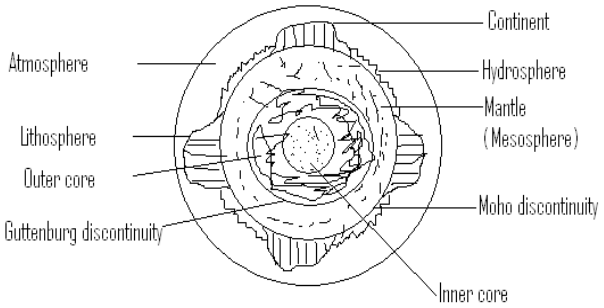
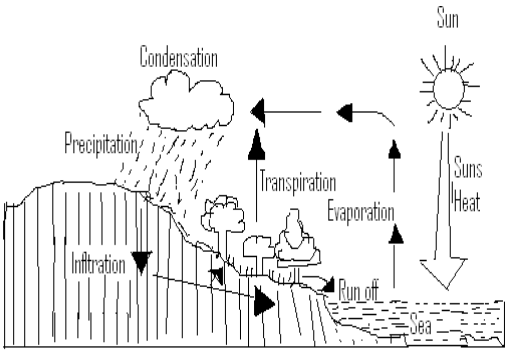
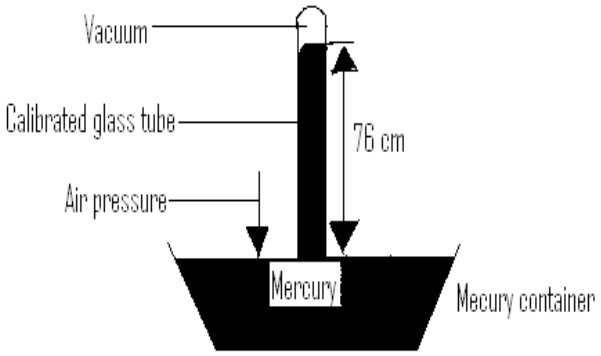
SYLLABUS BASED MSCE PHYSICAL GEOGRAPHY







SUMMARY NOTES

FORWARD

The syllabus based Malawi School Certificate of Education (MSCE) Physical Geography summary notes has been designed in relation to the standards of the senior Geography teaching syllabus of Malawi. It has been compiled to be a user friendly and easy to understand material worth to be used by both the teacher and students. It is document that will be trusted by the user while preparing for Malawi National Examination Board Examinations as far as Physical Geography is concerned. I wish you well as you are going through the book.

Chipoza H.M.

TOPICS

1. *LITHOSPHERE*

2. *HYDROSPHERE*

3. *THE SOLAR SYSTEM*

4. *ATMOSPHERE*

5. *CLOUDS*

6. *CLIMATE AND VEGETATION*

7. *ECOSYTEMS AND ENVIRONMENT*

TOPIC 1: LITHOSPHERE

DEFINITION: A solid crust that surrounds the mantle of the earth.

Litho means rock or rock.

Lithology is the study of rocks.

INTERNAL STRUCTURES OF THE EARTH

- Core (Barysphere)
- Mantle (Mesosphere)
- Crust (Lithosphere)

CHARACTERISTICS OF THE INTERNAL STRUCTURE OF THE EARTH

CORE

- The most interior part of the earth also called the **Barysphere**
- It has the outer and the inner part
- It is 3476 km in radius
- Made up of Iron(Fe) with some Nickel(Ni) – hence – called **NIFE**
- The temperature is estimated to be about 1927°C and subjected to high pressure. It is also expected to be in liquid state due to high temperature
- It is the source of gravitational force (Centripedal force)

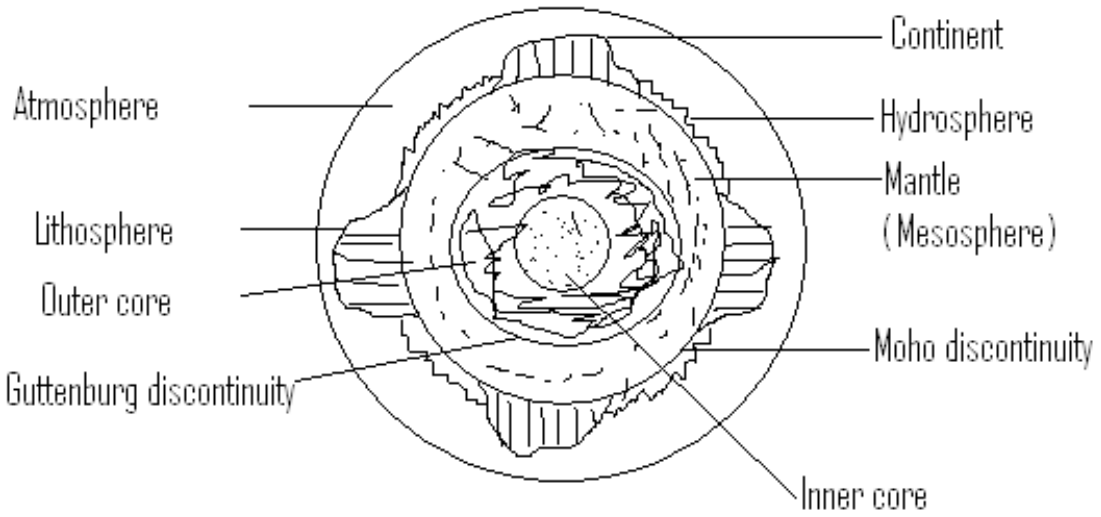
MANTLE

- 2900km thick
- Found between the core and crust
- Composed mainly of dense rocks rich in olivine and silicate minerals
- Upper part capable of flowing
- Convectional currents present causing plate movements
- Separated from the core by the imaginary line called the Gutenberg discontinuity

CRUST

- 5 to 48km thick
- The solid crust that surrounds the mantle of the earth
- Separation from the mantle by the **Moho discontinuity**
- Consists of a thin loose layer called soil
- It extends to a depth of 33 km below the earths surface
- Projects above the hydrosphere to form continents
- It has two parts: **Upper part** forming continents and its minerals are Silica and alumina (SIAL) and **lower part** with denser basaltic rocks forming oceanic floor i.e. Silica and magnesium (SIMA)

FIGURE 1: LAYERS OF THE EARTH



CONTINENTAL DRIFT THEORY

DEFINITION: The moving apart of continents due to the movements of the tectonic plates

PHYSICAL OCCURENCES WITHIN CERTAIN PERIODS, MILLION YEARS AGO

a. **Permian Period (225 Million years ago):** A single super continent **Pangaea** surrounded by a single super ocean **Panthalasa**
b. **Early Triassic (200 Million years ago):** The Pangaea broke apart and the land blocks separated in a sideways direction.
c. **Late Triassic (180 Million years ago):** Two land masses formed i.e. **Laurasia** broke into North America, Greenland, Madagascar, India, Australia and Antarctica. **Gondwanaland** broke into Africa and South America.
d. **Late Jurassic (135 Million years ago):** Land masses formed from Laurasia and Gondwanaland gradually moved apart.
e. **Late Cretaceous (65 Million years ago):** India moved northwards to join Asia. South America drifted northwards to join North America that was moving westwards. Antarctica moved southwards.
f. **Quaternary (Less than 1 Million years ago):** The continents attained their present position but still continue to drift apart.

NOTE: *The water of the super continent formed the oceans we see today e.g. Atlantic, Indian and Pacific Ocean.*

EVIDENCES SUPPORTING THE THEORY

- Magnetism of ancient rocks
- Climatic changes
- Southern continents fitting in jigsaw
- Almost identical rock layers
- Folded ranges of Argentina are similar in structure to those of the cape in South Africa
- West African rocks similar to those of Brazil

WEAKNESSES OF THE THEORY

- It is not clearly known when the movement took place
- It does not explain what caused the drifting process
- Fossil plants seen today might have been drifted away by ocean currents or wind and not the continental drift
- Polar wandering: The position of the magnetic poles seem to have wandered all over the earth

RIFT VALLEY

When the earth's crust bends, folding occurs but when it cracks, faulting takes place.

Faulting may be caused by tension (moving apart) or compression (moving closer)

Tensional forces tend to pull the crust apart leading into the formation of faults.

If the block surrounded by the faults does not move or rise and the land on either side sinks, the outstanding block becomes a horst or a block mountain.

The subsided (central) part sinks and forms the rift valley when tensional forces occur.

CHARACTERISTICS OF RIFT VALLEYS

- The sides are very steep
- They are along and deep e.g. The Great East African valley is about 7,200 km long with 5,600 km within Africa
- Almost flat floors

PLATE TECTONICS THEORY

EXPLANATION

a. DEFINITION OF THE PLATE TECTONIC THEORY

- The earth is composed of oceans and continents which are carried on six large and several other small plates which float on the soft layer called the **Asthenosphere** and continuously moving due to the convectional cells or currents operating within the upper part of the mantle.

b. CAUSE OF TECTONIC ACTIVITY

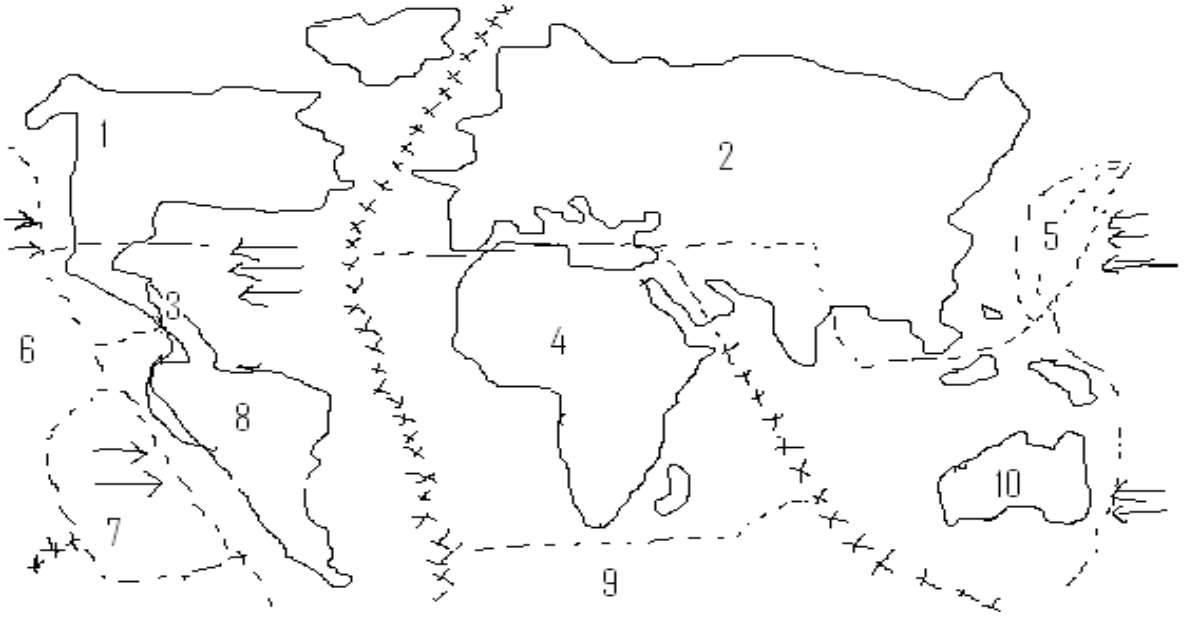
- Convectional currents that operate within the upper part of the mantle cause this tectonic activity
- These currents are responsible for plate spreading or divergence and collision or convergence.

c. TYPES OF PLATES

The plates are also called ***Lithospheric slabs.***

- **Continental plates:** They are lighter and they carry continents e.g. North American Plate etc
- **Oceanic plates:** They are denser as they contain heavier basaltic rocks forming oceanic floors e.g. Pacific plate.

FIGURE 2: WORLD DISTRIBUTION OF PLATES



TYPES (EXAMPLES) OF PLATES AND MOVEMENT

1. North American Plate - Westward
2. Eurasian plate - Eastward
3. Caribbean plate - Westwards
4. African plate – NE wards
5. Philippine plate - Eastwards
6. Pacific plate - Westwards
7. Nazca plate - Eastwards
8. South American plate - Westward
9. Antarctic plate -
10. Australian plate – NE wards

d. PLATE COUNDARIES

Zones of instability and the changes that place in the margins lead to the formation of some of the following features: rift valleys, plateaux, block mountains, oceanic ridges, oceanic islands, volcanic and fold mountains.

- **Destructive margins:** Margins of converging plates and they are called destructive margins because this is where the crust is destroyed.
- **Constructive margins:** These are margins of diverging plates so – called because these are places where new crust is formed.
- **Conservative margins:** Margins that occur where two plates move past one another

e. **MAJOR MOVEMENTS OF PLATES**

- Spreading or divergence (Plates move apart) forming Marine ridges/oceanic ridges e.g. Mid Atlantic ridge

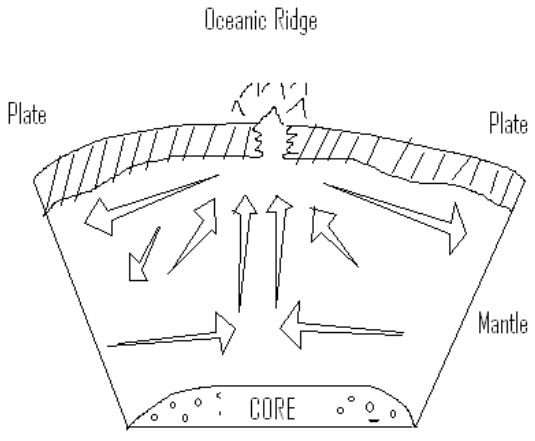
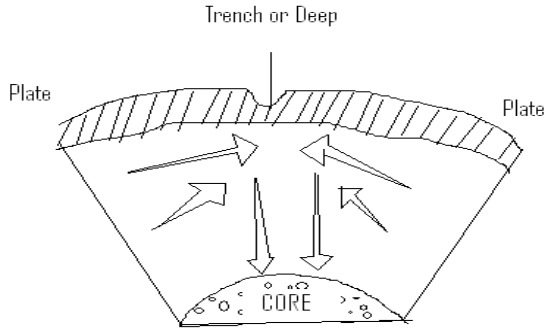


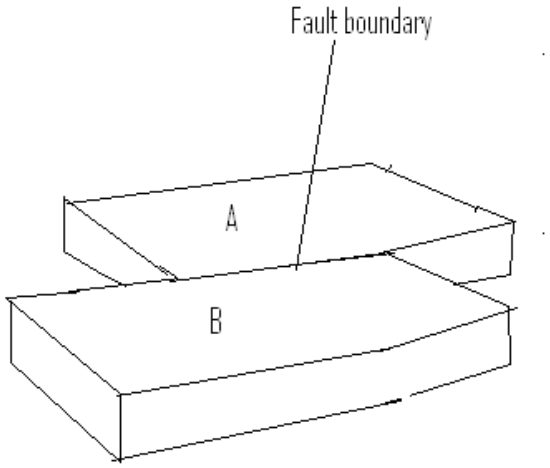
PLATE SPREADING OR DIVERGING

- Converging (Plates move towards each other) forming block mountains, rift valleys and oceanic islands



CONVERGING PLATES

- Shearing (Plates move past each other) separated by the fault boundary.
- Earthquakes are very common



SHEARING OF PLATES

RESULTS OF TECTONIC ACTIVITY

- Formation of Oceanic ridges e.g. Mid Atlantic Ridge.

