

PART ONE: FORM ONE WORK

TOPIC 1: THE SOLAR SYSTEM

DEFINITIONS OF TERMS

- a) **Solar system**
 - ❖ This refers to the sun, planets and other heavenly bodies such as comets.
 - b) **Planet**
 - ❖ It means the erratic ways in which the planetary objects seem to drift (move) among the fixed stars.
 - c) **Sidereal period**
 - ❖ It means the time a planet takes to complete one revolution around the sun.
 - d) **Satellites**
 - ❖ These are celestial bodies that move around the earth or other planet.
 - ❖ These are often called moons.
 - ❖ For example, the earth has one satellite, Mars has two satellites and Jupiter has four large satellites.
 - e) **Comet**
 - ❖ This is a frozen ball of ice and dust that travels in an elliptical orbit around the sun.
 - ❖ Examples include methane, monoxide and ammonia.
 - f) **Galaxy**
 - ❖ This refers to a system of millions or billions of stars, together with gas and dust held together by gravitational attraction.
 - g) **Asteroids**
 - ❖ These are celestial, metallic and rocky bodies which vary in size and revolve around the sun, with their orbits lying chiefly between Mars and Jupiter.
 - ❖ They are too small to be classified as planets.
 - h) **Meteors**
 - ❖ These are very small bodies from outer space that burn up once they enter the earth's atmosphere.
 - For this reason they are called shooting stars.
 - Meteorite**
 - ❖ These are meteors that land on the earth's surface.
- ### COMPONENTS OF THE SOLAR SYSTEM
- The solar system is found within a galaxy called the **Milky Way**.
 - A galaxy has several million stars; our milky way for example has over 1000 million stars.
 - The solar system comprises the sun and other lesser bodies.
 - The planets revolving around the sun are *Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune*. To easily remember these planets in their order, use the acronym **MVEM J. SUN**
 - These planets shine only when illuminated by the reflected lights of the sun.
 - They remain within their respective orbits because of the strong gravitational pull.
 - They revolve around the sun in an anticlockwise direction.
 - These planets revolve around the sun in their elliptical **orbits**.

Orbit

- It is the path along which a planet revolves around the sun.

NOTE

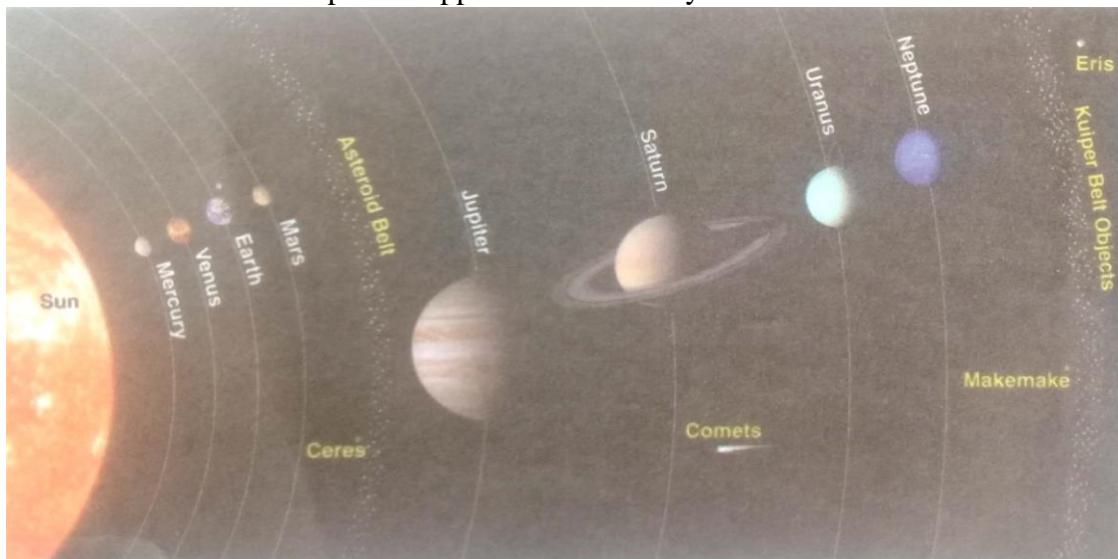
- ❖ Since the planets do not revolve around the sun in a circular pattern, but rather in an elliptical one, there is a time when they appear to be closer and sometimes away from the sun.

Perihelion

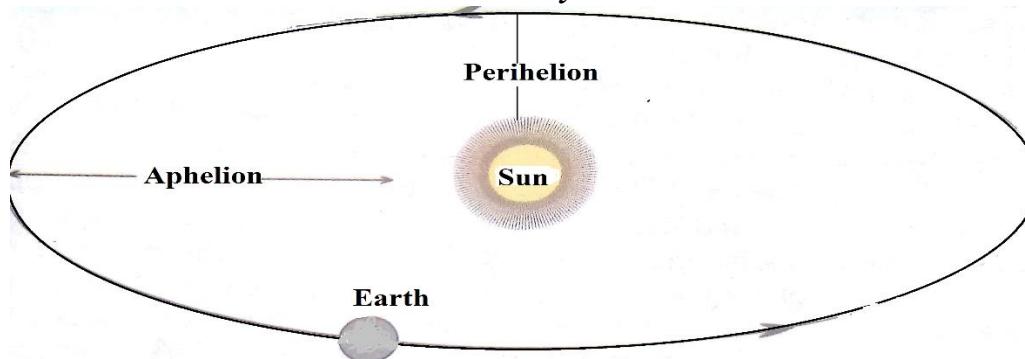
- ♦ This is the time when the planets appear to be close to the sun.

Aphelion

- ♦ This is the time when the planets appear to be far away from the sun.



The Solar System



The Perihelion and Aphelion

The Sun (Some facts about the Sun)

- ✓ Has a surface temperature of about 6000°C which increases to about $21,000\,000^{\circ}\text{C}$ in its interior part.
- ✓ It is about 300 000 times bigger than the earth.
- ✓ Fiery gases cover its surface and glow like a volcano during an eruption.
- ✓ We are able to see heavenly bodies mainly because the sun's great light is reflected on them.

Categories of Planets

a) Inner planets

- ♦ These are planets that are closest to the sun.

Examples of inner planets

- ✓ Mercury

- ✓ Venus
- ✓ Earth
- ✓ Mars

b) Outer planets

- ◆ These are planets that are found on the outer part of the solar system.
- ◆ They are called gas giants because they are made of **hydrogen** and **helium** gases.

Examples of inner planets

- ✓ Jupiter
- ✓ Saturn
- ✓ Uranus
- ✓ Neptune

c) Dwarf planets

- ◆ It is a celestial body that orbits around the sun.

Examples of Dwarf planets

- ✓ Ceres
- ✓ Pluto
- ✓ Haumea
- ✓ Makemake
- ✓ Eris

- ❖ It has enough mass to assume a nearly round (spherical) shape but it is not a moon.

DIFFERENCES BETWEEN DWARF PLANETS AND OTHER PLANETS

- Other planets have a clear path around the sun while dwarf planets do not.
- Dwarf planets are smaller in size than the planet mercury.

SOME FACTS ABOUT THE EIGHT PLANETS

a) Mercury

- ❖ It is named after the mythical Roman god Mercury.
- ❖ It is the smallest of all the eight planets (its diameter is 4878km).
- ❖ It is closest to the sun (58, 900 000km from the sun).
- ❖ It takes 88 days to complete its sidereal period (to go around the sun).
- ❖ It takes 58.7 days to make a complete rotation on its own axis.
- ❖ It has no moon or rings around it.

b) Venus

- ❖ It is next closest to the sun (107, 200, 000km away).
- ❖ It orbits around the sun in 224.7 days and takes 243 days for it to complete a rotation on its axis, making one day longer than its year.
- ❖ It rotates in a clockwise direction from east to west (thus sun rises from west and sets in the east).
- ❖ People cannot live on it because the atmosphere contains carbon dioxide and sulfuric acid.
- ❖ It is the hottest of all the planets with about 4000⁰C.

c) Earth

- ❖ It is the only planet that supports life.
- ❖ It rotates in an anticlockwise direction on its axis once in 24 hours.
- ❖ It is 148, 800, 000 km away from the sun and takes 365½ days to make one complete revolution around the sun.
- ❖ The moon revolves from east to west around the earth once in 27 days.
- ❖ It is 509, 700, 000km².

d) Mars

- ❖ It is fourth from the sun (227, 200, 000 km away from the sun).
- ❖ It has two satellites (moons) that revolve around it.
- ❖ It rotates on its own axis within 24.6 hours and revolves around the sun within 687 days.
- ❖ It appears reddish in colour when viewed through a telescope from the earth, but has dark spots on its surface.

e) Jupiter

- ❖ It is the largest in the solar system.
- ❖ It is made up of many gases such as hydrogen, helium and methane.
- ❖ It is 780, 000, 000 km away from the sun, so it is very cold.
- ❖ It completes one rotation on its axis in 9.8 hours, and 12 years to complete one revolution around the sun.
- ❖ It has 67 satellites (moons) revolving around it.

f) Saturn

- ❖ It is the second largest planet and sixth planet from the sun.
- ❖ It is 1, 417, 600, 000 km away from the sun.
- ❖ It has three satellites (moons) revolving around it.
- ❖ It takes 29½ years to complete a revolution around the sun.
- ❖ It rotates at a great speed on its own axis, taking approximately 10 hours to complete one rotation.

g) Uranus

- ❖ It is the seventh planet after Saturn and it is 2, 854, 400 km away from the sun, and has very low temperatures.
- ❖ It is 50 times larger than the earth.
- ❖ It revolves around the sun in a clockwise direction from east to west.
- ❖ It has 27 satellites that revolve around it.
- ❖ The poles on Uranus are flattened and the planet takes about 23 hours to complete one rotation on its axis.
- ❖ It revolves around the sun on its orbit in 84 years.
- ❖ The atmosphere surrounding it is composed of methane which is greenish in colour.

h) Neptune

- ❖ It is the eighth planet, and is about 4, 468, 800, 000 km away from the sun.
- ❖ It has thirteen satellites.
- ❖ It is extremely cold since it is far away from the sun.
- ❖ It takes 164.8 years to revolve around the sun on its orbit and 22 hours to rotate on its axis.

NOTE

- ◆ Venus and Uranus rotate from east to west while all the other planets rotate from west to east.

NEW DEVELOPMENTS RELATED TO THE SOLAR SYSTEM

a) Differences in the number of planets

Previously it was known that there were nine (9) planets revolving around the sun (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune and Pluto). But, in 2006, the International Astronomical Union agreed that Pluto should no longer be classified as a planet because it did not fit the criteria of the description of a planet.

- 1) It should have an orbit around the sun. But Pluto'
- 2) The gravity of celestial body needs to be strong enough to enable it to retain its spherical shape.

- 3) A planet needs to clear the neighbourhood of its orbit around the sun. This means that the gravitational force of the planet needs to be dominant in its orbit as it revolves around the sun.

Pluto is just a dwarf planet

Characteristics of dwarf planets

- ✓ They are celestial bodies that orbit around the sun.
- ✓ They are not moons or satellites.
- ✓ The gravity of the dwarf planet is sufficient to allow it to assume a nearly round shape.
- ✓ They do not clear the neighbourhood around their orbit.

b) Shifting of poles

- ◆ The current North Pole and South Pole are rapidly shifting.
 - ✓ This means switching of the magnetic fields, such that the North Pole and South Pole will eventually switch places at a rate of 40 miles annually.
 - ✓ This shifting can be proved by observing the angle at which the earth is currently tilted. The difference between the true North Pole and magnetic north is called *angle of declination*.

The Cause of the shifting of the North Pole

- ✓ Climate change that is also responsible for disasters such as tsunamis and hurricanes.

c) Inclination of the planets

- ◆ Planets revolve around the sun on their specific orbits, on the same orbital plane called the **ecliptic**. A planet has its orbit lying on the ecliptic at an inclination of zero degrees. However, not all planets orbit the sun on the ecliptic.
- ◆ Some planets have a relatively small inclination from the common plane. Inclination means extent at which the plane of the orbit is tilted with reference to the ecliptic plane. Pluto and Eris are exempted since they have inclinations to the ecliptic of 17° and 44° respectively.

Reason why the Earth supports life

- a) The distance from the sun is right such that it is neither hot nor cold.

RELATING THE POSITION OF THE EARTH TO THE SUN

THE SHAPE OF THE EARTH

- ◆ The shape of the earth is geoid or oblate spheroid. This means that it is not perfectly round, it bulges at the equator due to its rotation. The rotation momentum tends to force the earth to bulge at the equator, and this causes the diameter at the equator to be 43km than the diameter from pole to pole.
- ◆ The equatorial circumference is about 40,085km.

NOTE:

- ❖ All living and non-living things are kept close to the earth because of the **gravitational force**, which is also called **centripetal force**. This force originates from the core.

EVIDENCE TO SHOW THAT THE EARTH IS A SPHERE

1) Aerial photographs

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

2) Circumnavigation of earth

- The first navigation (voyage) around the world by Ferdinand Magellan and others from the year 1519 to 1522 proved that the earth is spherical. They started off from Spain and

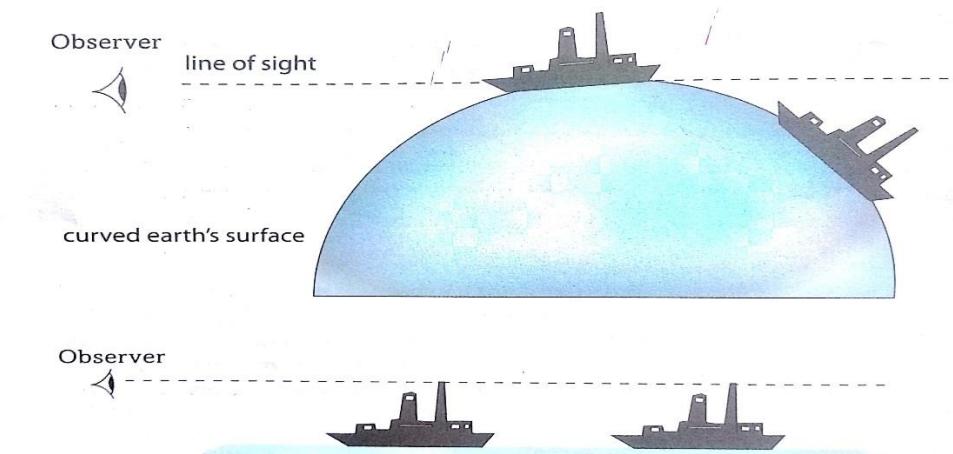
sailed towards the west; eventually they ended up arriving at the same point where they started their journey. This means that the earth is (spherical) round.

3) The circular horizon or earth's curved horizon

- Standing outside a room and look far ahead you see that at a certain point the earth seems to meet the sky. This happens because the earth's surface appears a bit curved in front of you. This prevents someone from seeing beyond the horizon.
- Also when you look ahead of you when standing next to a beach, it seems as if at a certain point the sea and the land have met, and it appears to be curved. This shows that the earth is spherical.

4) Ship's visibility

- When the ship leaves the harbour, it disappears little by little beginning with its lower body followed by its funnel, mast and smoke.
- When the same ship approaches the harbour, it appears little by little. This happens because the earth is spherical in shape.



Visibility of a Ship from a Curved and Flat Surface

5) Sunrise and sunset

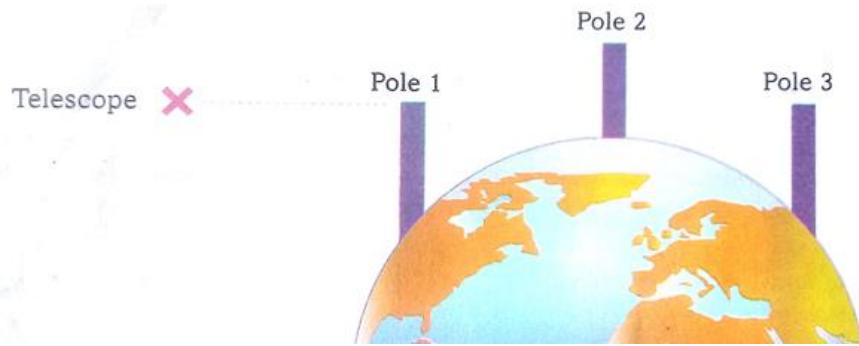
- The sun rises and sets at different times in different places. As the earth rotates from west to east, the sun rises in the east and sets in the west. This means that places in the east experience the sun earlier than those in the west. If the earth were flat, every place on the earth would experience the sunrise and sunset all at the same time.

6) The lunar eclipse (Eclipse of the moon)

- This occurs when the earth is between the sun and the moon. When this happens, a shadow of the earth is cast onto the moon. This shadow is always circular in shape. This is a good evidence that the earth is spherical.

7) Surveying with poles on level ground (Wallace's experiment)

- ◆ Poles of equal lengths when driven into level ground at equal intervals, do not show the same height. The central pole projects above the level of the poles on the sides when observed through a telescope. This happens because the earth is spherical. If the earth were flat, the tops of all the poles would have the same height when observed through the telescope.



Wallace's Experiment to prove that the Surface of the Earth is Spherical

EFFECTS OF THE SHAPE OF THE EARTH

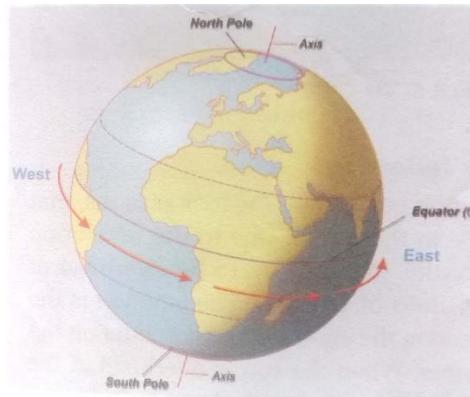
- The rotation of the earth on its axis allows various places on the surface to experience the sunset and sunrise at different times.
- Varying (changing) levels of sun's intensity at different places and times of the year. For example, areas around the equator has high temperatures than those at Polar Regions.

MAIN MOVEMENT OF THE EARTH

- Rotation
- Revolution

ROTATION OF THE EARTH

- It means the turning of the earth on its axis from west to east once in 24 hours.
- It rotates through 15° in one hour or 1° in 4 minutes.



Rotation of the Earth

RESULTS OF ROTATION OF THE EARTH

- It causes day and night**
 - Rotation causes one half of the earth to face the sun, and that side experiences day light
- Deflection of winds and ocean currents to the right in the northern hemisphere and to the left in the southern hemisphere**
 - Rotation produces a coriolis force which deflects freely moving substances such as ocean currents and winds to the right (clockwise) in the northern hemisphere and to the left (anticlockwise) in the southern hemisphere. This is according to the Ferrel's Law of Deflection.
- Daily rising and falling of tides**

- ◆ On water bodies such as oceans, the coriolis force or centrifugal force pushes the surface water to create waves or tides which rise and fall around the water.

4) The spherical shape of the earth

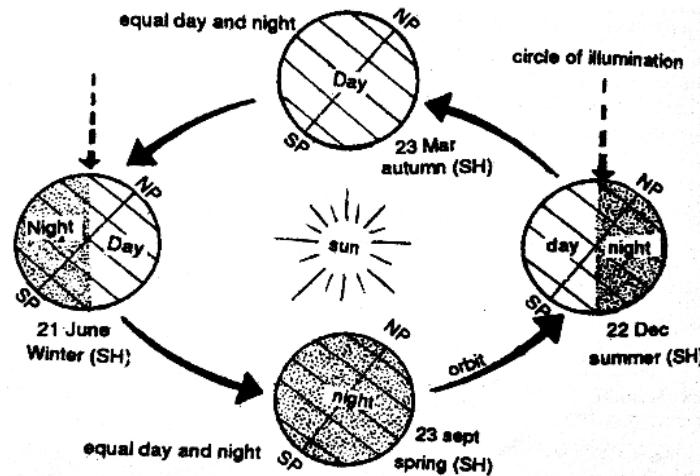
- ◆ Rotation results to flattening of the earth at the poles and the bulging of the earth along the equator.

5) The creation of standardized time zones

- ◆ The earth completes one rotation in 24 hours. This means that there is one hour range for every 15° of longitude or meridian, or 4 minute-difference for every 1° of rotation.

REVOLUTION OF THE EARTH

- ◆ It is the movement of the earth around the sun along the orbit in an anticlockwise direction once in $365\frac{1}{4}$ days.
- ◆ The average speed of revolution is 30km per second or 107, 182 km per hour.



Revolution of the earth

RESULTS OF RELUTION OF THE EARTH

- a) It causes seasons (summer, autumn, winter and spring).
- b) There are differences in the position of the noon day sun.
- c) There are varying (changing) length of days and night at different times of the year.

TOPIC 2: THE HYDROSPHERE

- ◆ This is the part of the earth that is made up of water bodies such as dams, lakes and rivers.

THE DISTRIBUTION OF WATER ON THE EARTH'S SURFACE

- ◆ Above 71% of the surface of the earth is made up of water. This is unique because it is the only part that has stable and consistent amounts of liquid water on its surface.
- ◆ The water on the earth's surface is composed of both fresh and saline water. Fresh water has salinity percentage of less than 1%.
- ◆ Saline (salty) water makes up about 97% of the total water available on the earth's surface, while about 2.5% of this total is mainly fresh water.

THE HYDROLOGICAL OR WATER CYCLE

- ❖ This is the continuous movement of water in its various states from the land and water bodies as well as vegetation to the atmosphere and back to land, water bodies and vegetation.
- ❖ It is the ongoing circulation of water in its various forms between the land and atmosphere.

FEATURES IN THE HYDROLOGICAL CYCLE

- a) Sun
- b) Vegetation
- c) Water masses (ground water, lakes, rivers, dams, etc.)
- d) Clouds

PROCESSES IN THE HYDROLOGICAL CYCLE

a) Evaporation

- ❖ This is a process in which water changes to vapour (gas).

b) Transpiration

- ❖ This is the process where water is lost from plants through its leaves.

c) Evapo-transpiration

- ❖ This is a combined loss of water vapour from vegetation, land and water bodies.

d) Condensation

- ❖ This is the point at which water vapour forms water droplets.

e) Precipitation

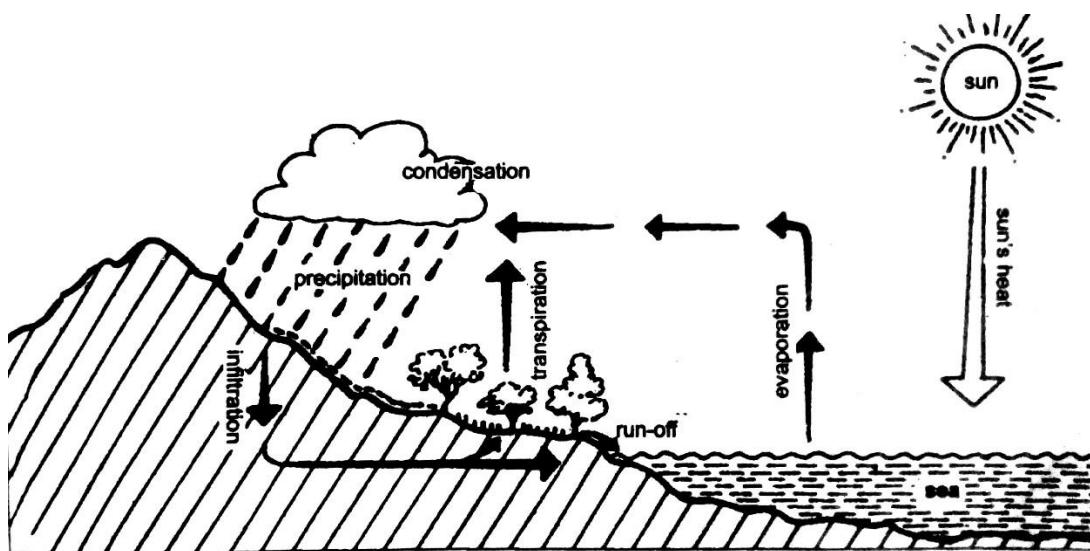
- ❖ This is the falling of solid or liquid water from the atmosphere.

f) Infiltration

- ❖ This is the soaking of water into the soil.

g) Capillary attraction

- ❖ The process in which water is attracted by plants until it is finally absorbed.



The Hydrological Cycle

EXPLANATION OF THE HYDROLOGICAL CYCLE

The heat energy from the sun heats up vegetation, surface of the earth and water bodies and transforms liquid water into vapour through transpiration and evaporation respectively. On rising, the air gets cooled and condensed, in which vapour forms water droplets. This leads to cloud formation. When the clouds can no longer hold excess water droplets, liquid or

solid water falls from the clouds to the earth's surface. This is called precipitation. On the earth's surface, the water runs to water bodies such as rivers, while the other amount of water infiltrates into the ground where it percolates and joins water in bodies; and a certain amount of water is taken up by the plants. The process then starts all over again, completing the cycle.

IMPORTANCE OF THE HYDROLOGICAL CYCLE

- ✓ It sustains life on earth since it acts as a habitat for aquatic species such as fish.
- ✓ It is used for the production of hydro-electric power.
- ✓ Water bodies such as lakes promote the tourism industry since they provide an attractive scenery.
- ✓ Water is used for industrial and domestic use.
- ✓ Water is used for transportation through the movement of ships.
- ✓ It regulates (controls) temperatures by ensuring that moisture is available in the atmosphere.
- ✓ Water is used for sporting activities such as swimming.
- ✓ Water is used for plant growth.

FACTORS THAT CAN DISTURB THE HYDROLOGICAL CYCLE

a) Deforestation

- ◆ Deforestation reduces the rate of transpiration. This leads to little or no rainfall.

b) Poor agricultural practices

- ◆ These may include shifting cultivation and cultivation on steep slopes. These may reduce vegetation, thereby reducing the rate of transpiration, leading to little or no rainfall.
- ◆ Cultivation of steep slopes also promotes soil erosion and siltation of water bodies. This makes water bodies not to keep water, and this can reduce the rate of evaporation and can lead to little rains.

c) Climate change

This means a gradual change of climate from one type to the other due to changes in weather patterns. When greenhouse gases (such as carbon dioxide and methane) destroy the ozone layer, direct sun rays can be reaching the earth's surface, causing **global warming**.

- ◆ Global warming can increase the rates of transpiration and evaporation in some areas, leading to heavy rains.
- ◆ Global warming can also disturb the process of condensation, leading to little or no rainfall.

d) Acid rain

This rainfall is formed when greenhouse gases from homes and industries react with water molecules in the atmosphere.

- ◆ Acidic rains destroy the leaves of vegetation. This reduces the rate of transpiration, leading to little or even no rainfall.
- ◆ Acidic rains also reduce the amount of water molecules as more of water molecules react with greenhouse gases.

WAYS OF MAINTAINING THE HYDROLOGICAL CYCLE

1) Practicing good farming practices

- ◆ These may include avoiding cultivation of steep slopes and avoid shifting cultivation. These may reduce siltation of water bodies to keep enough water for evaporation maintain vegetation for transpiration.

2) Afforestation and reforestation

- ◆ This helps to increase the rate of transpiration, leading to good rainfall.
- ◆ Afforestation can also reduce the concentration of greenhouse gases such as carbon dioxide in the atmosphere they use for photosynthesis. This in turn can reduce the occurrence of global warming that disturbs the hydrological cycle by leading to too much or little rainfall.

3) Avoiding the release of greenhouse gases into the atmosphere

- ◆ This can reduce the occurrence of global warming that disturbs the hydrological cycle by leading to too much or little rainfall.

4) Civic education on environmental protection

- ◆ This can help change people's mindset on environmental degradation. This in turn can promote environmental protection, leading to good transpiration and evaporation rates that yield good rains.

5) Conserving water catchment areas

This can be done by planting trees around water bodies and in mountains which are river sources.

- ◆ This can help keep water in water bodies, which can promote evaporation and lead to good rains.
- ◆ Protection of water catchment areas can also maintain vegetation that helps in transpiration. This can lead to good rainfall.

TOPIC 3: THE ATMOSPHERE

- ❖ The word atmosphere comes from a **Greek** word **atmos** which means **vapour**. Therefore, the word atmosphere means the part of the earth that is made of different gases.

Composition of gases in the atmosphere

Gases	Their composition (%)
Oxygen	20.54
Nitrogen	76.55
Carbon dioxide	0.03
Argon	0.91
Other gases	0.01
Water vapour	1.96

LAYERS OF THE ATMOSPHERE

- 1) The `troposphere
- 2) The stratosphere
- 3) The mesosphere
- 4) The thermosphere

THE TROPOSPHERE

- ◆ This extends from the surface of the earth's surface to a height of 13km at the equator and 8km at the poles.
- ◆ It contains 90% of the water vapour of the atmosphere.

Characteristics of the troposphere

- It is the lowest layer of the earth's atmosphere.
- Much of the weather conditions are experienced in this level.
- It is the only layer in the atmosphere that supports life.
- Atmospheric pressure decreases with increasing altitude (height).
- Temperature decreases with increasing altitude (normal or positive lapse rate).
- The top part is bounded by a layer of air called the tropopause or isothermal layer which separates the troposphere from the stratosphere.
- The temperatures at the tropopause remain constant (this is zero lapse rate).

THE STRATOSPHERE

- ❖ This extends from the upper surface of the troposphere (13km) to 50km.

Characteristics of the stratosphere

- ◆ Absence of clouds which allows for great visibility.
- ◆ It causes meteorites (rocks from the outer space that hits the earth's surface) to burn up before they can hit the surface of the earth. It is a protective layer.
- ◆ Temperatures increase with increasing altitude. (There is temperature inversion or negative lapse rate).
- ◆ This temperature inversion prohibits vertical winds so that horizontal winds are almost parallel to the ground, which ensures fast and smooth flying of aircrafts.
- ◆ Aircrafts fly through the lower part of the stratosphere as it provides easier flying conditions.
- ◆ It has the ozone layer.
- ◆ It is the transitional zone between the troposphere and the mesosphere.

THE MESOSPHERE

- ❖ It extends from 50km to 80km above the surface of the earth.

Characteristics of the stratosphere

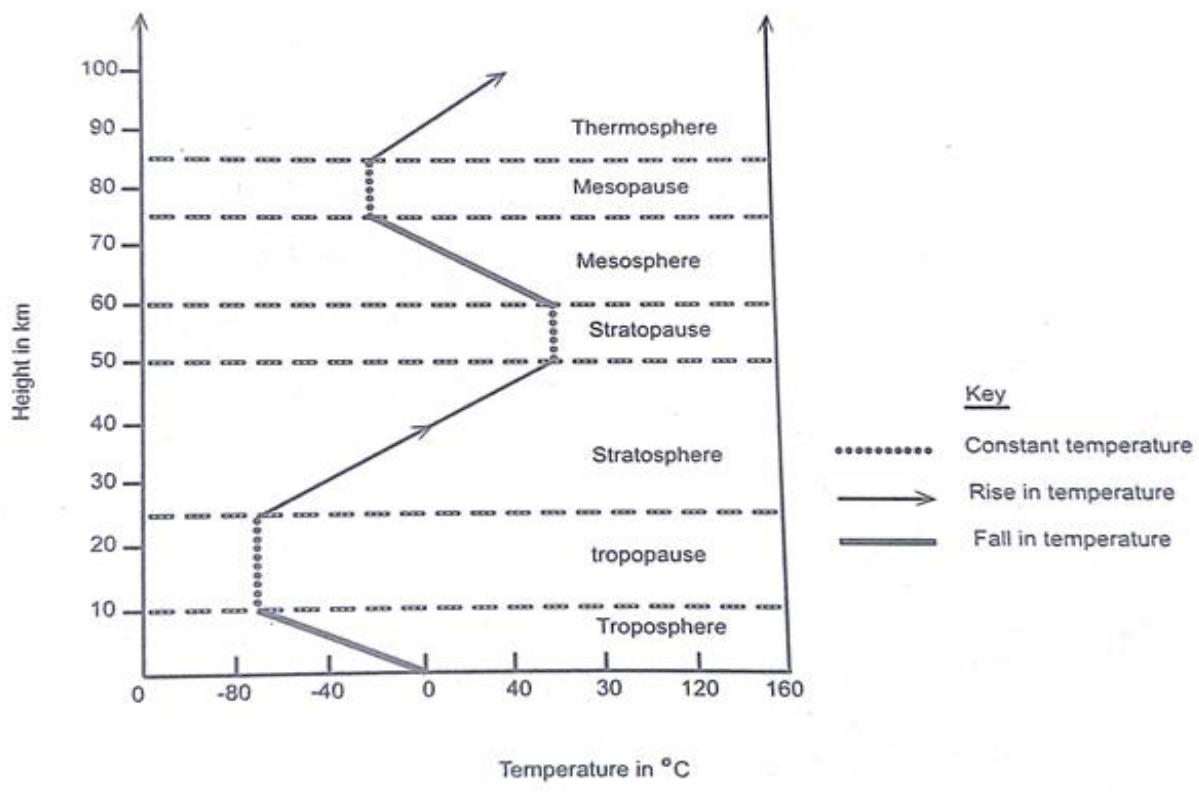
- ❖ Temperature decreases with increasing altitude.
- ❖ The ionised particles concentrate in a D-zone layer which reflects radio waves sent from the surface of the earth.
- ❖ Its upper part is called the mesopause and it has zero lapse rate.
- ❖ It experiences the strongest winds than other layers.
- ❖ Ionisation (changing into ions) occurs in this layer as sunlight reduces the molecules to electronically charged particles.

THE THERMOSPHERE

- ❖ It extends from 80km to over 400km above the earth's surface.

Characteristics of the thermosphere

- i) It contains ionosphere and the exosphere.
- ii) Temperatures increase rapidly with increasing altitude. (Negative lapse rate).
- iii) The exosphere being the outer layer of the thermosphere extends thousands of kilometres above the surface of the earth.
- iv) Increasing in temperatures take place mainly because the atomic oxygen present here absorbs the ultraviolet radiation.
- v) The upper part of the ionosphere is called the ionopause, and it is a transitional zone between the ionosphere and the exosphere.
- vi) Ionisation continues to take place in the lower layer of the thermosphere (ionosphere) producing belts that reflect rapid waves. This is the reason this layer is good for communication.



Layers of the Atmosphere

IMPORTANCE OF THE ATMOSPHERE

- a) It helps to control temperatures on earth.
- b) It protects us from the harmful sun's ultraviolet rays.
- c) It has several gases such as oxygen that sustain life on earth.
- d) It helps to control the weather patterns and conditions on the earth's surface.
- e) It protects us from the meteorites (rocks from the space) since it helps to burn them up before they hit the earth's surface.
- f) It helps in communication (phones, radios and television), since the sound waves are transmitted and reflected back to the earth.

(IMPACTS) EFFECTS OF RAPID POPULATION GROWTH ON AIR (ATMOSPHERE)

1) Air pollution

- ❖ This can take the form of water, air or land pollution. This pollution may result from waste discharged from homes, industries and gases from cars.

2) Global warming

- ❖ This is caused by the harmful greenhouse gases produced by refrigerators, air conditioners, or cars. These destroy the ozone layer that protects us from harmful sun rays, leading to increasing temperatures on the earth's surface.
- ❖ Global warming is also caused due to deforestation as people clear forests for settlement or farming. Trees absorb carbon dioxide for photosynthesis so, clearing forests promotes the accumulation of greenhouse gases (such as carbon dioxide) in the atmosphere that damage the ozone layer, leading to global warming. **NOTE:** The impacts of greenhouse gases on global warming is called **greenhouse effect**.

TOPIC 4: WEATHER AND CLIMATE

WEATHER

- ❖ It means the condition of the atmosphere for a short period of time.
- ❖ It changes any time, it can be sunny, cloudy, etc.

CLIMATE

- ❖ It is the average weather condition of a particular place observed over a long period of time.
- ❖ This period can be 25 to 30 years.

THE DIFFERENCE BETWEEN WEATHER AND CLIMATE

- ◆ Weather conditions change frequently while the climate of a place takes a longer time to be known and established.

