

There is less demand of rail transport because settlements are forced away to the coastal region from the Sahara Desert.

2. NORTH EAST AFRICA

There are almost no railways in this region because of the following reasons

High plateau with deep valleys in between

Ethiopian Highlands with their escarpment and deep river valleys.

3. CENTRAL AFRICA

Construction of railways in this region is problematic because of;

- Hot equatorial climate and frequent thunderstorms
- Low level of economic development
- Presence of mountains to the eastern part e.g. Kilimanjaro, Elgon and Ruenzori.

4. SOUTHERN AFRICA

This region has the highest concentration of railway lines because of the following factors

More economic activities take place there e.g. tea, tobacco production in Malawi, mining in Zambia and Zimbabwe and manufacturing in South Africa.

South Africa has the highest concentration of railways.

EXAMPLES OF RAILWAYS IN AFRICA

1. Tanzara Railway Line
   - From kapiri Mposhi in Zambia to dares-Salaam in Tanzania.
   - It was opened to help Zambians export copper and import manufactured goods.
   - This rail way carries people cement, minerals and fuel.
2. The Trans Cameroon Railway Line
   - Designed to link north of Cameroon, Chad and Central African Republic.
   - The goods transport through this rail are cattle, cocoa, coffee, cotton and ground nuts
3. The Nacala Railway Line
   - This links Malawi and Mozambique.
   - It runs from Nkaya to Nayuchi in Malawi and Nayuchi to Nacala in Mozambique.
   - Malawi's imports and exports are carried through this railway line.
4. The south African Railway
5. The Lobito Beira Railway line
6. Njamena-massawa Railway
7. Zimbabwe Railway line
8. Uganda Railway line which joins Lake Victoria.

TRADE

Trade is the buying and selling of commodities between two countries which is done through import and export.

Trade is done because no country can provide all that is required to increase national worthy. To achieve trade requirements, regional economic groupings of countries are formed .These trade groupings encourage free trade.

Countries compete in specialized areas in which they have comperative advantages.

Free trade is established to abolish tariffs between countries within a grouping in order to increase trade volumes.

Examples of Economic Groupings

COMESA	Malawi,Zambia,Zimbabwe,Tanzania,Angola,S.Africa
SADC	Malawi, Zambia, Zimbabwe, Tanzania, Angola, S.Africa , DRC,Swaziland, Congo, Lesotho, Seychelles, Mauritius
ECOWAS	Chad ,Nigeria, Burkina Faso, Senegal, Sierra-Leone, Mali, Ivory Coast
LAFTA	Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, Paraguay, Peru, Uruguay, Venezuela.
EAC	Kenya, Tanzania, Uganda.
CACEU	Cameroon, Central African republic, Congo, Gabon
CFTA	Barbados, Guyana, Jamaica, Trinidad, Togo, Antigua, Honduras, Dominican Republic, Grenada, Montserrat, St.Lucia, St.Vincent
AG	Bolivia, Chile, Ecuador, Peru, Columba
EU	25 European States
CACM	Costa Rica, Elsalvador, Guatemala, Honduras, Nicaragua

ABREVIATIONS

AG : Andean Group (1969)

CFTA: Caribbean Free Trade Area (1968) and 1973 as Caribbean community.

CACEU: Central African Customs and Economic Union (1964)

EAC: East African Community

ECOWAS: Economic Community of West African States(1975)

LAFTA: Latin American Freed trade Area

SADC: Southern African development Community (1980) –head quarter in Gaberone in Botswana

Aims of SADC

- To achieve peace and security
- To achieve economic growth and common political values.
- To encourage employment opportunities among member states.

Aims /Functions of COMESA

- To form a free trade area
- T o formulate economic property through regional grouping.
- To improve transport and communication between member states.

The Economic Integration

- This provides a big domestic market.
- Encourages a rational division of labour among countries.

- Coordinates industrial planning.

Importance

- Expansion of commercial interchange
- There is full use of industrial capacity.
- Specialization of production increases industrialization and fosters economic growth

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