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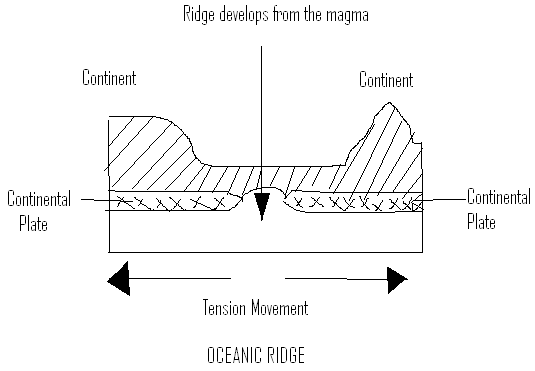

OCEANIC RIDGE

- Formation of Oceanic islands

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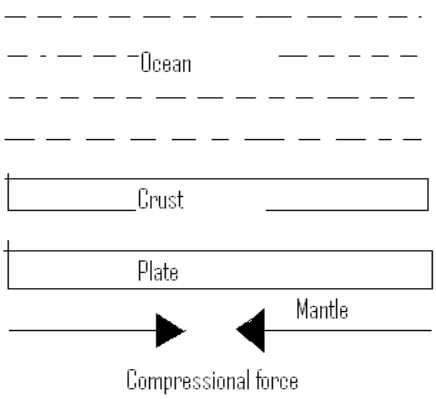

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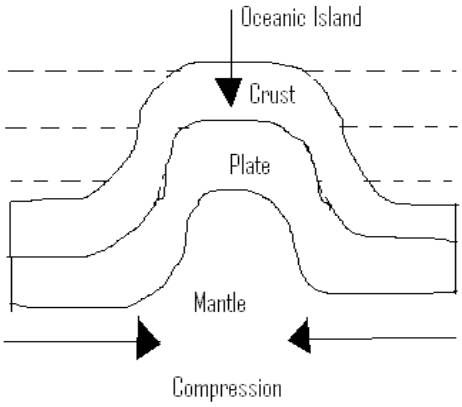
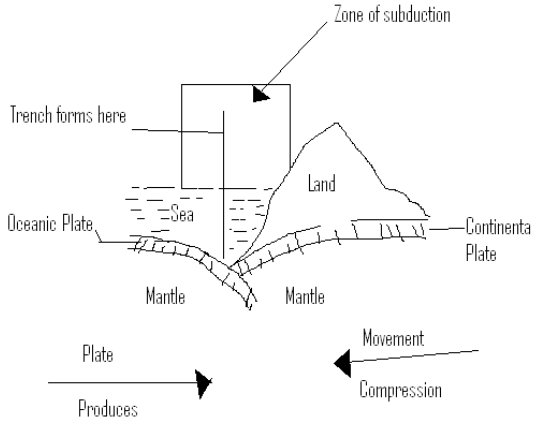
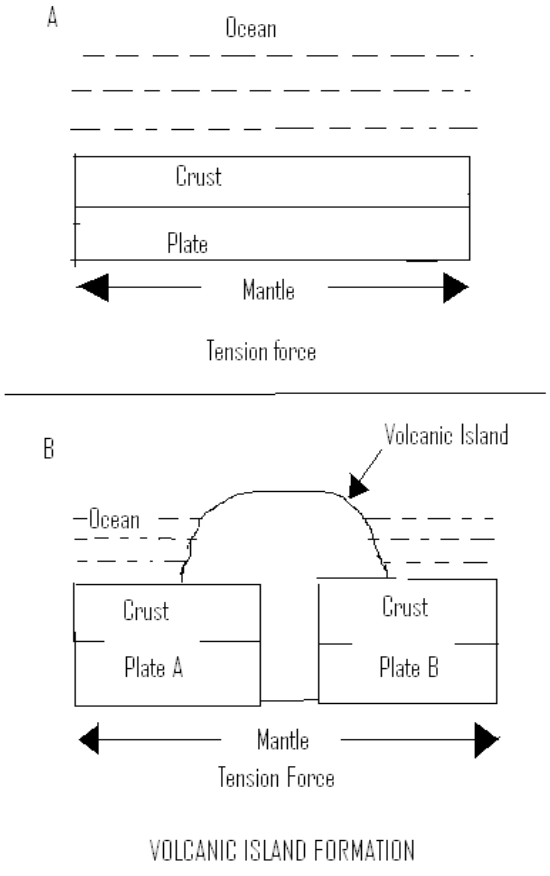


OCEANIC ISLAND

- Formation of Trenches in the destructive margins called zones of subduction.



- Mountains i.e. fold and block
- Earthquakes
- Formation of volcanic islands



VOLCANIC ISLAND FORMATION

When the plates move apart due to tension force, a hole (Vent) is created through which magma passes. Later the magma protrudes above the surface of the water and finally cools and solidifies to form a Volcanic Island.

EARTH MOVEMENTS

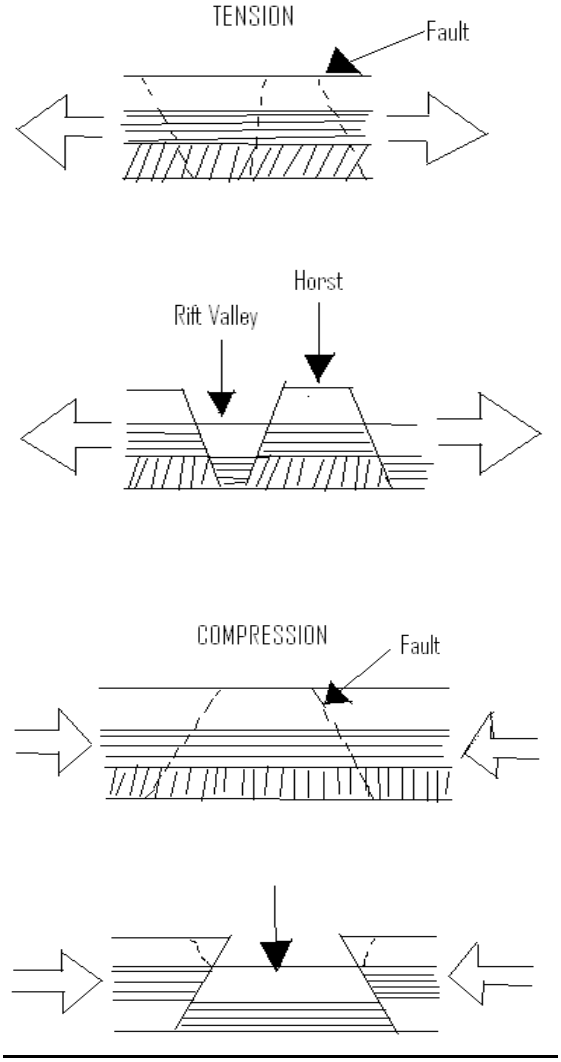
a. Lateral movements i.e. side ways direction
b. Vertical i.e. up and down movements

These movements exert great forces of tension and compression though slowly but produce very impressive features

FEATURES PRODUCED

- Mountains
- Plateaus
- Rift valleys
- Plains

RIFT VALLEY FORMATION



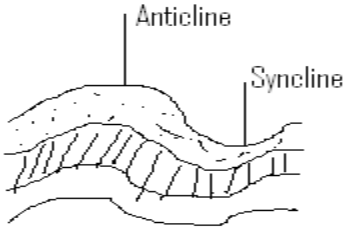
MOUNTAIN BUILDING PROCESSES

DEFINITION: The processes that are involved during mountain formation.

FOLDING: Formed when the crust bends.

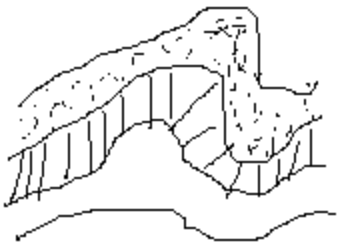
TYPES OF FOLDS

a. SIMPLE FOLD



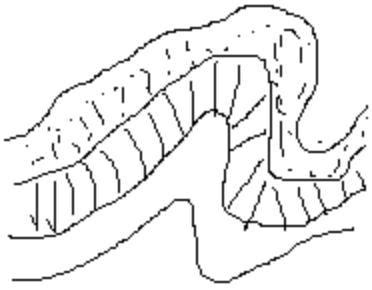
Simple Fold

b. OVER FOLD



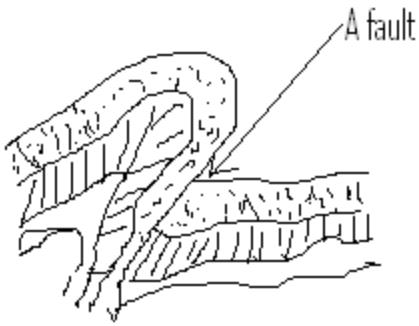
Over fold

c. RECAMBENT FOLD



Recumbent fold

OVERTHRUST FOLD

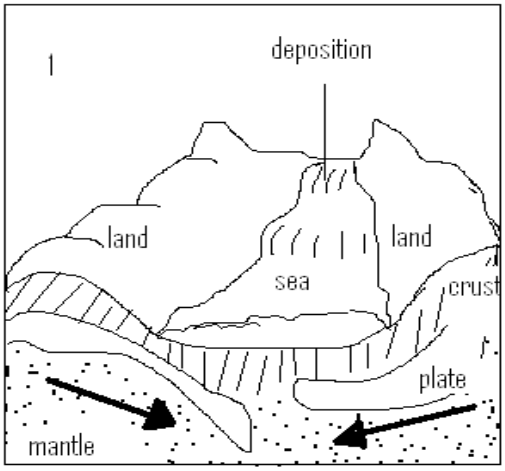


Overthrust fold or nape

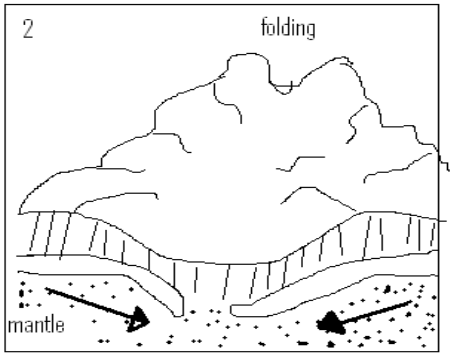
TYPES OF MOUNTAINS

a. Fold mountains
b. Residual mountains
c. Block mountains or Horst
d. Volcanic mountains

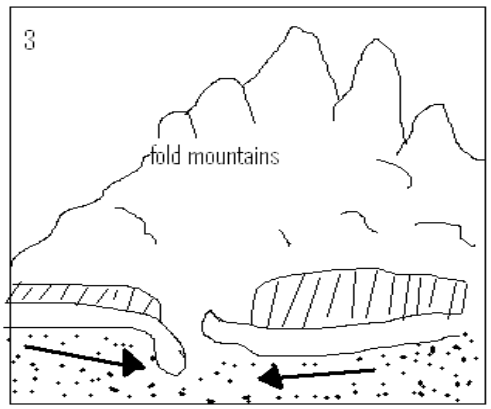
FOLD MOUNTAIN FORMATION



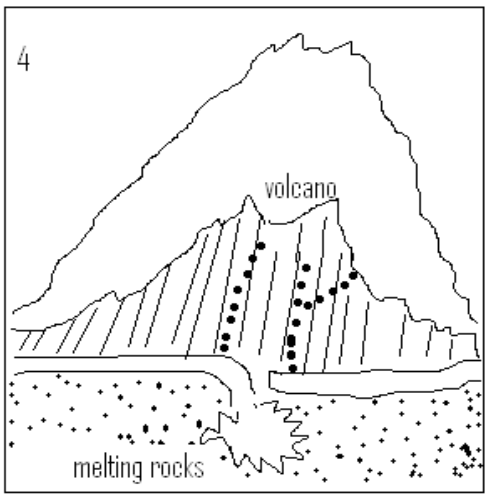
Deposition takes place in a depression (sea) and later sedimentary rocks are formed.



Due to crustal compression the rocks are folded to form Fold Mountains in 3



Fold Mountains formed



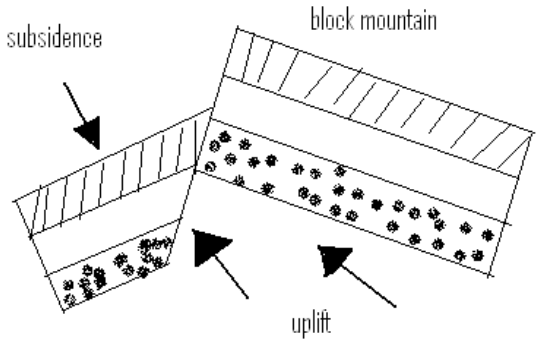
The plate that dips into the mantle melts to from magma which may come out to form volcanoes on the earth's surface.

CHARACTERISTICS OF FOLD MOUNTAINS

- They are long and high
- Associated with volcanoes especially in circum – pacific fold mountain system
- They contain rich minerals such as tin, copper, gold and petroleum
- Generally found on the western continental margins and their interiors are badly folded
- They are characterized by volcanic intrusions.