ELEMENTS OF WEATHER

- ✓ Temperature
- ✓ Rainfall
- ✓ Air pressure
- ✓ Wind
- ✓ Humidity
- ✓ Cloud cover
- ✓ Sun shine

MEASUREMENT OF ELEMENTS OF WEATHER

a) Traditional methods

b) Modern methods

TRADITIONAL METHODS OF MEASURING ELEMENTS OF WEATHER

- Migration of insects and birds was an indication that dry conditions were approaching. The flying of some insects and appearance of termites was an indication that the rainy season was about to start.
- The shedding of leaves of trees was a sign that rainy season was about to begin.
- The continuous croaking of frogs was a sign that the rainy season was about to start.
- The appearance of thick dark clouds in the sky was a sign that it was going to rain.
- Excitement in animals such as cows such as running fast was an indicator that the rains were about to fall.
- White and light clouds were a sign that rains were not going to come.
- The appearance of a rainbow was sign that rains were not going to come.

MODERN METHODS OF MEASURING ELEMENTS OF WEATHER

a) TEMPERATURE

- ◆ This means how hot or cold something is.
- ◆ Or it is the degree of hotness or coldness of something.

MEASUREMENT OF TEMPERATURE

- ◆ It is measured in degrees Celsius ($^{\circ}\text{C}$) or Fahrenheit, using an instrument called thermometer.

TYPES OF THERMOMETERS

a) Single tube thermometer

b) Maximum and minimum thermometer (Six's Thermometer)

MAXIMUM AND MINIMUM THERMOMETER (SIX'S THERMOMETER)

- ❖ This measures the highest (maximum) and lowest (minimum) temperatures.
- ❖ The temperature readings for both the daily maximum and minimum temperatures are observed at the bottom end of the metal indicators.
- ✓ The glass tube contains mercury in the middle and alcohol on either end of the tube. The right-hand side measures the maximum temperature and the left-hand measures minimum temperatures for the day. When the temperature decreases, the alcohol contracts and pulls the mercury up along the tube on the left side. The mercury pushes up the metal indicator. The minimum temperature is obtained by reading the scale at the end of the index which is nearer to the meniscus.
- ✓ When temperature rises, the alcohol expands and this pushes the mercury on the right tube upwards which pushes up the index. The maximum temperature is obtained at the end of the index which is in contact with the mercury on the right hand limb. The readings are taken once a day, in the morning.

NOTE:

The thermometer must be reset for the next day's measurements. This is done by drawing the indicator back to the meniscus (curved surface in the liquid that is created by tension of the liquid surface of the mercury), using a magnet.

INTERPRETING TEMPERATURE DATA

- ◆ Once the temperature readings for the day are taken, interpretation begins.
- ◆ Using the two readings, we can calculate:
 - a) Mean diurnal temperature
 - b) Daily temperature range
- 1) **MEAN (AVERAGE) DIURNAL TEMPERATURE**
- It is found by adding the highest (maximum) and lowest (minimum) temperature for the day by 2. Use the formula below:

$$\text{Mean Diurnal (Daily) Temperature} = \frac{\text{Daily Max. Temp.} + \text{Daily Min. Temp}}{2}$$

Example:

- 1) The table below shows the temperature readings for Mzuzu City on a certain day. Use it to calculate the Mean Diurnal (Daily) Temperature for the city.

Time	8am	9am	10am	11am	12 noon	1pm	2pm	3pm	4pm
Temp. (°C)	18	24	22	19	17	16	23	26	24

SOLUTION

$$\text{Mean Diurnal (Daily) Temperature} = \frac{\text{Daily Max. Temp.} + \text{Daily Min. Temp}}{2}$$

$$\text{Mean Diurnal (Daily) Temperature} = \frac{26^{\circ}\text{C} + 16^{\circ}\text{C}}{2}$$

$$= \frac{26^{\circ}\text{C} + 16^{\circ}\text{C}}{2}$$

$$= \frac{42^{\circ}\text{C}}{2} \\ = 21^{\circ}\text{C}$$

2) DIURNAL (DAILY) TEMPERATURE RANGE

- ◆ This is found by subtracting the daily minimum temperature from the daily maximum temperature.

Example:

The table below shows the temperature readings for Mzuzu City on a certain day. Use it to calculate the Diurnal (Daily) Temperature Range for the city.

Time	8am	9am	10am	11am	12 noon	1pm	2pm	3pm	4pm
Temp. ($^{\circ}\text{C}$)	18	24	22	19	17	16	23	26	24

SOLUTION

$$\begin{aligned} \text{Daily Temperature Range} &= \text{Daily Max. Temp} - \text{Daily Min. Temp} \\ &= 26^{\circ}\text{C} - 16^{\circ}\text{C} \\ &= 10^{\circ}\text{C} \end{aligned}$$

- ◆ We can also calculate the mean monthly temperature, mean monthly temperature range, annual temperature range and mean annual temperature.

MONTHLY/ANNUAL TEMPERATURE RANGE

- ◆ This is calculated by subtracting the lowest (minimum) mean monthly/annual temperature from the highest (maximum) mean monthly/annual temperature.

$$\text{Temperature Range} = \text{Max. Temp} - \text{Min. Temp}$$

Example

Using the table below, calculate the monthly temperature range.

Time	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Temp ($^{\circ}\text{C}$)	16	18	24	22	27	19	17	16	23	26	24	21

SOLUTION

$$\text{Temperature Range} = \text{Max. Temp} - \text{Min. Temp}$$

$$\begin{aligned} \text{Temperature Range} &= 27^{\circ}\text{C} - 16^{\circ}\text{C} \\ &= 11^{\circ}\text{C} \end{aligned}$$

MEAN (AVERAGE) MONTHLY TEMPERATURE

$$\text{Mean Monthly Temp.} = \frac{\text{Daily Mean Temp. in a Month}}{\text{Number of Days in that Month}}$$

MEAN (AVERAGE) ANNUAL TEMPERATURE

$$\text{Mean (average) Annual Temp.} = \frac{\text{Sum of mean monthly Temp. for the Year}}{12}$$

NOTE:

- ◆ On maps, the lines joining places of equal temperatures are called **ISOTHERMS**.
- ◆ **The knowledge of temperature analysis in the following ways:**
 - a) It is used to forecast weather and climatic trends for the region.
 - b) It can be used to tell the types of crops that can be grown in an area and animals that can be kept in an area.

FACTORS THAT AFFECT TEMPERATURE

1. Altitude
2. Latitude
3. Distance from the sea
4. Cloud cover
5. Vegetation
6. Winds
7. Length of the day

ALTITUDE

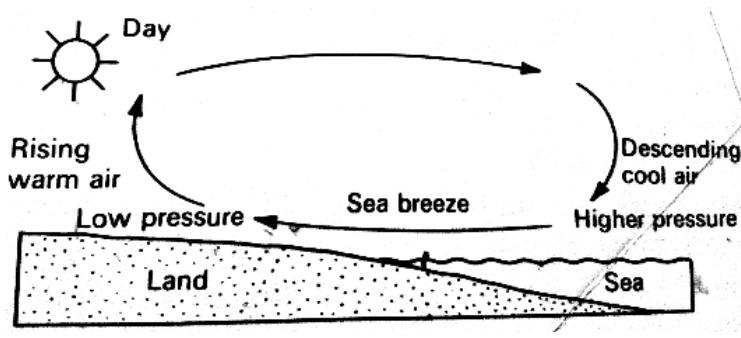
- This refers to the height above the sea level.
- Temperatures decrease with increasing altitude by 6°C every 1000 metres that one rises. This is called Environmental Lapse Rate (ELR). This means that areas in higher altitudes such as Mzuzu experience low temperatures while areas in lower altitudes such as Chikhwawa experience higher temperatures.

LATITUDE

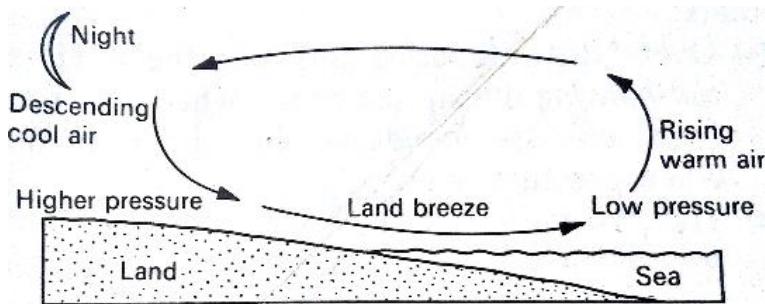
- This means the distance of a place from the equator.
- The earth receives varying amounts of heat from the sun throughout the year. On the one hand, areas that are close to the equator (in the tropics) experience high temperatures. This happens because most of the energy from the sun is focused towards this region. On the other hand, areas in Polar Regions experience lower temperatures because these areas do not receive enough energy from the sun.

DISTANCE FROM THE SEA

- ❖ During the sea breeze, the air blowing the sea towards the land will lower the temperatures on the adjacent land masses.
- ❖ During the land breeze, the air blowing from the land towards the sea will low the temperatures on the sea.



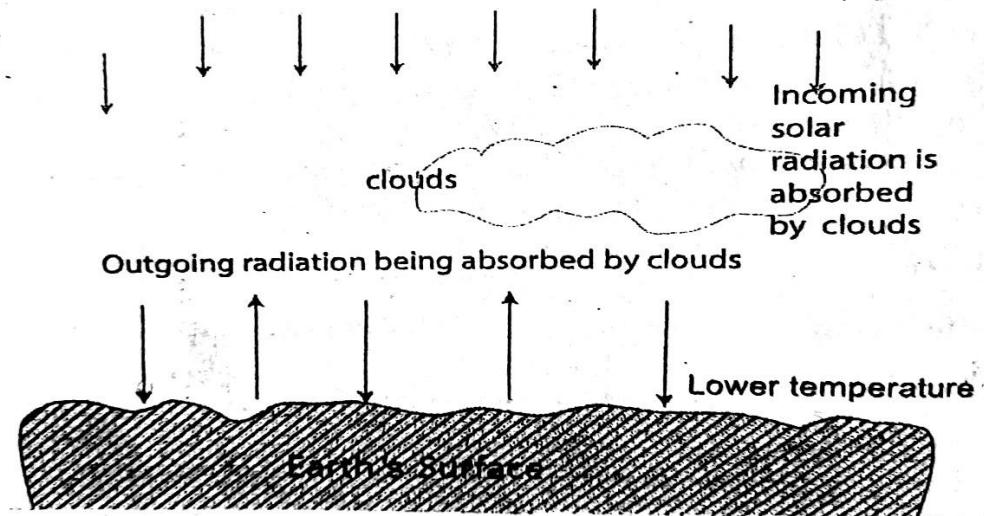
A Sea Breeze



A Land Breeze

CLOUD COVER

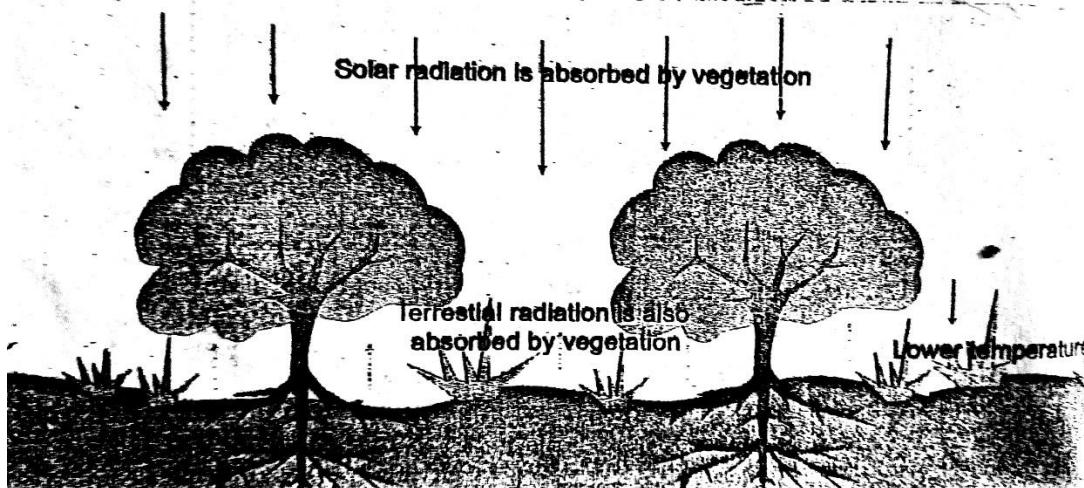
- ❖ Cloud cover reduces the amount of solar radiation reaching the earth's surface from the sun, and that it also reduces the amount of radiation leaving the earth's surface. The greater the cloud cover in the sky, the lower the temperatures on the earth's surface will be. When there are no clouds in the sky, the atmosphere experiences higher temperatures. This leads the earth to experience a greater daily temperature range.



Effects of Cloud Cover on Temperature

VEGETATION

- ❖ There is a cooling effect on the earth's surface when there is vegetative cover. But when there is no vegetative cover on the land, more energy from the sun reaches the earth's surface and more of it will be released back into the atmosphere.



Effects of Vegetation on Temperature

WINDS

- ❖ Hot, dry winds blowing in a particular area brings about hot and dry conditions in areas they blow to.
- a) **Length of the day**
- ❖ Longer days lead to greater amount of isolation received. This mainly happens when the hemispheres experience summer solstice.

DEFINITION OF TERMS

i. Evaporation

It is the process whereby water changes from liquid to state to gas (vapour). It takes place on both water and land masses.

Factors that influence the rate of evaporation

- Heat: high temperatures encourage it.
- Wind: higher (strong) winds encourage evaporation.
- Dryness of air: dry air absorbs moisture more than wet or humid air.

ii. Transpiration

It is the loss of water vapour from leaves of vegetation through **stomata**.

iii. Sublimation

This is the changing of water from solid form directly to vapour. It happens when solar radiation abruptly becomes high in cold regions or high-altitude areas where frozen water is common.

iv. Evapotranspiration

It is the combined loss of vapour from both vegetation (*transpiration*), and land and water masses (*evaporation*).

v. Adiabatical cooling

It is when the water vapour cools below its dew point. This happens as the vapour starts losing its temperature to the air that surrounds it following since temperature decreases with increasing altitude.

vi. Condensation

This is when tiny water droplets start forming, which eventually enlarge as more and more water droplets join. This results from adiabatical cooling.

- These water droplets later form clouds.
- When the diameter of water droplets enlarges, the cloud can no longer be held in the atmosphere, but fall on to the ground in the form of **precipitation**.

vii. Precipitation

- It refers to the falling of liquid or solid water from the atmosphere.

viii. Infiltration

It refers to the soaking of water into the soil.

ix. Run-off/overland flow

It is the moving of water on the earth's surface. This water joins water masses (sea, lakes, oceans, etc.)

x. Percolation

It is the movement of water into the soil. It can either be vertical (to join underground water) or horizontal (to join water masses).

xi. Capillary attraction

It is the process by which underground water rises until it is absorbed by roots of vegetation.

- Eventually, this water will also transpire again, thus completing and restarting the hydrological cycle.
- The water that percolates joins water masses.

xii. Cloud

A cloud is a mass of small water drops or ice crystals that is formed by condensation of water vapour in the atmosphere.

xiii. Dew-point

It is the temperature at which the atmosphere becomes saturated with water.

FACTORS THAT INFLUENCE OVERLAND FLOW (RUN-OFF)

1) The amount of precipitation

- The higher the amount of precipitation the higher the amount of water that will flow downstream.

2) Intensity and persistence of rainfall

- The high intense and persistent rainfall promotes run-off since water easily becomes saturated.

3) The initial soil moisture content

- When the soil already contains a lot of moisture, water easily fills the soil pores and runs off.

4) The texture and structure of soil

- Porous soils promote infiltration while fine textured soils such as clay promote run-off.

5) Slope of the land

- Steep slopes (gradients) promotes the rate of run-off while gentle slopes reduce it, and promote infiltration of water into the soil.

6) Vegetation

- Bare grounds promote run-off, but presence of vegetation promotes the infiltration of water into the ground.

PRECIPITATION

Precipitation is any form of liquid or solid water falling from the atmosphere.

LIQUID FORMS OF PRECIPITATION

1. Rain

2. Freeze rain

➤ These are rain droplets which fall in super-cooled liquid form, but freeze on impact with the ground or another object to form clear ice.

➤ It develops as falling snow encounters a layer of warm air deep enough for the snow to completely melt and become rain.

➤ It causes a great deal of damage by coating roads, sidewalks and rail ways, making them impassable.

3. Drizzle

➤ This means to rain lightly

SOLID FORMS OF PRECIPITATION

1) Hail

➤ These are balls or pieces of ice falling, often in connection with thunderstorm- (*matalala*)

2) Sleet

- This is a mixture of rain and snow.

3) Snow

- This is a frozen state of water (tiny ice crystals stuck together).

CONDITIONS NECESSARY FOR PRECIPITATION

- a) Air must be saturated.
- ✓ This means the air is full of water vapour (has high humidity).
- b) Air must contain small dust particles (nuclei), around which the droplets form.
- c) Air must be cooled below its dew-point.
- ✓ Dew point means the temperature at which the atmosphere becomes saturated with water.
- d) Wind blowing from water masses (lakes, oceans etc.) carrying water vapour towards mountains. This yields relief rainfall upon rising.
- e) Warm moist air must meet cold air mass along a line (front). This brings cyclonic rainfall.
- f) Sufficient amount of evaporation from the water bodies to supply water vapour into the atmosphere.

NOTE: *Dew or morning mist is not a form of precipitation since it forms on the earth's surface following a decrease in temperature.*

VIRGA

- ✓ These are grey streaks that appear below a cloud. They are formed when rainfall evaporates before reaching the ground.
 - Take note that rain may also not reach the ground because of updrafts. This is when the wind is blowing upward more than the rain is falling.

Conditions necessary for air to be cooled

- ✓ Air must be made to rise by convectional currents and mountains.
- ✓ When warm air passes over cold air.
- ✓ When air passes over cold surfaces such as cold ocean currents or land.

TYPES OF RAINFALL AND THEIR FORMATION

TYPES OF RAINFALL

- a. Convectional rainfall
- b. Cyclonic/frontal/depression
- c. Orographic/relief rainfall

A. Formation of Convectional rainfall

- ❖ When the earth's surface is greatly heated, air rises and expands, leading to its cooling. Continued cooling makes the air to become saturated and then condensed to form clouds from which heavy rain falls.

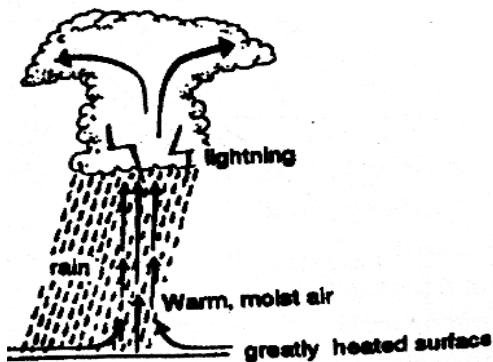
NOTE!

☞ The colder air in the atmosphere slowly sinks to take the place of warm rising air. This creates a convectional circulatory movement.

☞ This type of rainfall is common in equatorial regions and in summer as in the temperate interiors. It often comes in the afternoon after great heating of land surfaces.

Characteristics of convectional rainfall

- i. It is associated with thunder and lightning
- ii. It covers a small area
- iii. It falls heavily but for a short period of time.
- iv. It has anvil-shaped clouds.
- v. It often comes in the afternoon after great heating of land surfaces.



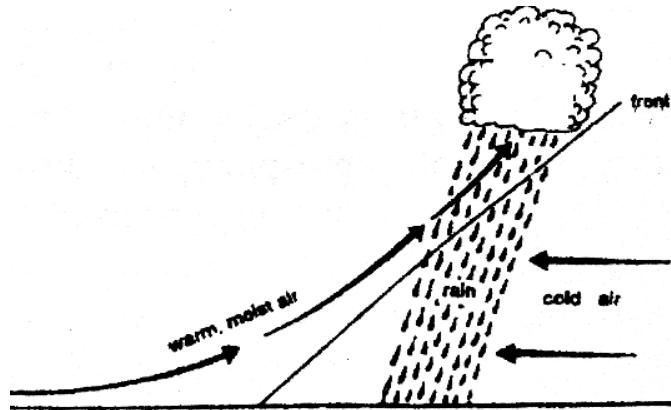
Formation of Convectional Rainfall

B. Formation of Frontal/Cyclonic rainfall (depression)

❖ This rainfall is formed when a warm air mass and a cold air mass meet at a front. After meeting, the warm air mass rises over the cold air mass. Upon rising, it cools and condenses to form clouds which eventually bring rainfall.

Characteristics of cyclonic rainfall

- i. Heavy rainfall that lasts for a short time.
- ii. It produces cumulonimbus clouds.
- iii. It is associated with storms (cyclones)
- iv. Lighter rainfall that lasts for a long time.
- v. Commonest throughout the doldrums where the trade winds meet.



Formation of Cyclonic Rainfall

C. Formation of Relief/Orographic rainfall

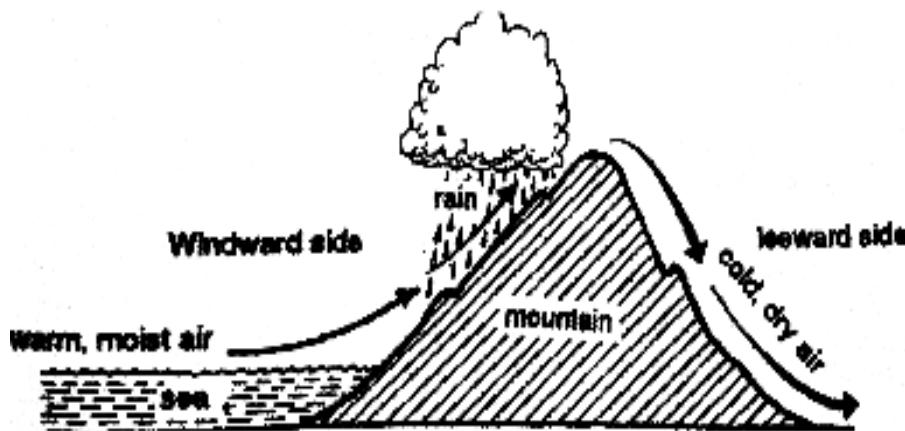
- ❖ This rainfall is formed when a mountain stands in the path of moisture laden air. The air is forced to rise and is then cooled. If sufficient water vapour is present, rain falls on the high ground on the **windward side**. The other side of the mountain the **leeward side** or **rain shadow** is always dry (or little or no rainfall at all).

Reasons why there is little or no rainfall on the leeward side of the mountain

This is so because on descending the leeward side, a decrease in altitude leads to an increase in pressure and temperature. The air is compressed and warmed hence relative humidity drops. Instead there is evaporation.

Characteristics of Relief/Orographic rainfall

- ☞ It is widespread.
- ☞ It falls for a long time.
- ☞ It occurs in the mountain on the side that faces the direction of wind (windward side)



Formation of Relief (Orographic) Rainfall

SIMILARITIES AMONG THE THREE TYPES OF RAINFALL

- 1) They all involve warm moist air rising.
- 2) They all involve warm air cooling.
- 3) In all cases water vapour condenses to form clouds.
- 4) They all involve further cooling that leads to precipitation.

DIFFERENCES AMONG THE THREE TYPES OF RAINFALL

- Differences are seen in the way air rises, as discussed below.
 - In convectional rainfall, air rises because it is being heated.
 - In relief rainfall, air is forced to rise over mountains.
- In frontal rainfall, warm air is rising over cold air.

MEASUREMENT OF RAINFALL

- ☞ Rainfall is measured using a rain gauge.

COMPONENTS OF A RAIN GAUGE

a) Funnel

- ☞ This directs water into the collecting glass bottle or bucket.

b) Collecting bucket

- ☞ Using this, the water is poured into the measuring cylinder where readings are taken.

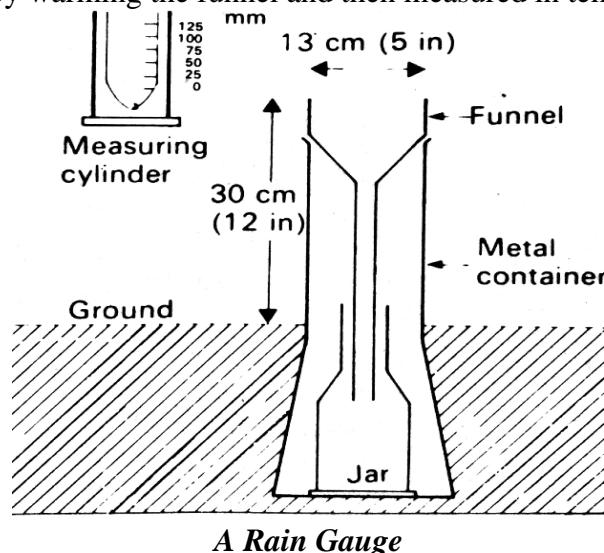
c) Measuring cylinder

REASONS FOR PLACING THE GAUGE AT LEAST 30CM ABOVE THE GROUND

- ☞ To avoid splashing of water into the funnel.
- ☞ To prevent evaporation of water from the funnel due to the reflected heat from the ground.
 - The instrument should be sited well away from tall buildings, high trees and other objects *to avoid sheltering it*.
 - ☞ This helps to avoid wrong readings due to in-splashing of rain drops from tree leaves or roofs of buildings.

HOW TO MEASURE RAINFALL USING A RAIN GAUGE

- It is done by removing the funnel from the cylinder.
- Emptying the rain water from the container into a graduated cylinder with a 3.8cm.
- The readings should be done at eye level and to an accuracy of 0.25mm. For greater accuracy, a special kind of tape measure which tapers at the bottom is used.
- The rain gauge must be examined every day.
- Snow is melted by warming the funnel and then measured in temperate cold regions.



A Rain Gauge

INTERPRETATION OF RAINFALL DATA FROM GRAPHS

- Interpreting rainfall data from graphs helps to compare the rainfall patterns of different locations.

CLOUDS

- A cloud is a mass of small water drops or ice crystals, formed by condensation of water vapour in the atmosphere.
- ❖ Clouds made up of ice crystals are white and those that are full of water are dark, grey or black in colour.

FORMATION OF CLOUDS

✓ Clouds are formed when water vapour condenses into water droplets of ice crystals. There are tiny solid particles of dust and soot in the atmosphere, called the **aerosols**. The water vapour and these aerosols bump into each other. When the air is cooled at its dew point, some water vapour turns into liquid water droplets and stick to the aerosols when they condense to form clouds.

✓ Clouds form when the air is saturated and cannot hold any more water vapour.

CONDITIONS NECESSARY FOR CLOUD FORMATION

1) Increased amount of water vapour in the atmosphere.

- This can result from transpiration and evaporation.

2) Low atmospheric temperature.

- The air should be cooled below its dew point to promote condensation.

3) Soot and dust particles (aerosols or condensation nuclei)

- These act as nuclei around which water vapour condenses.

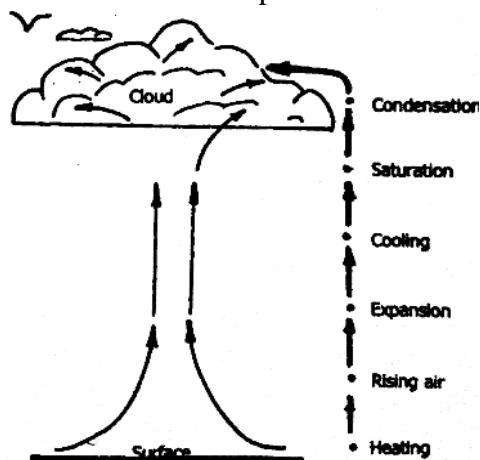


Illustration of Cloud Formation Process

BASIS FOR THE CLASSIFICATION OF CLOUDS

- 1) General form (shape) or appearance
- 2) Altitude

ON THE BASIS OF SHAPE (APPEARANCE)

- ☞ Stratiform or layered
- ☞ Cumuliform or heaped (massive globular) type

CLASSIFICATION OF CLOUDS

LATIN WORD	TRANSLATION	EXAMPLE
Cumulus	Heap	Fair weather cumulus
Stratus	Layer	Altocumulus
Cirrus	Curl of hair	Cirrus
nimbus	Rain-bearing	Cumulonimbus

CLOUD HEIGHT, APPEARANCE AND ITS ASSOCIATED WEATHER

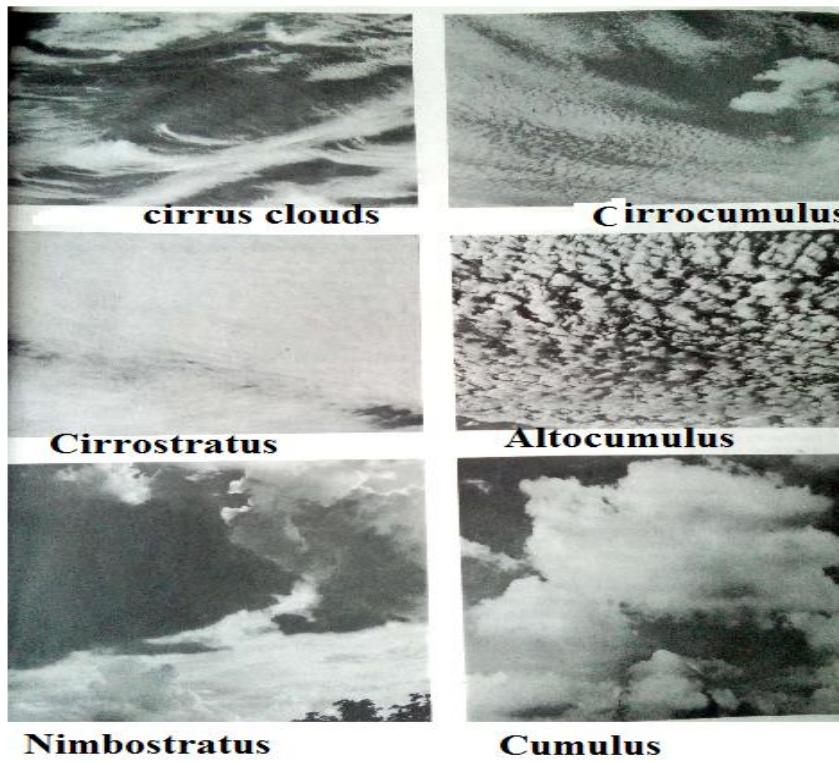
HEIGHT	CLOUD	APPEARANCE	WEATHER
Very high (6000-12000 metres)	Cirrus	Delicate, wispy, feathery, sometimes it forms streaks across the sky	Fair
	Cirrocumulus	White-heaped or globular masses, forming ripples in "mackerel sky"	Fair
	Cirrostratus	Thin white sheet or veil, milky sun forms a "halo"	Fair
Intermediate (2000-6000 metres)	Altocumulus	Wooly, bumpy, layered and looks like waves in the blue sky	Fine
	Altostratus	Denser, greyish with "watery" look	Fine
Intermediate (2000-6000 metres)	Stratus	Grey and thick, appears like low ceiling of highland fog	Dull and light drizzle
	Nimbostratus	Dark, full, grey, white sheets and clearly layered rain-cloud	Continuous rain or sleet
Low clouds (below 2000 metres)	Stratocumulus	Rough, bumpy, wavy, (but more than altocumulus)	Fair
	Cumulus	Rounded top, horizontal base	Fair
Great vertical height	Nimbocumulus	Black, anvil-shaped thunder cloud	Torrential, convectional thunderous rain

CHARACTERISTICS OF STRATIFORM CLOUDS

- ✓ They are blanket-like.
- ✓ They often cover large areas.
- ✓ They are fairly thin in comparison to horizontal distance.
- ✓ They are composed of ice crystals.

NOTE: Stratiform clouds are subdivided according to altitude.

- The **middle** clouds are altostratus and altocumulus. **Alto** means **middle**.
- If rain or snow is falling from a **stratus cloud**, the name changes to **nimbostratus** or **stratocirus**.
- **Nimbus** means "**rain-bearing**".



Appearance of Some Clouds

MEASUREMENT OF CLOUD COVER

- ☞ Cloud cover refers to the fraction of the sky covered by the clouds when observed from a particular location.
- ☞ An okta is a unit of measurement used to describe the amount of cloud cover at a given location such as a weather station.
- ☞ 0 oktas means the sky is completely clear, and 8 oktas indicates that the sky is completely covered by clouds. 9 indicates that the sky is totally covered due to fog or heavy snow.

Symbol	Scale	Cloud Cover
○	0 Oktas	Clear sky
◐	1 Oktas	12.5% (sky almost clear)
◑	2 Oktas	25% cloud cover (scattered clouds)
◑	3 Oktas	37.5% (sky partly cloudy)
◑	4 Oktas	50% (sky half cloudy)
◑	5 Oktas	62.5% cloud cover
◑	6 Oktas	75% (sky mostly cloudy)
◐	7 Oktas	87.5% cloud cover
●	8 Oktas	100% (sky completely cloudy)
⊗	9 Oktas	Sky obscured from view

Table Indicating Cloud-Cover Measurement

IMPORTANCE OF CLOUDS

- 1) They regulate temperature by reflecting and scattering solar radiation, absorbing and distributing heat.
- 2) They are a necessary condition for precipitation.
- 3) (They indicate the type of atmospheric processes. For example, cumulus clouds indicate surface heating.

NOTE:

☞ Lines drawn on a weather map joining places of equal cloud cover are called **Isonephhs**.

WIND

- ◆ It is any air in motion.

PREVAILING WINDS

- ◆ These are the winds that blow more frequently than type of wind in a particular area.
- Wind normally blows from an area of high pressure to an area of low pressure.

ASPECTS OF WIND

a) Wind direction

b) Wind speed

c) Wind strength

A) WIND DIRECTION

- ❖ Take note that the name of the wind is known after the direction from which it blows.
For example, the wind from the sea is called a sea breeze; that from the east is called an easterly wind.

Instruments used to measure wind direction

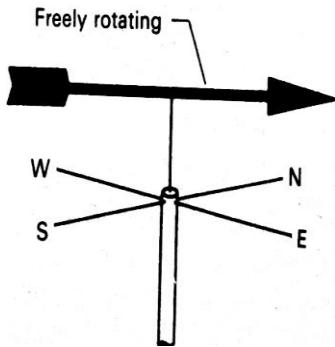
☞ Wind vane

☞ Wind rose

☞ Wind sock

WIND VANE

- ◆ It is made up of a rotating arm pivoted (fixed) on a vertical shaft. A compass is also fixed on the vertical shaft.
- ◆ The arrow of the rotating arm normally points to the direction where the wind is blowing from.



A Wind Vane

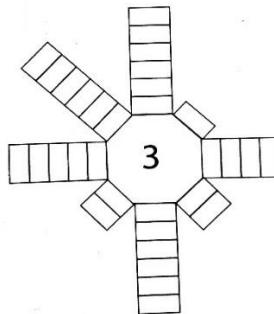
WIND ROSE

- ◆ It is used for recording wind direction for a particular place.

- ◆ It is an eight-sided chart, and each side of the wind rose represents a cardinal point.

How to draw a wind rose

1. Draw the eight-sided figure (octagon) at the centre.
2. Draw the arms of the wind rose using the frequencies of wind direction. The length of each arm will depend on the frequency of the wind.
3. Indicate the number of calm days at the centre.



A Wind Rose

DESCRIBING WIND FREQUENCY

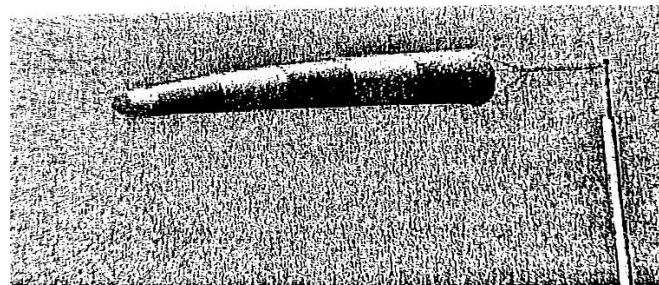
- ❖ Cardinal points show how many times the wind has blown from one direction. A cardinal point that is longest has the most frequency of the wind.
- ❖ The number of calm days (when wind did not blow from any direction) is indicated at the centre of the rose.