BLOCK MOUNTAINS

Compression or tensional forces bring about the formation of block mountains i.e. the two parallel faults subsiding with the adjacent blocks being uplifted as a block mountain. See figure below:



CHARACTERISTICS OF BLOCK MOUNTAINS

a. Faulted side is very steep
b. Usually long especially when formed along rift valleys
c. The side facing away from the faulted side is generally less steeps

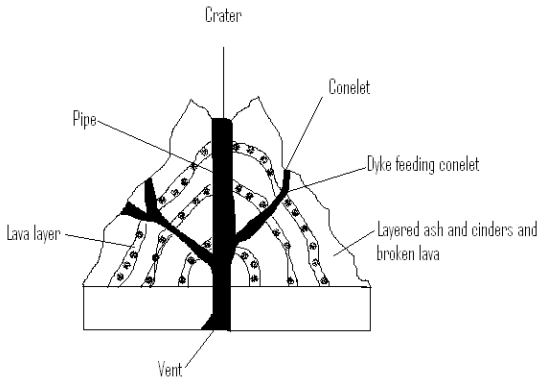
EXAMPLES OF BLOCK MOUNTAINS

- Vosges
- Hunsruck
- Black forest
- Ruwenzori in Africa

VOLCANIC MOUNTAINS

This is formed from the accumulation of viscous lava. The mountain usually contains ash, cinder, trapped mud and volcanic bombs i.e. rock chunks

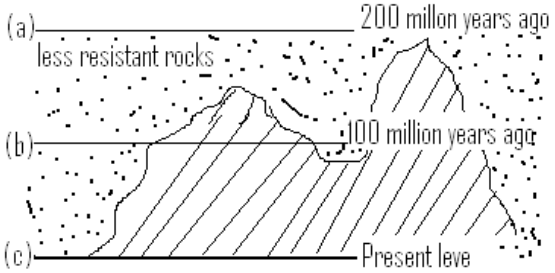
The only characteristic is that they steep sided and also called mountains of accumulation.



VOLCANIC MOUNTAIN

RESIDUAL MOUNTAINS

They are Denudation Mountains. Erosion resistant rocks standup as mountains and the less resistant ones are washed away and valleys are formed. See below:



FAULTING: Formed when the Crust cracks due to tension or compression.

EFFECTS OF MOUNTAIN BUILDING PROCESSES

- Rise of rivers due to some mountains receiving high rainfall e.g. Indus and Ganges (Himalaya) used for HEP
- Exposure of some minerals e.g. Bauxite, Gold etc
- Some mountains are valuable timber resources with coniferous soft wood and foothills of Himalayas with teak.
- The mountains formed negatively affect communication and climate.

VOLCANISM

DEFINITION: All the various ways by which molten rock and gases are forced into the earths crust and out on to its surface

FORMATION

- High rock temperatures below the crust and high pressure makes them to be in a semi solid state
- Due to friction of the tectonic plates makes the rocks to be in a semi liquid state called magma.
- As the magma rises through cracks it forms batholiths, sills and dykes
- When magma reaches the the surface it loses its gases and its called Lava

TYPES OF LAVA

a. Acidic Lava (violent) because they are very viscous and they accumulate in the vent and in turn obstruct the flow of the outpouring lava resulting in loud explosions that throw out volcanic bombs.
b. Basic Lava

CHARACTERISTICS OF LAVAS

A. ACIDIC

- Highly viscous with a high melting point
- They are light colored
- They have low density
- High percentage of silica
- Flow slowly and seldom travel far before solidifying
- The resultant cone is steep sided

EFFECTS OF ACIDIC LAVAS

- Loud explosions
- Formation of a spine or plug
- Steep sided cone

B. BASIC

- Very hot about 1000°C
- Highly fluid with a speed of 16 – 18 km/hr
- Dark coloured like basalt
- Rich in Iron and Magnesium but poor in Silica
- They flow quickly and are not explosive

EFFECTS OF BASIC LAVAS

- Affect extensive areas before they solidify
- The resultant volcano is greatly sloping with a wide diameter and forms flattered shield or dome.

TYPES OF VOLCANO

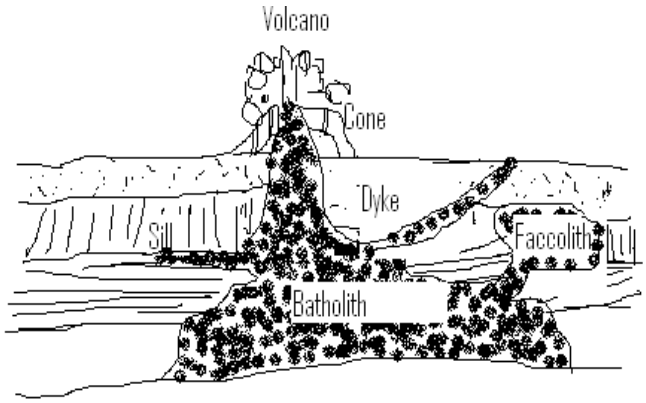
a. **Active:** Erupting frequently at least when they have erupted within recent time
b. **Dormant:** Have known to erupt and show signs of possible eruption in future
c. **Extinct:** That have not erupted at all in historic times but retain the features of volcanoes

FEATURES PRODUCED (INTRUSIVE AND EXTRUSIVE)

INTRUSIVE

- Batholith i.e. a very large mass of magma which accumulates in the crust
- Laccolith
- Dyke i.e. a wall like feature formed when a mass of magma cuts across a bedding plane.
- Sill i.e. forming when a sheet of magma lies along a bedding plane

FIGURE 3: INTERNAL FEATURES OF THE VOLCANO



EXTRUSIVE

- Ash
- Gas
- Steam
- Molten rock material
- Solid rock particles
- Lava

EFFECTS (ENVIRONMENTAL ASPECTS)

Destructive

- Loss of life and property during eruption
- Surfaces of volcanoes remain barren for a long time
- Great deal of damage

Constructive

- Where volcanic ash is present there is light and the soil productivity is improved
- Tourism enhancement due scenic features and beauty
- Sources of crushed rock for concrete aggregate or rail road ballast or substratum
- Geo thermal power

NOTE: *Volcanoes are concentrated in the Circum Pacific region called the Pacific Ring of Fire.*

e.g. The Mongolian Plateau, Islandic Plateau, Siberian Plateau, Drakensberg Plateau, Deccan plateau

COURSES OF A RIVER

A. UPPER COURSE

It is sometimes called the youth stage of a river. The main action of the river is vertical corrasion.

FEATURES PRODUCED

- Gorges
- Rapids
- Waterfalls which are barriers to navigation but good for Hydro Electric Power.

B. MIDDLE COURSE

It is also called the maturity stage. The main of the river is lateral corrasion.

FEATURES PRODUCED

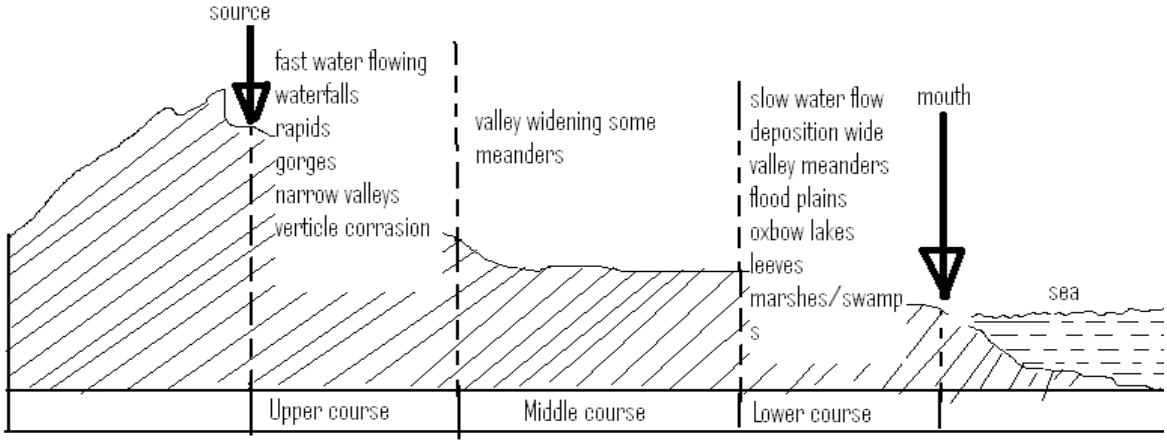
- Meanders
- River cliffs

C. LOWER COURSE

It is also called the late maturity stage. The main action of the river is deposition. Lateral corrosion is still operational.

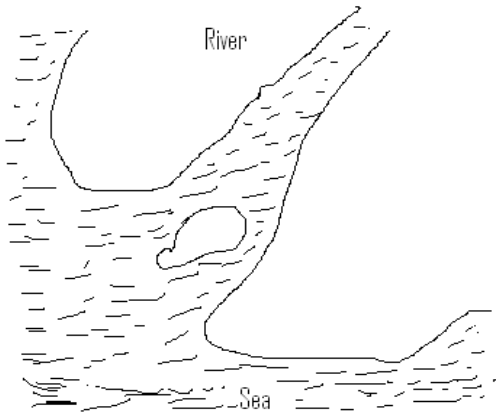
FEATURES PRODUCED

- Flood plains – formed spreading of the river load over low lying nearby areas
- Levees – raised river banks through accumulation of deposits
- Delta – a fan shaped alluvial area at the mouth of the river due deposition.

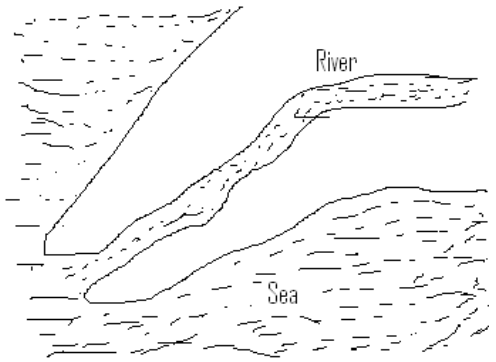


TYPES OF DELTAS

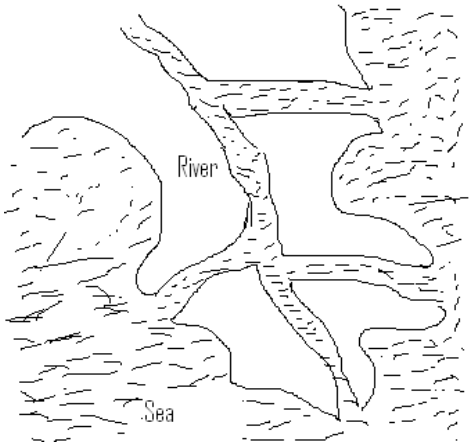
- Estuarine Delta: The river mouth is drowned submerged e.g. Seine, Ob, Elbe and Vistula



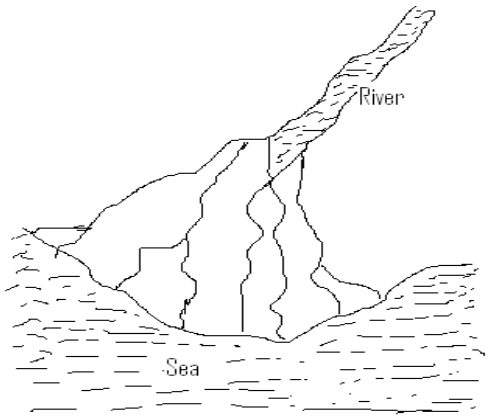
- Cuspate: The delta is pointed. An example of this delta is the mouth of Tiber River.



- Birds foot: Also called a digtate delta. Made of slit e.g. Omo, Vardar and Mississippi



- Arcuate: Triangular in shape with many distributaries. Some of the examples are Indus, Ganges, Niger, Nile and Menkong deltas.



PLATEAUS

DEFINITION: A raised upland with extensive level surface and usually descends steeply to the surrounding lowland. Sometimes it is called a table land.

CLASSES OF PLATEAUS

- **TECTONIC PLATEAUX:** Formed by earth movements which cause uplift are normally of great size and fairly uniform altitude.
- **VOLCANIC PLATEAUX:** Formed by the molten lava spread over the earths surface to form successive sheets of basic lava.

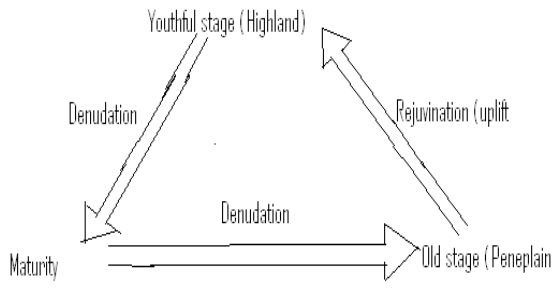
PLAINS

DEFINITION: An area of low land, either level or undulating.

TYPES OF PLAINS

- **STRUCTURAL:** Depressed areas of the world that make up some extensive natural lowlands of the earths surface e.g. Great Plains of USA.
- **DEPOSITIONAL PLAINS:** Formed by the depositional materials brought by various agents of transportation such wind, water and ice. e.g. Nile Delta.
- **EROSIONAL PLAINS (PENE PLAINS):** Formed by agents of erosion sun as rain, rivers, wind and ice.

CYCLE LAND FORM CHANGE IN AHUMID REGION



IMPORTANCE OF PLAINS

- Good places for agriculture because of the alluvial soils
- For settlements

EARTH QUAKES

DEFINITION: Sudden movements of the earth or vibrations in the lithosphere.

CAUSES

a. Sliding of plates
b. Volcanic eruptions
c. Converging movements of plates

OCCURRENCE:

- The mid ocean ridges
- The ocean deeps and volcanic islands
- The ridges of crustal compression

NATURE: The point of origin in the lithosphere is called the Focus. The point directly above the focus on the earth's surface is called the Epicenter.

MEASUREMENT: By Seismograph recording the vibrations of the earthquake. The amount of energy released by an earthquake is called the Magnitude. Measured on a Richter scale from 0 to 9. The higher the number, the more destructive the earth quake.

EFFECTS OF EARTH QUAKES

- Causes land slides
- Raising or lowering coastal rocks or parts of the sea floor
- Can displace lithosphere vertically or horizontally

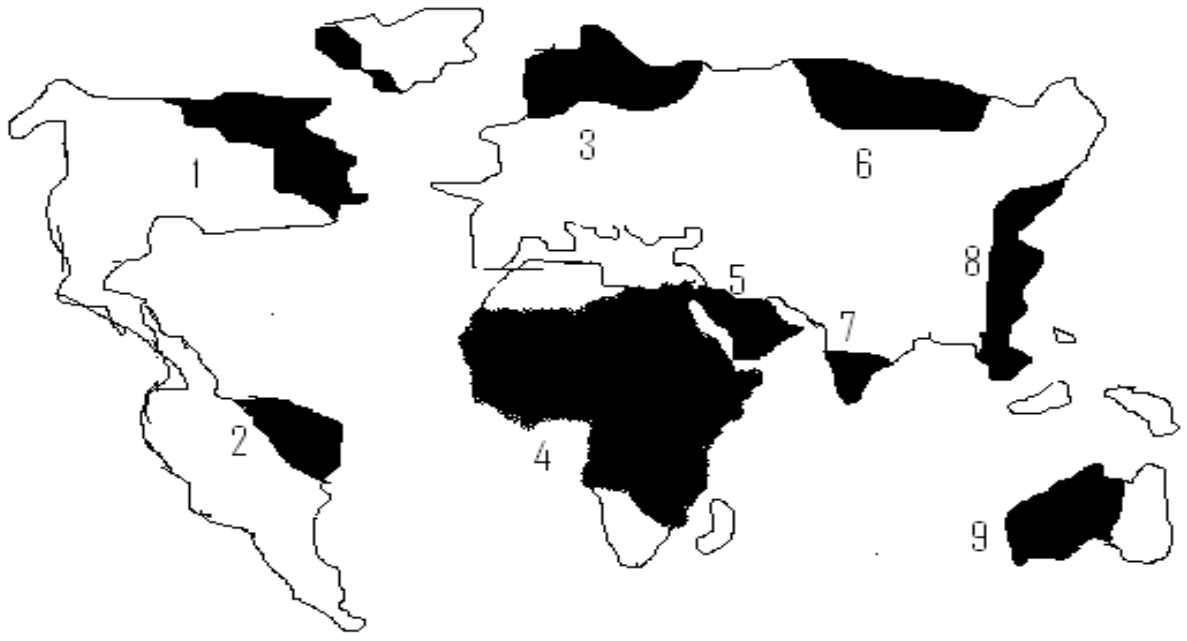
RELATIONSHIP OF VOLCANIC ZONES, EARTHQUKE ZONES AND FOLD MOUNTAINS ZONE.

- Associated with folding and faulting
- Occurring in plate boundaries
- Earth movement (horizontal or vertical)

SHIELDS

DEFINITION: The most stable parts of the earth.

FIGURE 4: SHIELDS OF THE WORLD



EXAMPLES OF SHIELDS

1. Laurentian shield
2. Brazilian shield
3. Baltic shield
4. African shield
5. Arabian shield
6. Siberian shield
7. Deccan shield
8. China shield
9. Australian shield

ROCKS

TYPES

- Sedimentary rocks (Clastic and non clastic)
- Igneous rocks (Volcanic (basalt)and plutonic (Granite)
- Metamorphic (Mable from clay, slate from clay, gneiss from granite, quartzite from sand and graphite from coal)

FORMATION

SEDIMENTARY ROCKS

- Mechanically formed (wind deposited - loess, river deposited – clays, gravels, glacier deposited – moraines, sands and sea deposited – river deposited.)
- Organically formed (from animals – chalk and coral, from plants – peat, lignite and coal)
- Chemically formed (rock salt, nitrates, gypsum, borax, potash and certain lime stones

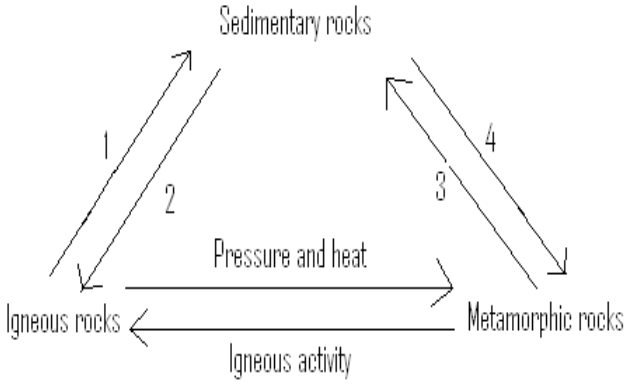
IGNEOUS

- Volcanic (Formed upon being solidified on the earth's surface – lavas, e.g. basalt.
- Plutonic (Formed upon being solidified deep in the earth's crust e.g. granite

METAMORPHIC

- Formed due heat causing the minerals to recrystallize
- Due pressure which alters the rocks
- Due to water which dissolves rock material and other materials thereby changing the composition of the rock.

FIGURE 5: THE ROCK CYCLE



KEY

1. Weathering and melting
2. Igneous activity
3. Weathering and deposition
4. Pressure and heat

CHARACTERISTICS OF ROCKS

SEDIMENTARY

- They are layered or stratified (clastic rocks)
- They are fossilized (they contain fossils)
- They are non – crystalline (classic rocks)

IGNEOUS ROCKS

- They are crystalline
- They are non – stratified
- They are non – fossilized (Don't contain fossils)

METAMORPHIC ROCKS

They have characteristics of both sedimentary and igneous rocks.

IMPORTANCE OF ROCKS

- They contain some valuable minerals e.g. iron and aluminum in granite
- Chalk which is used in schools is made from rocks.
- Mable for playing bawo and other decorations is made from rocks.

HYDROSPHERE

DEFINITION: All water of the earth in rivers, lakes, seas and oceans e.t.c.

COMPOSITION: Covering about 70% of the earth's surface.

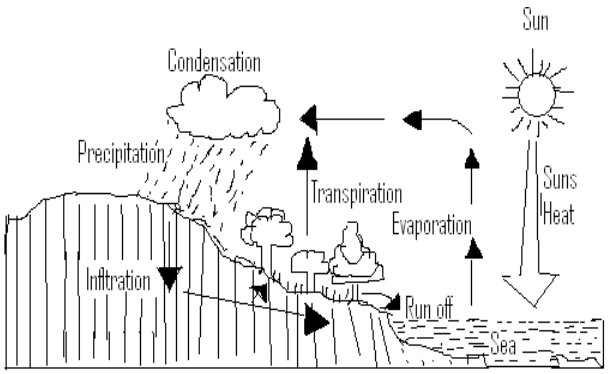
FEATURES OF THE HYDROLOGICAL CYCLE

- Ground water
- Oceans
- Clouds
- Vegetation
- Rivers
- Surface runoff
- Animals

PROCESS OF THE HYDROLOGICAL CYCLE

- Evaporation
- Transpiration
- Condensation
- Infiltration
- Percolation
- Respiration

FIGURE 6: THE HYDROLOGICAL CYCLE



Hydro means water taken from the formula H20

FACTORS THAT CAN DISTURB THE HYDROLOGICAL CYCLE

- Global warming
- Deforestation
- Acid rain
- Poor agricultural practices

IMPORTANCE OF THE HYDROLOGICAL CYCLE

- It maintains the availability of water used in many ways.

WAYS OF MAINTAINING THE HYDROLOGICAL CYCLE

- Conservation of water catchment areas
- Reducing emission of various elements in solution, e.g. carbon dioxide, oxygen, nitrogen, surphur e.t.c.
- Weather forecasting

OCEAN CURRENTS

DEFINITION: Large bodies of surface water that circulate in regular patterns around the oceans.

TYPES OF OCEAN CURRENTS

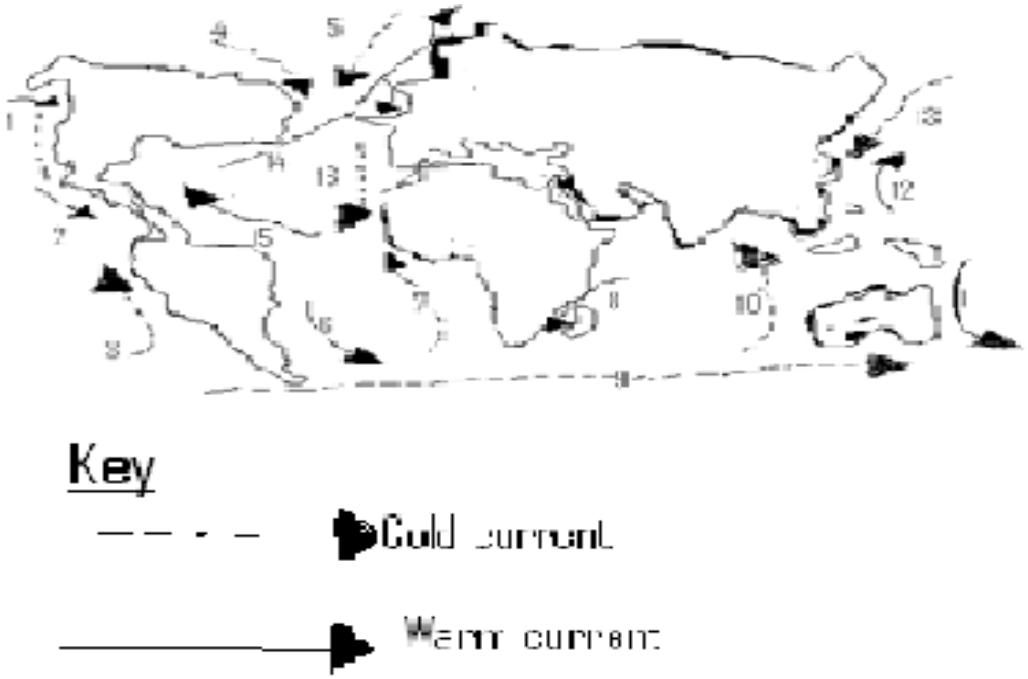
- Warm currents and cold currents

EXAMPLES

WARM CURRENTS	COLD CURRENTS
Brazilian, Kurosiwo, North Atlantic Drift, Mozambique, East Australian	Peruvian (Humboldit), Labrador, Canaries, Kamchatka, West Australian, Benguela,

	California and Irminger

FIGURE 7 DISTRIBUTION OF WARM AND COLD CURRENTS



1. North Atlantic Drift
2. California
3. Peruvian
4. Labrador
5. East Greenland
6. Brazilian
7. Benguela
8. Mozambique
9. West Wind Drift
10. West Australian
11. East Australian
12. Kurosiwo
13. Kamchatka

CAUSES OF OCEAN CURRENTS

- Temperature (Convection Currents) – Difference in water temperature on the equator and at the poles i.e. from waters moves from an area of higher temperatures to areas of low temperatures.
- Salinity – Waters with more salt is denser and the lighter unsalted water flows on the

surface of the denser high salinity water.
- Wind (Drifts)– Prevailing winds e.g. trade winds move equatorial waters pole wards and westwards and warm eastern coasts of continents e.t.c.
- Rotation of the earth Coriolis force (Geostrophic) of the earth as it rotates makes freely moving objects to deflect to the right in the northern hemisphere and to the left in the southern hemisphere (Ferrell's Law)

DIRECTION OF OCEAN CURRENTS

FACTORS

- Shape of the continents – Flowing along the coasts of the continents
- Wind direction – Flowing in the direction of the wind
- Temperature – Flowing from higher temperatures to low temperatures.
- Rotation of the earth – Flowing as per the Coriolis force of the earth.

EFFECTS OF OCEAN CURRENTS

- Climate e.g. North Atlantic Drift brings mild winters to North Western Europe.
- Fishing (Where warm and cold currents meet are areas where fishing usually takes place e.g. Kamchatka and Kurosiwo.
- Shipping (They are sometimes a barrier to shipping)

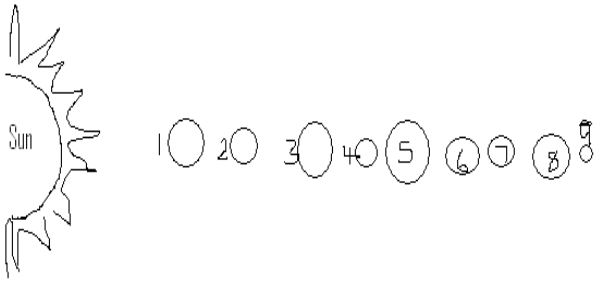
THE SOLAR SYSTEM

DEFINITION: The group of celestial or heavenly bodies made up of the sun, planets and the asteroids which revolve round it.

PLANET: A spherical roughly spherical body which revolves round the sun.

ORBIT: An elliptical path taken by a planet as it revolve around the sun

FIGURE 8: PLANETS IN THE SOLAR SYSTEM



1. Mercury
2. Venus
3. Earth
4. Mars
5. Jupiter
6. Saturn
7. Uranus
8. Neptune
9. Pluto

PELIHELION: A situation when the planets are sometimes nearest to the sun because of the elliptical shape of the orbits.

APHELION: A situation when the planets are furthest from the sun

The earth is furthest from the sun on 4th July when it is 151, 200, 000km away from it.

It is closest to the sun on 3rd January when it is 146, 400, 000km from the sun.

Mercury is the planet closest the sun i.e. 57.6 million km away from it. Pluto discovered in 1930, is the outer planet and is 5850 million km from the sun. Mercury, Venus and earth are called inner planets.

THE EARTH

MOVEMENTS

- Rotation which causes day and night where the other side is faces the sun and other side is in darkness. The line which divides the two sides is called a circle of illumination
- Revolution of the earth causing seasons and varying lengths of day and night (at different time of the year)

RESULTS OF A DECREASE IN ROTATION WITH INCREASE IN LATITUDE

- Centrifugal force: Greater at the equator i.e. a thing weighing 131.4 kg on a non rotating earth weighs 130.9 kg on the equator
- Deflection of objects: More especially fluids e.g. water and air i.e. they deflect to the right in the northern hemisphere and to the left in the southern hemisphere.

LATITUDES AND LONGITUDES

LATITUDE: Angular distances of a point on the earths surface north or south of the equator measured in degrees from the centre of the earth. They are parallel to a line, the equator, which lies midway between the poles (Parallels of latitude)

The most important latitudes are as follows:

- Equator 0°
- The tropic of Cancer 23½°N
- The tropic of Capricorn 23½°S
- Arctic Circle 66½°N
- The Antarctic Circle 66½°S

SEE THE FIGURE BELOW

On average 1°of latitude equals 111km important because it can be used for calculating distances between places e.g. Beira in Mozambique is 20°S and therefore it is 111 x 20 km from the equator.