WAYS OF RECORDING WIND DIRECTION USING THE WIND ROSE

- 1) When there is wind blowing from a particular direction, the following happen:
 - a) A line is drawn across the rectangle representing the direction from which the wind blows.
 - b) A date is indicated in the correct rectangle representing where the wind is blowing from.
- 2) When there is no wind, the number of calm days is indicated in the centre of the wind rose. For example, the number of calm days in the wind rose above is **3**.

WINDSOCK

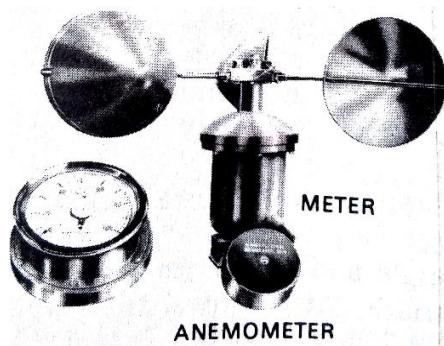
- It is an instrument used to show both wind direction and wind strength.
- It is kept in an open space in places such as airports to know how strong the wind is blowing, and its direction.
- If the wind is very strong, the windsock is stretched out parallel to the ground in the direction the wind is blowing. When the wind is blowing gently (lightly), the windsock will be close to the shaft (vertical pole), indicating that it is a gentle breeze.



A Wind Sock

B) WIND SPEED

- It is measured by an instrument called **cup anemometer**. Metals are fixed to the ends of the arms which rotate from a central frame as the wind blows. All the cups fixed at the end of the arms face in the same direction in order to capture and contain the wind when it blows. When the wind blows, the cups are filled with air and this forces them to rotate. There is a meter in the anemometer which automatically reads and records the wind speed in kilometers per hour (km/hr). The stronger the wind blows, the faster the cups will rotate and vice versa.



A Cup Anemometer

A BEAUFORT SCALE

- A Beaufort scale can also be used to give the wind speed.

Scale No	Symbol	Description	Speed (kmh ⁻¹)	Observed effects
0	○	Calm	Less than 1.6	Smoke rises vertically
1	—→	Slight breeze	1.6-5	Smoke-drift, not shown by vane
2	—→	Slight breeze	7-11	Leaves rustle, vane moved
3	—→	Gentle breeze	13-19	Wind extends light flags
4	—→	Moderate breeze	21-29	Raises dust, paper
5	—→	Fresh breeze	31-39	Small leaves sway
6	—→	Strong breeze	41-50	Whistling in telephone wire
7	—→	Moderate gale	51-61	Whole tree in motion
8	—→	Fresh gale	63-74	Twigs broken off trees
9	—→	Strong gale	75-86	Slight structural damage occurs
10	—→	Whole gale	88-101	Trees uprooted, considerable damage
11	—→	Storm	103-120	Widespread damage
12	—→	Hurricane	more than 120	Widespread devastation (tropical areas)

A Beaufort Scale

NOTE:

Wind speed can be estimated and its strength determined approximately by observing how certain objects are moved by the wind using the Beaufort scale. It shows wind description, speed and its effects on the environment.

FACTORS THAT AFFECT WIND

- a) Obstacles
- b) Air pressure
- c) Rotation of the earth

OBSTACLES

- ◆ Obstructions in the path of the wind, reduces wind strength; and it cannot be windy. On other hand, in an open space, wind strength is well felt, and its direction can easily be known.

AIR PRESSURE

- ◆ Since air moves from an area of high pressure to an area of low pressure, it means that wind blows more strongly between areas of very high and low pressure. This means that air pressure may affect wind strength and direction.

ROTATION OF THE EARTH

- ◆ Rotation of the earth creates a coriolis force which deflects winds to the right in the northern hemisphere and to the left in the southern hemisphere. The means that rotation of the earth affects wind direction.

AIR PRESSURE

- ❖ It means the force of air that is exerted at a place due to its weight.
- ❖ It is also called **atmospheric pressure**.
- ❖ It is measured in millibars (mbs).
- ❖ At the sea level (0 metre), air exerts the pressure of 986 grams per square centimeter and a mercury column of 760mm or 76cm.

NOTE

- All lines drawn on weather maps joining places of the equal (of the same) air pressure are called **Isobars**.

MEASUREMENT AND RECORDING OF WEATHER

- ◆ Air pressure is measured using an instrument called **Barometer**.
- ◆ It is also measured by a **Barograph**, which is another type of aneroid barometer.
- ◆ A barometer was inverted by scientists **Galileo** and **Torricelli** in the year 1643.
- ❖ There are two ways of measuring air pressure.
 - a) **Mercury barometer**
 - b) **Aneroid barometer**

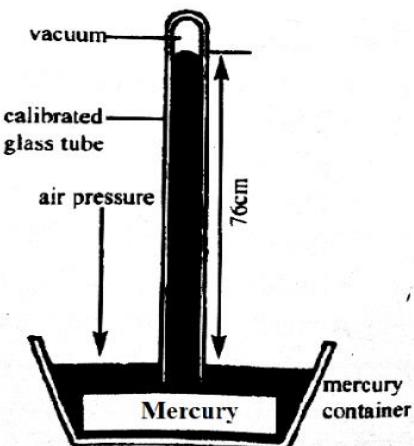
MERCURY BAROMETER

- ◆ It is made up of a glass tube that is one metre long, and it is open at one end.
- ◆ The tube if filled with mercury and inverted in a bowl of mercury.
- ◆ Mercury is used because it is very dense (heavy), and can be used within a short column.

HOW A MERCURY BAROMETER WORKS

- ❖ When air pressure increases, the air pressing on the surface of the mercury forces it to rise up the mercury column. This makes the barometer to register high pressure.

When the air pressure decreases, the mercury column drops since there is low weight on the mercury in the container. This makes the barometer to register low air pressure. The pressure readings are taken on the scale on the glass tube.



The Mercury Barometer

ADVANTAGE OF THE MERCURY BAROMETER

- It is an accurate instrument for measuring air pressure.

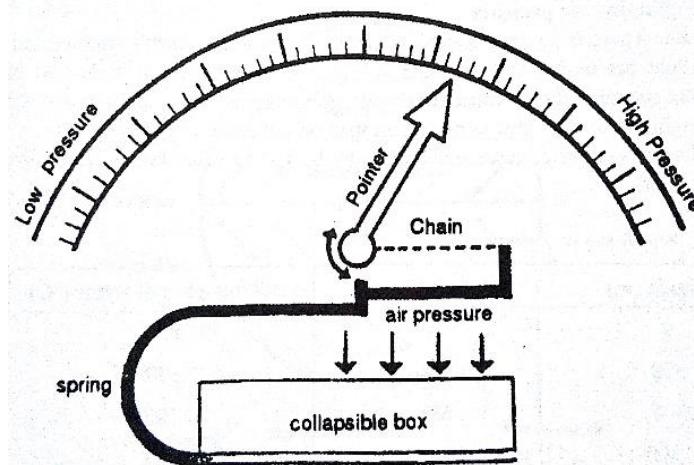
DISADVANTAGE OF THE MERCURY BAROMETER

- The mercury barometer is not good for outdoor measurement.

AN ANEROID BAROMETER

HOW AN ANEROID BAROMETER WORKS

- ❖ It consists of a metal box with very little air inside. Any increase in air pressure on the outside of the box makes the lid to move inwards. This makes the chin to be pulled to the right, making the pointer to move to the right as well to register high air pressure.
When pressure decreases; the lid of the box moves outwards. This makes the pointer to move to the left to register low air pressure.



An Aneroid Barometer

DISADVANTAGE OF AN ANEROID BAROMETER

- It is less accurate than a mercury barometer.

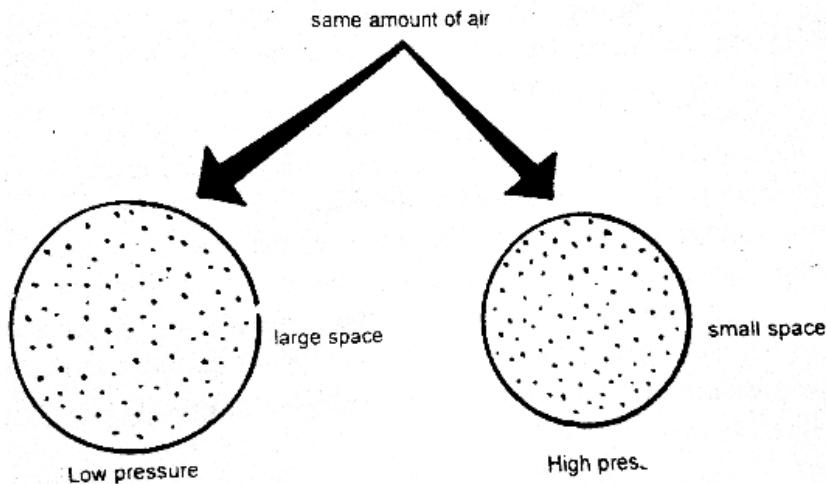
A BAROGRAPH

- ❖ This is another type of an aneroid barometer.

HOW A BAROGRAPH WORKS

It has a pen which is attached to the pointer. The pen sticks ink onto a paper that is fixed to a rotating drum. As the drum rotates, readings depending on the air pressure are taken on a continuous basis.

A Barograph



Effects of Volume on Air Pressure

FACTORS THAT AFFECT AIR PRESSURE

- Altitude
- Temperature
- Rotation of the earth
- Amount of water in the air (humidity)
- Speed of the wind

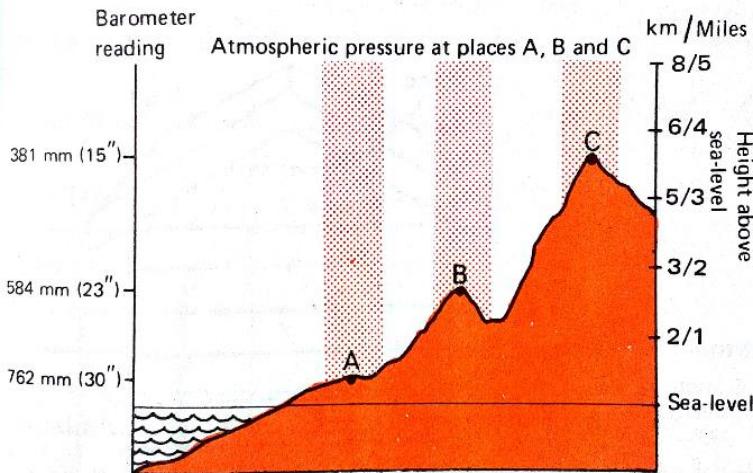
1) ALTITUDE

- More air molecules are concentrated at the earth's surface than at higher altitudes. This increases its weight per unit area, and this increases air pressure.
- At higher altitudes, the air is thin, since it expands to occupy a larger space. This makes its weight per unit volume to be less than on the earth's surface. This leads to low air pressure.
- NOTE:** The atmospheric pressure decreases by $\frac{1}{30}$ of its value every 275 metres one goes upwards into the air.

Effects of Altitude on Air Pressure

Altitude and Air Pressure

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



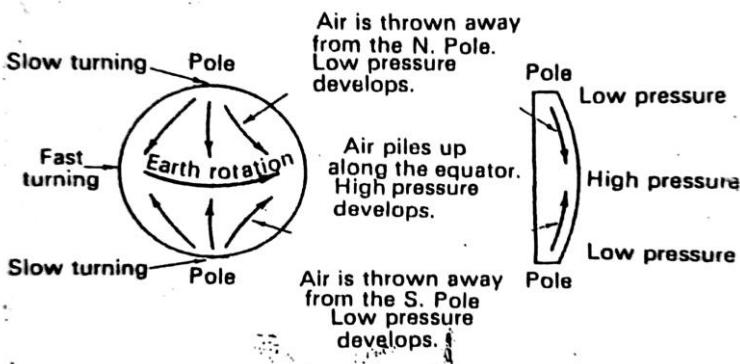
How Air Pressure decreases with Increasing Altitude

2) TEMPERATURE

- When air is heated, it becomes less dense (lighter) and rises. This reduces air pressure.
- But when air is cooled, it becomes heavier and sinks back to the earth's surface. This increases air pressure.

3) ROTATION OF THE EARTH

- When air is thrown away from the poles as the earth rotates, it is spread and occupies larger latitudes (space). This reduces air pressure.
- The air that goes back to the poles from the equator occupies shorter latitudes and gets concentrated on a small space. This increases air pressure.



The Impact of Rotation on Air Pressure

4) AMOUNT OF WATER IN THE AIR (HUMIDITY)

- Water vapour is lighter than air. This means that on the one hand, a large amount of water vapour in the air (high humidity) reduces air pressure.
- On the other hand, low humidity increases air pressure.

5) WIND SPEED

- Removing air molecules from a given space reduces air pressure.
- Strong winds lower air pressure.

HUMIDITY

☞ It refers to the amount of water vapour the air can hold at a particular time.

ABSOLUTE HUMIDITY

☞ This means the actual amount of water vapour in a given volume of air at a particular temperature.

RELATIVE HUMIDITY

- This is the ratio between absolute humidity of a given mass of air and the maximum amount of water vapour that it could hold at the same temperature.

$$\text{RELATIVE HUMIDITY} = \frac{\text{Amount of Water in the Air} \times 100}{\text{Max. Water Vapour the air can hold at the same Temperature}}$$

NOTE

- Air is not vapour because vapour comes from water after being heated and so air contains vapour. Humidity depends on temperature. For example, with high temperature, there is high rate of transpiration (loss of water from vegetation) and evaporation (loss of water from land and water bodies) increases.

MEASUREMENT OF HUMIDITY

- It is measured by using a hygrometer. It is also called a wet and dry bulb thermometer.

- It is used to measure humidity.
- Humidity is the amount of water vapour in the atmosphere.

RELATIVE HUMIDITY

- This refers to the measure of the amount of water vapour in a given volume of air compared to the total amount of moisture that the volume of air can hold at a given temperature. For example, at 40°C, 2m³ of air can hold a total of 12 grams of water vapour.

ABSOLUTE HUMIDITY

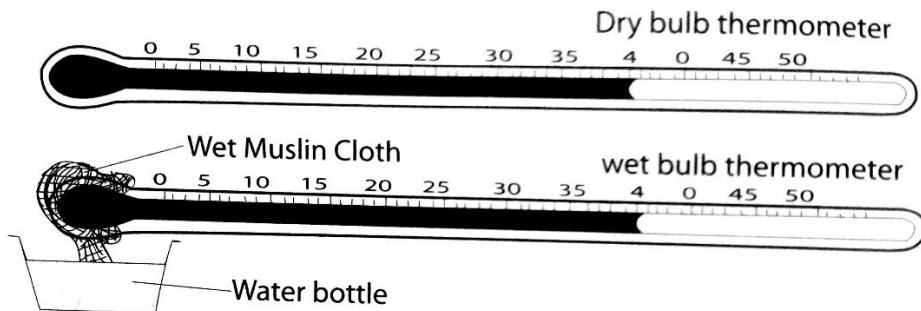
- It refers to the actual amount of water vapour in the atmosphere expressed in grams per cubic metre.
- The hygrometer is made up of two thermometers. One is called **Dry Bulb thermometer** and it measures **dry air temperatures** within the Stevenson screen.
- The other is called the **Wet Bulb** thermometer because it is covered by a wet muslin cloth which is wrapped around its base.

HOW THE HYGROMETER WORKS

- When the air is saturated or 100% full of moisture, there is no evaporation taking place from the muslin cloth.
- The two thermometers will then show the same readings.
- But, when the air is not saturated (not 100% full of moisture), moisture evaporates from the muslin cloth. Mercury contracts when evaporation is taking place.
- Temperature is therefore lowered in the wet bulb by this evaporation. But the temperature in the dry bulb remains the same.
- The difference between the two readings shows the humidity of the air.

Summary of how it works

THERMOMETER READING	MEANING
No difference	Air is saturated
Small difference	Humidity is high
Large difference	Humidity is low



Hygrometer (Wet and Dry Bulb Thermometer)

USES OF HUMIDITY DATA (INFORMATION)

- It is possible to know the amount of rain that can be received in a particular area.
- It is possible to tell the amount of heat that is held in the atmosphere in a particular area.

FACTORS THAT AFFECT HUMIDITY

- a) Cloud cover
- b) Amount of dust in the atmosphere
- c) Temperature
- d) Wind speed

a) Cloud cover

- ❖ There will be low rates of transpiration and evaporation when there is a lot of cloud cover.
- ❖ There will be high rates of in places of small cloud cover. So, the larger the cloud cover, the lower the humidity.

b) Amount of dust in the atmosphere

- ❖ Presence of dust particles in the atmosphere promotes cloud formation as water droplets form around them. Thus, the more the amount of dust in the atmosphere, the larger the cloud cover and higher the humidity and vice versa.

c) Temperature

- ❖ High temperatures promote the rate of transpiration and evaporation. This leads to high humidity.

d) Wind speed

- ❖ On the one hand, high wind speed carries away a lot of water vapour, this leads to low humidity. On the other hand, low wind speed makes the air to hold a lot of vapour which increases the humidity.

e) Latitude

- ❖ Areas that are close to the equator experience high temperatures, and thus have high humidity resulting from high transpiration and evaporation rates.
- ❖ Areas in Polar Regions have low humidity due to their low temperatures that reduce evaporation and transpiration rates.

f) Distance from the sea

- ❖ Areas closer to water bodies are likely to experience high humidity due to high rates of evaporation than areas far away from water bodies.

SUNSHINE

- ◆ This refers to the rays that we receive on earth directly from the sun.

MEASUREMENT AND RECORDING OF SUNSHINE

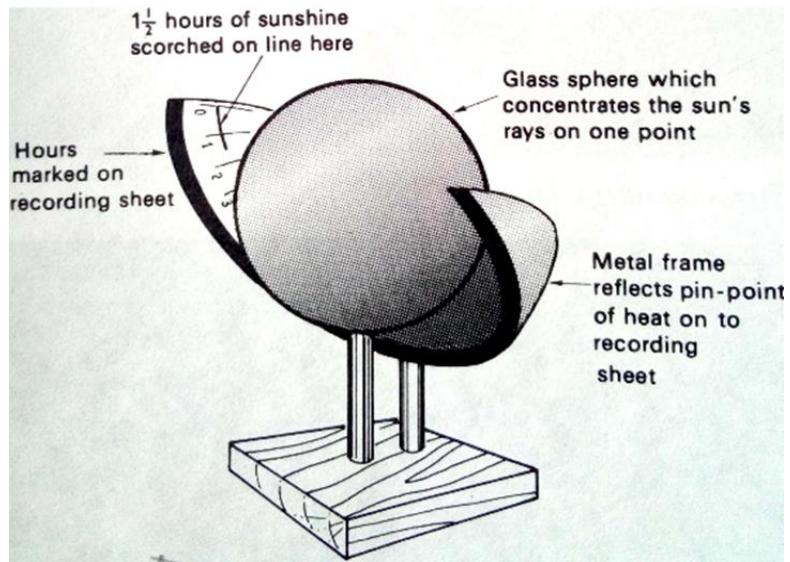
- ◆ It measured by an instrument called a **sunshine recorder**.

- Is used to measure the amount of sunshine a place receives, that is it records the number of hours and minutes of sunshine and the intensity per day.
- It is composed of a spherical glass which is partially surrounded by a metal frame. There is a sensitive card inside the metal frame which is graduated in hours and minutes.

HOW A SUNSHINE RECORDER WORKS

The sun rays are focused on the sensitive card by the spherical glass on the recorder which is graduated in hours and minutes. Energy from the sun burns or traces a line on the card. When there is no sunshine, there will be no burning, thus no trace lines will be indicated. At the end of the day, the card is taken out and the length of the trace burned on it is turned into hours and minutes, to represent the total amount of sunshine for that day.

- ☞ All places that receive equal sunshine duration are joined by lines called **Isohels**.



A Sunshine Recorder

FACTORS THAT AFFECT THE AMOUNT OF SUNSHINE

- 1) Cloud cover
- 2) Amount of dust in the atmosphere
- 3) Humidity
- 4) Aspect
- 5) Latitude
- 6) Revolution of the earth

1) Cloud cover

☞ Clouds absorb energy from the sun and thus, reduce its impact on the earth's surface. The larger the cloud cover, the less the amount of sunshine that will be measured and recorded by the recorder.

2) Amount of dust in the atmosphere

☞ Presence of dust in the atmosphere promotes cloud formation as water droplets form around them, which reduces sunshine. But fewer dust particles reduces cloud formation and thus, increases sunshine.

3) Humidity

☞ Water vapour absorbs sun's heat, and in turn this can reduce the amount of sunshine an area can receive.

4) Aspect

☞ This means the direction a slope faces in relation to the overhead sun. Areas facing the sun receive a lot of sunshine as compared to areas facing away from the sun.

5) Latitude

☞ A lot of sunshine is received in areas close to the equator since the equatorial regions experience sunshine for a greater length of time than the Polar Regions.

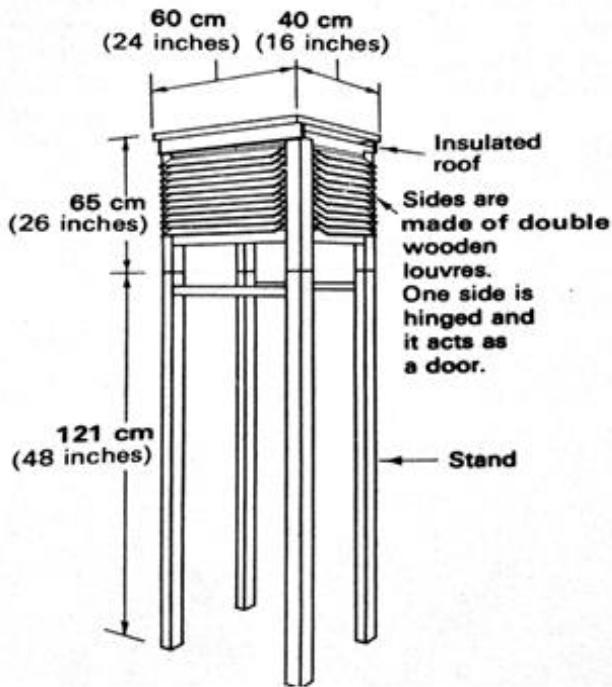
6) Revolution of the earth

☞ Revolution causes seasons such as summer, autumn, winter and spring. Some seasons such as summer receive greater sunshine intensity, while some seasons such as winter receives shortest amounts of sunshine.

☞ The earth also revolves around the sun along its **elliptical orbit**. This makes the earth sometimes to be closer to the sun (perihelion) and sometimes the earth is far away from the sun (aphelion). This means that when the earth is closer to the sun there is greater sun's intensity received on the earth and when the earth is far away from the sun the earth experiences less intensity of the sun.

THE STEVENSON'S SCREEN BOX

- ✓ This is a box with louvered sides which is used to hold sensitive weather instruments.
- ✓ It is made up of wood and painted white.
- ✓ It is found in most weather stations.



Stevenson's Screen

Reason why the Stevenson's Screen is louvered (slatted)

- ✓ To allow air to flow into and out of the box easily.

Reason why the Stevenson's Screen is painted white

- ✓ To ensure that it reflects sunshine.

Reason why the Stevenson's Screen is placed at 1.2 metres above the ground

- ✓ To prevent the heat from the ground from affecting the reading in the Stevenson's Screen. This helps meteorologists (people who study weather) to get more reliable data (readings).

Reason why in the southern hemisphere the opening of the box faces south

- ✓ To allow direct sunshine not to shine into the screen when someone opens it.

WEATHER INSTRUMENTS CONTAINED IN THE STEVENSON'S SCREEN BOX

- ☞ Thermometer
- ☞ Hygrometer
- ☞ Barometers

USES OF THE STEVENSON'S SCREEN

- ❖ Protecting the weather instruments from damage.
- ❖ To regulate (control) the air flow so that accurate weather readings can be collected.
- ❖ Providing shade for the instruments so as to have accurate readings.

POINTS TO CONSIDER WHEN SETTING UP A WEATHER STATION

- Flat area that is also free from flooding.
- Minimum interference from people and animals.

- Free flow of air without obstacles such as wind and breakers.
- Open and clear place away from the trees, buildings and other objects for accurate measurements.
- Presence of a Stevenson's Screen which houses delicate instruments such as thermometers, hygrometers and barometers.

ANNUAL TEMPERATURE DISTRIBUTION OF MALAWI

- a) Along lakeshore areas and Shire Valley experience high temperatures, of over 24°C. Along the rift valley floor it varies between 20°C and 30°C. Around Nsanje it goes beyond 32°C.
- b) In higher altitudes (mountains and highlands), there are low temperatures ranging between 14°C and 18°C. These areas include Dedza-Kirk Range, Viphya and Nyika Plateaus, Zomba Plateau and Mulanje Mountains.

ANNUAL RAINFALL DISTRIBUTION OF MALAWI

- a) **Plateaus**
 - ❖ These receive a lot of relief rainfall because they face the rain-bearing winds from the lake.
- b) **Plains**
 - ❖ These receive moderate rainfall between 750mm and 1000mm. These include Chirwa-Phalombe plains.
- c) **The Shire Valley**
 - ❖ It receives an average of 650mm of rain per year.
 - ❖ This area is within the rain shadow area.
- d) **Lakeshore areas**
 - ❖ These areas receive an average annual rainfall of between 1250 mm and 1500mm. These areas include Rumphi, Nkhatabay-Bay, Nkhotakota, Mulanje, Thyolo, and parts of Karonga district.

CLIMATE EXPERIENCED IN MALAWI

- ◆ Malawi experiences **Tropical Continental** climate. It is also called **Sudan or Savanna** climate.
- ◆ It receives heavy convectional rainfall in summer, and winters are generally dry.
- ◆ Summers are hot with temperatures around 32°C and winters are cooler about 21°C, with an annual temperature range of 11°C.
- ◆ High temperatures occur just before the rainy season.

CLIMATIC REGIONS OF MALAWI

1) Highland Modified Climate (Cool areas)

- This is mainly experienced in mountains and plateaus.
- It has a maximum temperature of more than 22°C.
- It receives relief (orographic) and convectional types of rainfall.

2) Tropical Savanna Climate (Moderate areas)

- This is mainly experienced in middle-latitude areas such as Lilongwe plains.
- It has a maximum temperature of 28°C.
- Annual rains are received during the hot and wet season.

3) Humid Savanna Climate (Hot areas)

- ❖ This is experienced in very hot areas, such as the rift valley.
- ❖ It has maximum temperature of about 32°C.
- ❖ It receives unreliable rainfall which may get up to 800mm per annum

- ❖ They have high risks of drought and famine.

FACTORS THAT AFFECT CLIMATE OF MALAWI

- Altitude
- Prevailing winds
- Aspect
- Latitude
- Distance from the lake

ALTITUDE

- Areas of high altitudes such as Nyika plateau receive heavy relief rainfall as warm moist air from Lake Malawi is forced to rise over these areas. These condense to give rise to relief rainfall.
- High altitude areas also have lower temperatures since temperature decreases with increasing altitudes. But low lands experience high temperatures.

PREVAILING WINDS

- Malawian climate is influenced by the south east trade winds which originate from the Indian Ocean. These lower the temperatures during the day time in summer.
- These winds also bring about persistent low clouds which bring drizzle (little rainfall) in the southern region Malawi because they carry warm, moist air from the Indian Ocean.

ASPECT

- This means the angle of slope on the earth's surface.
- Areas on slopes facing the sun experience higher temperatures than those facing away from the sun.
- Also areas that face the sun receive a lot of rainfall due to the high rates of transpiration and transpiration experienced in these areas that result from high temperatures.

LATITUDE

- Areas in equatorial regions have higher temperatures than areas in Polar Regions.
- High temperatures in the equatorial regions also help increase the rates of transpiration and evaporation, leading to heavy convectional rainfall in summer, and winters are generally dry.

DISTANCE FROM THE LAKE

- During the day, the air blowing from the sea to the land (sea breeze) lowers summer temperatures in the surrounding land masses. During the night, the air blowing from the land to the sea (land breezes) lowers the temperatures in the water bodies.

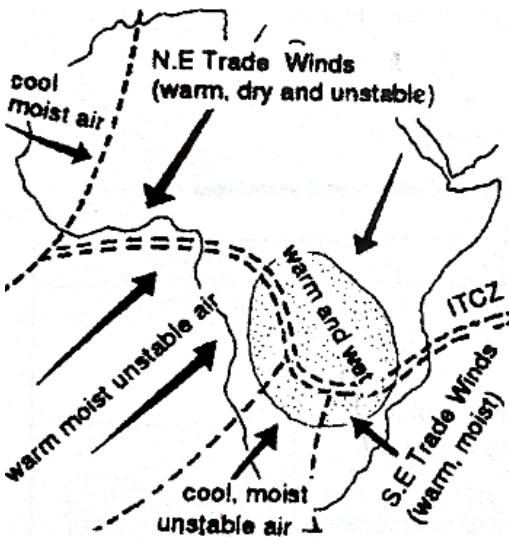
THE INTER-TROPICAL CONVERGENCE ZONE (ITCZ)

- It is a zone of low pressure which is created because of high temperatures. Due to the low pressure, a conducive environment is created where air of different characteristics meet.
- This is an area where air masses meet and is indicated by the apparent movement of the sun.
- It is also called the meteorological equator or the equatorial trough.

FORMATION OF THE ITCZ IN AFRICA

1) IN JANUARY

- The warm dry stable air masses from the land, north of the low pressure zone and the moist unstable maritime air from the Atlantic and Indian Oceans and the Zaire air masses meet in the southern hemisphere.
- Such meeting makes the moist air to rise over the warm stable one, resulting in rainfall.



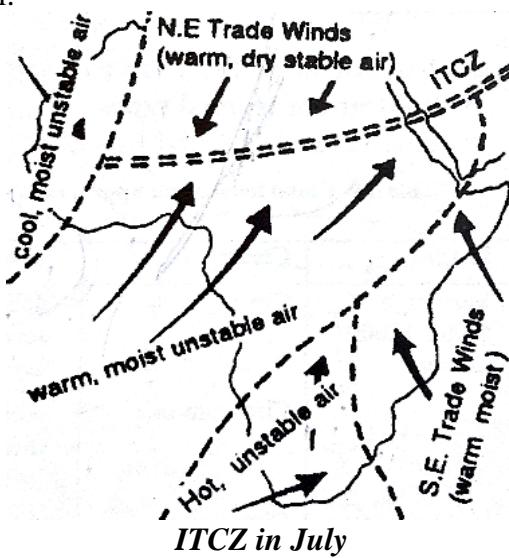
ITCZ in January

2) IN JULY

- The ITCZ shifts to the North.
- The warm moist air from the Atlantic (western coast), meet the warm dry stable air from the land North of Africa, including Sahara.
- This leads to rainfall.

TYPES OF RAIN EXPERIENCED IN THE CONVERGENCE ZONE

- Cyclonic rainfall
- Convectional rainfall.



NOTE:

- The type of rainfall experienced in Central Africa is largely influenced by the ITCZ, and if it fails to form in the area, droughts may occur.

ITCZ AND RAINFALL

- ✓ Rainfall can be predicted by studying the position of the ITCZ, in Central Africa.
- ✓ In Africa, rains are expected to be good if the ITCZ is positioned between Mid-Tanzania and Southern Zimbabwe.
- ✓ Any disturbing conditions that would increase pressure would lead to poor distribution of rainfall.

TOPIC 5: THE BIOSPHERE

- ❖ The word **bio** means life.
- ❖ So, the term **biosphere** refers to the entire environment where all living things are found.
- Some of the living things found on the biosphere include people, vegetation and animals.

COMPONENTS OF THE BIOSPHERE

- ◆ Suffice to mention that organisms in the ecosystem depend on each other.
- ◆ It has a network where each of the living things depend on each other and on the environment around them for their existence.
- ◆ It includes all the living organisms and abiotic (non-living) environment on which the living organisms depend for their energy and nutrients necessary for life. **The Components are:**
 - a) The hydrosphere
 - b) Lithosphere
 - c) The atmosphere

The Hydrosphere

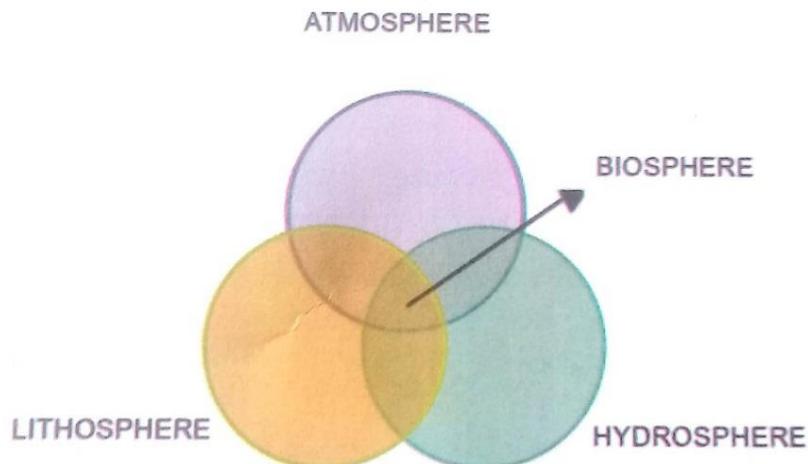
- This is the part of the earth that is made up of water bodies, and living organisms live there.
- It includes rivers, lakes, oceans, seas and streams.
- The living things that leave in the hydrosphere include algae, mosses, weeds and marshes.

The Lithosphere

- This is the part of the earth made up of rocks or stones.

The Atmosphere

- This is the part of the earth that is made up different gases.



Components of the Biosphere

RELATIONSHIP AMONG THE COMPONENTS OF THE BIOSPHERE

- Human beings plant trees where they have been cut down, thus helping in the continuity of the forests.
- Animals provide food to people, while people look after the domestic animals and ensure they have sufficient food, water and medication.

- Both people and animals use oxygen which is released by plants, while plants use the carbon dioxide for photosynthesis which is released by both animals and people.
- Vegetation provides food for animals and people. We also obtain wood (timber) for various uses as well as medicine from plants; in exchange animals provide manure that improves soil fertility and helps plants to grow well.

IMPORTANCE OF THE BIOSPHERE

- Plants help to bring about rainfall through transpiration.
- Animals provide manure that is used by plants to grow well.
- Animals and plants help to promote the tourism industry.
- Vegetation helps to purify the air by giving out oxygen and taking in carbon dioxide during photosynthesis.
- The hydrosphere helps to provide water that is used to sustain life on earth.
- Plants provide food for animals and people.
- Animals provide food in the form of meat, milk and eggs to people.
- Plants provide timber and firewood for various domestic purposes.

PROBLEMS AFFECTING THE BIOSPHERE

i. Overstocking and overgrazing

- Overstocking means keeping too many animals in a small area than the land can support, this can lead to over grazing, leaving the land bare and prone to soil erosion and siltation of water bodies.

ii. Poor methods of farming

- Such as shifting cultivation, cultivation on steep slopes.

iii. Deforestation

- Forests are cleared for settlement and farming.

iv. Poor waste disposal

- This comes from industries and homes, being discharged into water bodies or on land.

v. Industrialization

- This is the major contributor of air pollution.

vi. Pollution

vii. This may take the form of air, water and land pollution.

WAYS OF MAINTAINING THE BIOSPHERE

- ✓ Afforestation and reforestation to maintain the vegetation.
- ✓ Creation of game reserves and national parks to maintain wildlife.
- ✓ Civic education to the people on the importance of wild life conservation (protection).
- ✓ Avoiding bush fires to conserve vegetation.
- ✓ Doing fish farming to conserve fish species and increase their numbers.
- ✓ Avoid fishing using poisonous herbs, nets with small mesh and avoid fishing during closed fishing seasons to allow the fish breed.
- ✓ Controlling rapid population growth to reduce demand on the environmental resources.
- ✓ Practicing proper farming methods such as bush farrowing to provide vegetative cover and control soil erosion.
- ✓ Construction of dams to keep water that can help in the hydrological cycle.
- ✓ Practicing agroforestry, where trees are grown in the same field with crops. This helps bind the soil together and control soil erosion.

TOPIC 6: THE ENVIRONMENT

- ◆ These are living and non-living surroundings. These may include people, vegetation, wildlife, etc.

COMPONENTS OF THE ENVIRONMENT

- 1) Physical or natural environment
- 2) Human or social or built environment

Physical or natural environment

- ◆ This part contains natural features or resources such as land, water, air, mountains, human beings, animals and vegetation.

CLASSIFICATION OF THE NATURAL (PHYSICAL) ENVIRONMENT

a) Lithosphere

- ◆ This is the part of the earth that is made up of rocks or stones.

b) Hydrosphere

- ◆ This is the part of the earth that is made up of water bodies such as lakes and rivers.

c) Atmosphere

- ◆ This is the part of the earth that is made up of different gases, such as oxygen.

d) Biosphere

- ◆ These are the parts of the earth in which living things are found.

Human or social or built environment

- ◆ This is the part of the environment that is made up of things made by human beings, such as bridges, roads and dams.

RELATIONSHIP BETWEEN THE LIVING AND NON-LIVING THINGS IN THE ENVIRONMENT

- ✓ Plant leaves provide manure to the soil when they fall to the ground and decompose. This improves soil's fertility that helps other plants to grow well.
- ✓ Vegetation helps prevent soil erosion by holding soil particles together. This reduces runoff and promotes infiltration.
- ✓ Plants reduce the rate of evaporation by providing shade to the soil.
- ✓ Human beings and animals obtain their food from plants.
- ✓ Vegetation provides timber for construction of buildings and used as electric poles.
- ✓ Vegetation helps in rain formation through transpiration.
- ✓ Plants release oxygen that supports life on earth, while people and animals release carbon dioxide that is used by plants during photosynthesis.
- ✓ Soil provides nutrients to plants and provides support to the plants.
- ✓ The land acts as a habitat for people and animals.
- ✓ Water dissolves soil nutrients used for plant growth.
- ✓ Water provides a habitat for aquatic species such as fish.
- ✓ Water is used for domestic purposes in homes.
- ✓ Animals provide food for people, as they provide proteins.
- ✓ Animals provide manure for the soil which is used by plants.

IMPORTANCE OF VARIOUS COMPONENTS OF THE ENVIRONMENT

- a) Water is used for photosynthesis in plants.
- b) Water is used for domestic purposes in homes.
- c) Water provides a habitat for aquatic species such as frogs.
- d) Water is used for the generation of hydro-electric power.

- e) Water is used for transportation by boats.
- f) Water acts as a solvent for nutrients used in plants.
- g) Water is used as a preservative when in a frozen state, which is used to keep food fresh for a long time.

IMPORTANCE OF LANDFORMS (RELIEF) OR LAND AS A COMPONENT OF THE ENVIRONMENT

- ❖ Mountains contain minerals which is mined and used for many purposes.
- ❖ Mountains receive relief rainfall that gives rise to important rivers.
- ❖ Mountains provide timber for construction.
- ❖ Mountains, vegetation and streams are used for tourist attraction.

IMPORTANCE OF VEGETATION IN THE ENVIRONMENT

- 1) It is a source of medicine.
- 2) It is a source of timber.
- 3) It is a source raw materials for making paper.
- 4) It provides firewood.
- 5) It is used to attract tourist.
- 6) It protects the soil from soil erosion by providing soil cover.
- 7) It provides food to people and animals.
- 8) Plants help in rain formation through transpiration.
- 9) Plants help to purify the air by taking in carbon dioxide for photosynthesis and releasing oxygen.

IMPORTANCE OF AIR AS A COMPONENT OF THE ENVIRONMENT

- It is used for respiration, thereby supporting life on earth.
- It is used for the generation of wind energy.
- Wind is used for cooling living organisms.
- Air is used for combustion, with the help of oxygen.
- It is used as a medium that conducts sound.
- It is used for flying aero planes and parachute.
- It makes navigation easy when wind blows in the same direction of ships.
- It is used for pollination in plants.
- It helps to reduce air pollution in an area by removing bad smell.

HUMAN ACTIVITIES THAT ENDANGER THE ENVIRONMENT

1. DEFORESTATION

- ♦ This is the careless cutting down of trees without replacing them.

Effects of deforestation

- a) Climate change
 - ☞ Deforestation reduces the rate of transpiration. This leads to little or no rainfall.
 - ☞ It promotes the accumulation of greenhouse gases into the atmosphere which may damage the ozone layer, leading to global warming.
- b) It damages the habitats for wild animals such as birds and lions.
- c) It encourages soil erosion, leading to loss of soil fertility. This results in low crop yield.
- d) It promotes siltation of water bodies which may cause floods.

- e) Ecological imbalance since the interdependence of living things in the environment is destroyed.

2. SETTING BUSH FIRES

- ◆ This is done when clearing the forests during and preparation, and also during hunting.

Effects of setting bush fires

- a) Climate change
 - ☞ Deforestation reduces the rate of transpiration. This leads to little or no rainfall.
 - ☞ It promotes the accumulation of greenhouse gases into the atmosphere which may damage the ozone layer, leading to global warming.
- b) It damages the habitats for wild animals such as birds and lions.
- c) It encourages soil erosion, leading to loss of soil fertility. This results in low crop yield.
- d) It promotes siltation of water bodies which may cause floods.
- e) Ecological imbalance since the interdependence of living things in the environment is destroyed.

3. OVERFISHING

- ◆ This problem has been worsened by rapid population growth which has increased the demand for fish resources.
- ◆ People catch fish during the breeding season, and they also catch fish using nets that have small mesh.

Effects of overfishing

- a) It leads to the reduction in the number of fish species.
- b) It leads to extinction of fish resources.
- c) It negatively affects the tourism industry.

4. POACHING

- ◆ This is the illegal killing of wild animals in protected areas.
- ◆ Animals are killed for their meat, skins, ivory, etc.

Effects of poaching

- a) It leads to reduction in the number of animal species.
- b) It leads to extinction of some animals.
- c) Tourism is negatively since the game that attract tourists are killed.

5. POOR WASTE DISPOSAL

- ◆ Wastes from homes and industries are disposed of in water bodies, on the land and some fumes also escape into the atmosphere causing air pollution.

Effects of poor waste disposal

- a) It leads to air pollution which is responsible for global warming and acidic rainfall.
- b) It leads to land pollution when wastes are discharged on the land.
- c) It leads to water pollution when wastes are discharged in water bodies.

6. POOR FARMING PRACTICES

- ◆ Some of the practices may include cultivation in river banks, cultivation on steep slopes, sifting cultivation, etc.

Effects of poor farming practices

- a) Destruction of vegetation.
- b) Water cycle will be disturbed.

- c) They promotes soil erosion and loss of soil fertility.
- d) Poor crop yield and famine.
- e) Flooding which causes loss of life and property.

ENVIRONMENTAL MANAGEMENT

- ◆ This means the process of enhancing the relationship between the environment and human beings in order to improve the quality of the two.

ENVIRONMENTAL MANAGEMENT PRACTICES IN MALAWI

a) Measures taken to manage and conserve vegetation

- ❖ Afforestation and re-afforestation.
- ❖ Following good farming practices.
- ❖ Agro-forestry. This is the growing of arable crops together with trees.
- ❖ Controlling population growth to reduce the demand on forest resources.
- ❖ Civic education on the importance of conservation.
- ❖ Establishment of forest reserves.

b) Measures taken to manage and conserve wildlife

- ❖ Creation of game reserves and national parks.
- ❖ Civic education on conservation.
- ❖ Stiff punishment of offenders such as poachers.
- ❖ Having closed seasons to allow the fish breed.
- ❖ Practicing fish farming.
- ❖ Controlling population growth to reduce the demand on fish resources.

c) Measures taken to manage and conserve soil

- ❖ Controlling population growth.
- ❖ Practicing agro-forestry.
- ❖ Practicing strip cropping.
- ❖ Practicing crop rotation.
- ❖ Practicing contour ploughing.
- ❖ Afforestation
- ❖ Re-afforestation

TOPIC 7: THE ECOSYSTEM

a) Ecosystem

- ❖ A community of interdependent organisms and the environment in which they live.

b) Ecology

- ❖ This means the study of organisms in relation to the natural environment.

c) Biosystem

- ❖ It means a variety of living organisms and species found in an environment.

- An ecosystem is made up of living (biotic) and non-living (abiotic) things.

Examples of non-living things

- Weather
- Terrain
- Rocks

Examples of living things

- Insects
- Plants
- Animals

- ❖ Ecosystems are large in size and all the elements that make them up. However, each element is independent of the other.
- ❖ Ecosystems can exist in a sea, forest, land or marsh.
- ❖ Organisms that live in an ecosystem is dependent on other organisms. This means that if one part of the ecosystem is damaged, it has devastating impacts on the other organisms that depend on them.
- ❖ Healthy ecosystems are called **sustainable**. This means that all the elements have a balance in their existence and that they are capable of reproducing themselves.

COMPONENTS OF AN ECOSYSTEM

- a) Physical (natural) factors
 - b) Animal (faunal) communities
 - c) Plant (floral) communities
- a) Physical (natural) factors**

- Under this one there are the following:

Water availability

- ◆ Water availability enables plants to grow and animals to survive in the ecosystem.
- ◆ If producers (vegetation) do not survive because of drought, it can lead to the death of primary consumers such as herbivores.
- ◆ If vegetation does not survive, it can make oxygen concentration to decrease which can negatively affect the respiration of people and animals.
- ◆ Water also helps plants to manufacture their own food.

Oxygen concentration

- ◆ Low oxygen levels can affect the respiration process in people and animals.

Carbon dioxide concentration

- ◆ Low levels of carbon dioxide in the environment can negatively affect the process of photosynthesis in plants, leading to low crop yield. This can in turn negatively affect the survival of plants and animals.

Sunlight intensity

- ◆ Sunlight is used in the process of photosynthesis in plants. If plants do not survive, other levels in the food chain would not survive as well.

Wind speed

- ◆ This affects the amount of heat and humidity in an area. Low wind speed will lead to high humidity and heat. This can in turn help in the rain formation and plants can survive well. As a result primary consumers will find food and the food chains and food webs will be maintained.

Humidity

- ◆ This is the amount of water vapour in the atmosphere. This affects the growth of plants and animals in the food chain. It also helps to bring about good rainfall when humidity is high. Therefore, low humidity results in low rainfall and there would be less vegetation and herbivores.

Soil

- ◆ The type and fertility of the soil affects the growth of plants. Infertile soils discourage the growth of plants and the survival of the primary consumers in the food chain, and the survival of other organisms as well.
- b) Animal or faunal communities**
- ◆ This is a category made up of animals of different kinds that are living together in a part of an ecosystem.
- c) Plant or floral communities**
- ◆ These are plants of different species that live together in a part of the ecosystem. Examples of these plants may include baobab, acacia and palm trees.

INTERRELATIONSHIP AMONG COMPONENTS OF THE ENVIRONMENT

- 1) Plants use carbon dioxide during photosynthesis released by animals, and animals use oxygen produced by plants.
- 2) Plants and some bacteria manufacture compounds from carbon dioxide during photosynthesis. Animals obtain them in ready-made-form by feeding on vegetation and decomposers obtain them when they break down the dead bodies or waste of other living things. These processes recycle the carbon over and over again.
- 3) Plants need nitrogen for the production of proteins and other compounds. Some plants fix nitrogen in the soil. The nitrogen cycle recycle nitrogen between living organisms and the environment. However, some cause loss of nitrates from the environment.
- 4) Plants and animals form complex food chains and food webs. Big fish eat small fish. Vegetation provides food to people and animals. Animals provide food to people and manure to plants, and plants are habitats for various organisms. Vegetation also provides medicine.

FACTORS THAT CAN DISTURB THE ECOSYSTEM

a) Deforestation

- ◆ Careless cutting down of trees promotes soil erosion, leading to infertile soils and low crop yield. This affects the animals that feed on plants and also disturbs air purification.
- ◆ It also destroys the habitat for different organisms.

b) Setting bush fires

- ◆ This destroys vegetation and can affect the food web.
- ◆ It also destroys the habitat for different organisms.
- ◆ It reduces the amount of oxygen in the atmosphere.

c) Poaching

- ◆ This is the illegal killing of animals in national parks and game reserves. This reduces the process of photosynthesis as the removal of animals reduces the concentration of carbon dioxide in the atmosphere.
- ◆ It also reduces the production of manure, and affects the growth of vegetation.
- ◆ It can also eliminate the some animal species, negatively affecting the tourism sector in the process.
- ◆ People's diet would also be negatively affected.

d) Water pollution

- ◆ Water pollution through the use of herbs in fishing and dumping of industrial and domestic waste into water bodies can lead to the death of aquatic species such as fish. This disturbs the food chains in water bodies. Extinction of fish leads to poor diets and the tourism industry can also be negatively affected.

e) Poor farming practices

- ◆ Poor farming practices such as shifting cultivation depletes vegetation and promotes soil erosion and siltation of water bodies.
- ◆ Depletion of vegetation destroys the habitats for various organisms.
- ◆ It also reduces the amount of oxygen in the environment.

f) Disruption of the food chain

- ◆ This can happen when some species in the ecosystem are killed or become extinct. This leads to loss of food in the form of proteins.
- ◆ It also leads to reduction in the production of carbon dioxide which is used by plants for photosynthesis.

WAYS OF MAINTAINING ECOSYSTEMS

- ❖ Afforestation
- ❖ Civic education on environmental conservation
- ❖ Competitions on environmental protection
- ❖ Proper farming practices such as agroforestry and avoid cultivation of steep slopes.
- ❖ Controlling rapid population growth to reduce demand on environmental resources.
- ❖ Provision of alternative energy sources such as solar energy to reduce pressure on forest reserves.
- ❖ Establishing conservation areas such as forest reserves, botanical gardens, game reserves and national parks.

IMPPORTANCE OF ECOSYSTEMS

- 1) Source of foreign exchange in form of poles, ivory, etc.
- 2) They promote tourism as tourists come to view game.
- 3) They are a source of food since we eat meat.
- 4) Plant communities provide a habitat for animals.
- 5) Vegetation helps to bring about rainfall through transpiration.
- 6) Vegetation provides medicine, paper, firewood, etc.
- 7) Water is used to produce hydro-electric power.
- 8) Water is used for sporting activities such as swimming and fishing.
- 9) Vegetation is used to purify air releasing oxygen and taking in carbon dioxide.
- 10) Vegetation provide manure to the soil which promotes farming.
- 11) Water is used for transportation.

TOPIC 8: NATURAL RESOURCES

These are things provide by nature.

Examples of natural resources

- Sun
- Vegetation
- Soil
- Wind
- Water

Types of natural resources

- Renewable resources
- Nonrenewable resources

Renewable resources

- These are resources that can replace or replenish themselves after being used up.

Examples of renewable resources

- ✓ Water
- ✓ Air
- ✓ Forest
- ✓ Fish
- ✓ Animals

Nonrenewable resources

- These are resources that cannot replace or replenish themselves after being used up.
- They are finite resources.

Examples of renewable resources

- ✓ Fossil fuels (petroleum, coal, natural gas, etc.)
- ✓ Minerals (copper, gold, diamond, etc.)

Renewable resources and Nonrenewable resources compared

Renewable resources	Non-renewable resources
They can be replaced after being used	They cannot be replaced after being used
They are not affected by human activities	They are affected by human activities
They cannot be exhausted	They can be exhausted
They have a higher rate of decomposition than their rate of consumption	They have a lower rate of decomposition than their rate of consumption

Ways of renewing some natural resources

1. Water	✓ Recycling
✓ Recycling	✓ Afforestation
This means treatment of substances already used, so that further use is possible.	3. Forests
✓ Afforestation	✓ Afforestation
This means planting trees where there were no trees.	✓ Reforestation
✓ Reforestation	4. Animals
This means replanting trees where trees were cut down.	✓ Reproduction
2. Air	5. Fish
	✓ Fish farming
	This helps to reduce demand on fish from natural water bodies.

WAYS OF CONTROLLING (CHECKING) THE DEPLETION AND EXTINCTION OF RENEWABLE RESOURCES

a) Closed fishing season

- ✓ This is the breeding period when no one is allowed to do fishing. The government of Malawi implements this with the help of Village Beach Committees (VBCs).
- Closed season is important because it allows the fish breed properly.

- b) Fish farming**
 - ✓ This helps to reduce demand on fish from natural water bodies.
- c) Conservation farming**
 - ✓ These are good farming practices that help to protect natural vegetation.
 - Examples of conservation farming include making ridges across the slopes, making box ridges, etc.
- d) Creating of national parks, games reserves, etc.**
 - ✓ This will help reduce the killing of wild animals aimlessly.

IMPORTANCE OF NATURAL RESOURCES

- i) Air sustains life of people, animals and plants.
- ii) They are a source of income after selling minerals, pole, etc.
- iii) They are a source of food. For example we eat fish, fruits, etc.
- iv) They are a source of raw materials. For example, fish are used for making fertilizer.
- v) Forests and water are habitats for wild animals and fish.
- vi) They are used for tourist attraction. For example, water in lakes and wild animals attract tourists.
- vii) Water is used for sporting activities.

WAYS IN WHICH NATURAL RESOURCES ARE MISMANAGED IN MALAWI

- 1) Poaching**
 - This is the illegal killing of wild animals.
- 2) Poor waste disposal**
 - These wastes come from industries and homes. These include glass, plastics, metals, etc.
 - These are often discharged in water bodies and bare land, contributing to water, land and air pollution.
- 3) Overfishing**
 - This is the catching of fish from water bodies at a faster rate than the rate at which they can reproduce.
 - This is done by using fishing nets that have small mesh, which catch even immature fish. Sometimes poisonous herbs such as *katupe* are used to catch fish.
- 4) Poor farming practices**
 - These may include overgrazing, cultivation in river banks, and making ridges along the slopes.
 - These destroy vegetation, leaving the land bare, and prone to soil erosion.
- 5) Deforestation**
 - This is the careless cutting down of trees as people clear forests for farming and settlement.
- 6) Bushfires**
 - People set bush fires to clear the land for settlement and farming. Bush fires are also set by hunters to easily catch the hiding animals

EFFECTS OF MISMANAGING NATURAL RESOURCES

- a) Poaching**
 - This reduces the population of wild life, leading to their extinction. This in the end can negatively affect the tourism industry.
- b) Poor waste disposal**
 - Discharging untreated wastes in water bodies can lead to the death of aquatic species such as fish.

- Burning of waste produces a lot of poisonous gases that can be poisonous and lead to global warming.
 - Waste disposed of on bare land can also make the land barren and destroy plants.
- c) Overfishing**
- This reduces the population of fish in water bodies, leading to poor health of human beings since fish are a reliable source of proteins.
 - Overfishing can also lead to extinction of fish, which can negatively affect the tourism industry.
- d) Poor agricultural practices**
- These can result into soil erosion and siltation of water bodies and flooding.
 - Clearing of forests as it happens in shifting cultivation can disturb normal rainfall patterns since deforestation can reduce the rate of transpiration.
- e) Deforestation**
- These can result into soil erosion and siltation of water bodies and flooding since deforestation discourages infiltration.
 - Clearing of forests can disturb normal rainfall patterns since deforestation can reduce the rate of transpiration.
- f) Bushfires**
- It leads to loss of soil fertility, leading to poor crop yield.
 - It can also disturb normal rainfall patterns since deforestation can reduce the rate of transpiration.
 - It also destroys habitats for wild life.
 - It leads to ecological imbalance in the environment.

WAYS OF MANAGING NATURAL RESOURCES

- a) Awareness campaigns**
- People need to be civic educated on the negative effects of mismanaging natural resources.
 - Civic education to people on the importance of caring for natural resources can also help to change people's mindset.
- b) Demonstration projects**
- These are run by individual groups of people with the help of cooperatives and self-help schemes. These teach people various ways of caring for the natural resources such as wild life and forest reserves.
- c) Competition**
- The government and non-governmental organizations can organize competitions aimed at protecting natural resources in the environment from grass root levels.
 - Prizes can be given to people in these competitions to encourage people that take part in them.

TOPIC 9: NATURAL DISASTERS IN MALAWI

DEFINITION OF SOME TERMS

- a) Natural disasters**
- ◆ These are any catastrophic effects caused by hazards in nature that lead to deaths and injuries to people, animals and cause damage to property.
- b) Disasters**

- ◆ These are serious disruptions of the functioning of a community involving widespread human, material, economic losses and effects which exceed the ability of the affected community to cope using its own resources.
- c) **Risk**
- ◆ This is the probability of harmful consequences, or expected losses resulting from interactions between natural or human-induced hazards and vulnerable conditions.
- d) **Hazard**
- ◆ This means the potentially dangerous event, substance, human activity that may cause loss of life, injury or other health effects. Property damage, loss of livelihoods and services.
- e) **Vulnerability**
- ◆ It refers to the characteristics and circumstances of a community, system or asset that make it prone to the damaging effects of a hazard.
- f) **Natural hazards**
- ◆ These are natural threats that exist in nature, such as floods, tsunamis, earthquakes and typhoons.

DIFFERENCE BETWEEN NATURAL DISASTER AND NATURAL HAZARD

- ✓ **Natural disasters** are effects felt by animals, people and property when a disaster takes place while **natural hazards** are natural threats that exist in nature.

NOTE

- Natural disasters do not automatically follow natural hazards.
- If the hazard occurs but does not have any effect, then there is no natural disaster.
- The resulting loss after a disaster will be dependent on the vulnerability of the population affected to resist it.

TYPES OF NATURAL DISASTERS

1) Volcanic eruptions

- ❖ These are formed when magma from beneath the earth's surface is ejected out.

2) Hurricanes

- ❖ These are very violent and destructive blowing winds.

3) Floods

- ❖ A flood is an overflow of a very large amount of water on the earth's surface.

- ◆ Floods occur when there is excess rainfall which may lead to water bodies be filled with water and overflow to dry land.

4) Earthquakes

- ❖ An earthquake is a sudden movement of the earth.

5) Fire disasters

- ❖ These can be bushfires, wild fires or forest fires. They can be caused by smokers that may drop a cigarette which can start fire.

6) Droughts

- ❖ A drought is an extended time period when there is lack of rainfall in an area. They lead to poor crop yield.

NATURAL DISASTERS COMMON IN MALAWI

a) Flash floods

Areas where floods are common in Malawi

- ☞ Mouth of Domasi River
- ☞ Shorelines of Lake Chiuta in Zomba district
- ☞ Mouth of Phalombe River
- ☞ In Nsanje around Ndindi and Elephant marshes
- ☞ In Mangochi on the Lowlands around the lower arm of Lake Malawi

- ☞ Near the mouths of Linthipe and Bwanje Rivers
- ☞ In Nkhotakota around Dwambazi and Bua deltas and floodplains
- ☞ In Karonga, in Songwe delta

FACTORS THAT INCREASE VULNERABILITY TO FLOODS

- Deforestation promotes surface run-off.
- Cultivation along river banks promotes soil erosion and siltation of water bodies.
- Overgrazing promotes soil erosion and surface run-off.
- Poorly constructed houses at a high risk of being washed away by floods.

b) Tremors

- ◆ These are slight vibrations of the crust caused by movements inside the crust.
- ◆ They are common in the lakeshore plains.
- ◆ The previous well known tremor occurred in the year 1989, and affected such districts as Dedza, Salima and Mchinji. On the Richter scale it was 6.7.

c) Earthquakes

- ◆ These are sudden movements in the lithosphere.
- ◆ They are common in the rift valley floor since Malawi falls within this rift valley belt extending from Beira in Mozambique, through Ethiopia via the Gulf of Suez into Israel.

d) Droughts

- ◆ This is a prolonged period without rainfall. Greatly affects the Lower Shire areas.

e) Cyclones

- ◆ These are strong storms.
- ◆ They mainly originate from Mozambique and mainly affect the southern region of Malawi.

f) Landslides

- ◆ This is where the surface layers of rocks and soil crumble and slide downslope when soaked by rain water.
- ◆ They are common in hilly areas that receive heavy rains.
- ◆ They are also caused by earthquakes.

SOME AREAS AFFECTED BY LANDSLIDES

1) Deforestation

- ◆ This promotes floods by encouraging surface run-off, soil erosion and siltation of water bodies.

2) Earth movements

- ◆ Convective currents that operate in the upper part of the mantle are responsible for plate movements that cause such natural disasters as earthquakes, tremors and volcanic eruptions.

3) Climate change

- ◆ Disasters such as floods and droughts primarily result from climatic change.
- ◆ Climate change is encouraged by activities of human beings on earth that increase the production of greenhouse gases such as methane and carbon dioxide. These gases escape into the atmosphere and damage the ozone layer that protects the earth from direct and harmful sun rays, causing global warming. Global warming disturbs the normal rainfall patterns by disturbing the process of condensation, leading to little or no rains. Global warming also increases the rate of transpiration and evaporation, causing too much rains that cause floods.

4) Poverty

- ◆ Poverty is directly linked to increasing deforestation as people clear the forests to find money by making firewood and charcoal. As discussed above, deforestation promotes surface run-off, soil erosion and siltation of water bodies. This leads to flooding.

EFFECTS OF SOME NATURAL DISASTERS

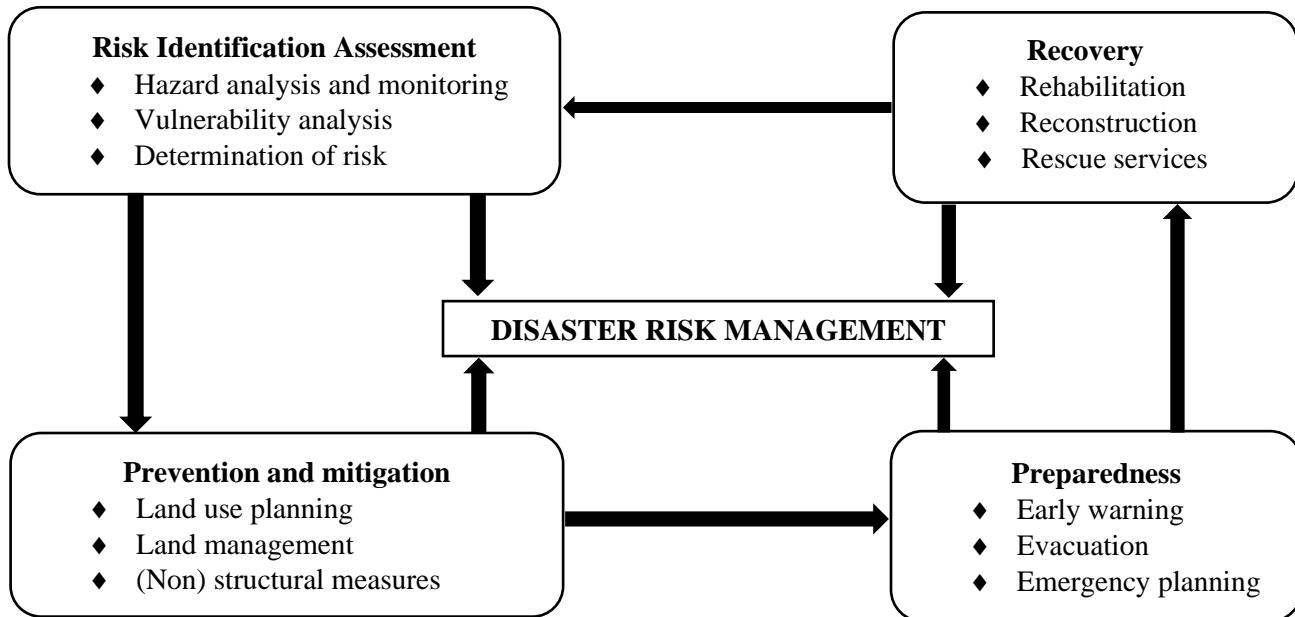
- i) High demand for relief items
- ii) Loss of life and property.
 - ❖ These result from earthquakes, floods, etc.
- iii) Destruction of the environment.
 - ❖ Eg Napolio in 1946 on Zomba plateau killed many people in Zomba district.
- iv) Interruption of social life and activities.
 - ❖ For example when there is a flood or earthquake, people cannot go on with normal life such as doing business, but focus on mitigation measures to the effects caused.
- v) Spread of diseases
 - ❖ Floods promote the spread of water borne diseases such as cholera and malaria.
- vi) Loss of livelihoods
 - ❖ Natural disasters negatively affect the economic status of people and render them jobless. For example, floods sweep away people's crops in fields and droughts lead to poor crop yields.
- vii) Pollution
 - ❖ Volcanoes lead to barren lands, floods lead to water, land and air pollution.
- viii) Destruction of buildings and infrastructure
 - ❖ Earthquakes, volcanoes, hurricanes and floods may damage the roads, buildings and other infrastructure.
- ix) Emotional turmoil
 - ❖ The loss of life and property to natural disasters affects people psychologically as many survivors of natural disasters have high risks of suffering from trauma.

WAYS OF MANAGING DISASTERS

DISASTER RISK MANAGEMENT

- ❖ Disaster Risk Management is an ongoing process by which the government, development partners, private sector, civil society, communities, household and individuals plan for and reduce the impacts of disasters, react during, and immediately after a disaster and take steps to recover after a disaster has taken place.

Disaster Risk Management Cycle



- The four stages in the disaster risk management in the diagram above starts with **recovery** after a disaster has taken place.

- **Second**, there comes **assessment** is done to investigate the extent of damage the disaster has caused.
- **Thirdly, prevention and mitigation** measures are done to ensure that every possible precaution is put in place in the event of other future occurrences.
- **Lastly**, the relevant authorities ensure that **preparedness** measures are affected to ensure that in case of a future disaster, the response will be effective and timely to minimize the effects anticipated.

1) PREVENTION AND MITIGATION

- ◆ This includes all activities that provide complete avoidance of adverse impacts of hazards and related disasters.
- ◆ It includes all the precautionary that can be taken against natural disasters.

PRECAUTIONARY MEASURES AGAINST NATURAL DISASTERS

a) Floods

- ✓ Moving immediately to higher grounds.
- ✓ Teaching children about the hazards of floods.
- ✓ Listening to the radio and reading newspapers to get updates on floods.
- ✓ Keeping foods, medicine etc. in store needed when flooding occurs.
- ✓ Monitoring water levels in rivers regularly during rainy season. This helps to warn people to move to higher grounds in good time.
- ✓ Identifying in advance safer places for evacuation.

b) Earthquakes

- ✓ Keeping adequate food in government grain silos.
- ✓ Storing items that are required when a disaster strikes. E.g. medicine, food, tents, etc.
- ✓ Monitoring and checking records of earthquake waves or shocks regularly in areas an earthquake is likely to take place.
- ✓ Constructing buildings that can withstand the effects of earthquakes.
- ✓ Awareness campaigns in areas prone to earthquakes to prepare them for necessary action in an event that an earthquake strikes.

c) Drought

- ✓ Having enough food stock in grain silos.
- ✓ Listening to weather forecasting on radio to know changes in weather conditions.
- ✓ Production of drought tolerant crops to have enough food during drought time.
- ✓ Conserving water in dams and harvesting rain water to be used for irrigation farming.
- ✓ Recycling waste water from the sewage, and treat it for reuse.
- ✓ Desalinating the sea water to be used for domestic purposes or irrigation farming during droughts.

d) Volcanic eruptions

- ✓ Avoid settling close to mountains have active volcanic eruptions.
- ✓ Close monitoring and recording of the eruption patterns of active volcanic mountains in order to detect any potential volcanic activity in good time and take precautionary measures.
- ✓ Awareness campaigns for the people to have necessary information in the event that a volcanic eruption occurs.
- ✓ Conducting research on other areas that have been affected by volcanic eruptions so the every possible precaution can be taken by both the government and the people in countries that are likely to be affected.

e) Fire disaster

- ✓ Civic education on the negative effects of setting bush fires.
- ✓ Avoid burning bushes as a means of clearing land.
- ✓ Having well-equipped fire-fighting units located within reasonable distances to where people live and where industries are set up so that there will be rapid response whenever a fire occurs.
- ✓ Conducting trainings in organisations to ensure that all employees take preventive measures against fire accidents.

2) PREPAREDNESS OF NATURAL DISASTERS

- ❖ These are all activities and measures taken in advance to ensure effective response to minimize the effects of hazards. Some of these measures are as follows:
- ✓ Civic education to the public about natural disasters.
- ✓ Dissemination of timely and effective early warnings in the event of a disaster.
- ✓ Temporary evacuation of people and property from threatened locations.
- ✓ Training workers in organisations and institutions where many people work together to ensure that everyone is prepared in the event of a disaster.

3) RESPONSE TO NATURAL DISASTER

- ✓ This involves the provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts and ensure public safety.

4) RECOVERY FROM NATURAL DISASTERS

- ✓ This refers to decisions and actions taken after a disaster with the view of restoring or improving the pre-disaster living conditions of a stricken community while encouraging and facilitating necessary adjustments to reduce disaster risk.

WAYS OF MANAGING DISASTER RISKS

- ❖ People can move to areas of high altitude where water cannot reach them.
- ❖ Construction of strong storm drains and channels to direct flood water away from settlements.
- ❖ Disaster preparedness by keeping in store food items and drugs to help people during disasters.
- ❖ Avoiding cultivation in river banks to reduce siltation of water bodies and floods.

WAYS OF RECOVERING FROM FLOODING

- ◆ Replant crops in all affected areas.
- ◆ Mobilise resources for rehabilitation.
- ◆ Clean and disinfect anything that got wet.
- ◆ Return home only when authorities indicate that is safe.
- ◆ Rebuild the damaged infrastructure in a better and safer way.
- ◆ Stay out of any building if it is surrounded by flood waters.
- ◆ Provide psycho-socio support to children and traumatised persons.
- ◆ Stay away from downed power lines and report to ESCOM and other authorities.

TOPIC 10: POPULATION IN MALAWI

DEFINITIONS OF TERMS

1) POPULATION

➢ It is the total number of people living in an area at a given time.

2) POPULATION DENSITY

➢ It is the average number of people living in a unit area (per square kilometre).

3) POPULATION GROWTH RATE

- This is the net addition through birth and migration to the existing population per year.
- This rate is usually expressed as a percentage of the existing population.

4) POPULATION EXPLOSION

- This is when the population grows rapidly.

5) POPULATION IMPLOSION

- This happens when the population decreases sharply.

6) BIRTH RATE

- It is the number of people born in a year every one thousand (1000) people.

7) MORTALITY RATE (DEATH RATE)

- This is the number of people dying in a year per one thousand (1000) people.

8) PUSH FACTORS

- These are negative factors that drive people from some areas.

- Examples of push factors are harsh climate, lack of employments.

9) PULL FACTORS

- These are positive factors attract people to settle in an area.

- Examples of pull factors include fertile soils, good transport, and improved living conditions.

10) YOUTHFUL POPULATION

- This is the population that is made up mostly of young people because the population growth rate is high.

11) AGEING POPULATION

- This is the population that is composed of adults because the population growth rate is low.

12) POPULATION DISTRIBUTION

- This is the way in which the population is spread out in a particular area.

13) IMMIGRATION

- This is the coming of people into a country or an area from other countries or areas.

14) EMIGRATION

- This is the going out of people from an area to other areas or countries.

15) FERTILITY RATE

- This is the average number of children born alive per 1000 women aged 15-49 in a year.

16) LIFE EXPECTANCY

- This is the number of years a baby is expected to live after birth.

17) DEPENDENCY RATIO

- This is the proportion of the total population of a country in the ages 0-15 and above 64 (64+).

- Dependents are non-working people but depend on the economically active (aged 15-64).