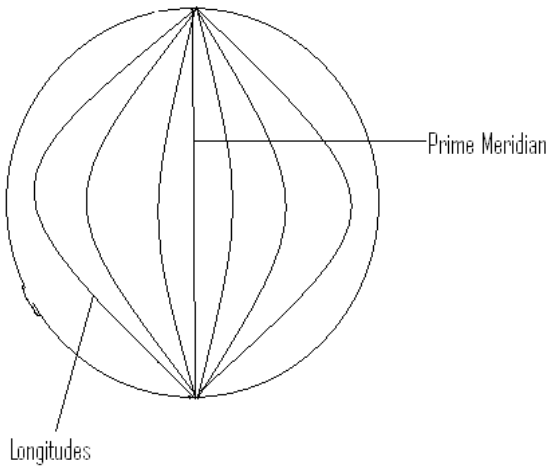
CHARACTERISTICS OF LATITUDES

- They are always parallel to each other
- Many of them can be drawn on the globe
- They run from east to west
- They intersect longitudes at right angles
- They are small circles except the equator which is a great circle.

LONGITUDES

LONGITUDE: Angular distances measured in degrees along the equator east or west of Prime Meridian (0°).

They run from pole to pole. The earth's circumference is 40, 084 km. Therefore 1° of longitude is 111.3 km along the equator.



CHARACTERISTICS OF LONGITUDES

- For suitability and convenience, just like the latitudes, they are selected at equal distances apart

- They run in a north – south direction
- They are halves of great circles
- They are spaced farthest apart at the equator and converge at a poles

They determine local time in relation to Greenwich Mean Time (GMT). Since the earth makes a complete rotation of 360º in 24 hours, it passes 15º in one hour or 1º in 4 minutes.

The earth rotates from west to east, so every 15º eastwards local time is advanced (Pushed forward) by 1 hour and westwards local time is retarded (Reduced) by 1 hour.

EXAMPLES

1. It is 4 pm in London (0º). What is the time in New York (74ºW)? Mathematically, New York is 4 hours 56 minutes behind London i.e.

   $$\frac{74 \times 4 \text{ hours}}{60}$$

   Therefore, time in New York is 11.04 am i.e. 4 pm or 16 hours minus 4.56 hours.

2. What is the time Yokohama (140ºE)
   Mathematically Yokohama is 9 hours and 20 minutes ahead of London i.e.

   $$\frac{140 \times 4 \text{ hours}}{60}$$

   Therefore, the time in Yokohama is 1.20 am i.e. 16 + 9.20 =25.20 pm or 1.20 am

When going to east time, is gained from Greenwich (0º) until he reaches meridian 180ºE, i.e. 12 hours ahead of GMT. By going to the west time is lost i.e. 12 hours behind the GMT. The International Date Line determines the change of the day. It Zigzags the countries to avoid one country having two dates.

In crossing the IDL from west to east a day is gained e.g. Tuesday to Monday. But from east to west a day is lost, e.g. from Monday to Tuesday.

GREAT CIRCLES

DEFINITION: This is a circle on the earth's surface whose plane passes through its centre and hence bisects it into two hemispheres. Any two opposite meridians together form a great circle e.g. 30ºE and 150ºW, 5ºW and 175ºE. The equator (0º) is also a great circle.

CHARACTERISTICS

- A great circle results when a plane passes through the centre of the globe
- They are the largest possible circles that can be drawn on the surface of the globe.
- One and only one great circle can pass through any two points on the surface of the globe.
- Intersecting great circles bisect each other.

ATMOSPHERE

Atmos means vapour and atmosphere means a sphere of vapour

SEASONS

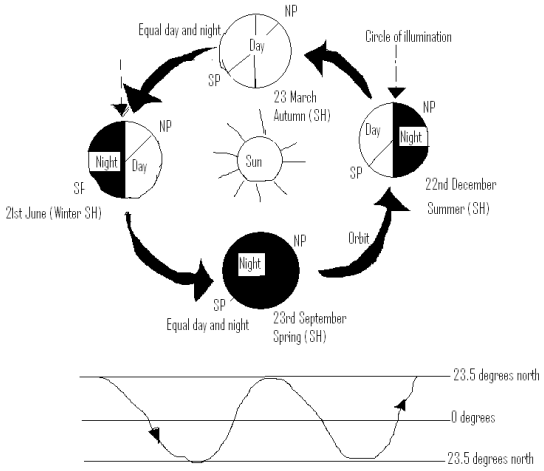
DEFINITION: Times of the year when the world experiences different weather patterns.

SEASONS OF THE WORLD

PERIOD	S H Sphere	N H Sphere
March, April, May	Autumn	Spring
June, July, Aug	Winter	Summer
Sept, Oct,	Spring	Autumn

Nov		
Dec, Jan, Feb	Summer	Winter

FIGURE 9: SEASONS OF THE WORLD



CAUSES OF SEASONS

- Revolution of the earth

CHARACTERISTICS OF SEASONS

- They determine the lengths of days and nights
- They bring about temperature changes

TERMS CONNECTED TO SEASONS

- Equinoxes i.e. equal nights (21st March and 23rd September when the sun is overhead the equator.
- Summer Solstice (NHS) and Winter Solstice (SHS) – 21st June and 22nd December when the sun is overhead the Tropic of Cancer.

SEASONS IN MALAWI

PERIOD	SEASON
November to April	Hot, wet season
May to July	Cool, dry season
August to October	Hot, dry season

AIR PRESSURE

DEFINITION: The force of air at a place due to the weight of the column of the said air above that point

FACTORS INFLUENCING AIR PRESSURE

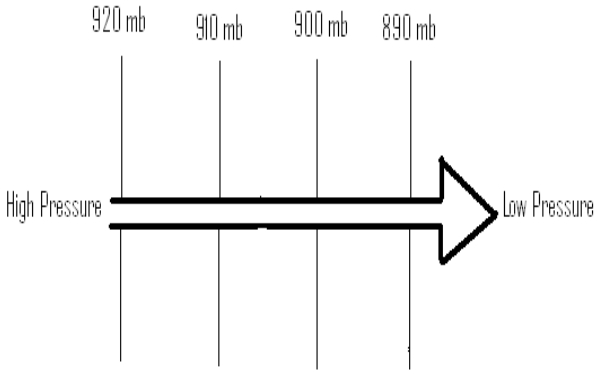
- Altitude i.e. height of a place (The higher the altitude the less the pressure the lower the altitude the less the more the pressure.
- Temperature (The higher the temperature the less the pressure, the lower the temperature the higher the pressure).
- Rotation of the earth (Deflection of the waters and winds to the right in the northern hemisphere and to the left in the southern hemisphere).

TABLE OF ALTITUDE AND PRESSURE

ALTITUDE (m)	PRESSURE (cm)	BOILING TEMPERATURE OF WATER (°C)
0	76	100
300	73	99
900	68	97
1500	63	95
3000	53	90

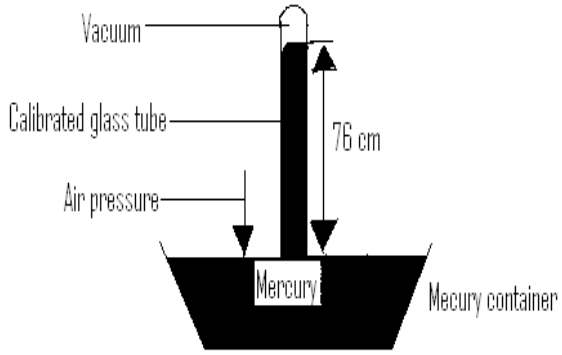
TERMS IN CONNECTION TO AIR PRESSURE

i. **BAROMETER:** An instrument for measuring air pressure
ii. **MILLIBARS:** Unit of pressure
iii. **ISOBER:** The line joining all places of the same pressure



iv. **PRESSURE GRADIENT:** The rate at which the atmospheric pressure changes horizontally in a direction on the earth's surface.

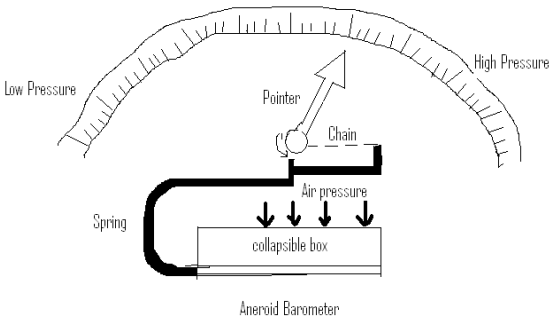
FIGURE 10: PRESSURE INSTRUMENTS



HOW A MERCURY BAROMETER WORKS

- It consists of a mercury container and a calibrated glass tube.
- When there is high pressure, some of the mercury in the container is pushed up the tube registering higher readings
- When the pressure is low, some of the mercury in the glass tube goes down registering low pressure.

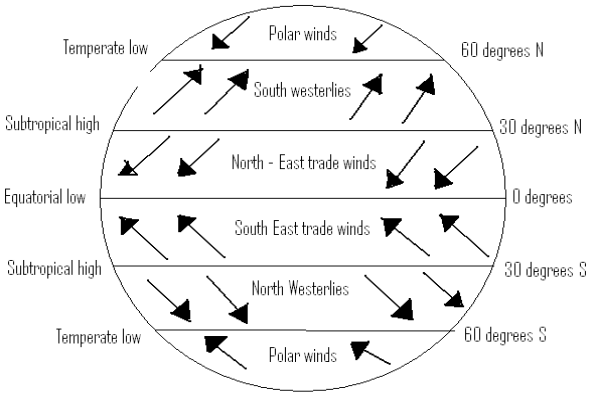
ANEROID BAROMETER



HOW AN ANEROID BAROMETER WORKS

- It consists of a collapsible metal box, a chain, a pointer and a scale.
- When there is high pressure outside the lid is pushed down wards and the chain moves to the right registering high pressure on the scale
- When there is low pressure the lid goes up and the chain goes the left to register low pressure.

WORLD PRESSURE BELTS AND WINDS



PRESSURE AND WIND

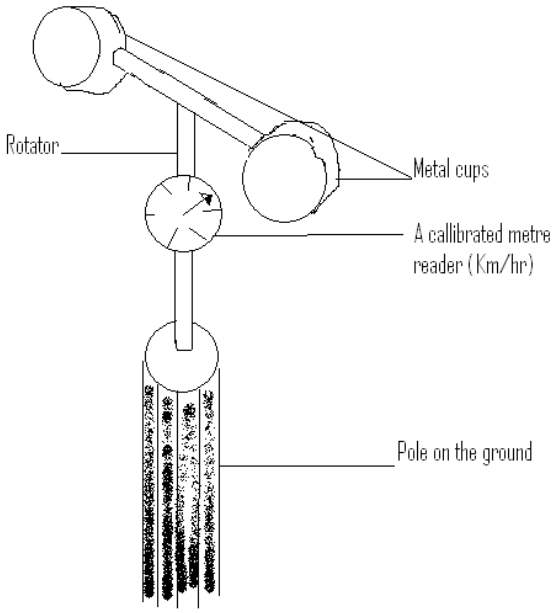
WIND

DEFINITION: Air in motion.

Wind direction is indicated by a Wind Vane, a Wind Sock and or a Weathercock.

Wind speed is measured by an anemometer. A word taken from a Greek word Anemos, meaning wind.

A CUP ANEMOMETER



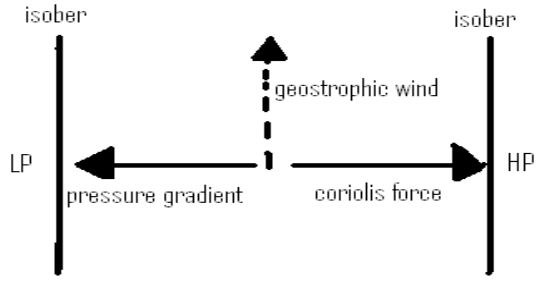
An Anemometer has got a calibrated meter reader with a rotator attached to it and the metal cups.

When the wind is blowing, the cups make the rotator to rotate.

Tne readings are taken on the meter to show wind speed in Km/hr.

Wind blows from high to low pressure zones but at higher levels it follows isobars. When the pressure gradient force balances the Coriolis force between two pressures the resultant wind is called the geostrophic wind.

FORMATION OF GEOSTROPHIC WIND



Winds are always named from the direction they low i.e. west wind is the one blowing from the west.

Wind direction is affected by the rotation of the earth so that it is to the right in the northern hemisphere and to the left in the southern hemisphere.

WIND DIRECTION IN THE NORTHERN HEMISPHERE

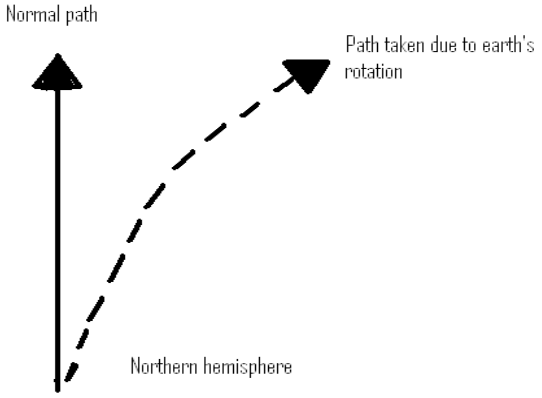
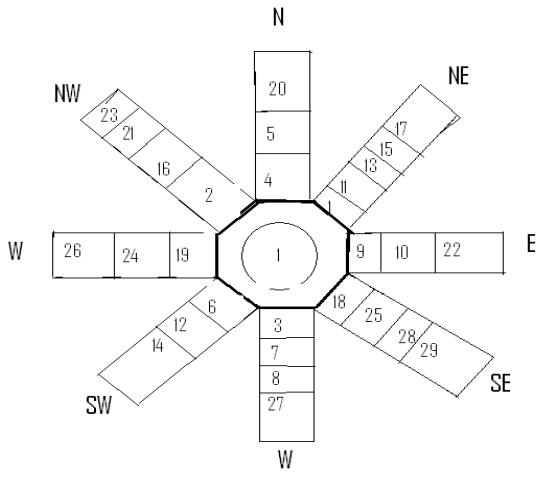


FIGURE 10: WIND INSTRUMENTS

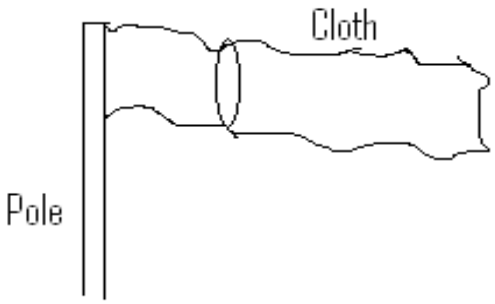
A WIND ROSE



A Wind Rose is used to record the direction of prevailing winds of a place over a period of a month.