18) CENSUS

- This is a count of all the people living in an area such as a country.

- It is done after 10 years (inter-censal period).

19) POPULATION COMPOSITION

- This refers to the differences in proportion of people that make up the population in terms of ethnic groupings, race, age and sex.

20) SEX RATIO

- This is the number of males per 100 females.

21) NATURAL INCREASE

- This happens when there is high birth rate than death rate in a population.

- It leads to a rapid increase in the population.

THE POPULATION COMPOSITION OF A GIVEN AREA

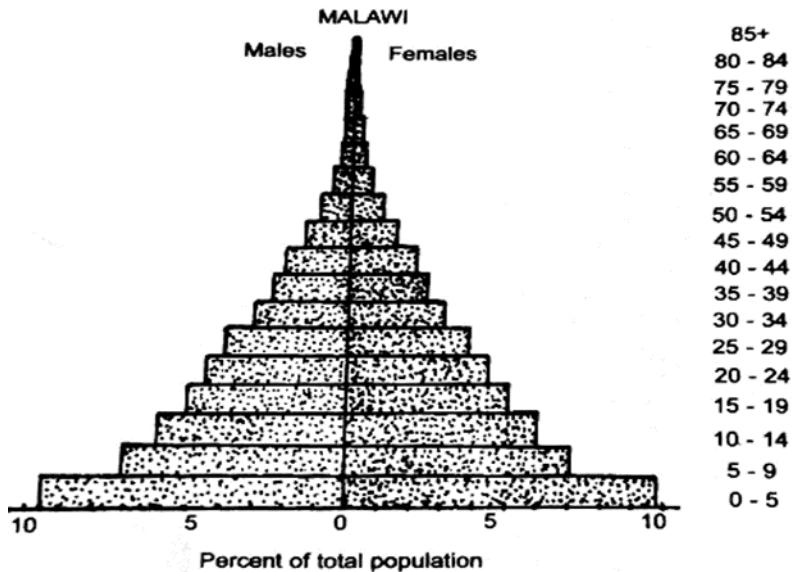
- ◆ The population composition of any given population can be described in terms of ethnic groups, race, age, and sex.
- ◆ The population composition may consist of all males and females and their different age groups. This classification is based on the age and sex structure of any given population.
- ◆ Regarding ethnic groups, some of them in Malawi include Ngoni, Yao, Lomwe, Tumbuka, Sena, etc.

Ethnic Diversity in Malawi

Ethnic Group	Percentage
Chewa	32.6%
Sena	3.6 %
Nyanja	5.8%
Tumbuka	8.8%
Ngoni	11.5%
Yao	13.5%
Lomwe	17.6%
Tonga	2.1%
Ngonde	1%
Others	3.5%

NOTE:

- ❖ The population composition of a given area or country can also be analyzed graphically. Such a graph is called a **population pyramid**.
- ❖ Population pyramids usually show the age and sex composition of any given area or country.



A Population Pyramid for Malawi

Interpretation and analysis of the population pyramid above

- Malawi experiences rapid population growth since it registers high birth rates. This is indicated by the broad base of the pyramid.
- There is also almost equal number of males and females in the population in lower age groups (i.e. below age group 30-34). In older ages (above 30-34), females are slightly more than males since there are longer bars for females than males.

- Malawi is a youthful population since it is mainly made of young people (below the age of 25).
- Malawi has a high dependency ratio (many people like those below the age of 15 and old people above the age of 64 are dependent on the economically active age group, that is 16 to 44).
- The largest and fastest growing age group is that of 0-4.

PROBLEMS EXPERIENCED IN COUNTRIES THAT HAVE YOUTHFUL POPULATION STRUCTURES

- High unemployment levels.
- High crime rates.
- Shortage of food.
- Over-exploitation of the environmental resources such as trees.
- Low standards of living.
- Pressure on social services such as hospitals and schools.
- There will be traffic congestion.
- Development of slums (squatter settlements) due to shortage of housing.

POPULATION COMPOSITION AT DISTRICT AND REGIONAL LEVELS IN MALAWI

- Rural-urban migration increases the population of males in all the four cities of the country (Lilongwe, Mzuzu, Blantyre and Zomba). This is the case as males look for greener pastures in urban areas.
- At regional level, there are more females than males in all the three regions of the country (northern, central and southern region).
- The same trend, as at regional level, is seen at district level. The main reason for this is that males are more likely to migrate to urban areas for greener pastures (jobs and businesses).

POPULATION DISTRIBUTION

- ❖ This means the way in which the population is spread out in a given area.
- ❖ The population may not be evenly distributed, with some areas having more people than others. For example, the southern region has the highest population of the three regions, seconded by the central region, and northern region has the least population.

FACTORS THAT DETERMINE THE POPULATION DISTRIBUTION

A) NATURAL (PHYSICAL) FACTORS

a) Soil

- ◆ Fertile soils usually attract settlements, and are expected to have dense populations; while infertile soils have few people. For example, lower shire Basin has a lot of people due to its fertile alluvial soils.

b) Relief

- ◆ Flat areas have dense populations while hilly areas discourage settlements. For example on the one hand, Mponela plains in Dowa district, Mchinji, Kasungu and Lilongwe have flat lands that promote settlements and farming. On the other hand, hilly areas like those of Rumphi, Nkhatabay and Chitipa have sparse populations.

B) CLIMATIC FACTORS

- ◆ Temperature and rainfall are some of the important elements of climate that influence the type of farming to be done in an area, that is crops to be grown and animals to be kept.

- ◆ Areas that receive good rains and have moderate temperature have dense populations while areas with little rainfall and having high temperatures have sparse populations.

C) BIOTIC FACTORS

- ◆ Areas that are badly infested with tsetse flies and armyworms have sparse populations. Tsetse flies cause sleeping sickness in human beings and trypanosomiasis in cattle. Army worms also damage crops. These discourage settlements. Areas that are not affected by the above problems are likely to have high population densities.

D) SOCIAL-POLITICAL FACTORS

- a) The decision by the government to create protected areas such as national parks, game reserves and forest reserves can also promote sparse population densities since people will be forced to be moved out of those places.
- b) Coming of infrastructural development such as airports and markets can also promote the relocation of people, but the same time, when those developmental projects are completed, they may attract dense population densities as people come to look for employment and business opportunities.
- c) The construction of roads and railway lines for example can attract people to settle close to bus stations and railway stations for easy transportation and businesses.

E) Migration of people from one place to the other due to negative and positive factors can also influence population distribution of people in an area. In migration, places of origin experience low population densities while places of destination experience high population densities.

Positive factors the attract people to come into an area (pull factors)

- ✓ High quality education facilities.
- ✓ Better job opportunities.
- ✓ Better business investment opportunities.
- ✓ Lotteries for citizenship. For example, the USA gives people from other countries green card lotteries to become citizens of America.

Negative factors the discourage people from settling in an area (push factors)

- ✓ Political instability such as civil wars.
- ✓ Harsh climatic conditions such as droughts.
- ✓ Floods.
- ✓ High crime rates and insecurity.
- ✓ Air and noise pollution.

F) ECONOMIC FACTORS

a) Agricultural and development activities

- ◆ The opening of industries and commercial farms attract people to such areas to look for employment. For example, tea estates in Thyolo district.

b) Employment opportunities

- ◆ People migrate to urban areas to look for jobs.

c) Communication facilities

- ◆ Good communication facilities such as telephones and internet may promote dense populations in such areas.

HOW POPULATION DISTRIBUTION INFLUENCES THE ALLOCATION OF RESOURCES

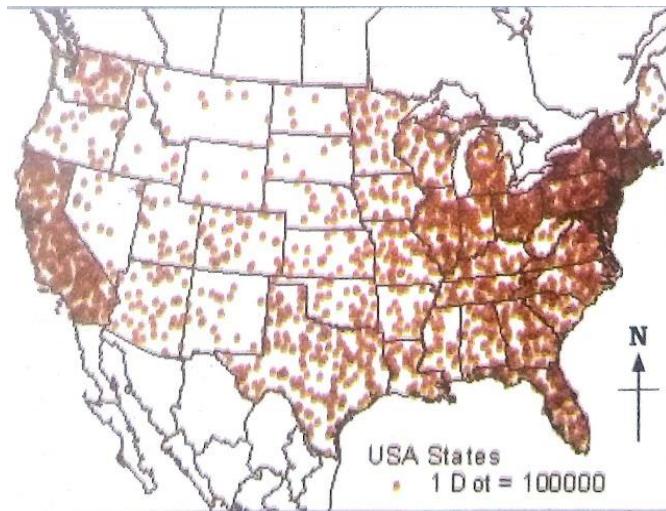
- The knowledge of population distribution in an area or a country is important when allocating social services.

- ✓ Areas that have dense population densities usually get greater allocations as compared to areas with low population densities.

WAYS OF SHOWING THE POPULATION DISTRIBUTION OF AN AREA

a) Dot maps

- ❖ This shows the distribution of geographical phenomena such as settlements, urban areas and population concentration.
- ❖ Dots are used to show the distribution of the population. Each dot represents population in thousands or millions and all dots have the same size and regular shape. The dots should not be too big or too small.



b) Choropleth maps

- ❖ These are also called area **density maps** or **shading maps**.
- ❖ Colours are used to show the distribution of a population. After calculating the population density, the area is classified into ranges according to the size of the area. 1-00.
- ❖ High population density areas are represented by dark colour shading and the lowest density is represented in a very faint colour.

POPULATION DENSITY

- ❖ This means the average number of people living per square kilometer (km^2), or per unit area.

CALCULATING POPULATION DENSITY

$$\text{POPULATION DENSITY} = \frac{\text{NUMBER OF PEOPLE IN AN AREA}}{\text{TOTAL AREA}}$$

EXAMPLE:

- 1) There are 1000, 000 people in an area. If the total area is 2 140 square kilometres, calculate the population density of this area.

SOLUTION

$$\text{POPULATION DENSITY} = \frac{\text{NUMBER OF PEOPLE IN AN AREA}}{\text{TOTAL AREA}}$$

$$\text{POPULATION DENSITY} = \frac{1,000,000 \text{ People}}{2,140 \text{ km}^2}$$

$$= \underline{\underline{467.28 \text{ People per km}^2}}$$

- ❖ Taking subject of the formula, Area can be found as follows:

$$\text{AREA} = \frac{\text{NUMBER OF PEOPLE}}{\text{POPULATION DENSITY}}$$

EXAMPLE

- 2) If the population density of an area is 106 people per unit area and the number of people is 1,615,864, calculate the unit area.

$$\text{SOLUTION}$$

$$\text{AREA} = \frac{\text{NUMBER OF PEOPLE}}{\text{POPULATION DENSITY}}$$

$$\text{AREA} = \frac{1,615,864}{106}$$

$$= \underline{\underline{15,244 \text{ km}^2}}$$

- ❖ Again taking the subject of the formula, the number of people can be found as follows:
- ❖

$$\text{NUMBER OF PEOPLE} = \text{POPULATION DENSITY} \times \text{UNIT AREA}$$

EXAMPLE

- 3) If the population density of a certain area is 64 people per square kilometre and the unit area is 3,521 km², calculate the number of people.

$$\text{NUMBER OF PEOPLE} = \text{POPULATION DENSITY} \times \text{UNIT AREA}$$

$$\text{NUMBER OF PEOPLE} = 64 \text{ People per km}^2 \times 3,521 \text{ km}^2$$

$$= \underline{\underline{225,344 \text{ people}}}$$

FACTORS THAT INFLUENCE THE POPULATION DENSITY OF A GIVEN AREA

- a) **Employment Opportunities**
 - ❖ Urban centres attract settlements as people look for employment there.
- b) **Soil Fertility**
 - ❖ Fertile soils attract people especially those that are farmers than infertile soils.
- c) **Urbanization**
 - ❖ This means an increase in the proportion of people living in urban areas as compared to those living in rural areas.
 - ❖ Urban areas attract people for jobs, businesses and also easy access to modern social services.
- d) **Accessibility**
 - ❖ Presence of good transport networks such as good roads, railway lines and airports attract people since transportation in such areas becomes easy.
- e) **Availability of social services**

- ❖ These may include things like good education facilities, health facilities, electricity, safe-piped water, etc. Areas that have plenty of these attract dense population densities, and if areas do not have a good supply of the same, settlements are discouraged.

f) Relief

- ❖ Hilly areas discourage settlements while flat areas promote dense population densities.

g) Favourable climate

- ❖ Good rains that can support farming and mild temperatures promote settlements while harsh climates such as hot areas like desert conditions, too cold areas like those tundra regions and areas that experience frequent droughts discourage settlements.

EFFECTS OF POPULATION DENSITY ON RESOURCES

- ♦ High population density exerts a lot of pressure on the available resources. This leads to over-use and depletion of the environmental resources such as forests and mineral resources.

EFFECTS OF HIGH POPULATION DENSITY ON RESOURCES

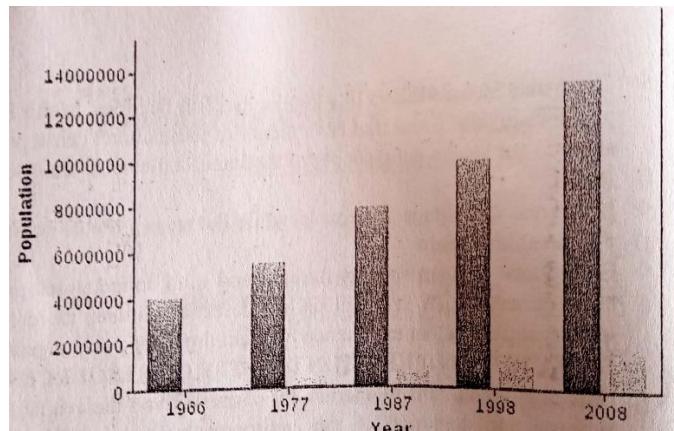
- ✓ It leads to unhealthy environments that are not safe to live in.
- ✓ There will be a lot of water, air, land and noise pollution.
- ✓ Shortage of housing that leads to creation of slums (squatter settlements).
- ✓ It leads to land fragmentation, leading to low crop yields.
- ✓ It promotes deforestation and depletion of environmental resources.
- ✓ It leads to high crime rates. This makes governments to spend a lot of money on security.
- ✓ Increased pressure on social services such as schools and hospitals.

EFFECTS OF LOW POPULATION DENSITY ON RESOURCES

- ✓ There will be under-utilization of the environmental resources such as minerals.
- ✓ Low food production as energetic people migrate to other areas for greener pastures.
- ✓ Reduced air, land, water and noise pollution.
- ✓ Reduced labour force.
- ✓ Low crime rates.

POPULATION GROWTH

- This refers to an increase or decrease of the population in a particular area.
- It is influenced by natural increase (high birth rates than death rates), the net migration (more immigrants than emigrants) or a combination of natural increase and net migration.
- For positive population growth, there should be more births than deaths in a population (natural increase), and more people coming into an area (immigration) than those going out of a population (emigration); thus net migration.
- For negative population growth to occur, there should be high death rates and low birth rates in a population. There should also be higher emigration than Immigration in a population.



Urban and National Population Growth of Malawi

FACTORS THAT INFLUENCE POULATION GROWTH

a) Natural increase

- ◆ When there is high birth rate than death rate in a population a population increases.

b) Migration

- ◆ When many people come into an area (immigration), the population increases, and when more people get out of a population (emigration), than those coming in, a population decreases.

c) Natural disasters

- ◆ These may include earthquakes, floods, droughts and hail storms. These may disperse people out of an area.

d) Political instability

- ◆ Civil unrest may force people out of an area or country. While political stability attracts many people into an area or a country.

e) Infrastructural development

- ◆ Infrastructural developments attract settlements and if areas don't have infrastructural developments, some people move out of that area.

FACTORS THAT LEAD TO RAPID POPULATION GROWTH IN MALAWI

- ✓ Political stability.
- ✓ High immigration rates than emigration rates.
- ✓ Early marriages make couple have a long child-bearing period.
- ✓ Favourable climatic conditions.
- ✓ High birth rates than death rates.
- ✓ Availability of proper health care systems.
- ✓ Cultural practices such as early marriages and polygamy.
- ✓ Lack of access to family planning services.
- ✓ Child preference as a man may prefer male children to female ones while females may prefer female children to male children.

FACTORS THAT LEAD TO LOW POPULATION GROWTH IN A COUNTRY

- ✓ Increased access to family planning services.
- ✓ Epidemics such as HIV/AIDS, Cholera and Ebola may kill a lot of people.
- ✓ Civil wars may lead to the death of many people in an area.

- ✓ Natural disasters such as floods and earthquakes may kill people and force others out of an area.
- ✓ High emigration rates than immigration.
- ✓ High cost of living in a country may force couples to have few children.
- ✓ Discouraging bad cultural practices such as polygamy and early marriages.

BIRTH RATES AND DEATH RATES

Fertility rate (crude birth rate)

- ❖ This is the number of live children born in a year per 1000 mothers of the population.

$$\text{CRUDE Birth Rate} = \frac{\text{Number of live births in a year}}{\text{Total Population}} \times 1000$$

For example, the total population of a certain country is 15, 000 000 and 250 000 live babies were born in 2020. Calculate the crude birth rate.

SOLUTION

$$\text{CRUDE Birth Rate} = \frac{250,000}{15,000,000} \times 1000$$

BIRTH RATE = 16.6

This means that for every 1000 people, 16.6 children were added to the population in 2020 in this country.

REASONS WHY MALAWI HAS HIGH BIRTH RATES

- Early marriages.
- Parents hope that children would help them in old age.
- Children are believed to help children in farming.
- Improved health care increase survival rates for infants.
- Lack of access to family planning services.
- Children are a symbol of high social status in the society.
- The need to name children after their relatives.
- Sex preferences where a couple is looking for male children but end up having girl children.
- Religious beliefs that discourage families from using contraceptives.
- Polygamous families also promote large families.

MORTALITY (DEATH) RATE

- ❖ This is the number of people dying in a year per 1000 people of the population.

$$\text{Crude Death Rate} = \frac{\text{Number of deaths in a year}}{\text{Total Population}} \times 1000$$

For example, the total population of a certain country is 20 370 000 and 3 657 000 people died in 2020. Calculate the crude death rate.

SOLUTION

$$\text{CRUDE Death Rate} = \frac{3657000}{20\,370\,000} \times 1000$$

DEATH RATE = 179.5

REASONS WHY DEATH RATES HAVE DECREASED IN MALAWI

- Improvements in medical care.
- Improvements in the living standards.
- Improved nutrition.

IMPACTS (EFFECTS) OF RAPID POPULATION GROWTH ON THE FAMILY AND THE ENVIRONMENT

a) ON THE FAMILY

- ◆ Shortage of housing.
- ◆ Lack of basic needs in the family such as clothes.
- ◆ It leads to low quality education.
- ◆ High unemployment rates.
- ◆ Increased poverty levels.
- ◆ It leads to food insufficiency.
- ◆ Low living standards.

b) ON THE ENVIRONMENT

- ◆ Increased deforestation as people clear forests for settlements and farming.
- ◆ Congestion for farming and settlement.
- ◆ Increased pressure on social services such as schools and hospitals.
- ◆ High cost of available resources such as food prices.
- ◆ Environmental degradation resulting from careless disposal of home and industrial waste.
- ◆ Increased bush fires as people hunt and open farms.
- ◆ Siltation of water bodies resulting from soil erosion as forests are cleared.

STRATEGIES FOR CONTROLLING RAPID POPULATION GROWTH IN MALAWI

- a) Civic education to people on the dangers of rapid population growth and importance of small family sizes.
- b) Provision of free and affordable family planning services.
- c) Legislation and enforcement of laws to force people have the required number of children.
- d) Promotion of late marriages.
- e) Discouraging cultural practices such as polygamy and wife inheritance after the death of a husband.
- f) Provision of old age social security systems can make people have few children.

IMPORTANCE OF CONTROLLING RAPID POPULATION GROWTH

- ① Availability of adequate resources.
- ② Protection and sustainability of resources in the environment such as water, soil and trees.
- ③ Adequate provision of social services.

PART TWO: FORM TWO WORK

TOPIC 11: LONGITUDES, LATITUDES AND GREAT CIRCLES

LATITUDES

- These are horizontal imaginary lines that run from east to west.

EXAMPLES OF LATITUDES

- a) Arctic Circle ($66\frac{1}{2}^{\circ}\text{N}$)
- b) Tropic of Cancer ($23\frac{1}{2}^{\circ}\text{N}$)
- c) Equator (0°)
- d) Tropic of Capricorn ($23\frac{1}{2}^{\circ}\text{S}$)
- e) Antarctic Circle ($66\frac{1}{2}^{\circ}\text{S}$)

NOTE:

- These lines are drawn at intervals of 1° on either side of the equator and each latitude is further subdivided in 60 minutes ($60'$).
- Since the equator divides the earth into two equal halves, it is important to note that the northern half is called the **northern hemisphere**, and the southern part is called the **southern hemisphere**.
- The latitudes that are close to the equator are called low latitudes, and those far away from the equator are called the high latitudes.

CHARACTERISTICS OF LATITUDES

- ☛ They are spaced equally apart (111km).
- ☛ They are parallel to each other.
- ☛ They are drawn at intervals of 1° .
- ☛ They run on the earth from east to west.
- ☛ They are not equal in length.
- ☛ The length of latitudes decrease as they move towards the poles.

IMPORTANCE (USES) OF LATITUDES

- ❖ They are used to locate places on the globe.
- ❖ They are used to calculate distances of places on the globe.
- ❖ They are used by sailors for navigation in the seas and oceans.
- ❖ They influence climate of places on the earth where they pass through.
- ❖ When used with longitudes they form a grid system that helps us to identify exact positions on the surface of the earth.

MEASUREMENT OF DISTANCE USING LATITUDES

NOTE: The average linear distance between each line of latitude is 111 kilometers (111 km), this is used when calculating distances.

Example 1:

Mr. Chibambo is at hotel at latitude 45° north of the equator. How far is he from the equator?

Solution

Since $1^{\circ} = 111\text{km}$,

Therefore, $45^{\circ} = \text{more}$

$$= \frac{45^{\circ} \times 111\text{km}}{1^{\circ}}$$
$$= 4995\text{km}$$

Example 2:

A certain town is located at a latitude of $36^{\circ} 25'$ south of the equator. How far is it from the equator?

Solution 1:

Change $36^\circ 25'$ to minutes

$$=(36^\circ \times 60') + 25'$$

$$=2160 + 25'$$

$$=2185'$$

To find distance:

Since $60' = 111\text{km}$,

Therefore $2185' = \text{more}$

$$=\frac{2185' \times 111\text{km}}{60'}$$

$$=4042.25\text{km}$$

=4042km (to the nearest km)

Solution 2:

Convert (change) $36^\circ 25'$ to degrees ($^\circ$)

$$=36^\circ + (\frac{25'}{60})$$

$$=36^\circ + 0.4167$$

$$=36.4167^\circ$$

To find distance:

Since $1^\circ = 111\text{km}$,

Therefore, $36.4167^\circ = \text{more}$

$$=\frac{36.4167^\circ \times 111\text{km}}{1^\circ}$$

$$=4042.2537\text{km}$$

=4042km (to the nearest km)

Solution 3:

Find the distance for 36° and $25'$ separately, and add the two figures; as done below:

$$=(36^\circ \times 111\text{km}) + (0.4167^\circ \times 111\text{km})$$

$$=3996\text{km} + 46.2537\text{km}$$

$$=4042.2537\text{km}$$

=4042km (to the nearest km)

LONGITUDES

- These are vertical imaginary lines that run from the North Pole to the South Pole.
- They are measured in degrees east or west of the Prime Meridian or the Greenwich Meridian.

- The Prime Meridian or Greenwich Meridian is the main meridian at 0° that passes through Greenwich in London and Accra in Ghana.

CHARACTERISTICS OF LONGITUDES

- All longitudes are equal in length.
- They are not parallel to each other.
- They intersect with latitudes at right angles.
- They converge (meet) at the North Pole and the South Poles.
- There are 180° of longitudes to the west of the prime meridian and 180° of longitudes to its east.

IMPORTANCE (USES) OF LONGITUDES

- They are used in the calculation of distances on earth.
- They help in the calculation of local time for any place on the earth.
- They are used to locate places on maps.
- They, together with latitudes are used in forecasting weather by tracking hurricanes.
- They are used in emergencies such as a plane crash or if a ship sinks in a sea. This is done by also using latitudes to locate the emergency zones.

GREAT CIRCLES

- They are imaginary lines drawn on the globe and they divide it into two equal halves.
- All longitudes are great circles.

EXAMPLES OF GREAT CIRCLES

- The equator
- The Prime Meridian
- The International date line

CHARACTERISTICS OF GREAT CIRCLES

- Their planes pass through the centre of the globe.
- They are the largest possible circles that can be drawn on the surface of the globe.
- Only one great circle can pass through any two points on the surface of the globe.
- Intersecting great circles bisect each other.

IMPORTANCE OF GREAT CIRCLES

- They are used to identify the shortest distance between two places.
- They are used in aircraft flights since travelling along these routes help save time.
- By saving the flight time, planes also save fuel.

TOPIC 12: TIME ZONES

MEANINGS OF WORDS

TIME ZONES

- It refers to a region within which time is unified so that all places within it have the same time.

LOCAL TIME

- This is the time set based on the location of places within a given longitude which are bound to experience the same time.

STANDARD TIME

- This is the time in any of the 24 time zones into which the earth is divided.

OR

- It is the local time a country selects from a central meridian or any other convenient meridian as its standard meridian.

OR

- ♦ It is the mean time or the official local time of a particular country or region at the central meridian of the given zone.

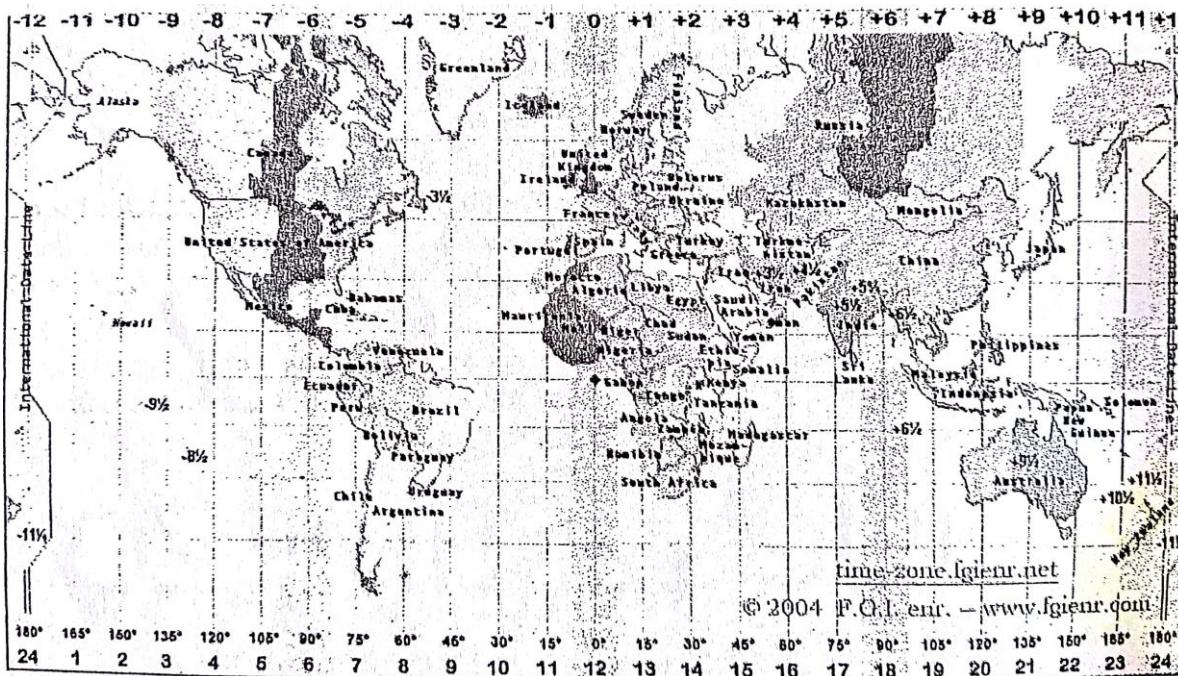
NOTE: The local time at the Greenwich in London is called the **Greenwich Mean Time (GMT)**.

INTERNATIONAL DATE LINE

- ♦ This is the line of longitude at 180° that separates one day from the other.
- ✓ The International Date Line passes through water bodies and in boundaries of countries to avoid cutting across a country. Cutting across the country would make one country to have several different dates at the same time.

THE CONCEPT OF TIME ZONES

- ☞ Since the earth rotates from west to east, it completes a full 360° in one day (24 hours).
- ☞ Since there are 24 hours in one day, the earth has been divided into 24 standard time zones, each of which extends over 15 degrees (15°) longitude. In one hour, the earth turns 15 degrees (15°) of longitude.
- ☞ Each 15° of longitude is equivalent to a time difference of 1 hour.
- ☞ Time zones are indicated as imaginary lines that run from north to south down the globe. They are not straight lines. The imaginary lines that divide the time zones sometimes curve around some countries to ensure that the entire country has the same time zone.
- ☞ However, some big countries such as Russia and USA have more than one time zones. Russia has 11 time zones and USA has four time zones.



Time Zones of the World

TRADITIONAL WAYS OF TELLING TIME COMMONLY USED IN THE PAST

a) Position of the sun

- ♦ For example, when the sun is in the centre of the sky, it is exactly noon.

b) Cockcrows

- ♦ The crowing of a cock at dawn means that the sun is about to rise. The cock may crow four times in a night, and the last crow it means that the time is 4 o'clock in the morning.

REASONS FOR CREATING TIME ZONES

- To bring to an end confusion of having many local times.
- For example, one country having several local times, leading to train and bus accidents.
- The need to have more efficient rail transport system which demanded a more uniform time-keeping system.

CALCULATION OF TIME FOR DIFFERENT COUNTRIES

➤ When calculating time, it is important to take note of the following points:

- ☞ The earth completes one rotation of 360° in 24 hours (1 day).
- ☞ It passes through 15° in one hour (1 hour).
- ☞ It passes through 1° in 4 minutes.

THUS:

- ✓ 360° in 24 hours
- ✓ 15° in 1 hour
- ✓ 1° in 4 minutes

STEPS TO FOLLOW WHEN FINDING THE TIME AND DAY IN TIME ZONES

- a) Determine the number of degrees between the two places.
- b) Find the time difference between the two places by dividing the number of degrees found above by 15° . **HINT:** if that leaves a remainder, multiply the remainder by 4 to convert (change) it into minutes, since the earth rotates through 1° in 4 minutes.
- c) Calculate the time by either adding or subtracting an hour for each time zone. This depends on whether you move eastwards or westwards. **NOTE:** You add when moving eastwards and you subtract when you move westwards.
- d) If you have crossed The International Date Line, identify the day. That is you lose a day when crossing the International Date Line from east to west, and, you gain a day by crossing the International Date Line from west to east.

NOTE: When calculating differences in degrees for longitudes follow the following tip:

- ☞ When both places are in the west of the Greenwich (Prime) Meridian, subtract their longitude values.
- ☞ When both places are in the east of the Greenwich (Prime) Meridian, subtract their longitude values.
- ☞ When one place is in the east and the other place is in the west of the Greenwich (Prime) Meridian, add their longitude values.

Understanding “AM” and “PM” when working on time problems.

- ☞ “AM” is from “Ante Meridian”, meaning before the sun crosses the Meridian.
- ☞ “PM” is from “Post Meridian”, meaning after the sun crosses the Meridian.

EXAMPLE 1:

- It is 12:00 noon in London. Calculate the time in Japan ($135^\circ E$).

Solution

Note: London is on (0°) because the Prime Meridian passes through it.

Difference in degrees of longitudes:

$$135^\circ - 0^\circ = 135^\circ$$

Time difference:

Since $15^\circ = 1$ hour,

Therefore, $135^\circ =$ more

$$\begin{aligned} &= \frac{135^\circ \times 1 \text{ hour}}{15^\circ} \\ &= 9 \text{ hours} \end{aligned}$$

Since Japan is to the east of the Prime Meridian, its time is ahead of London by:

$$= 12:00 \text{ noon in London} + 9 \text{ hours}$$

$$= 9:00 \text{ pm in Japan}$$

Example 2:

If it is 3pm at Greenwich Meridian, What is the time in Lilongwe ($30^\circ E$)?

Solution

Note: London is on (0°) because the Prime Meridian passes through it.

Difference in degrees of longitudes:

$$30^\circ - 0^\circ = 30^\circ$$

Time difference:

Since $15^\circ = 1$ hour,

Therefore, $30^\circ =$ more

$$= \frac{30^\circ \times 1 \text{ hour}}{15^\circ}$$

$$= 2 \text{ hours}$$

Since Lilongwe is to the east of the Prime Meridian, its time is ahead of the time at the Prime Meridian by:

$$= 3:00 \text{ pm in London} + 2 \text{ hours}$$

$$= \mathbf{5:00 \text{ pm in Lilongwe}}$$

Example 3:

Mr. Jere is at a certain longitude 165° west of the Greenwich Meridian, at 4:00am. What will be time at longitude 45° east of the Greenwich Meridian?

Solution:

Difference in degree of longitudes

$$165^\circ + 45^\circ = 210^\circ$$

Time difference

Since $15^\circ = 1$ hour,

$$\therefore 210^\circ = \text{more}$$

$$= \frac{210^\circ \times 1 \text{ hour}}{15^\circ}$$

$$= 14 \text{ hours}$$

Since longitude 45° is to the east of the Greenwich Meridian, its time is ahead that at longitude 165° west of the Greenwich Meridian by:

$$\begin{aligned} & 4:00 \text{ am} + 14 \text{ hours} \\ & = \mathbf{18:00 \text{ hours or } 6:00 \text{ pm}} \end{aligned}$$

Example 4:

It is 8:20am on the Prime Meridian. The local time at a certain longitude to the east of the Prime Meridian is 8:20pm. Find the degrees on this longitude.

Solution:

Difference in hours from 8:20am to 8:20pm

$$= 12 \text{ hours}$$

This means that from 8:20am, 12 hours are added (thus $8:20\text{am} + 12\text{hours} = 2020 \text{ hours or } 8:20\text{pm}$)

Since 1hour = 15°

Therefore, 12hours = more

$$= \frac{12 \text{ hours} \times 15^\circ}{1 \text{ hour}}$$

$$= 180^\circ$$

The longitude will be 180° east of the Prime Meridian (Greenwich Meridian)

Example 5:

It is 9:00am in town P (35°E). Calculate the time in Accra, Ghana.

Solution

Note: Accra is on (0°) because the Prime Meridian passes through it.

Difference in degrees of longitudes:

$$35^\circ - 0^\circ = 35^\circ$$

Time difference:

Since $15^\circ = 1\text{hour}$,

Therefore, $35^\circ = \text{more}$

$$\begin{array}{r} & & 2 \\ 15 & \boxed{3} & 5 \\ - 3 & & 0 \\ \hline & & 5 \end{array}$$

Remainder

Multiply remainder 5 by 4 minutes, to give 20minutes.

Therefore, time difference will be 2 hours 20minutes.

Since Accra is to the west of town P (34°E), its time is behind that of town P.

$$\begin{array}{r} 9 : 00\text{am} \\ - 2 : 20 \\ \hline 6 : 40\text{ am} \end{array}$$

The time in Accra, Ghana will be 6: 40am

CALCULATING FLYING TIME

Tips:

- ☞ To determine the arrival time of a flight, add the flying time to last step above, thus according to the steps to be followed, it is **step (c)**.
- ☞ To determine the departure time, subtract from the answer obtained after the last step (**step c**).

Example 6:

- ☞ Priscilla and Joyce from Lilongwe, Malawi (30°E) will be departing on a business trip to London (0°) on **21 March, 2020** at **8:00am**. Their flight will last for fourteen hours. What will be the time and date when they will arrive in London?

Solution:**Difference in degrees of longitudes**

$$30^\circ - 0^\circ = 30^\circ$$

Time difference

Since $15^\circ = 1\text{hour}$,

$$\begin{aligned} 30^\circ &= \text{more} \\ &= \frac{30^\circ \times 1\text{hour}}{15^\circ} \\ &= 2 \text{ hours} \end{aligned}$$

Since London is to the west of the Lilongwe, Malawi (30°E), its time is behind that of Lilongwe by 2 hours.

$$\begin{aligned} \text{Actual time} &= 8: 00\text{am} - 2\text{hours} \\ &= \mathbf{6: 00\text{am}} \end{aligned}$$

*Time and Date for arrival: Add the flying time (14 hours) to the Actual Time
6: 00am + 14hours (flying time) = 20: 00 hours or 8 pm on 21 March, 2020*

Practice Questions: Pair and Share

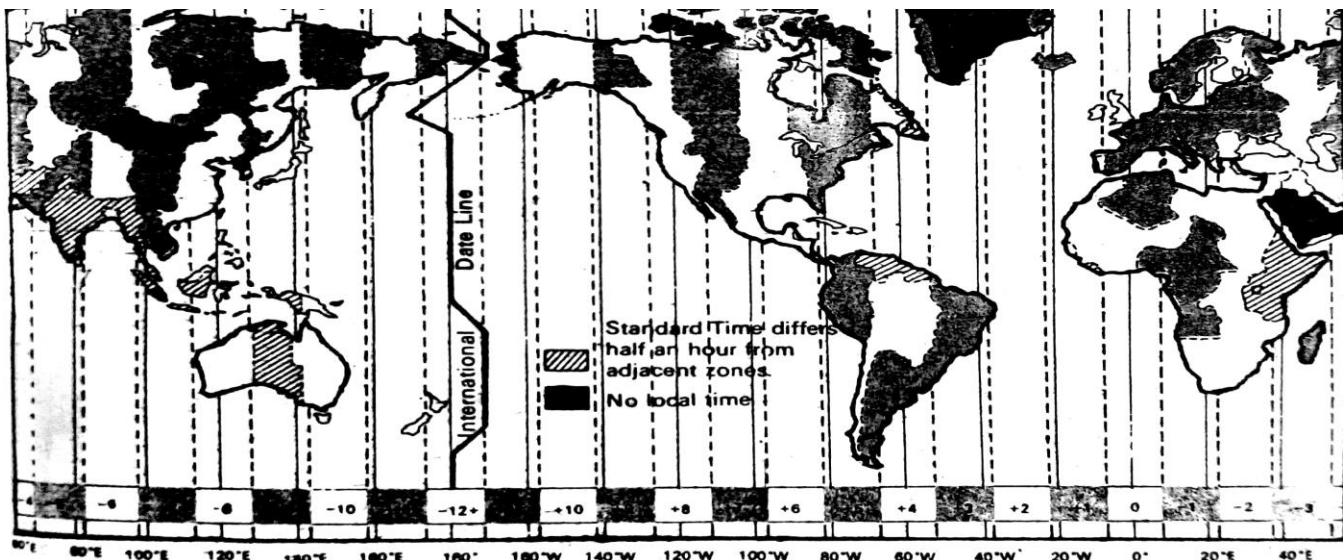
- 1) A journalist is at the longitude 180° east of the Greenwich Meridian at 7:30am on Tuesday. What will be the time and day at the longitude 180° west of the Greenwich?
- 2) The time at longitude 105° west of the Prime Meridian is 3:00pm. Find the longitude of a town to the east of the Greenwich Meridian whose time is 2:00am.

- 3) Mr. Chibambo is at longitude 180° to the east of the Prime Meridian on Tuesday at 9:00am. What will be the day and time for a fisherman who is at longitude 180° to the west of the Greenwich Meridian?
- 4) How many hours is an island which is at longitude 45° east of Greenwich Meridian from a town which is at longitude 135° west of the Greenwich Meridian?
- 5) Imagine flooding occurs at 6:00am on the longitude 75° east of the Greenwich Meridian.
 - a) How many hours will an airplane move from the town that is at longitude 120° west of the Greenwich Meridian to reach the area affected by flooding?
 - b) What will be the time at an island that is 90° west of the Greenwich Meridian?
- 6) During the 2009 FIFA confederations Cup, soccer spectators from Washington (74°W) and Tokyo (135°E) flew to South Africa (30°E) to attend the official opening of the soccer spectacle. The official time for opening in the Ellis Park Soccer Stadium in Gauteng was 7:00 (local time) on 14th June, 2009. The visitors from Washington and Tokyo landed in South Africa three hours before the official opening.
 - a) Calculate the departure time and the date in Washington if the flying time was 15 hours.
 - b) Calculate the departure time and the date in Tokyo if the flying time was 18 hours.
 - c) At the time of their arrival in South Africa, one of the spectators from Tokyo decided to phone his friend in Berlin (15°E). Calculate the time at which the phone call was received in Berlin.

IMPORTANCE OF USING STANDARD TIME

- It helps in organizing a uniform schedule for transport systems such as railway transport, aircrafts, etc.
- It helps to avoid confusion that would have been created by having many local times in a single country.
- It eliminates the cost of adjusting to the different time schedules and the subsequent loss of time.
- It helps to plan and execute activities in an organized manner. For example, football games.

THE INTERNATIONAL DATE LINE



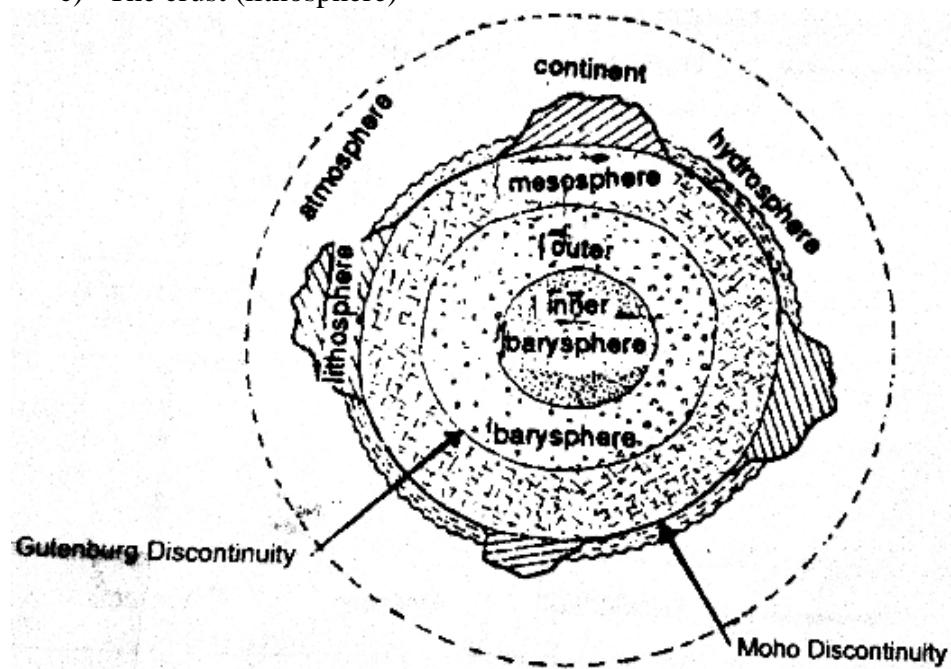
IMPORTANCE OF THE INTERNATIONAL DATE LINE

- Crossing the international dateline from west to east a day is gained, and crossing it from east to west a day is lost.
- It ensures that the entire country should experience only one date at a given time.

TOPIC 13: THE INTERNAL STRUCTURE OF THE EARTH

THREE DISTINCT PARTS OF THE EARTH

- The core (barysphere)
- The mantle (mesosphere)
- The crust (lithosphere)



The Internal Structure of the Earth

THE CORE (BARYSPHERE)

- It is also called the barysphere.
- It is the most interior part of the earth.
- It has a radius of about 3475km.
- It is the source of the gravitational (centripetal) force.
- It has very high temperatures of about 1927°C.
- It is divided into two parts, the inner core and outer core.

a) The inner core

- It is in a solid state.
- It has crystalline iron rocks.

b) The outer core

- It is in a liquid or molten state.
- It has Nickel (**Ni**) and Iron (**Fe**) minerals. That is why it is called **NiFe** zone.
- It forms 2220 kilometres.

IMPOORTANCE OF THE CORE TO LIFE ON EARTH

- The iron found inside the core helps create the earth's magnetic field. This field is used as a radiation shield, reflecting harmful charged particles floating around in the solar system such as those from the sun.

THE MANTLE (MESOSPHERE)

- It is also called the mesosphere.
- It is found between the core and crust.
- It is the largest part of the three layers, with a thickness of about 2900 kilometres.
- It is warm and rocky.
- It is separated from the core by Gutenberg discontinuity. It was discovered by a German geophysicist, so the boundary was named after him.
- The main minerals here are silicate, magnesium and iron.
- The upper part of the mantle has convectional currents.
- It is divided into inner and outer mantle.

a) The inner mantle

- It is in a molten state, and capable of flowing.
- It has higher temperatures than temperatures in the outer mantle.

b) The outer mantle

- It is in a solid state.
- Its temperatures are lower than those of the inner mantle.

THE CRUST (LITHOSPHERE)

- It is the thinnest layer, which is about 5km to 48km thick.
- It projects above the hydrosphere to form continents.
- It supports life of earth.
- It is separated from the mantle by the moho discontinuity (mohorovicic discontinuity). This is the case because it was discovered by a Croatian seismologist, Andrija Mohorovicic, so it was named after him.
- It is made up of two main parts, namely:
 - a) The upper part
 - It forms continents.
 - It has light granitic rocks.
 - It is rich in Silica and Alumina (SIAL) minerals.
 - b) The lower part
 - It forms the oceanic floor (sea bed).
 - Is has dense basaltic rocks.

- It is rich in Silica and Magnesium (SIMA) minerals.

FEATURES THAT SHAPE THE EARTH'S LANDSCAPE

- ◆ These are found on the crustal layer of the earth.

LANDFORMS (FEATURES) THAT SHAPE THE EARTH'S LANDSCAPE

- Valleys
- Plains
- Hills
- Mountains
- Inselbergs
- Rock cliffs
- Plateaus

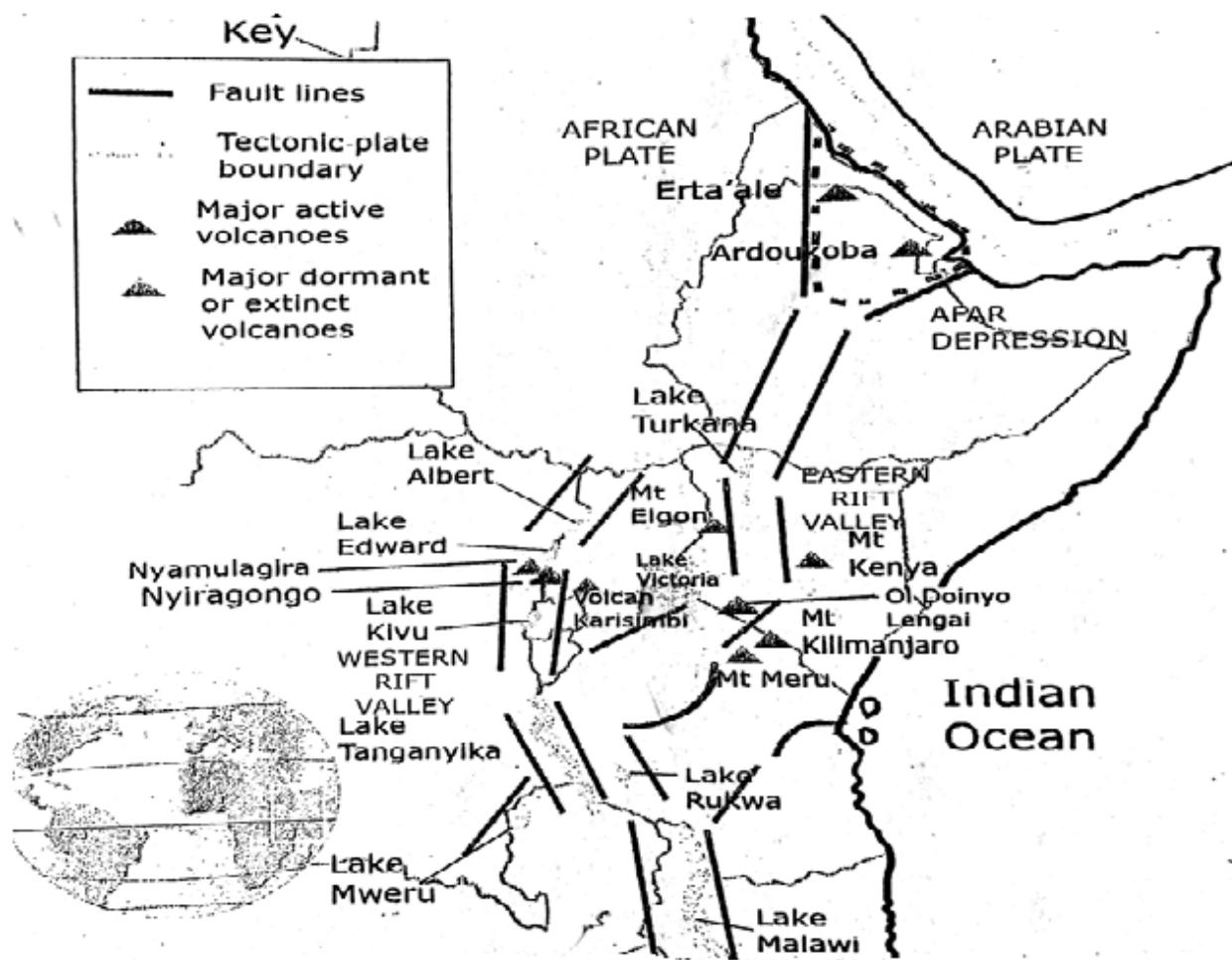
FORMATION OF THE FEATURES THAT SHAPE THE EARTH'S LANDSCAPE

- ◆ Emphasis will be on the formation of the following:

- Rift valleys
- Plains
- Plateaus

1. RIFT VALLEYS

- ❖ One of the well-known examples of rift valleys is the Great East African Rift Valley.
- ❖ It is about 7200 kilometres long, of which 5600 kilometres is in Africa. It starts from Beira in Mozambique, stretching northwards through Ethiopia into the Red Sea, via the Gulf of Suez and Gulf of Aqaba into Jordan of Israel.



The Great East-African Rift Valley

THE EASTERN PART

- Starts from Lake Turkana down through Lakes Magadi and Naivasha, then through Tanzania, into Malawi and finally ends in Mozambique.

THE WESTERN PART

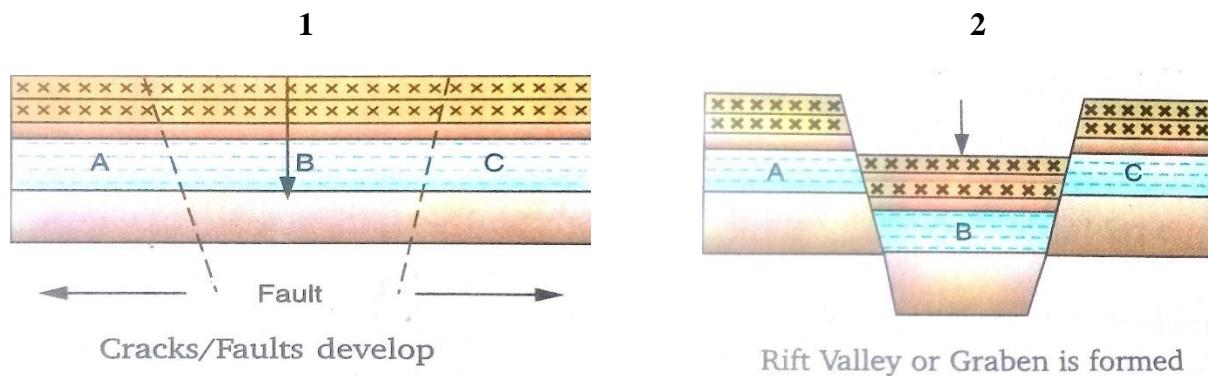
- It starts from Lakes Albert, Edward, Kivu, Tnganyika, Rukwa and finally Lake Malawi. Lake Victoria is found between these two parts arms of the Rift Valley.
- In Malawi, the valley floor covers areas such as Lake Malawi and its shore as well as Shire River valley.
- The lake shore plains are at an altitude of between 475 metres to 550 metres, and the shire river valley floor is 50 kilometres wide.

CHARACTERISTICS OF RIFT VALLEYS

- They are long and deep.
- The sides of a rift valley are very steep.
- The rift valley floor is almost flat.

FORMATION OF RIFT VALLEYS BY TENSIONAL FORCES

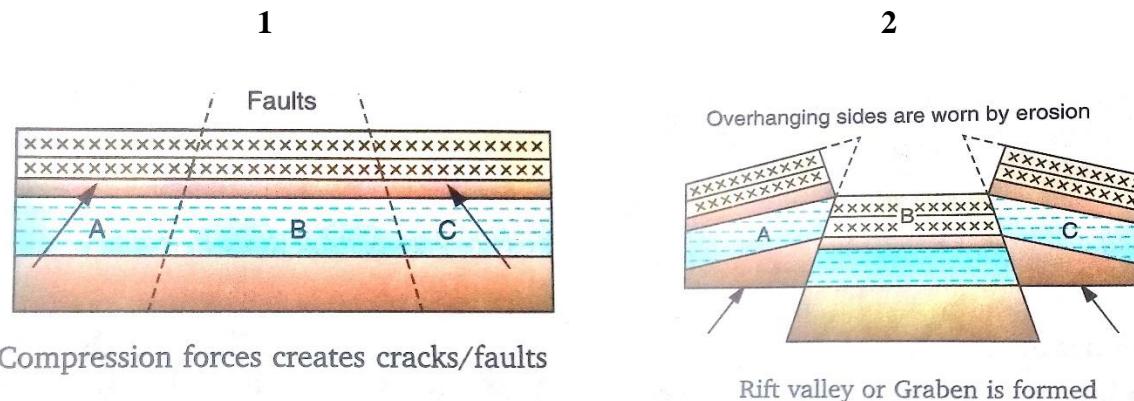
When tensional forces operate on the earth's crust, two almost parallel faults are created. The central block sinks to form a rift valley, and the adjacent blocks may be uplifted.



Formation of Rift Valleys by Tensional Forces

FORMATION OF RIFT VALLEYS BY TENSIONAL FORCES

When compressional forces operate on the earth's crust, two almost parallel faults are created. The central block sinks to form a rift valley, and the adjacent blocks may be uplifted. The overhanging sides of the rift valley may be worn out by erosion.



Formation of Rift Valleys by Compressional Forces

2. PLAINS

- These are very large flat areas.
- They are wide and may often include broad dambos.

CATEGORIES OF PLAINS IN MALAWI

- i) The Central Region Plateau
 - ii) The Mzimba Plain
 - iii) The Lake Chilwa-Phalombe Plain
 - iv) The Lufira Plateau
- i) **THE CENTRAL REGION PLATEAU**
 - ❖ It is the largest in Malawi, covering Lilongwe and Kasungu districts.
 - ❖ It has an altitude of 1, 200 metres.
 - ❖ It is bordered by Kirk Range in the south Lakeshore in the east and Viphya plateau in the north.
 - ❖ The western side has mountains and has important rivers within it.
- ii) **THE MZIMBA PLAIN**
 - ❖ It is bordered by Nyika Plateau in the west. Some relief features of this plain include Hora Mountain, Vwaza marsh and South Rukuru River.
- iii) **THE LAKE CHILWA-PHALOMBE PLAIN**
 - ❖ It is bordered by Chiripa Plateau and Kirk Range in the west, the Namwera Highlands in the north east and Mulanje mountain in the south.
 - ❖ Relief features of this plateau include Lake Chilwa and Lake Chiuta.
- iv) **The Lufira Plateau**
 - ❖ It is bordered by Misuku hills in the north, Nyika plateau in the south and Mafinga Mountain in the west.
 - ❖ Some relief features include hills, and rivers such as North Rukuru and Lufira, and some gorges.
 - ❖ It has fertile soils for farming resulting from erosion and deposition from highlands.

TYPES OF PLAINS AND THEIR FORMATION

- 1) Erosional plains
- 2) Deposition plains
- 3) Structural plains

FORMATION OF EROSIONAL PLAINS

These plains are formed as a result of denudation. As weathering and erosion occurs due to action of water and wind, highlands are reduced to almost flat areas, called plains.

FORMATION OF DEPOSITIONAL PLAINS

These plains are formed as a result of deposition of sediments by the moving water or wind. Such agents deposit a lot of sediments in the lower valleys slowly, building up flat surface of land called flood plains. These plains are common along deltas and lower courses of big rivers.

Examples of structural plains

- i) Egypt (Nile Delta)
- ii) India (Ganges Delta)
- iii) Malawi (lower shire river)

FORMATION OF STRUCTURAL PLAINS

These plains are formed through depression of an area that reduces it to natural lowland surface. These plains are common in the U.S.A and Australia (the central lowlands).

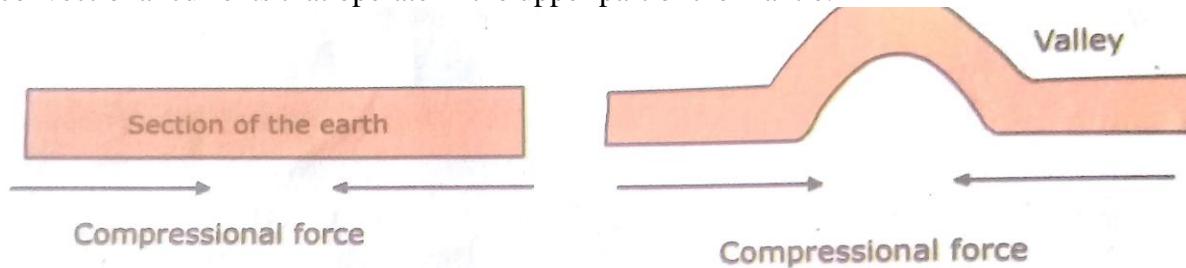
3. HIGH PLATEAUS IN MALAWI

- ✓ These are raised uplands with large surface levels which descend steeply to the surrounding lowlands.

Note: Plateaus are formed as result of folding and faulting.

FORMATION OF PLATEAUS BY FOLDING

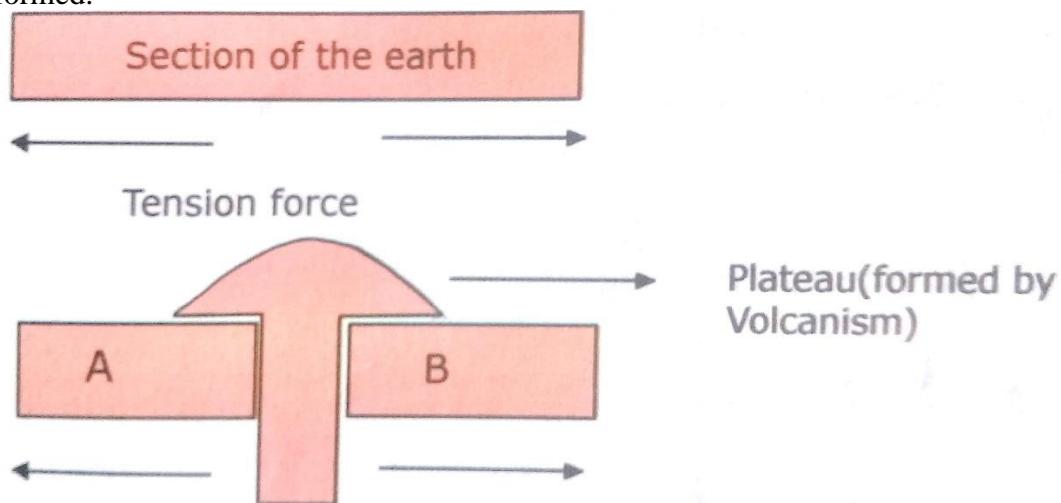
Plateaus are formed by the bending of the earth's crust due to compressional forces exerted by the movement of the earth. These forces mainly result from converging of plates caused by convectional currents that operate in the upper part of the mantle.



Formation of Plateaus by Compressional Forces

FORMATION OF PLATEAUS BY FAULTING

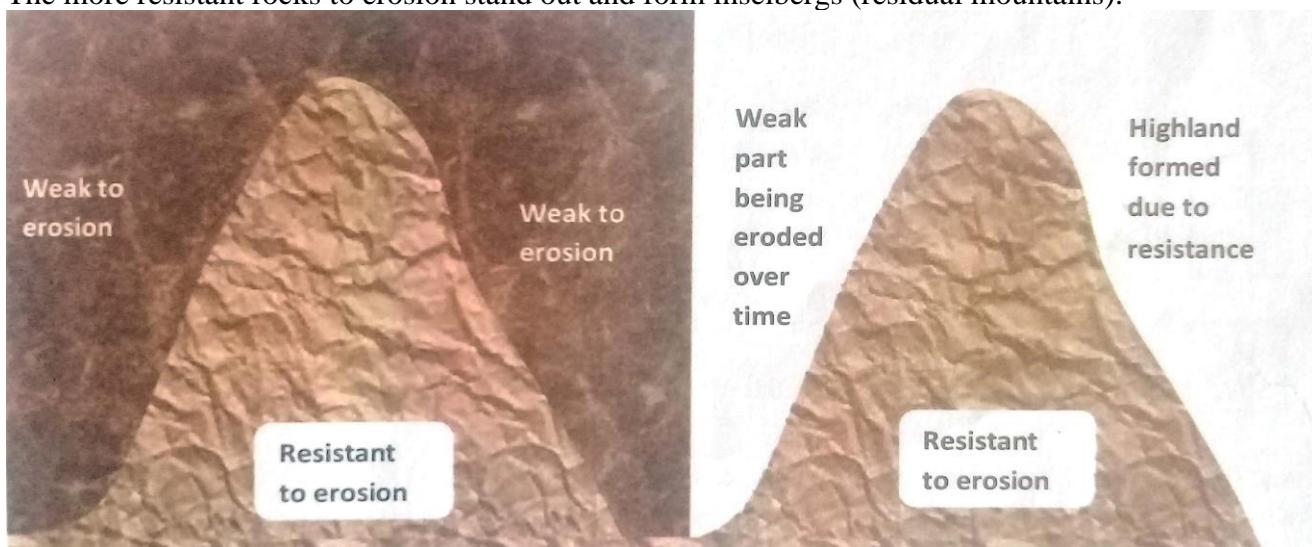
Diverging plate movements can lead to the creation of faults in the earth's crust. Magma can find its ways out onto the earth's surface. When this magma cools and solidifies, a volcanic plateau may be formed.



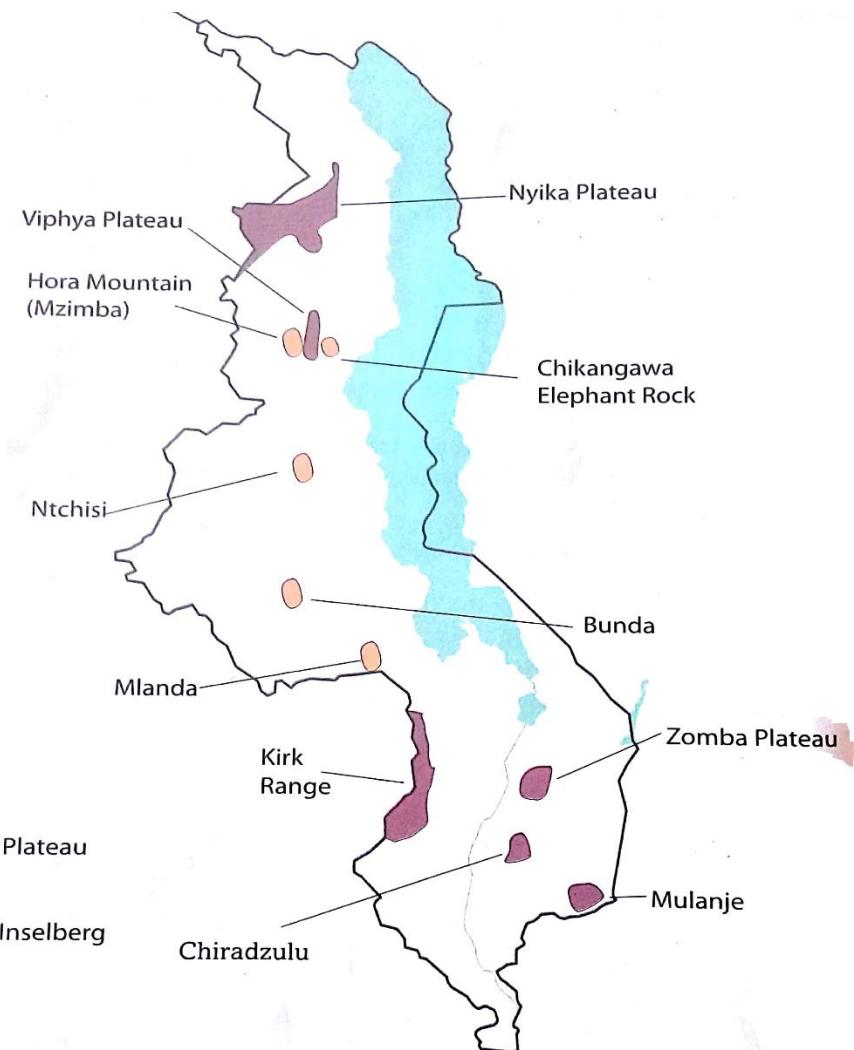
Formation of Plateaus by Tensional Forces

FORMATION OF RESIDUAL MOUNTAINS (INSELBERGS)

As denudation takes place, the less resistant rocks to erosion are eroded away to form valleys. The more resistant rocks to erosion stand out and form inselbergs (residual mountains).



Formation of Inselbergs (Residual Mountains)



Location of Major Plateaus and Inselbergs on Malawi

PROCESSES THAT SHAPE THE EARTH

INTERNAL PROCESSES

- Volcanic eruptions**
- Movement of the crust:** These result from the convectional currents that operate in the upper part of the mantle.
- Earthquakes:** These are vibrations in the lithosphere.
- Tsunamis:** This is the shaking of the seafloor during an earthquake.
- Landslides:** When rocks break away from the hillsides, blocking rivers, causing floods and alter the drainage system of an area.

EXTERNAL PROCESSES

- Weathering and erosion of sediments
- Deposition of sediments
- Extreme weather events such as droughts, storms, floods
- Impact craters: This is collision between earth and asteroids or other debris from space may create big craters.

IMPORTANCE OF STUDYING THE INTERIOR OF THE EARTH

- ❖ It helps us find valuable minerals in the crust.
- ❖ It helps us detect and cope with natural disasters such as earthquakes and volcanoes.
- ❖ It helps us understand how forces on and inside the earth work to shape our world.

ADVANTAGES OF PHYSICAL FEATURES TO LIFE AND HUMAN ACTIVITIES

- ✓ Rift valley floors are very fertile and are used for farming.
- ✓ Flood plains are fertile and used for agriculture.
- ✓ Plains are used for creation of national parks and game reserves.
- ✓ Plateaus, valleys, mountains and rivers are used for tourist attraction due to their attractive scenery.
- ✓ Exposed in the earth's crust expose various minerals. This promotes mining.
- ✓ People living on the windward sides of mountains receive enough rains that promote farming.
- ✓ Rivers, oceans and lakes are used for fishing and domestic purposes.

DISADVANTAGES OF PHYSICAL FEATURES TO LIFE AND HUMAN ACTIVITIES

1. Areas that experience frequent volcanic eruptions are dangerous to people, animals and plants.
2. People living in plains, lowlands and flood plains are also at risk of floods.
3. Hilly areas discourage farming and settlements.
4. Mountains act as communication barriers since they make the construction of communication lines such as roads, railways lines and telephone lines difficult.
5. People living on the leeward side of mountains receive little rains, which discourages farming.
6. Swampy areas are breeding grounds for disease-causing organisms.

TOPIC 14: FORMATION OF LAKES

LAKE: It is a hollow or depression on the earth's surface that is filled with water.



Major Lakes of East and Central Africa

WAYS IN WHICH LAKES ARE FORMED

- a) Through faulting (rift valley lakes)
- b) through down warping (basin lakes)
- c) Man-made lakes
- d) Through volcanic activity
- e) Lakes formed through deposition
- f) Lakes formed by erosion of glaciers

LAKES FORMED THROUGH FAULTING (RIFT VALLEY LAKES)

When tensional or compressional forces operate on the crust, two almost parallel faults are created. The middle block sinks to form a rift valley or a graben. When the rift valley or graben is filled with water, a rift valley lake is formed.

Characteristics of rift valley lakes

- ◆ They are long.
- ◆ They are narrow.
- ◆ They are deep.

Examples of rift valley lakes

- ✓ Lake Malawi
- ✓ Lake Tanganyika
- ✓ Lake Magadi (in Kenya)
- ✓ Lake Natron (in Tanzania)

LAKES FORMED THROUGH DOWN WARPING (BASIN LAKES)

These lakes are formed by the inward bending of the earth's crust caused by compressional forces. These forces are created due to the convectional currents that operate in the upper part of the mantle. The down warping leads to the formation of a depression in which water collects to form a lake.

Examples of lakes formed by the down warping of the crust (basin lakes)

- ✓ Lake Victoria (in Kenya)
- ✓ Lake Chad (in Chad)
- ✓ Congo Basin (in DRC)
- ✓ Lake Kyoga (in Uganda)

HUMAN-MADE LAKES

These lakes are constructed by people through building dams across big rivers. Dam walls are made, and water collects behind them to form an artificial lake.

Examples of Human-made lakes

- ✓ Lake Kariba (in Zambia and Zimbabwe)
- ✓ Lake Cabo Bassa (in Mozambique)
- ✓ Lake Nasser (in Egypt)
- ✓ Lake Volta (in Ghana)
- ✓ Lake Masinga (in Kenya)

LAKES FORMED THROUGH VOLCANIC ACTIVITY

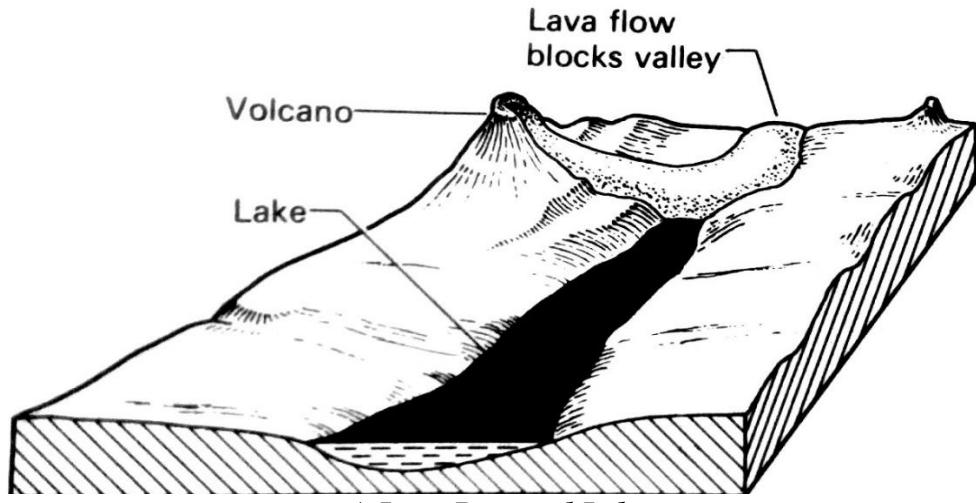
- ❖ Under this category there are two types:
 - a) Lava-dammed lakes
 - b) Crater lakes

FORMATION OF LAVA-DAMMED LAKES

These lakes after a volcanic eruption takes place. The lava may flow across river valleys, thereby blocking the course of the river channel. Water collects behind this lava barrier to form a lava-dammed lake.