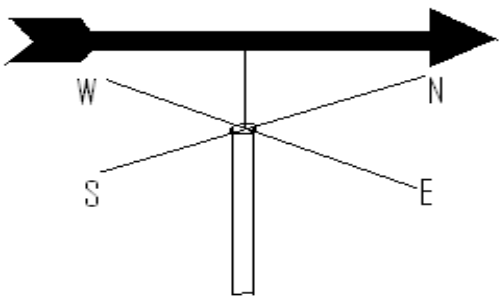
The squares represent the days of the month when the wind blew from that direction. The days when it was calm are indicated on the centre of the Wind Rose.

Where there is no anemometer, the Beaufort scale is used to measure wind speed



A wind sock

A wind sock cloth goes to the direction of the wind.



A wind vane

A wind vane always points where the wind is coming from.

PRESSURE MAP

DEFINITION: This is a map which shows a series of isobars displayed on it for identification. It can be used to determine wind direction and speed.

PREVAILING WINDS

DEFINITION: A wind that blows frequently in a particular area.

EXAMPLES OF PREVAILING WINDS

- **TRADES**
  . Originate from the sub tropical high pressure belts
  . The pressure belts are found at 30° north or south of the equator
  . They blow towards the equatorial low pressure belt, called doldrums.

  IMPORTANCE OF TRADE WINDS BELTS
  i. For west wards travel in the days of sailing vessels.
  ii. Steadiness of wind and clear weather makes a favorite zone of mariners

- **WESTERLIES**
  . Winds blow from the sub tropical high pressure belts pole wards to 60° parallel both north and south of the equator
  . In winter, in the NHS they move southwards affecting meditteranean regions, bringing winter rain to those areas
  . They blow from the westerly direction in both hemispheres hence the name westerlies.
  .Unlike trade wind, westerlies are variable in force and direction

. Almost constant procession of depressions and anticyclones moving eastwards, are common in areas where these winds blow.
. In the SHS they blow with great force and regularity throughout the year over oceans and are variably called roaring forties or the furious fifties or the screaming sixties

IMPORTANCE OF THE WESTERLIES

i. Good for long distance flying
ii. For westward flying strong head winds reduce speed and increase fuel consumption, this necessitates reduced payloads on the planes

- **POLARS**

LOCAL WINDS

DEFINITION: Winds that caused by the immediate influences of surrounding topography of relief**.**

IMPORTANCE OF LOCAL WINDS

- Exerting a powerful stress on animals and plants, depending on whether they are dry and extremely hot or cold.
- They affect the movement of pollutants such as pollution fumes far down the resources**.**

EXAMPLES OF LOCAL WINDS

- **Chiperoni** (Mostly affecting the Shire Highlands. it is warm and moist wind which originates from Mozambique.
- **Harmattan** (A strong north – easterly wind experienced in west Africa. it blows direct from the Sahara Desert and it is very hot, very dry and dusty.
- **Fohn** (The warm, dry wind which blows down leeward slope of northern Alps. It raises the temperature from 8ºC to 11ºC, snow is melted, trees and houses become excessively dry, avalanches may occur.
- **Chinook** (Snow - eater. It is warm, dry Fohn type of wind experienced along the eastern side of the Rocky Mountains in Canada and USA.

LAND AND SEA BREEZES

CAUSE: Differences in the heating and the loss of heat of land and sea.

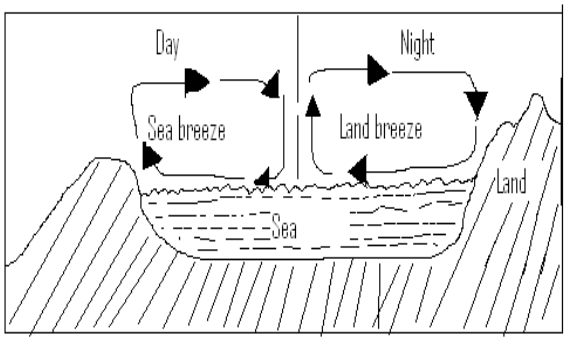
TYPES OF BREEZES

i. **SEA BREEZE** (During the day land becomes warmer than the sea. So air moves towards the land)
ii. **LAND BREEZE** (During the night the land loses heat faster than the sea and therefore air moves from the land to the sea)

EFFECTS OF LAND AND SEA BREEZES

- The sea breeze has cooling effect on the coastal communities i.e. attraction of the shore zone as a recreation facility.
- Land breeze is essential for the sailing of fishermen i.e. they sail at night and return in the morning with the sea breeze**.**

FIGURE 11: LAND AND SEA BREEZES



OTHER WINDS

- Mountain and valley winds (Anabatic). They blow from the valleys upward over rising mountain slopes.
- Drainage winds (Katabatic). They blow from higher to lower regions.
- Descending winds resulting from strong winds passing over a mountain range and descend on the leeward side. e.g Chinook and Fohn.

CYCLONES AND ANTICYCLONES

DEFINITION: A region of low atmospheric pressure.

TYPES

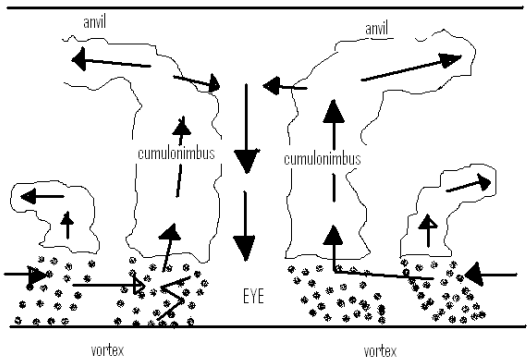
i. Depression – That of temperate latitudes
ii. Tropical cyclone – Much violent and typical of the tropics. Others are typhoons, hurricanes and tornadoes.

Depressions and tropical cyclones are similar in that their winds in the northern hemisphere circulate in an anticlockwise direction and in the southern hemisphere in a clockwise direction.

CHARACTERISTICS OF AN APPROACH OF A CYCLONE

- A fall in pressure
- Dull sky
- Oppressive air
- Strong winds

FIGURE 12: A CROSS SECTION OF A CYCLONE



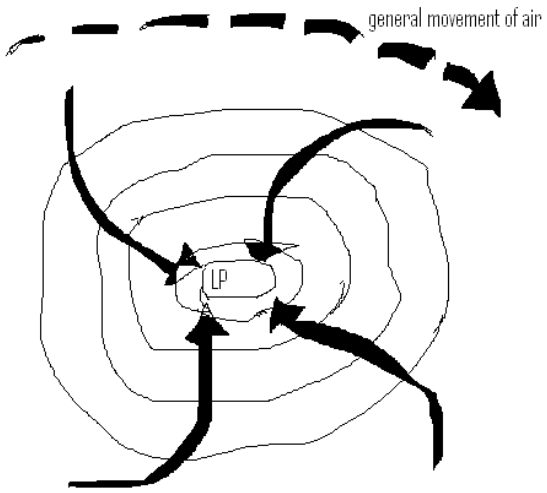
TROPICAL CYCLONE

DEFINITION: A storm generated by low atmosphere pressure in which isobars are closely spaced and they form a circular shape. Very strong winds spiral towards the centre.

GENERAL CHARACTERISTICS OF A TROPICAL CYCLONE

- Originates over oceans in the tropics in summer
- It develops between 5° and 20° north and south of the equator
- It is smaller than a frontal depression and is centered around an area of extremely low atmospheric pressure
- Once formed it moves westwards

- Its rotation is clockwise in southern hemisphere i.e. Buys Ballots law.



- Accompanied by heavy rain and showers which cause great deal of damage due to strong winds and floods
- The source of energy in a tropical cyclone is the large amount of latent heat freed as moist tropical air condenses
- Warm, moist air is drawn into the low pressure centre from a large area over the oceans
- Air spirals upwards, with great low pressure in the centre.

LIFE CYCLE OF A TROPICAL CYCLONE

- **FORMATIVE** (Two air masses meet at inter tropical front. Air pressure falls greatly to less than 1000hPa. One air mass is lifted upon the other. The rising air cools and its moisture condenses to produce heavy rainfall. Condensation frees latent heat which makes the cyclone to rotate.

- **GROWTH**
  i. **IMMATURE:** Air pressure in the centre falls below 1000hPa. The winds begin to reach the hurricane strength, that is 12 on the beaufort scale. The area affected is small 30 – 50 Km in diameter.
  ii. **MATURE:** As soon as air pressure stops to drop this stage is reached. The area affected increases considerably
- **DEGENERATION:** The drying out of the cyclone as reaches the land. Air pressure in the centre rises and the area affected is reduced making the system dying out completely.

CONDITIONS NECESSARY FOR TROPICAL CYCLONE DEVELOPMENT

- An abundant source of warm, moist air of temperature of about 27°C near to the sea surface.
- Air must be blowing inwards towards the centre and rising rapidly and nimbocumulus clouds must form to give heavy rains
- There must be an inward flow of air in the upper level of the atmosphere.

ASSOCIATED WEATHER

- As a front of vortex arrives, gusty winds develop and thick clouds appear
- When the vortex arrives, the winds become violent reaching speeds of over 240km per hour
- Calm conditions returns when the "Eye" arrives
- The arrival of the rear of the vortex brings in violent winds.

EFFECTS/CONSEQUENCIES OF TROPICAL CYCLONES

- Great winds cause waves of as much as 30m in the sea causing destructions in coastal areas
- Reduction of the flow of air to the low pressure centre. The availability of moisture also decreases due to the fact that land surface is drier.

NAMES OF CYCLONES IN DIFFERENT AREAS OF THE WORLD

CYCLONE	NAME
Typhoons	China sea
Tropical cyclones	Indian ocean, Madagascar, Mauritias
Hurricanes	West Indies, USA
Tornadoes	Guinea, Southern USA
Willy - Willy	Australia

ANTICYCLONES

DEFINITION: A region in which the atmospheric pressure is high at the centre.

CHARACTERISTICS OF ANTI CYCLONES

- The pressure gradient is gentle and winds are light.
- The normally herald fine weather. Skies are clear, the air calm and temperatures are high in summer but low in winter.
- In winter great cooling of the lower atmosphere may result in thick fogs
- Winds blow outwards and not inwards as in cyclones i.e. clockwise in the northern hemisphere and anticlockwise in the southern hemisphere.

MAIN ANTICYLONES

- South Atlantic High
- Indian Ocean High

AIR MASSES

DEFINITION: An Air mass in a large body of air in which the upward gradients of temperature and moisture are fairly uniform over a large area.

CLASSIFICATION OF AIR MASSES

They are classified according to:

i. Latitudinal position on the globe, which primarily determines thermal (Heat) properties.
ii. Underlying surface (continents or oceans) which determines the moisture content.

AIR MASSES AND PROPERTIES

AIR MASS	SYMBOL	PROPERTIES	TEMP °C	SOURCE
Continental Arctic	cA	Very cold and dry	-46	Arctic ocean nearby lands
Continental Antarctic	cAA	Very cold and dry	-46	Antarctic ocean
Continental polar	cP	Cold, dry (winter)	-11	Continents (50°-60°N, S
Marine polar	mP	Cool, moist (winter)	4	Oceans (50-60°N, S

Continental	cT	Warm, dry	24	Continents (20-35°C, N,S
Marine tropicalm	T	Warm, moist	24	Oceans (20-35°N, S
Marine Equatorial	mE	Warm, very moist	27	Oceans close to the equators

TYPES OF AIR MASSES

i. **STABLE:** When the air mass rises and becomes cooler than the surrounding air it tends to sink back to the ground if no longer forcibly carries upward. Such air is not likely to produce convectional rise, because the air resists lifting.

ii. **UNSTABLE:** An air mass in which rising (updraft) tends to increase in intensity as time goes on is said to be unstable. It continues to rise as long as its temperature is higher than that of the surrounding air.

Mostly yielding heavy showers and thunderstorms, mostly found in warm, humid areas such as the equatorial and tropical oceans and their bordering lands throughout the year and the middle latitude regions during the summer season.

The line of separation at the earth's surface between cold and warm air masses is called a front.

TABLE ON FRONTS AND PRESSURE SYSTEMS

TYPE	EXPLANATION
(H) or High	Centre of high pressure
(L) or Low	Centre of low pressure
	Cold front
	Warm front
	Occluded front
	Stationary front

COLD FRONT CONDITIONS

i. The wind changes direction as the front passes a point on the ground the wind always backs (changing direction to the left) in the southern hemisphere and veers (Changing direction to the right) in the northern hemisphere i.e. wind shifts.

ii. The decrease in temperature marking a sudden end of a period of warm weather when a cold air mass arrives.

iii. There is always a decrease in humidity since cold air does not contain as much moisture as warm air

iv. A fast – moving cold front preceded by warm, unstable, moist air produces cumulonimbus clouds with associated thunder, lighting, hail and turbulence.

v. An advancing cold front usually heralds a decrease in atmospheric pressure.

WARM FRONT CONDITIONS

i. A change in wind direction accompanies a warm front. In the southern hemisphere the wind always backs, but it is more gradual.

ii. There is an increase in temperature, but change

occurs more slowly than in case of a cold front

iii. The atmospheric pressure usually drops rapidly before the onset of the warm front and then it becomes gradual.

iv. A marked rise in the dew point is associated with the passage of a warm front. The clouds cover is much more extensive.