Examples of Lava-dammed lakes

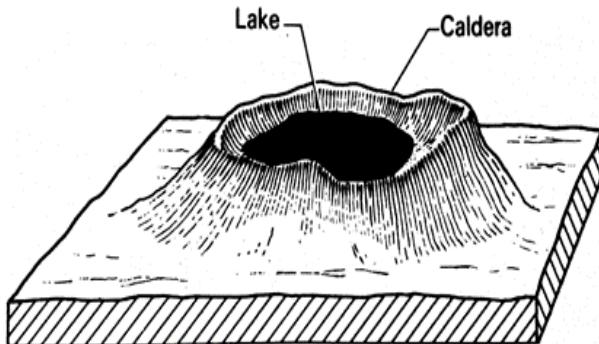
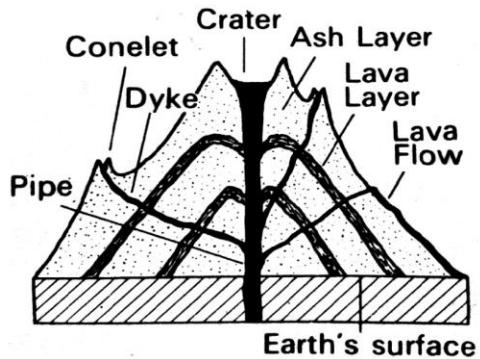
- The Sea of Galilee (also called Lake Kinret or Lake Tiberias)
- Lake Kivu (in Uganda)
- Lake Itasy (in Madagascar)
- Lake Tana (in Ethiopia)



A Lava-Dammed Lake

FORMATION OF CRATER LAKES

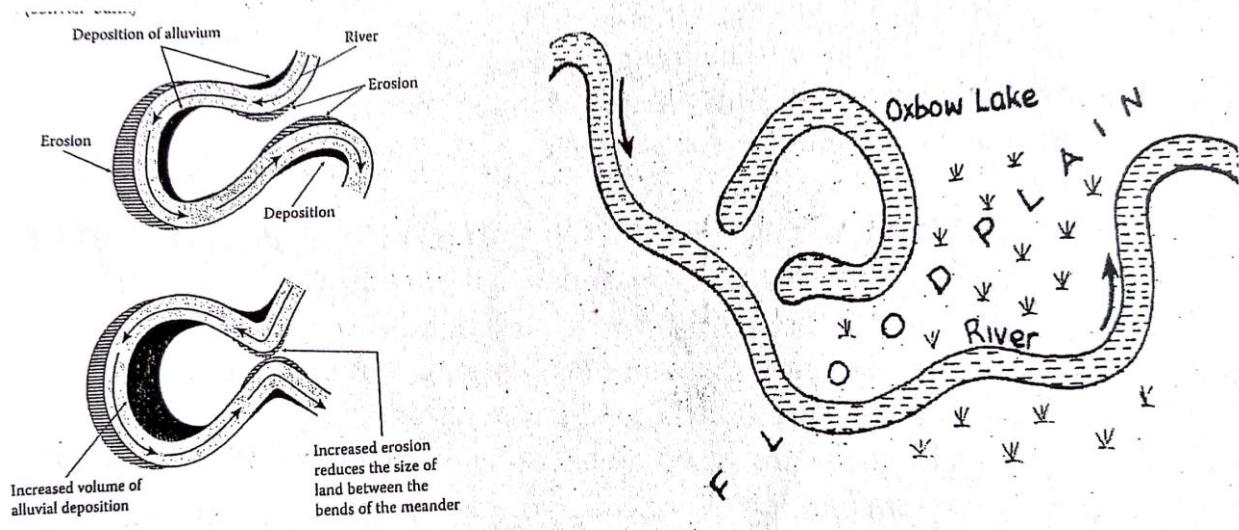
These lakes are formed after a volcanic eruption. Lava from inside the earth flows and solidifies on the earth's surface, forming a volcanic mountain. During the second eruption, the top part of a volcanic mountain may be blown off to create a hollow called a crater. Some lava may occupy and block the vent in the mountain. Rain water may fill this hollow to form a crater lake.



Formation of Crater Lakes

DEPOSITION LAKES

These lakes are formed in the lower course of the river, where the river flows slowly due to flat topography. Deposition of sediments from the upper and middle courses of the river makes the river to have meanders. Continuous erosion and deposition where the river meanders (bends) leads to cutting off and isolation of a section of the river. This isolated part forms an ox-bow lake.



Formation of an Ox-bow Lake

Examples of Ox-bow Lakes

- ◆ Lake Burullus (in Nile Delta in Egypt)
- ◆ Lake Mazala (in Nile Delta in Egypt)
- ◆ Lake Bilisa (in Kenya)
- ◆ Lake Shakababo (in Kenya)
- ◆ Lake Gambi (on river Tana in Kenya)
- ◆ Lake Utange (on River Rufiji in Tanzania)

g) LAKES FORMED BY EROSION OF GLACIERS

- ❖ A glacier is a large mass of ice moving slowly down a mountain slope. When huge blocks of ice glide down the mountain side, they carve depressions in the earth's surface. When they melt, ice collects to form lakes. They are called corries or tarns.

Example of a lake formed by glaciers

- ❖ Teleki Tarn on Mount Kenya.

SIZE AND LOCATION OF THE GREAT LAKES OF EAST AND CENTRAL AFRICA

NAME OF LAKE	SIZE (KM ²)	LOCATION
Victoria	69,485	Uganda, Kenya, Tanzania
Tanganyika	32,828	Tanzania, Rwanda, Burundi, Zambia
Malawi	29,600	Malawi, Tanzania, Mozambique
Rudolf/Turkana	6,405	Kenya
Albert	5,594	Uganda, Democratic Republic of Congo (DRC)
Kivu	2,693	Rwanda, Democratic Republic of Congo (DRC)
Rukwa	2,590	Tanzania
Edward	2,150	Uganda, Democratic Republic of Congo (DRC)

NOTE:

- ◆ They are called the Great Lakes because of their size and depth.
- ◆ They form one of the largest freshwater systems in the world.
- ◆ They are located in the nine countries, and all of them were formed through faulting (Rift Valley Lakes).

OTHER LAKES FOUND IN MALAWI

- ❖ Lake Malombe on Shire River. It has an area of 420km².
- ❖ Lake Chilwa in Zomba district. It is second largest in Malawi after Lake Malawi. It has Chisi Islands in it.
- ❖ Lake Chiuta in Machimanga district.
- ❖ Lake Kazuni in Rumphi and Mzimba districts.
- ❖ Lake Chikukutu in Nkhotakota.

IMPORTANCE OF LAKES AND RIVERS OF EAST AND CENTRAL AFRICA

- i) They are a source of fish that provide us with proteins.
- ii) They are used for transportation.
- iii) They provide water for domestic and industrial use.
- iv) They are used for irrigation farming.
- v) They are used for recreational activities such as boat riding, rafting and swimming.
- vi) They help to regulate (control) the climate of the surrounding areas.
- vii) They are used for the generation of Hydro-Electric Power.
- viii) They are a source of foreign exchange through promotion of the tourism industry.
- ix) They are a source of salts.
- x) They help to control floods by trapping the surface run-off.
- xi) Creation of employment through the construction of man-made lakes, hydro-electric power plants or in irrigation schemes.

WAYS OF PROTECTING (CONSERVING) LAKES AND RIVERS

- a) Avoiding the discharge of wastes from homes and industries to prevent water pollution.
- b) Practicing good farming practices such as avoiding setting bush fires, avoiding cultivation of steep slopes, avoiding cultivating in river banks, etc.
- c) Avoiding deforestation since vegetation forms river sources.
- d) Avoiding overfishing to ensure that fish breed.
- e) Protection of water catchment areas through afforestation.
- f) Avoid global warming by afforestation, and reducing the release of greenhouse gases into the atmosphere that damage the ozone layer.

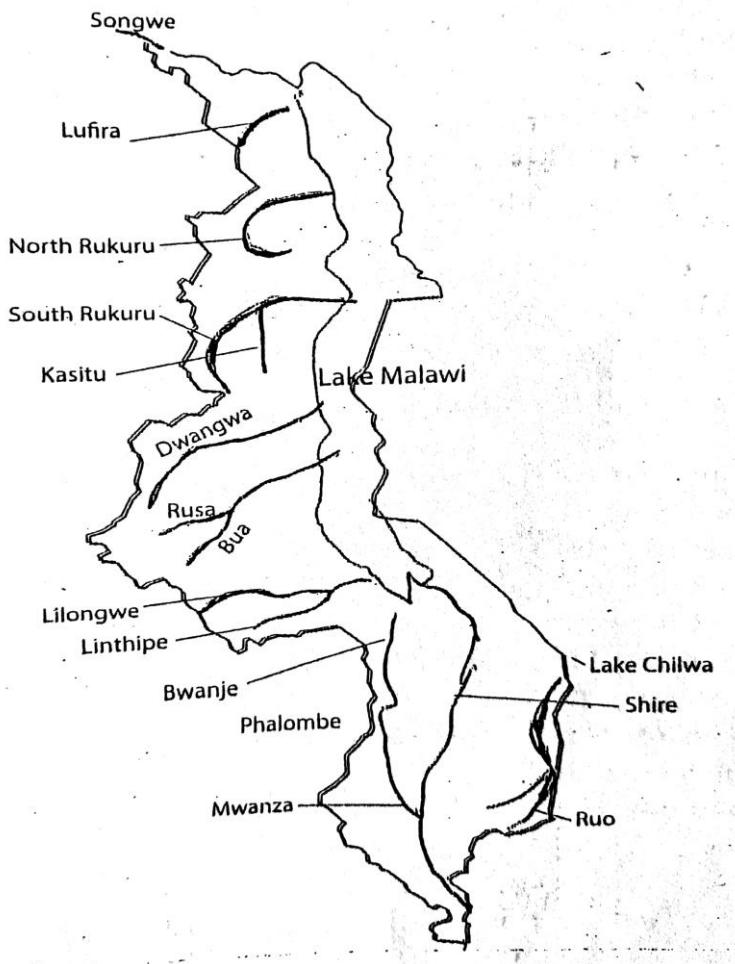
TOPIC 15: THE IMPORTANCE OF SHIRE RIVER

MAJOR RIVERS IN MALAWI

- Songwe river
- Lufira river
- North Rukuru river
- South Rukuru river
- Kasitu river
- Dwangwa river
- Rusa river
- Bua river
- Lilongwe river
- Linthipe river
- Bwanje river
- Phalombe river
- Mwanza river
- Shire river

- Ruo river

LOCATION OF MAJOR RIVERS IN MALAWI



THE COURSES OF SHIRE RIVER

- ❖ A river course is the path taken by the river from its source to its mouth.
- THREE MAIN COURSES (STAGES) OF A RIVER**

- a) Upper course
- b) Middle course
- c) Lower course

THE UPPER COURSE (YOUTHFUL STAGE)

- ❖ It is also called the youthful stage.
- ❖ It starts from the outlets at Mangochi to Matope.
- ❖ This section is not steep.
- ❖ Between Lake Malawi and Lake Malombe there is a broad marsh.
- ❖ The Namwera Highlands are found to the east and Chiripa Plateau is to the west of the river.

THE MIDDLE COURSE (MATURITY STAGE)

- ❖ It is also called the maturity stage.
- ❖ It starts from Matope and ends at Hamilton Falls covering a distance of 80 kilometres.
- ❖ This part is used for the generation of hydro-electric power due to the presence of water falls and rapids.

Examples of water falls that are found in this middle course of Shire River

- i) Kholombidzo falls
- ii) Nkula falls

- iii) Tedzani falls
- ❖ Mphatamanga gorge is found just after Tedzani Falls before Hamilton Falls.

Tributaries joining the middle course of Shire River

- i) Mkurumadzi river
- ii) Lisungwe river
- iii) Mlunguzi river
- iv) Rivi Rivi river

NOTE:

- ❖ Tributaries are small rivers that drain into a big river.
- ❖ The speed of the water in this course is higher than the water speed in the upper course of Shire River. This is the case because this course has steeper gradient than that of the upper course.

THE LOWER COURSE (OLD STAGE)

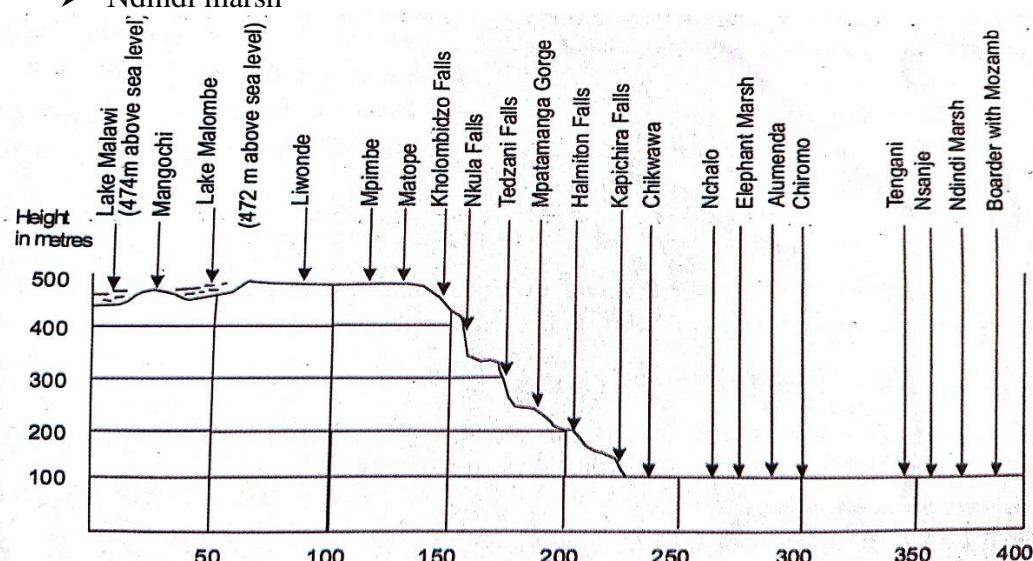
- ❖ It is also called the old stage.
- ❖ It starts from Chikwawa to the mouth on the Zambezi River.

MAIN TRIBUTARY OF THE LOWER COURSE OF SHIRE RIVER

- ❖ Ruo River, which originates from Mulanje Mountain.

Relief features of the lower course of Shire River

- Elephant marsh
- Ndindi marsh



The Profile of Shire River

SOCIAL AND ECONOMIC IMPORTANCE OF SHIRE RIVER

SOCIAL IMPORTANCE OF SHIRE RIVER

- ✓ It provides water for domestic purposes such as washing, cooking, bathing, etc.
- ✓ It is used for recreational activities such as swimming.

ECONOMIC IMPORTANCE OF SHIRE RIVER

- ✓ River banks have fertile soils for farming.
- ✓ Water from Shire River is used for irrigation farming.
- ✓ It is used for fishing. Fish are an important source of income and food.
- ✓ The middle course of Shire River is used for the production of hydro-electric power.
- ✓ For tourist attraction. Tourists bring foreign exchange earnings to the country.

CHALLENGES (PROBLEMS) FACED BY THE SOCIAL AND ECONOMIC ACTIVITIES ALONG SHIRE RIVER

- ♦ Flooding that leads to loss of lives and property.

- ◆ Water borne diseases such as cholera are common.
- ◆ Water hyacinth (*Namasipuni*) leads to the death of fish by reducing the oxygen levels in Shire River. This makes the fish to suffocate.
- ◆ Water pollution from homes and industries leads to the death of aquatic species such as fish.
- ◆ Deforestation that promotes soil erosion, leading to siltation of Shire River. Deforestation leads to little rains by reducing the amount of transpiration. This leads to fluctuation of water levels in Shire River, leading to persistent black outs less hydro-electric power is produced than the demand of electricity.

WAYS OF DEALING WITH CHALLENGES FACED ALONG SHIRE RIVER

- Afforestation along river banks.
- Introduction of cheap, alternative energy sources to reduce the demand of the forest resources for wood fuel, which is a major cause of deforestation.
- Relocation of people to other areas away from river banks to reduce pressure on the river.
- Proper waste management.
- Stiff punishment on offenders that pollute Shire River.
- Civic education on the importance of conservation Shire River, and on the importance of small families.
- Planting of fast-growing tree species that can replace trees that have been cut down.

TOPIC 16: SEASONS

- ❖ Seasons are periods of the year that bring changes in temperature, weather and length of days and nights.

FOUR MAIN SEASONS

- a) Summer
- b) Autumn
- c) Winter
- d) Spring

MAIN CHARACTERISTICS OF SEASONS

SUMMER

- i. It has high temperatures.
- ii. It receives heavy rainfall.
- iii. It has long days and short nights.

(it ends in autumn)

AUTUMN

- i. Temperatures start decreasing.
- ii. Rainfall starts decreasing.
- iii. Day lengths start decreasing and night lengths start increasing.

(it ends in winter)

WINTER

- i. It has low temperatures.
- ii. It has little rainfall.
- iii. It has short days and long nights.

(it ends in spring)

SPRING

- i. Temperature starts increasing.
- ii. Rainfall starts increasing.
- iii. Day hours start increasing and night hours start decreasing.

(it ends in summer)

SOLSTICES

- This means the time when the sun appears to be temporarily over the tropic of cancer or Capricorn.
- This happens as the sun moves in its apparent northward or southward directions.

SUMMER SOLSTICE IN THE NORTHERN HEMISPHERE

- ✓ This happens on the **21st of June** when the sun is overhead on the tropic of cancer.
- ✓ At this time, it is **WINTER SOLSTICE** in the Southern Hemisphere.

SUMMER SOLSTICE IN THE SOUTHERN HEMISPHERE

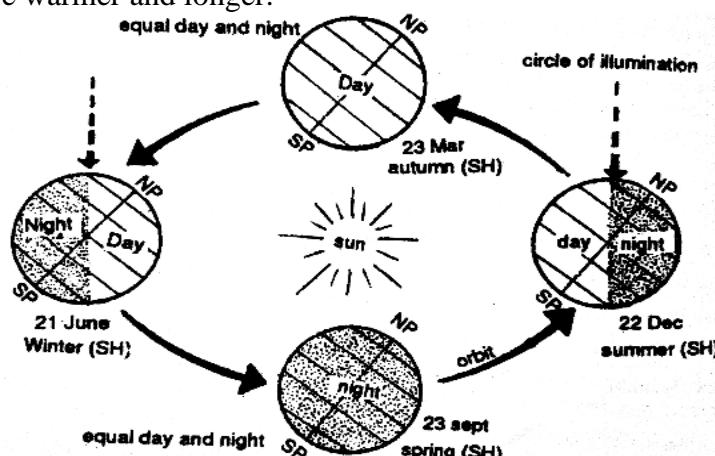
- ✓ This occurs on the **22nd of December** when the sun is overhead on the tropic of Capricorn.
- ✓ At this time it is **WINTER SOLSTICE** in the Northern Hemisphere.

CAUSES OF SEASONS

- The tilting of the earth's axis at an angle of $66\frac{1}{2}^{\circ}$
- The apparent movement of the sun

THE TILTING OF THE EARTH'S AXIS AT AN ANGLE OF $66\frac{1}{2}^{\circ}$

- ✓ From 21st to 23rd September, the northern hemisphere is tilted towards the sun and it is summer because heat from the sun reaches the ground as it is nearly overhead.
- ✓ This results in warm and long days.
- ✓ At this time, the southern hemisphere experiences winter since it is tilted away from the sun.
- ✓ From 22nd December to 21st March, the northern hemisphere is tilted away from the sun and it is winter season.
- ✓ At this time, the southern hemisphere has summer because the sun is nearly overhead there and the days are warmer and longer.

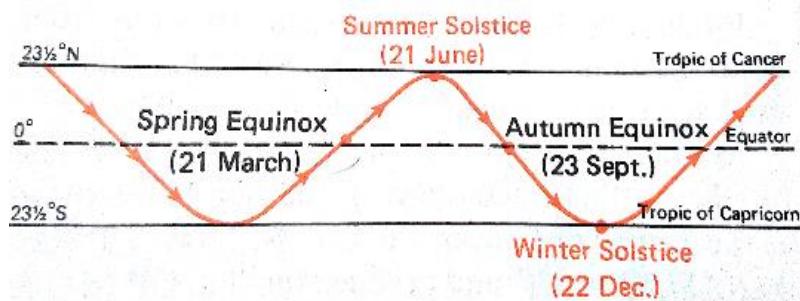


Revolution of the Earth

THE APPARENT MOVEMENT OF THE SUN

- The sun is overhead on the equator on 21st March and 23rd September every year.
- During this time, the length of days and nights are equal all over the world, thus why these two dates are called **Equinoxes**, which means “Equal Days and Nights”.

The Apparent Movement of the Sun



CHARACTERISTICS OF SEASONS ACCORDING TO REGIONS

1. The Polar Regions

- ☞ These are areas that surround the north and south poles.
- ☞ The arctic is the region that surrounds the North Pole, and the Antarctic region surrounds the South Pole.
- ☞ This region experiences *summer* and *winter seasons* only.

2. The Temperate Regions

- ☞ These regions lie between the tropics and the Polar Regions.
- ☞ They experience moderate temperatures.
- ☞ It experiences all the four seasons of the year (summer, autumn, winter and spring).

3. The Tropical Regions

- ☞ These areas are mainly found in the tropics (tropic of cancer and tropic of Capricorn).
- ☞ These are regions that are found around the equatorial regions.
- ☞ They experience warm and sunny conditions most times of the year.

SEASONS IN MALAWI

- i) Hot, wet season
- ii) Cool, dry season
- iii) Hot dry season

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

CHARACTERISTICS OF SEASONS IN MALAWI

1) Hot wet season

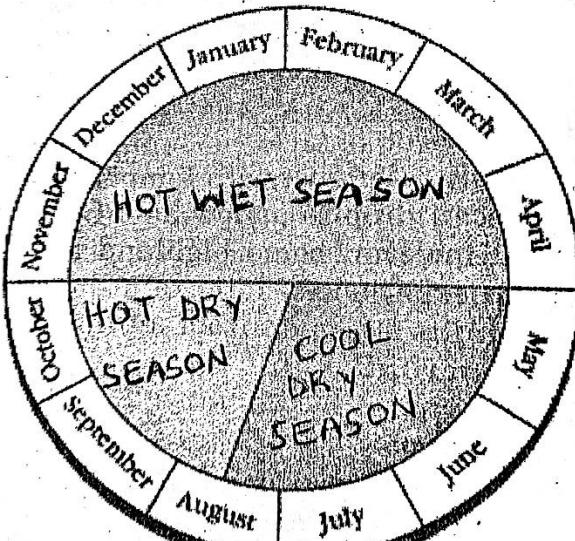
- It starts from November and ends in April.
- High temperatures.
- Heavy rainfall.
- Main growing season.
- Vegetation is evergreen.

2) Cool dry season

- It starts from May and ends in July.
- Low temperatures.
- There is little or no rainfall.
- Trees start to lose their leaves.
- Most organisms hibernate.
- Chiperoni winds are common especially in the southern and central regions of Malawi.

3) Hot dry season

- It starts from August and ends in November.
- It has high temperature.
- There are no rains.
- Most vegetation have no leaves to reduce the loss of water through transpiration.
- Organisms start to reappear from hibernation.



Pie Chart Showing Seasons in Malawi

TOPIC 17: FORESTRY

- It refers to the cultivation, maintenance and developing of all forested areas.
- Forests can either be planted or natural.

PLANTED FORESTS

- These forests are cultivated, planted and taken care of human beings.

NATURAL FORESTS

- These forests grow by themselves without the help of human beings.

CLASSIFICATION OF FORESTS IN MALAWI

➤ Classification of forests in Malawi can be done based on type and tenure.

BASED ON TYPE

- Natural (indigenous) forests
- Planted forests

Natural (indigenous) forests

- ◆ These form the majority of forests in Malawi.
- ◆ Most vegetation in Malawi are dominated by *miombo trees*.
- ◆ Most natural forests are found in national parks and wild life reserves.

Planted forests

- ◆ These are made up of exotic forests that are owned by the government and the private sector.
- ◆ Malawi's largest plantation is Viphya Plantation. Others are Chongoni in Dedza, Zomba and Mulanje.

BASED ON TENURE

- Public forests
- Customary (private) forests

Public forests

- ◆ These comprise of forest reserves, national parks and game reserves.

- ◆ They occupy a total area of about 1, 865, 974 hectares.

Customary (private) forests

- ◆ These are community-based forest reserves because they are found on areas that are ruled by traditional leaders.
- ◆ They cover about 11.7% of the total land use in Malawi.

FACTORS THAT INFLUENCE THE DISTRIBUTION OF NATURAL VEGETATION

1) Climate

- ◆ Areas of heavy rainfall have huge trees, while areas where rains are not reliable may have shrubs.
- ◆ Temperature also influences the type of plants to be found in an area. Cacti may do well in deserts, and broad-leaved plants survive well in areas that receive heavy equatorial rains.

2) Soil

- ◆ Deep and rich-in-nutrient soils promote the growth of different varieties of plants in an area. Shallow and poor soils discourage the growth of plants.

3) Topography

- ◆ Steepness of the area affects plant growth through differential solar radiation received, wind velocity, and soil depth.

4) Drainage

- ◆ Areas with good drainage promote the growth of varieties of plants, and poorly drained soils discourage the growth of plants.

IMPORTANCE OF FORESTS

- 1) Creation of employment for people to plant and care for the trees and harvesting trees.
- 2) Forests promote tourism due to their attractive scenery.
- 3) They are habitats for wild animals such as lions.
- 4) They are a source of timber.
- 5) They are a source of herbal medicines for treating various illnesses.
- 6) Trees act as wind breakers, thereby protecting property from damage.
- 7) They help purify the air by making use of carbon dioxide and releasing oxygen.
- 8) They help in preventing soil erosion by binding the soil together.

HUMAN ACTIVITIES THAT ENDANGER FORESTS

- ☛ Charcoal production
- ☛ Firewood making
- ☛ Setting of bush fires
- ☛ Increasing urbanization promote deforestation as vegetation is cleared for settlements and infrastructure development.

STRATEGIES FOR MANAGING AND CONSERVING FORESTS

- ❖ Afforestation: This means planting trees in areas where there were no trees.
- ❖ Re-afforestation: This means replacing trees in areas where trees have been cut down.
- ❖ Enforcement of forest laws that can help protect forests.
- ❖ Civic education to the people on the importance of conserving forests.

TOPIC 18: WILD LIFE

Wildlife is all animals, plants and other living things that live in the natural environment.

EXAMPLES OF WILDLIFE

- Lions
- Elephants
- Leopards
- Birds
- Frogs
- snakes
- Antelopes
- Rhinos



Wildlife habitat

- This is the physical environment where animals live and find all the necessities such as food, shelter, water and space.

Examples of habitats

- | | |
|--------------|-------------------------|
| i. Forests | v. National parks |
| ii. Wetlands | vi. Game reserves |
| iii. Lakes | vii. Nature sanctuaries |
| iv. Rivers | |

Endangered species in Malawi

- These are species that are near extinction.

Examples of endangered species in Malawi

- | | |
|----------------|-------------|
| a) Elephants | d) Leopards |
| b) Chambo fish | e) Birds |
| c) Lions | |

National parks and game reserves in Malawi to conserve wildlife

GAME RESERVE

- ❖ A game reserve is an area that has been set aside by the local authorities where animals can be protected.

NATIONAL PARK

- ❖ These are areas that have been set aside by the government where animals are taken care of and are protected.

Examples of National Parks IN Malawi

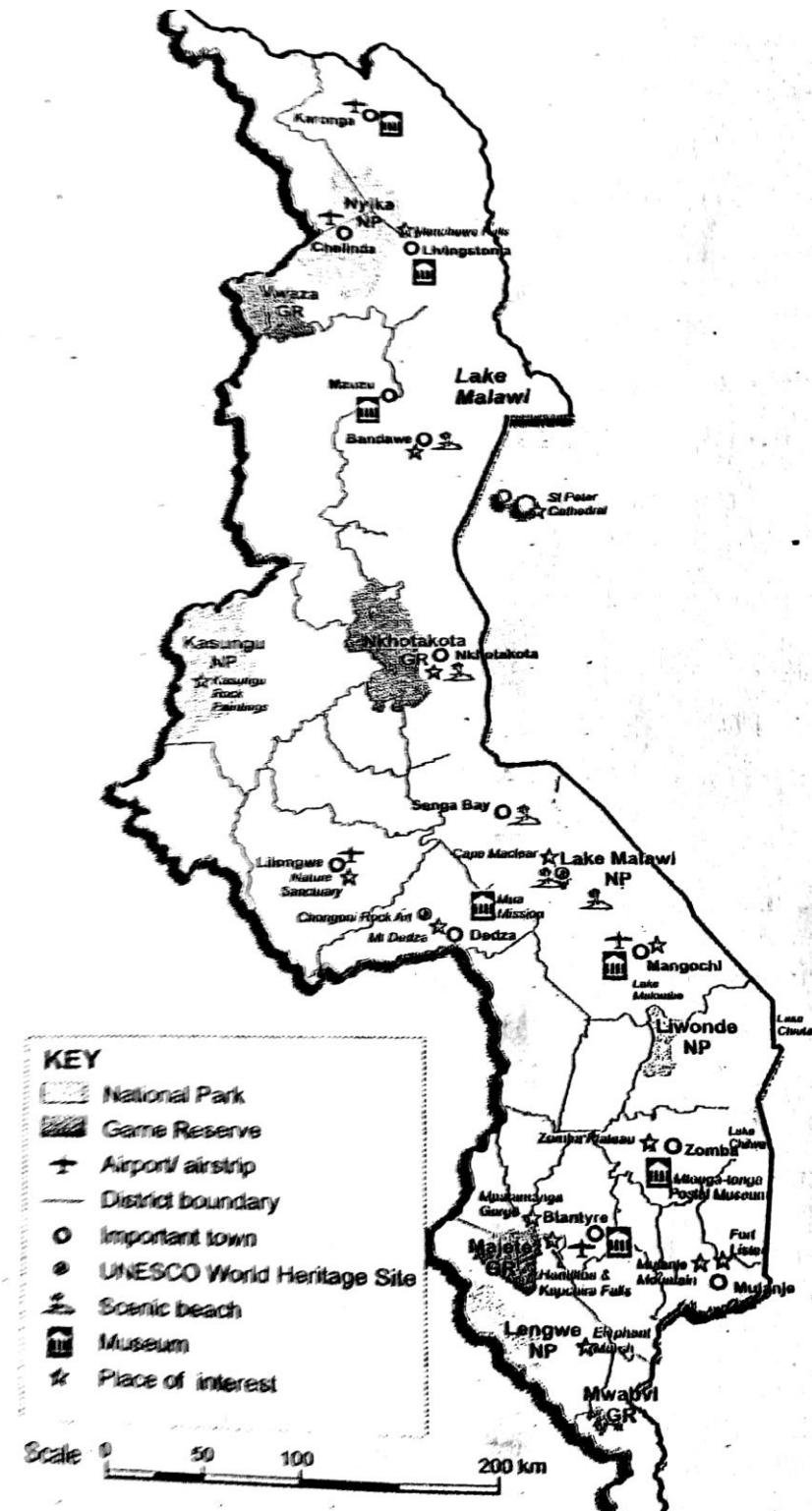
- ✓ Nyika national park (the largest park in Malawi)
- ✓ Kasungu national park (the second largest park in Malawi)
- ✓ Lengwe national park
- ✓ Liwonde national park
- ✓ Lake Malawi national park

Examples of Game Reserves in Malawi

- ❖ Nkhotakota game reserve
- ❖ Vwaza game reserve
- ❖ Majete game reserve
- ❖ Mwabvi game reserve

DIFFERENCES BETWEEN GAME RESERVES AND NATIONAL PARKS

- A game reserve allows very limited or no access (entry) to the general public while a national park gives access to the general public.
- ✓ Game reserves are meant to preserve the area; people are not allowed to disturb or damage the environment.



Wildlife Reserves in Malawi

NATURE SANCTUARY

- ✓ It is an area that has been set aside for the protection and preservation of specific animals and plants that are endangered.

OR

- ✓ It is a place of refuge where abused, injured and abandoned captive wildlife may live in peace and dignity.
- An example of a nature sanctuary in Malawi is the Lilongwe nature sanctuary.
- In a nature sanctuary, animals do not become familiar with people.

IMPORTANCE OF WILDLIFE IN MALAWI

- 1) It provides food to people.
- 2) It maintains the ecological balance by maintaining the food chains and webs.
- 3) It has economic value after sales of timber, gum, paper, etc.
- 4) It has medicinal value since plants and animals are used for making medicine.
- 5) Provision of raw materials such as ivory, leather, fur and honey for making things such as buttons, shoes, clothes, etc.
- 6) They are used for tourist attraction.
- 7) They have spiritual importance by being used as sacred objects in various religions.

ACTIVITIES THAT ENDANGER WILDLIFE IN MALAWI

NATURAL FACTORS

- ✓ Landslides
- ✓ Earthquakes
- ✓ Volcanic eruptions
- ✓ Storms
- ❖ These factors can kill, deform the terrain and destroy the wildlife habitats.

HUMAN FACTORS

a) Rapid population growth

- This increases the demand for wildlife as people use them for food or creation of settlements or farming.

b) Agricultural expansion

- This leads to clearing of vast areas of land. This promotes extinction of plant species and food for animal species.

c) Urbanisation

- This increases the demand for large areas for settlements and farming. This promotes depletion of wildlife as habitats and food are destroyed.

d) Pollution

- Water pollution from agricultural chemicals and discharge of industrial wastes into water bodies endangers the aquatic species by suffocating them.
- Water pollution also makes water to be unsafe for use by wild species.

e) Deforestation

- This may result from uncontrolled bush fire. Deforestation destroys the habitats and food for wildlife.

f) Poaching

- ❖ This means the illegal hunting of protected animals.

IMPACTS OF RAPID POPULATION GROWTH ON WILDLIFE

- ◆ It promotes the destruction of the habitats for wildlife.
- ◆ Depletion of wildlife species since the demand for wildlife increases.
- ◆ Extinction of species of wildlife.

WAYS (MEASURES) FOR CONSERVING WILDLIFE

1. Creation of protected habitats such as national parks and game reserves.
2. Using alternative sources of energy such as solar energy to reduce the demand and pressure on forest reserves.
3. Awareness campaigns (civic education) on the importance of protecting wildlife.
4. Enforcement of wildlife laws to protect wildlife.

TOPIC 19: SOIL

- Soil refers to the top loose material covering the earth's surface.

TYPES OF SOIL

- a) Sand
- b) Silt
- c) Clay
- d) Loam

CHARACTERISTICS OF SOIL TYPES

PROPERTIES OF SOIL

- 1) Soil texture
- 2) Soil colour
- 3) Size of soil particles
- 4) Water holding capacity

1. SOIL TEXTURE

- ❖ It means the coarseness and fineness of soil particles.

Coarse soil texture

- ❖ This soil has large particles, it feels gritty and rough when felt between the fingers.
- ❖ Example of this are sandy soils.

Fine soil texture

- ❖ This soil has fine particles, and feels smooth when rubbed between the fingers.
- ❖ An example of this is clay soil.

Medium soil texture

- ❖ This soil has medium particles.
- ❖ An example of this is loamy soil which has almost equal proportion of sand and clay particles.

2. SIZE OF PARTICLES

- ❖ Different soils have different sizes of particles depending on the type of soil. As discussed above, the soil can have large particles, medium or even small particles.
- ❖ The table below shows the sizes of soil particles.

SOIL PARTICLES	ACTUAL SIZE	DIAMETER IN MILLIMETERS
Coarse sand		0.2mm to 2.0mm
Fine sand		0.02mm to 0.2mm
Silt	Too small to see	0.002mm to 0.02mm
Clay	Too small to see	Less than 0.002mm

NOTE:

- ❖ Sandy soils are mainly made up of sandy particles (coarse-grained).
- ❖ Clay soil is made up of fine particles.
- ❖ Loamy soil is made up of almost an equal proportion of sand, clay and silt particles.