INTER – TROPICAL CONVERGENCE ZONE (ITCZ)

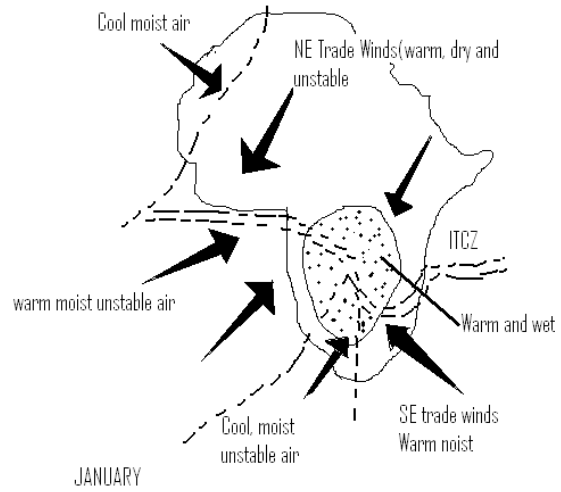
DIFINITION: The pattern of weather which is experienced between the two hemispheres when the sun is overhead on 21st January

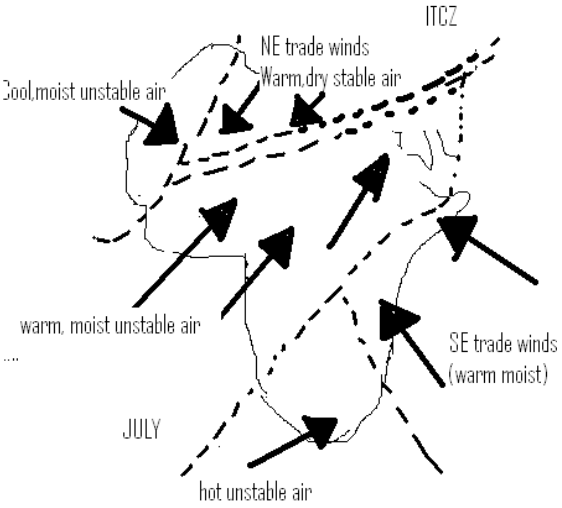
When the sun is overhead by January in the southern hemisphere, the sun produces intense heat in Central Africa and raises the temperature to between 21°C to 27°C while in the northern hemisphere the temperatures are low as 10°C and 16°C. Low pressure is produced in the southern hemisphere from November to April while high pressure develops in Indian and Atlantic oceans.

ITCZ AND RAIN FALL

In Africa rainfall is associated with the passage of the ITCZ. From November to April southern Africa receives rain while the north under the influence of hot and dry air mass experiences no rainfall. Gradually rains shift to the north following the apparent movement of the sun. Between May and October the north experiences ran fall while the south is dry.

FIGURE ON POSITION OF THE ITCZ





OCCLUSIONS

DEFINITION: This is when the cold front moves in more quickly than the warm front and eventually overtakes the warm sector uplifting the air.

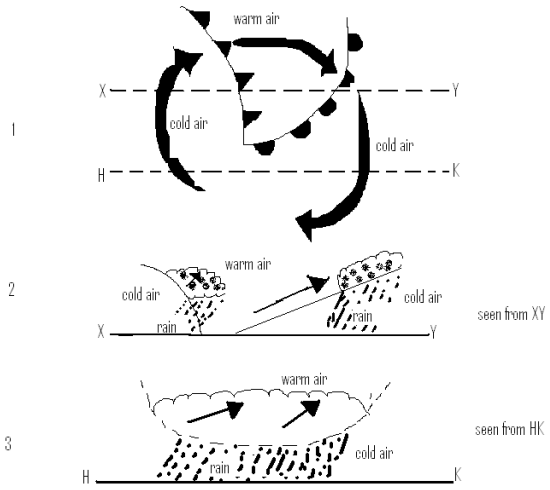
The boundary between the uplifted air and the cold air is called an occluded front.

COLD FRONT OCCLUSION

The air on the leading edge of an advancing cold front is warmer than the air behind. The result is that both the warm air mass behind the warm front and cooler air mass in front of the cold front are uplifted above the advancing cold front.

WARM FRONT OCCLUSION

The air ahead the warm front is cooler than air behind the advancing cold front. As the cold air overtakes the warm air, the advancing cold air rises above the cooler air ahead of the warm front.



CLOUDS

DEFINITION: A mass of small water drops or ice crystals, formed by the condensation of the water vapour in the atmosphere

CLASSIFICATION OF CLOUDS

They are classified on the basis of two major characteristics

i. General form or shape
   (Stratiform or layered types and cumuliform or heaped (Massive globular)
ii. Altitude

TABLE ON CLASSES OF CLOUDS

HEIGHT	**CLOUDS**	**APPEARANCE**	**WEATHER**
Very High (6000 – 12000) m	Cirrus	Delicate, wispy, featherly sometimes it forms streaks across the sky	Fair
	Cirrocumulus	White heaped or globular masses, masses, forming ripples in Mackerel sky.	Fair
	Cirrostratus	Thin white sheet or veil, milky sun forms a halo	Fair
Intermediate (2000 – 6000)m	Altocumulus	Wooly, bumpy, layered and looks like waves in the blue sky	Fine
	Altostratus	Denser, grayish with waterly look	Fine
Low clouds (Below 2000)m	Stratus	Grey and thick, appears like low ceiling or highland fog	Dull and light drizzle
	Nimbostratus	Dark, dull,	Continuous rain or sleet
	Stratocumulus		

		clearly layered rain cloud	Fair
	Cumulus	Rough, bumpy, wavy, (but more than altocumulus) Rounded top, horizontal base	Fair
Great vertical extent	Nimbocumulus	Black, anvil shaped, thunder cloud	Torrential, convectional, thunderous rain

PRECIPITATION

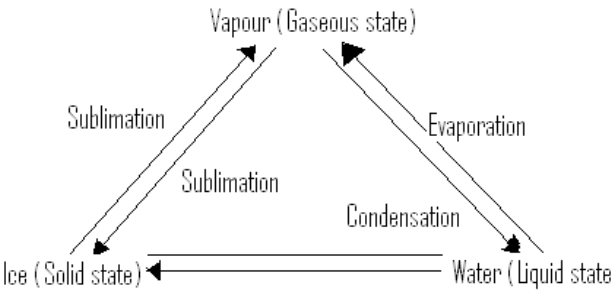
DEFINITION: The deposit of water either in liquid or solid from which reaches the earth from the atmosphere.

It includes not only rain, but also sleet, hail and snow.

STATES OF WATER

- Gaseous state called vapour
- Solid state called ice
- Liquid state called water

FIGURE 15: STATES OF WATER



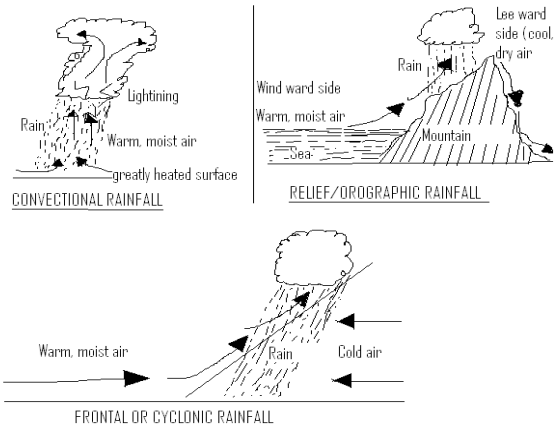
CONDITIONS FOR PRECIPITATION

- Air must be saturated
- Air must contain small particles of dust or nuclei around which the droplets from
- Air must be cooled below its dew point i.e. the temperature at which a volume of air gets saturated.

TYPES OF RAIN FALL

- Convectional Rainfall formed by the process of convection in the atmosphere.
- Relief or orgraphic rainfall caused by mountains standing in the path of moisture laden air.
- Frontal or cyclonic rainfall caused by a warm moist air mass moving upwards over cooler heavier air.

FIGURE 16: TYPES OF RAIN FALL



ADIABATIC LAPSE RATES (ALR)

DEFINITION: The drop rate in temperature as it rises and cooled.

Adiabatic means expansion and lapse means drop.

TYPES OF LAPSE RATES

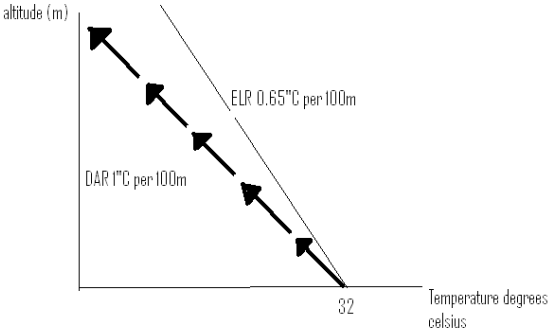
a. Environmental lapse rate (ELR) / Normal lapse rate (NLR):

Air temperature drops 0.65°C for every 100m it rises.

b. Dry adiabatic rate (DAR): Air temperature drops 1°C for every 100m ascent or rise.
c. Wet adiabatic rate (WAR): Air temperature drops 0.6° per 100m ascent.

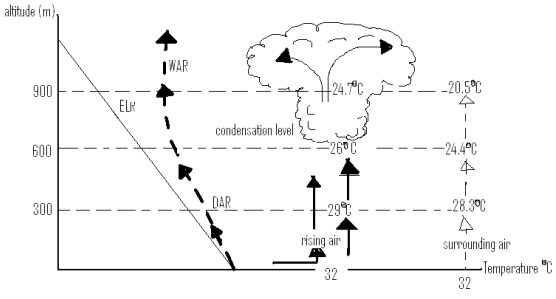
When combined, they influence atmospheric conditions of a given day.

STABLE ATMOSPHERIC CONDITIONS



When rising air is cooler than the surrounding air it sinks down i.e. representing stable conditions.

UNSTABLE ATMOSPHERIC CONDITIONS



The rising air has higher temperature than the surrounding (environmental) air i.e. the air will continue rising.

At about 600m the rising air condenses and forms clouds.

The air is wet but continues to rise because its temperature is still higher than the surrounding air's temperature.

It will stop rising when its temperature is the same as the temperature of the surrounding air i.e. unstable atmospheric conditions.

WEATHER

DEFINITION: The condition of the atmosphere at a certain time or over a short period as dictated by meteorological factors which include atmospheric pressure.

INSTRUMENTS FOR MEASURING WEATHER ELEMENTS

- Atmospheric pressure measured by mercury and aneroid barometers in mill bars
- Rainfall measured by a Rain gauge in millimeters
- Temperature measured by a thermometer which is placed in a shelter called a Stevenson Screen
- Winds indicated by a wind vane or weather cock
- Sunshine measured by a sunshine recorder
- Humidity which is the moisture in the atmosphere is measured by a Hygrometer.

IMPORTANCE OF WEATHER

- The direction of winds once controlled the pattern of trading route
- Farmers and their crops are influenced by weather
- Temperature, humidity and rainfall may promote or discourage diseases which may destroy both animals and crops
- Death rates are high in the tropical countries and low in deserts for germs are not transmitted readily in regions of high temperatures and low temperatures

- The safety of modern air travel is tied to accurate weather conditions and records from ground stations.

CLIMATE

DEFINITION: The average weather conditions of a place or region throughout the seasons and over long periods of time.

WORLD CLIMATIC REGIONS

DEFINITION: The main areas into which the earth is divided according to climate.

THE MAIN CLIMATIC REGIONS OF THE WORLD

TEMPERATE BELT	**CLIMATIC REGIONS**
Hot zone (0º - 30ºN,S)	Hot, wet equatorial, Tropical monsoon, Tropical continental (Sudan type), Hot desert.
Warm Temperate zone (30º - 40ºN,S)	Western Margin (Mediterranean type), Central continental (Steppe type), Eastern margin (China type)
Cool Temperate Zone (45º - 65ºN,S)	Western Margin (British type), Central continental (Siberian type), Eastern Margin (Laurentian type)
Cold zone (65º - 90ºN,S)	Artic polar (Tundra), Alpine zone (Mountain ranges),Alpine (Mountain)

CRITERIA USED IN CLASSIFYING THE CLIMATIC REGIONS

(See below table)

- Latitude
- Position of relative continents and oceans
- Local geographical conditions
- Amount of rainfall
- Temperature ranges

CLIMATIC REGION	HIGHEST TEMP.	LOWEST TEMP.	RANGE	TOTAL RAIN	PLACE	ALT
Equatorial Temperate	25°C	23°C	2°C	1582mm	Kananga	670 M
Tropical Continental (Sudan Type)	23°C	14°C	8°C	857mm	Lilongwe	915M
Warm Temperate western climate	24°C	11°C	13°C	762mm	Algiers	59M
The Cool Temperate Continental (Siberian)	20°C	-19°C	39°C	538mm	Winnipeg	240M
Tropical Desert	33°C	20°C	13°C	227mm	Timbuktu	301M

CLIMATIC ELEMENTS

- Temperature
- Precipitation
- Pressure
- Winds

The above elements are the most important.

FACTORS AFFECTING THE CLIMATIC ELEMENTS

- Latitude
- Altitude
- Ocean currents
- Continentality
- Insolation
- Prevailing winds (Go down)
- Slope
- Aspect

THE IMPORTANCE OF TEMPERATURE

- It influences water vapour present in the air and therefore decides the moisture carrying capacity of the air
- It influences the rate of evaporation and condensation, hence dictates the degree of atmospheric stability
- Since relative humidity depends on temperature of the air, it affects the nature and types of cloud formation and precipitation.

SUMMARY OF THE CLIMATIC REGIONS ACCORDING TO AMOUNT OF RAINFALL AND TEMPERATURE RANGES

A. EQUATORIAL TEMPERATE CLIMATE

CHARACTERISTICS

- Convectional rainfall throughout the year
- North east trades, North east and south west monsoon abundant
- Annual temperature range is 1°C and 2°C
- Ever green vegetation with broad leaves, thick canopy, trees very tall

e.g. mahogany, ebony, greenheart, chengal

Amazon basin, Zaire basin, Guinea Coast, Malay Peninsula, Indonesia and Philippines are main areas where this climate prevails

ECONOMIC ACTIVITIES

- Shifting cultivation is practiced.
- Plantation agriculture in some areas i.e. Java, Sumatra, West Africa (Cocoa)

FACTORS RETARDING DEVELOPMENT

- Excessive heat and humidity
- Prevalence of bacteria and insect pests
- Thickness of vegetation makes clearing and maintenance of land difficult
- Rapid deterioration of tropical soil
- Difficulties in lumbering and livestock farming (Due to tsetse fly, e.g. in Africa)

	J	F	M	A	M	J	J	A	S	O	N	D
°C	25	25	25	25	25	24	23	25	25	25	25	25
mm	138	144	194	190	83	24	13	58	117	173	225	223

B. TROPICAL CONTINENTAL (SUDAN TYPE) CHARACTERISTICS

- Hot rainy season from May to October in the Northern Hemisphere the rest is the cool dry season, November to April in the Sothern hemisphere and the rest is the cool dry season
- The monthly temperatures range from 21°C to 32°C and the range is 11°C
- Tall grass with short scattered trees which form a parkland or bush veld (Savanna) e.g. baobab and acacias. Most of these trees are umbrella shaped and deciduous
- A home of wild animals called the big game country.

ECONOMIC ACTIVITIES

- Growth of cotton, sugarcane, coffee, oil palm, groundnuts and even tropical fruits.

FACTORS RETARDING DEVELOPMENT

- Serious droughts
- Leaching is also a problem leading to poor lateritic soils
- Tsetse flies not good for animal rearing

	J	F	M	A	M	J	J	A	S	O	N	D
°C	22	21	21	19	16	14	15	16	20	22	23	22
mm												

	205	220	154	36	8	0	0	4	5	9	85	131

C. THE WARM TEMPERATE WESTERN MARGIN (MEDITERRANEAN) CHARACTERISTICS

- A dry warm summer with off – shore trades hence no rain. The air is dry, heat is great and relative humidity low
- A concentration of rainfall in winter with on shore westerlies
- A bright sunny weather with hot, dry summer and wet mild winters. Summers are warm and bright and winters are so mild and cool that many tourists come at all times of the year.
- Mediterranean evergreen forests, coniferous trees and shrubs and bushes

ECONOMIC ACTIVITIES

- Fruit farming (Citrus fruits i.e. oranges, lemons, limes, citrons, grape fruit).
- Grazing of animals on mountain pastures i.e. sheep, goats and cattle.
- Transhumance is practiced
- Wine production is also common

	J	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
ºC	20	22	25	30	32	33	31	30	30	30	30	20
mm	0	0	0	2	3	25	77	83	37	0	0	0

D. THE COOL TEMPERATE CONTINENTAL (SIBERIAN) CHARACTERISTICS

- Bitterly cold winter of long duration and cool brief summer.
- Spring and autumn are merely brief transitional periods
- Temperatures so low in winter that heavy snowfall is common.
- Precipitation varies from 380 to 635mm.
- The annual temperature range is very large i.e. 30ºC.

ECONOMIC ACTIVITIES

- Lumbering is the most activity in this climatic region i.e. sawmilling, paper and pulp industry, as fuel and as an industrial raw material
- Trapping (Many fur bearing animals are found here e.g. beaver, mink, muskrat.
- Hunting is another activity e.g. silver fox.
-

	J	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
ºC	11	11	14	16	20	22	24	24	22	20	15	11
mm												

	115	84	74	40	48	13	8	8	38	75	126	133

- Drought resistant scrub

ECONOMIC ACTIVITIES

- Nomadic hunting and food gathering
- Mining e.g. gold in Great Australian desert, diamonds and copper in the Kalahari.
-

E. TROPICAL DESERT CHARACTERISTICS

- Precipitation in scarce and unreliable
- Temperatures are high throughout the year due to clear cloud less sky, intense insolation, dry air and rapid rate of evaporation.
- There is no cold season in the deserts.

	J	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
ºC	-19	-18	-10	0	13	17	20	17	12	0	-8	-17
mm	25	25	32	36	57	76	75	62	61	37	27	25

NATURAL VEGETATION

DEFINITION: Different types of plants (trees, grass, shrubs etc) growing without any noticeable or modification by the human race

WAYS OF MODIFYING NATURAL VEGETATION

- Animal rearing
- Agro forestry
- Urbanization
- Fire

CLASSES OF VEGETATION

a. Forest
b. Savanna (Forest and grass)
c. Grassland
d. Desert

WAYS OF DESCRIBING VEGETATION

a. Life form i.e. trees, and shrubs
b. Size i.e. tall, medium or low in height
c. Coverage i.e. sparsely covered e.g. in deserts and continuous e.g. in equatorial forests.
d. Their response to annual climatic cycle e.g. deciduous i.e. losing leaves seasonally, semi deciduous i.e. shedding leaves but not seasonally a nd evergreen
e. Leaf size i.e. broad leaf or needle leaf
f. Leaf texture i.e. thick, thin and delicate and others may be hard, thick and leathery and thick and spongy

TYPES OF VEGETATION

1. **TROPICAL VEGETATION/TROPICAL RAINFOREST/EQUATORIAL FOREST**

LOCATION

In equatorial climate regions

CHARACTERISTICS

- Contains a variety of plants and animals
- The forest has three layers i.e. upper, middle and lower layer
- Trees grow very closely
- Growth is continuous (Flowering, fruits, shedding leaves)
- Most trees have broad leaves and long roots ensuring strong support
- Evergreen trees
- Tall trees forming a canopy resulting into little undergrowth

TREES FOUND

a. Mahogany
b. Ebony
c. Orchids
d. Rosewood
e. Iron wood
f. Green heart

All the above trees are hard woods

ECONOMICAL IMPORTANCE OF TROPICAL EVERGREEN FOREST

a. Used for lumbering e.g. Mahogany
b. Used for Sculpture e.g. Ebony
c. Used for poles

2. TROPICAL GRASSLAND

LOCATION

Found in tropical continental (Savanna Climate)

CHARACTERISTICS

i. Tall grass with scattered trees
ii. The grass dries up in the dry season
iii. The trees are deciduous (Shed their leaves)
iv. They have long roots

VEGETATION FOUND

- Baobab
- Palms
- Acacias
- Gum trees
- Elephant grass

NAME OF DIFFERENT TROPICAL GRASSLANDS

a. Campos – In Brazil
b. Llanos in Guinea Highlands
c. Savanna in Africa and Australia

DIFFERENCES BETWEEN VEGETATION IN THE EQUATORIAL CLIMATE AND IN SAVANNA CLIMATE

a. Equatorial vegetation is dominated by trees while the Savanna is dominated by grass
b. Equatorial vegetation has continuous canopy while the Savanna does not because in most cases it is spiced by grass
c. Growth, flowering and fruiting etc of trees is there all the time in Equatorial while in Savanna it is seasonal
d. There are more species in the Equatorial than the Savanna.
e. Trees in Equatorial are evergreen while in Savanna it is deciduous

3. DESERT VEGETATION

LOCATION

Located in tropical desert climate regions.

CHARACTERISTICS

a. They grow long roots that get to the depth
b. They have very thick leaves and stems to store water
c. Have waxy leaves that prevent transpiration and also have tiny leaves
d. They produce sleepy seeds (those that lie dormant when it is dry) and germinate when water is available.
e. Have scattered vegetation of drought resistant species

VEGETATION FOUND

- Cacti
- Thorn bushes
- Date palms
- Shrubs

4. TEMPERATE VEGETATION

LOCATION

Found in Mediterranean climate regions

CHARACTERISTIC FEATURES

- Evergreen trees most of which are not naturally growing
- Trees have needle shaped leaves
- There are shrubs, grasses scattered all over
- Very little natural vegetation

HOW VEGETATION WITHSTAND THE DRY SUMMER

- Water is stored in their thick barks and leaves
- The plants have spreading and deep roots that easily trap water
- Needle shaped leaves ensure less transpiration

SPECIES OF PLANTS FOUND

- Cedars
- Conifers
- Eucalyptus
- Marquis
- Chaparral
- Malle
- Oaks

NOTE: One common characteristics feature of Mediterranean plants is that they are all in one way or another adapted to the summer drought.

5. CONIFEROUS FOREST

LOCATION

Found in cool Temperate Interior Climate regions

CHARACTERISTICS

a. Composed evergreen coniferous
b. Have needle – shaped leaves
c. Have umbrella – shaped structure
d. Trees grow at a reasonably slow rate
e. They have big area or mass of wood than leaves
f. No undergrowth

TREES FOUND

- Hemlock
- Spruce
- Pine
- Fir

NOTE: *These are all soft woods*

ECONOMIC IMPORTANCE OF CONIFERUS FORESTS

a. Soft wood is used for making paper
b. Soft wood is used for making furniture
c. Soft wood is used for making matches
d. Soft wood is used for making synthetic fibres such as rayon

6. TEMPERATE GRASSLANDS

LOCATION

Found in temperate desert regions

CHARACTERSITICS

- Extensive area of grass without trees
- Grass occurs together with herbs
- The grass becomes short as we move towards the temperate areas.

EXAMPLES OF TEMPERATE GRASSLAND

a. Prairies (Canada/USA)
b. Pampas (Argentina)

c. Steppes (Eurasia)
d. Darling Murray (Australia)
e. Veldt (South Africa)

7. TUNDRA GRASSLAND

LOCATION

Found in Tundra climate

CHARACTERISTICS FEATURES

- A variety of grass growth together with mosses and linches
- The grasses are short due to slow growth because of the very cold climate
- The grass is punctuated by very stunted growth of bushes

NOTE: *Tundra grasslands are only found in the Northern Hemisphere because it has large land masses than the Southern Hemisphere*

IMPORTANCE OF GRASSLANDS

1. Habitats of a variety of animals e.g. in tropical grasslands – Antelope, Gazelles, Temperate grasslands – horses, antelope, Tundra vegetation – mosquitoes, musk ox, arctic hares, arctic white fox, fox
2. Offer ideal land for agriculture
3. Other grasslands are turned into National Parks and Game Reserves
4. Beauty of a country

8. TROPICAL MONSOON FOREST

LOCATION

In areas having Tropical Monsoon climate

CHARACTERISTICS

- There is smaller number of species
- Most trees are deciduous
- Tall trees
- Trees are sparsely spread
- Undergrowth is denser

EXAMPLES OF TREES

- Teak
- Bamboo
- Sal
- Sandalwood
- Acacia
- Eucalyptus

All the above are hard woods

ECONOMIC IMPORTANCE OF TROPICAL MONSOON FOREST

a. Trees are used for lumbering.g. teak
b. Used as poles e.g. eucalyptus

THE ENVIRONMENT

DEFINITION: Environment refers to surroundings made up of the biotic (living) and non living things.

ECOLOGY: The study of mutual reliance and interaction among organisms and their environment.

ECOSYSTEM: All living organisms and the physical, a biotic (non – living) environment in which they live and interact.

EXAMPLES OF ENDANGERED WILD AND AQUATIC LIFE SPECIES IN MALAWI

a. Chambo fish
b. Elephants
c. Nyala (The rare shy)

HUMAN ACTIVITIES THAT ENDANGER THE ENVIRONMENT

- Deforestation encouraging greater run off and large scale erosion
- Poor agricultural practices e.g. cultivating along the slope
- Pollution i.e. emission of gases and industrial disposals.
- Poor waste disposal
- Disruption of the food chain
- Misuse of insecticides
- Salination

CONSERVATION OF THE ENVIRONMENT

- Establishment of conservation areas such as forest reserves, national parks, game reserves
- Catching and relocating game
- Protection of rare and endangered species
- Civic education on conservation

WETLANDS

This refers to swamps, marshes and begs.

EXAMPLES OF WET LANDS

- Ndindi elephant marsh
- Lake Chirwa
- Vwaza Marsh

IMPORTANCE OF WETLANDS

a. Beatifying the environment
b. Reproduction of life e.g. fish
c. Stabilising shore lines
d. Habitat for birds, fish and plants
e. Locking up Carbon in form of peat

HUMAN ACTIVITIES THREATENING WETLANDS

- Encroachment i.e. draining them for cropping

MANAGEMENT OF WETLANDS

a. By government, civic education on the importance of wetlands
b. Individuals by avoiding encroachment
c. Communities by dealing with those who encroach

DESERTIFICATION

DEFINITION: Living the land bare. i.e. Carrying off the top soil leaving the land barren

MAIN CAUSE OF DESERTIFICATION

Misuse of land e.g. clearing of land for farming and settlement

EFFECTS OF DESERTIFICATION/PROBLEMS

- Climate change
- Erosion
- Poor crop yields
- Soil degradation
- Depletion of water resources

MEASURES OF CONTROLLING DESERTIFICATION

- A forestation
- Re a forestation
- Proper land husbandry
- Civic education
- Controlling rapid population growth
- Provision of alternative sources of energy.
- Environmental education

TYPES OF POLUTION

- Air pollution
- Water pollution
- Land pollution

CAUSES OF POLLUTION

a. AIR POLLUTION
- Removal of vegetative cover
- Emissions
- Noise
- Water disposal

b. WATER POLLUTION
- Waste discharge
- Oil spills

c. LAND POLLUTION
- Waste discharge
- Nuclear testing

EFFECTS OF POLLUTION

AIR

- Respiratory problem
- Odour
- Acid rain
- Poor visibility

WATER

- Loss of aquatic life
- Diarrheal problems
- Scarcity of safe and portable water

LAND

- Loss of biodiversity

WAYS OF CONTROLLING POLLUTION

- Proper waste disposal
- Using clean energy
- Legislate and enforce laws which protect the environment

FLOODS

DEFINITION: A body of water which covers land which is usually not under water.

EFFECTS

- Destroying property
- Wipe out homes

CAUSES OF FLOODS

- Too much rain
- Siltation which makes river channels shallow and enables rivers to over – flow their banks
- Removal of grass and other vegetation which holds water and prevent soil erosion

HOW TO CONTROL FLOODS

- Planting trees on highlands where floods start.
- Reclaim dry, barren highlands by planting grass and trees
- Building reservoirs along river banks, some distance from the river.
- Building levees to prevent river over flow

CLIMATE CHANGE

CAUSES

a. Deforestation i.e. the wanton cutting down of trees due to rapid population growth
b. Emission of gases (Green house effect)

EFFECTS OF CLIMATE CHANGE

a. Global warming i.e. caused by the release of green house gases e.g. methane, carbon dioxide etc
b. Increasing storms: Due to the development of cyclones
c. Changing Ocean Currents: The movement of warm and cold currents is visa versa
d. Shrinking of the Antarctic Ice Cap

SOLUTIONS TO THE CAUSES OF CLIMATIC CHANGE

a. Civic Education
b. Avoidance of use of machines or activities that release dangerous gases
c. A forestation and re a forestation
d. Avoidance of setting bushfires

GLOBAL WARMING

DEFINITION: The warming of the atmosphere due to the increase of some gases in the atmosphere.

CAUSES OF GLOBAL WARMING

- The burning of the fossil fuels such as coal, oil and natural gas.
- The destruction of forests
- Release of some gases in the atmosphere

EFFECTS OF GLOBAL WARMING

- Shift rain fall patterns
- Raise the sea level as icebergs melt
- Alter ecological balance

THE END