3. SOIL COLOUR

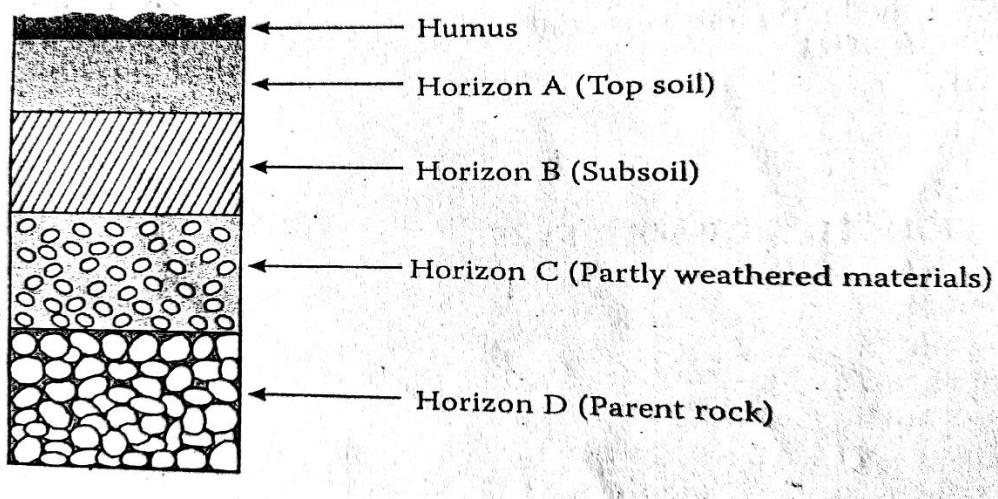
- ❖ Different soil types have different colours. For example, sandy soils are light-coloured, clay soil is dark in colour and loamy soil looks red or dark in colour.

4.. WATER HOLDING CAPACITY

- ❖ This primarily is being influenced by texture of the soil. Clay soils hold a lot of water, sandy soils do not hold a lot of water and loamy soils holds a moderate amount of water.

SOIL PROFILE

- ◆ This refers to the vertical arrangement of the soil layers from the parent rock to the surface.
- ◆ The different layers of soil that are shown are called horizons.



The Soil Profile

UNDERSTANDING THE SOIL PROFILE

- The upper part of the soil is a mixture of sand and clay particles, with humus which makes it darker in colour.
- The sub-soil (B horizon) is less dark and is often red or yellow in colour.
- The partly eroded parent material which has bigger rock particles than A and B horizons.
- The parent rock (bed rock) is at the bottom and it supports the rest of the horizons.

HUMAN ACTIVITIES THAT ENCOURAGE SOIL EROSION

i) Deforestation

- Trees are cleared for farming and settlement, leaving the land bare.

ii) Overstocking

- This is the keeping of more animals on a small piece of land than the land can support. The animals trample the soil, making it loose and makes it prone to erosion.

iii) Overgrazing

- This results from overstocking. It also makes the soil loose and prone to erosion.

iv) Rapid human population growth

- This increases the demand for forest and land resources. This increases deforestation, bush fires, etc.

v) Poor farming practices

- These may include shifting cultivation, cultivation on steep slopes, and cultivation of river banks. This makes the soil loose, and prone to soil erosion.

IMPORTANCE OF SOIL

- a) It absorbs the unwanted waste materials.
- b) It stores water that is used by plants and animals.
- c) It provides raw materials for construction.
- d) They are used for decoration.
- e) It is habitat for various micro and macro organisms.
- f) Soil provides nutrients to the plants.
- g) Soil is a source of minerals such as copper and gold.
- h) It influences the distribution of plants and animals in an area.

WAYS OF CONSERVING SOIL

a) Re-afforestation

☞ This means replanting trees where deforestation has taken place.

b) Contour ploughing

☞ This is form of cultivation where ridges are made across the slopes.

c) Terracing

☞ This means making terraces on steep slopes to create a flat surface for the crops to be easily grown.
This reduces run-off, and soil erosion.

d) Controlling rapid population growth

☞ This helps reduce the pressure and demand on land resources.

e) Agro forestry

☞ This is the growing arable crops together with trees. This helps provide vegetative cover which helps reduce soil erosion since tree branches reduce the rain drop impacts and roots of vegetation help bind the soil together.

f) Strip cropping

☞ This means planting crops and trees in alternating strips. This ensures vegetative cover, hence, reducing soil erosion.

g) Crop rotation

☞ This is the successive growing of different crops on the same piece of land without fallowing it.
☞ This helps improve soil fertility.

h) Bush fallowing

☞ This is where farmers leave a piece of land without cultivating on it for some few years.
☞ This helps to restore soil fertility and provide vegetative cover which helps reduce soil erosion.

i) Mulching

☞ This involves covering the soil in the field with grass. This prevents the soil from splash erosion and loss of nutrients through evaporation.

j) Application of organic and inorganic fertilizers

☞ Application of manure helps to improve the soil structure by binding the soil particles together.
☞ Fertilizer and manure application also helps to improve the soil fertility.

TOPIC 20: ENERGY

- ❖ It is the ability to do work.

TYPES OF ENERGY

- Renewable energy
- Non-renewable energy

RENEWABLE ENERGY

- ❖ This refers to the sources of energy that can replenish themselves when used up.

EXAMPLES OF RENEWABLE FORMS OF ENERGY

- ◆ Biogas
- ◆ Solar energy
- ◆ Hydro-electric power
- ◆ Nuclear energy
- ◆ Thermal energy
- ◆ Wind energy
- ◆ Geothermal energy

NON-RENEWABLE ENERGY

- ❖ These are sources of energy that cannot replenish (replace) themselves if they are used up.
- ❖ They are finite resources.

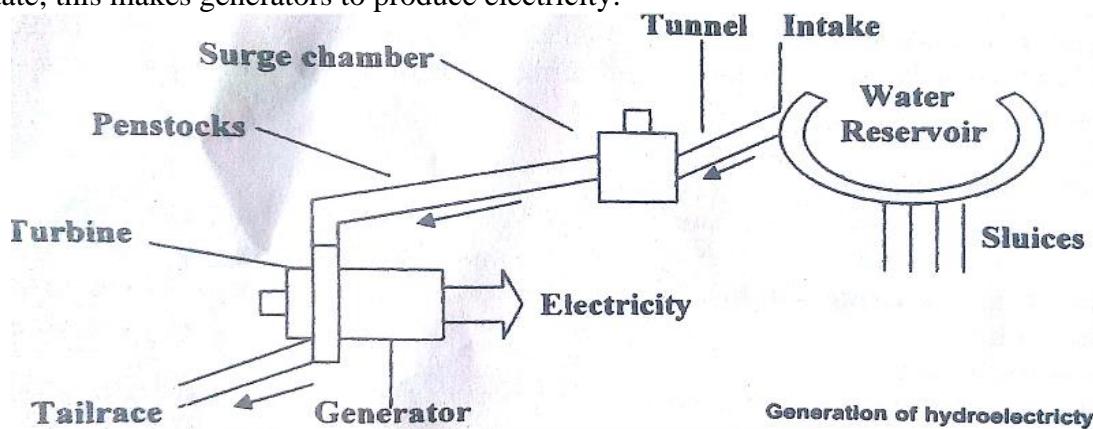
EXAMPLES OF NON-RENEWABLE FORMS OF ENERGY

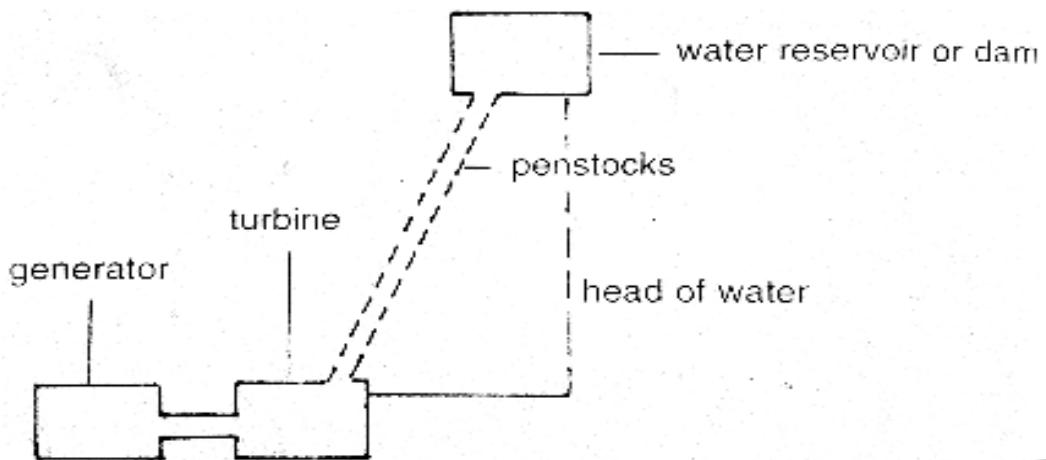
- Coal**
 - ❖ It is a fossil fuel that is produced after the decomposition of organisms. It is mined and as thermal energy.
- Natural gas**
 - ❖ It is also a fossil fuel that is formed after the decomposition of minute marine organisms.
- Crude oil**
 - ❖ It is a liquid form of oil that is also formed after the decomposition of minute marine organisms.

A. HYDRO-ELECTRIC POWER (H.E.P.)

PRODUCTION OF HYDRO-ELECTRIC POWER

Water is stored in a reservoir, such as a dam. Pipes called penstocks lead this water from the reservoir on a steep slope to the turbines that are placed on the lower end of the station. The water makes the turbines to rotate; this makes generators to produce electricity.





Production of Hydro-electric Power

ADVANTAGES OF HYDRO-ELECTRIC POWER

- It is sustainable because it uses water which is renewable.
- It is a relatively cheap form of electricity.
- It causes limited pollution.
- The construction of dams reduces the risk of flooding and water shortages.
- It is efficient and reliable.

DISADVANTAGES OF HYDRO-ELECTRIC POWER

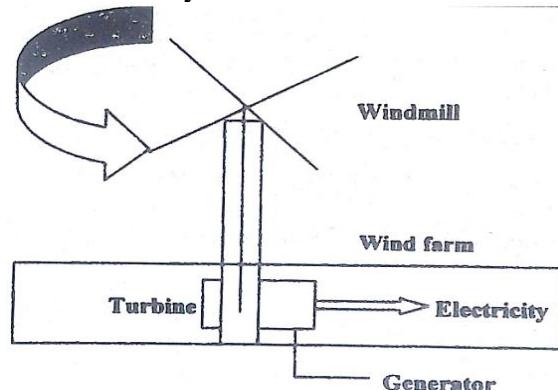
- It is expensive to set up.
- Construction of dams promotes water-borne diseases.
- It cannot be stored.
- When dams break, flooding occurs.
- Dams destroy habitats for wildlife.
- It leads to relocation of people and animals since large areas of farmland and wildlife habitats are flooded.
- When the area is flooded, decaying vegetation release methane and carbon dioxide which are greenhouse gases responsible for global warming.

B. WIND ENERGY

- It is ideal for small-scale generation.

PRODUCTION OF WIND ENERGY

Several windmills are connected and joined to turbines. When the wind blows, propellers rotate, which make the turbines to rotate as well. The rotation of the turbines makes generators connected to them to produce electricity.



Production of Wind Energy



(A Windmill Farm)

ADVANTAGES OF WIND ENERGY

- ✓ It is safe since it does not give off radio-active emissions.
- ✓ It is clean since it does not release greenhouse gases.
- ✓ It has minimal effects on local ecosystem.
- ✓ Its production is relatively cheap.
- ✓ It is sustainable since wind is renewable.
- ✓ There is no air, water and land pollution.
- ✓ There are no finite resources involved.
- ✓ Source of income to farmers using them since work can be done even at night. This increases production.

DISADVATAGES OF WIND ENERGY

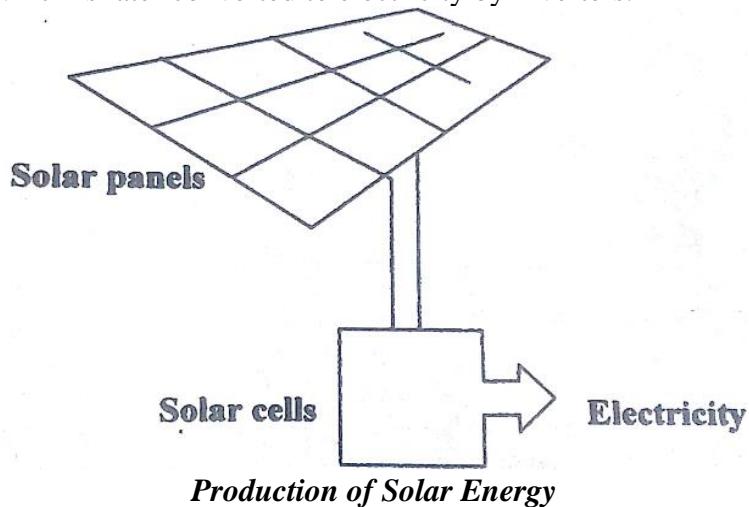
- ◆ It is not reliable since wind does not blow all the time.
- ◆ It cannot be stored during storms for use during calm periods.
- ◆ It is very expensive to set up and maintain.
- ◆ It is not efficient.
- ◆ It causes visual pollution.
- ◆ It causes noise pollution.

C. SOLAR ENERGY

- This type of energy is derived from the sun.

PRODUCTION OF SOLAR ENERGY

This type of energy is produced through solar panels or cells, absorber pipes and mirrors. These absorb energy from the sun which is later converted to electricity by inverters.



ADVANTAGES OF SOLAR ENERGY

- It is ideal (suitable) for small-scale production.
- It is a clean form of energy since it does not cause pollution.
- It is cheap for household purposes.
- There is unlimited supply.
- It can be stored.

DISADVANTAGES OF SOLAR ENERGY

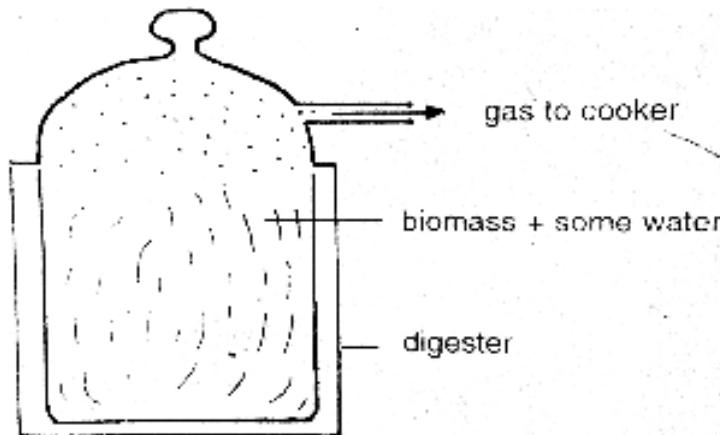
- It is affected by clouds, seasons or darkness.
- It is not always possible when demand exists.
- It is expensive to buy panels, batteries, inverters and to install.

- Limited supply since solar panels convert only 30% of solar energy to electricity.

D. BIOGAS (BIOMASS)

PRODUCTION OF BIOGAS

This type of energy uses biomass such as wood, dung and grass. These materials are put in digesters where bacteria act on them to be fermented. Fermentation releases methane gas which is burned and can be used for heating, cooking, etc.



Production of Biogas Energy

ADVANTAGES OF BIOGAS ENERGY

- It is relatively cheap.
- It is renewable.
- Raw materials are obtained easily. For example dung.
- It is one way of disposing large quantities of wastes, such as cow dung.

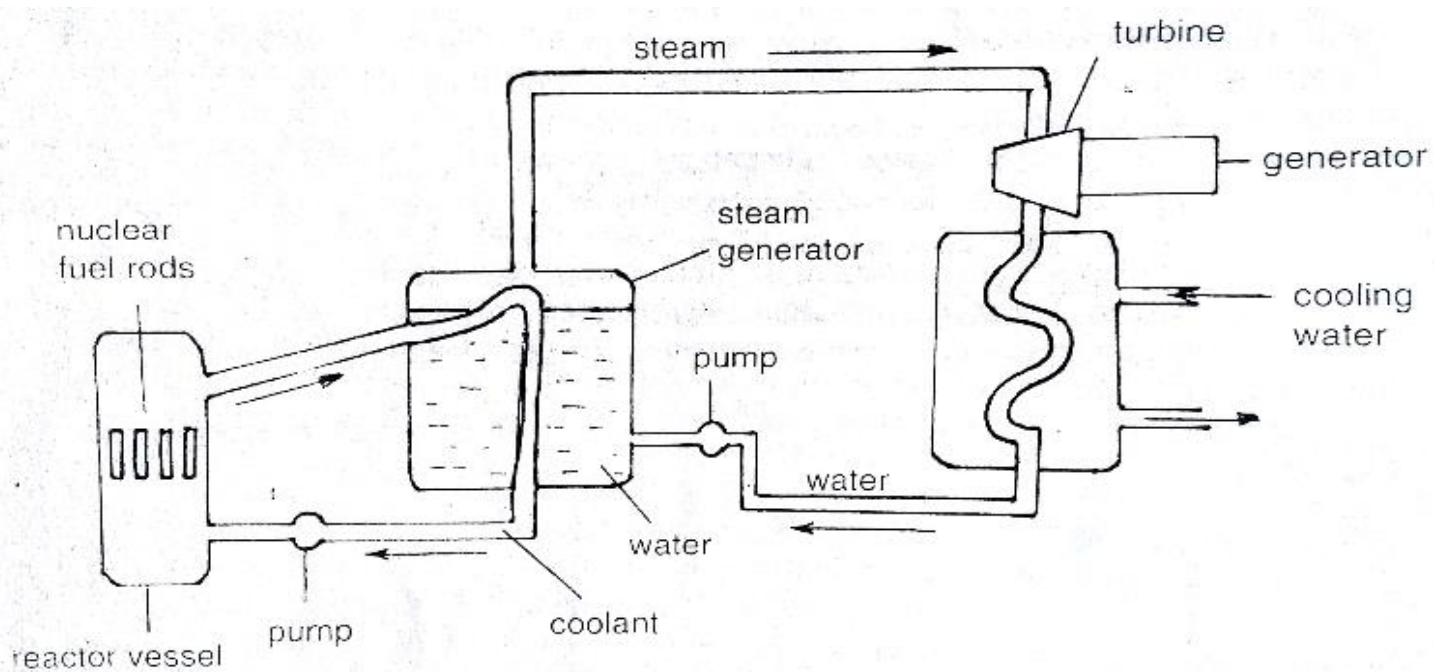
DISADVANTAGES OF BIOGAS

- The release of methane gas causes global warming.
- Farmers are forced to buy fertilizer for farming since dung can no longer be used as manure on farms.
- It requires a lot of wastes from the environment. This may cause ecological imbalances.
- The use of firewood and charcoal promotes deforestation.
- It cannot provide a constant supply of energy since the materials for its production are not always available in the environment.

E. NUCLEAR ENERGY

PRODUCTION OF NUCLEAR ENERGY

This energy is produced from splitting of nuclei of radio-active materials, such as uranium in a nuclear reactor. This is done by bombarding (intense stream of high-energy particles) the nuclei with several neutrons. This process is called **fission**. When this happens, great heat is produced which heats up water in the steam generator, where steam is produced. The steam is then directed to turbines, making them to rotate. The rotation of turbines makes generators connected to them to produce electricity.



Production of Nuclear Energy

ADVANTAGES OF NUCLEAR ENERGY

- It requires limited raw materials to be produced.
- Nuclear waste is limited and can be stored underground.
- There are limited risks of accidents since there are several safeguards.
- It causes little pollution.

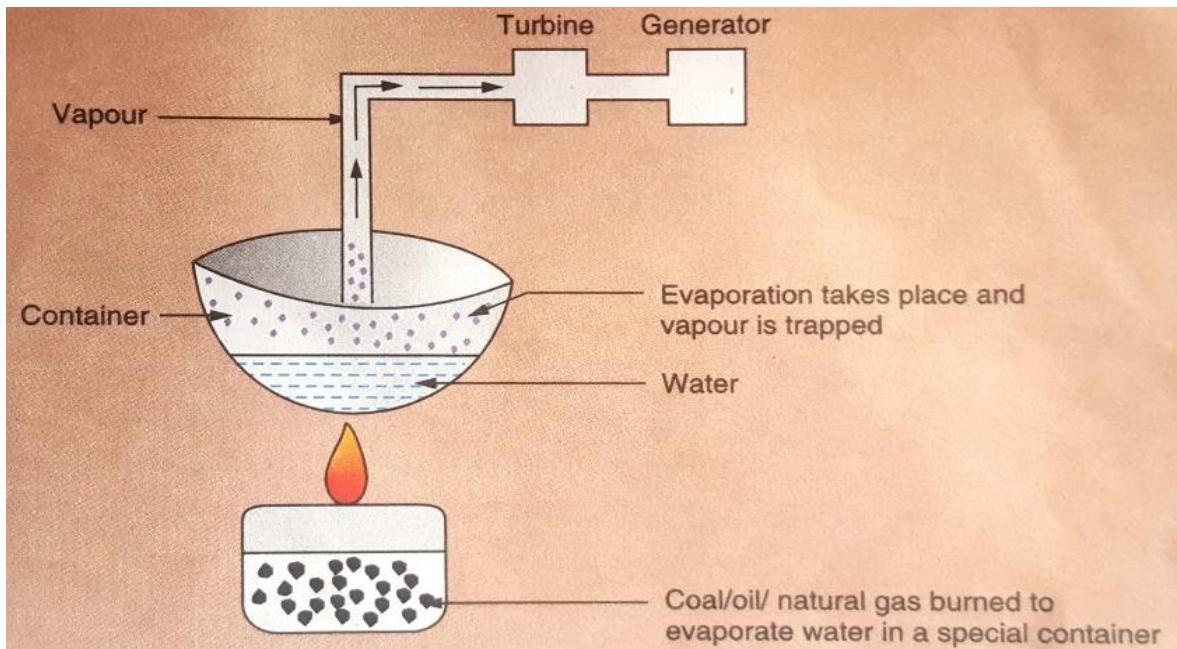
DISADVANTAGES OF NUCLEAR ENERGY

- It poses health risks (not safe) because the wastes can remain radio-active (unstable decay) for many years. These may cause cancer and many other health problems.
- It leads to accidents that have devastating effects, such as the Chernobyl nuclear disaster.
- It is very expensive.
- There is limited demand for nuclear energy since there are many other alternative energy sources.
- High cost of shutting down old power stations.

F. THERMAL ENERGY

PRODUCTION OF THERMAL ENERGY

This power is produced by burning fossil fuels such as coal or natural gas. When these are burned, heat is produced which is used to heat water in special containers. From the heated water steam is produced, which is trapped and directed to turbines, making them to rotate. The rotation of the turbines makes generators connected to them to produce electricity.



Production of Thermal Energy

ADVANTAGES OF THERMAL ENERGY

- It is safer than nuclear energy.
- Oil and gas are more efficient to burn, easier to transport and distribute.
- Initial costs are cheaper as they are erected in more accessible positions.
- The energy sources can be stored such as coal, oil, etc.

DISADVANTAGES OF THERMAL ENERGY

- ❖ The burning of fossil fuels produces a lot of greenhouse gases which cause global warming and acid rain.
- ❖ Destruction of the environment, for example, during deep mining of coal.
- ❖ The most easily accessible deposits have been exhausted.
- ❖ Increased production costs are involved.
- ❖ Labour costs are high since fossil fuels are bulky to move from one place to the other.
- ❖ Thermal plants produce limited outputs.

G.GEO-THERMAL ENERGY

- Geo-thermal means “heat from the earth”. This heat originates from either magma or rocks beneath the earth’s surface.

PRODUCTION OF GEO-THERMAL ENERGY

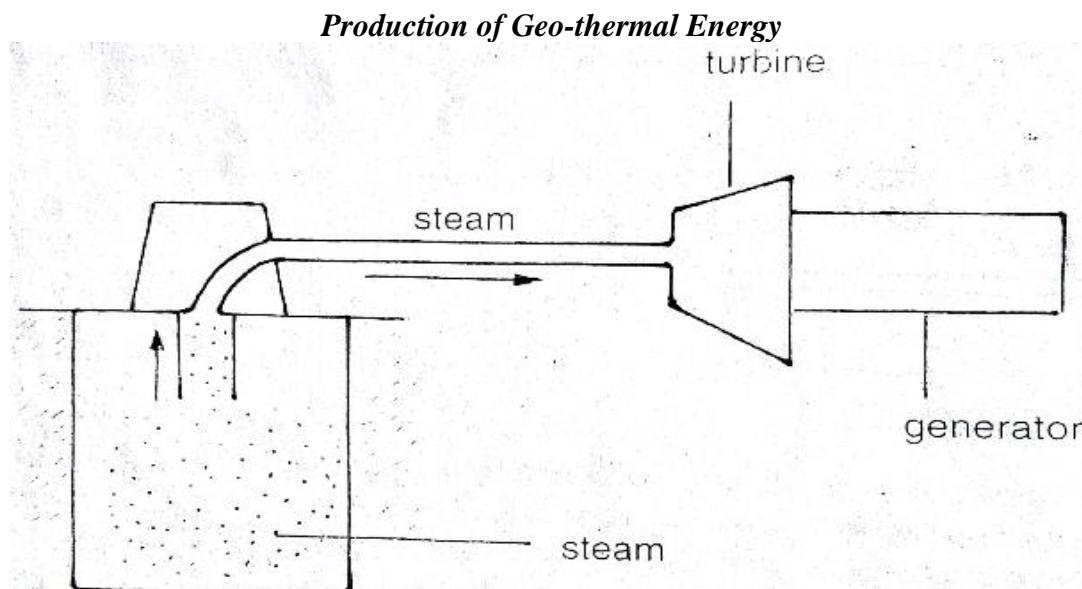
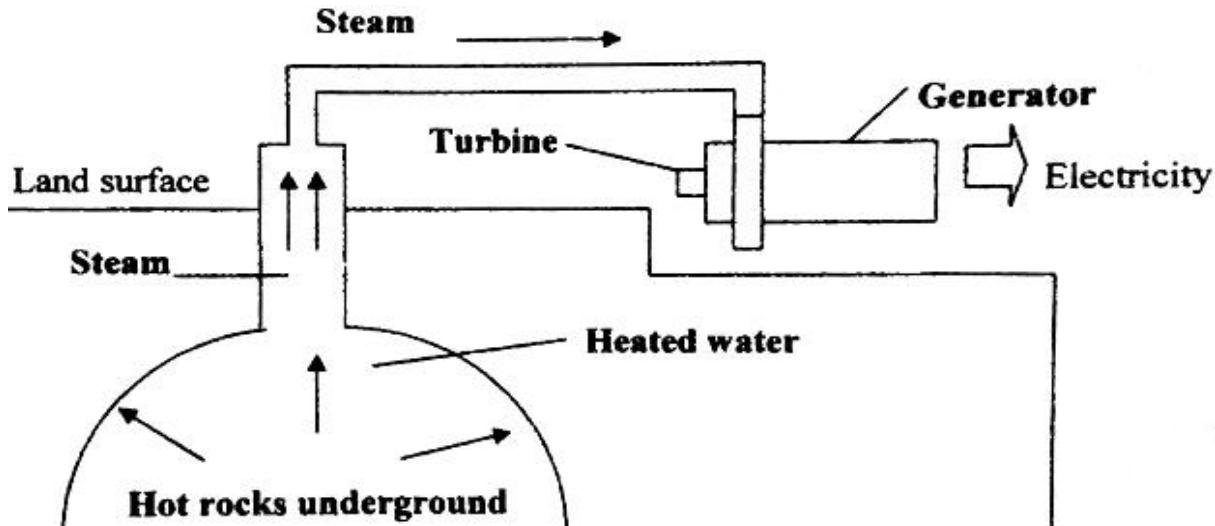
When rain falls, it infiltrates the soil through cracks. This water comes into contact with the heated rocks where it is heated to produce steam. Sometimes heat from magma can warm water present inside the earth. This water may then be ejected to the earth’s surface either as hot spring or geyser. Hot springs may be used for heating in homes and offices, and geysers produce steam which is trapped and directed to turbines which are connected to generators to produce electricity.

NOTE: A hot spring is superheated water that is ejected slowly while a geyser refers to both superheated water and gases that is ejected explosively.

Countries that produce geo-thermal energy

- | | |
|-------------------|---------------|
| • New Zealand | • Former USSR |
| • Iceland | • USA |
| • Central America | • Japan |
| • Italy | |

- ✓ These countries are located within the volcanic belts and have heated rocks which exist close to the earth's surface.



Production of Geo-thermal Energy

ADVANTAGES OF GEO-THERMAL ENERGY

- It is suitable since it is renewable.
- It does not cause pollution of air, water or land.
- It is freely available.
- It is a reliable source of energy.

DISADVANTAGES OF GEO-THERMAL ENERGY

- High cost of construction and maintenance.
- High risk of volcanic eruptions and earthquakes in stations.
- Emission of sulfur into the atmosphere.
- Its production is limited only to areas with hot rocks present near the earth's surface.

IMPORTANCE OF ENERGY IN DEVELOPMENT

- ☞ It is used for operating machinery in factories.
- ☞ It is used for transportation.
- ☞ It is used for lighting, heating and cooling in homes, offices, factories, etc.

- ☛ It promotes trade within and across countries through efficiencies in transportation
- ☛ It raises the living standards of people when using it for entertainment, lighting, cooking, heating, etc.

WAYS OF CONSERVING ENERGY RESOURCES

- ◆ Use of energy saver bulbs.
- ◆ Switching off all electrical appliances that are not in use.
- ◆ Use of renewable forms of energy such as wind and solar energy.
- ◆ Recycling of wastes.
- ◆ Planting a lot of trees to replace those that have been cut down.
- ◆ Controlling rapid population growth to reduce the demand for various energy sources.

HYDRO-ELECTRIC POWER IN MALAWI

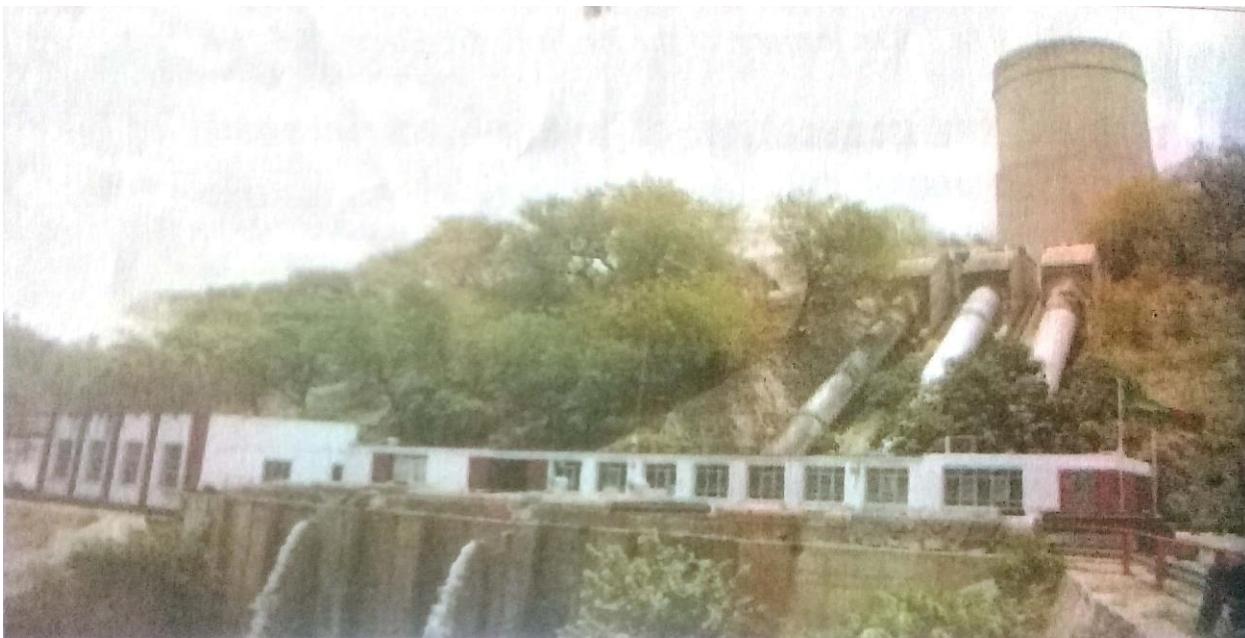
CASE STUDY 1: THE NKULA HYDRO-ELECTRIC POWER SCHEME



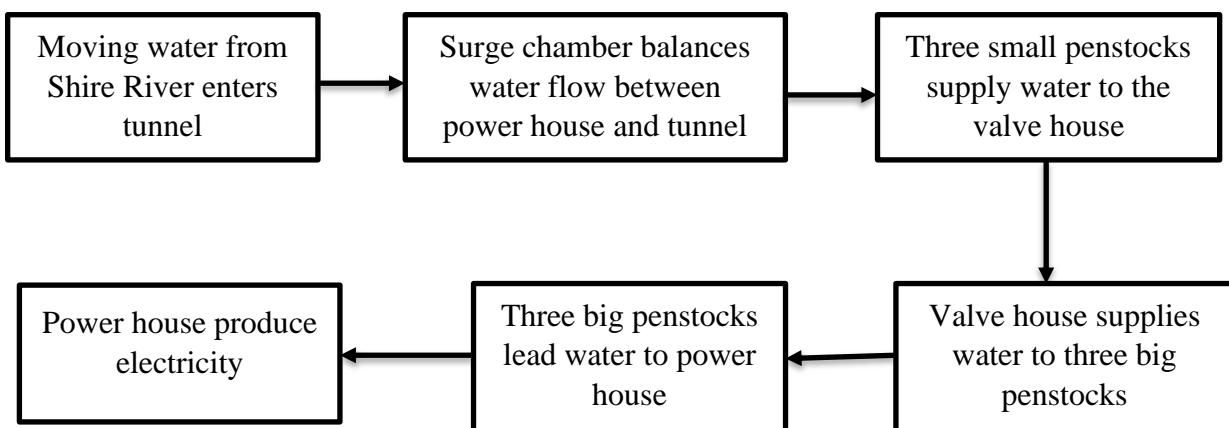
Location of Nkula Hydro-Electric Power Plant

FACTORS IDEAL (SUITABLE) FOR THE GENERATION OF HYDRO-ELECTRIC POWER AT NKULA POWER SCHEME

- 1) A constant volume of running water from a certain height that provides kinetic energy that is converted (changed) to electricity by turbines.
- 2) Presence of steep slopes that create natural water falls (such as Nkula and Tedzani falls).
- 3) High population that creates a large market (high demand) for electricity.
- 4) Skilled personnel that set up and manage the station.



Nkula Hydro-Electric Power Station



Flow diagram of how hydro-electric power is produced at Nkula hydro-electric power station

NOTE:

The energy produced is transmitted to Mzuzu, Lilongwe, Blantyre, Zomba and other parts of the country.

IMPORTANCE OF NKULA HYDRO-ELECTRIC POWER STATION TO THE ECONOMY OF MALAWI

- ❖ Creation of employment for people who work at the plant and the Electricity Supply Commission of Malawi (ESCOM).
- ❖ It is a source of power in homes and industries.
- ❖ Since it promotes industrialization, it helps the government to save the money for importing goods from other countries since.

CHALLENGES (PROBLEMS) ASSOCIATED WITH THE GENERATION, TRANSMISSION AND USE OF HYDRO-ELECTRIC POWER IN MALAWI

Problems in the production and transmission of energy at Nkula

a) Siltation

- ❖ This is the accumulation of soil and silt around the turbines.

Solution

- ❖ Regular removal of sand and silt around the turbines.

b) Fluctuation of water levels in Shire River

- ❖ During the rainy season the water level goes up, and during the dry season it goes down. This negatively affects the functioning of the turbines.

Solution

- ❖ Re-afforestation helps to maintain normal rainfall patterns. It also helps reduce siltation by holding the soil together, reducing soil erosion in the process.

c) Water hyacinth (*namasipuni*)

- ❖ These weeds also negatively affect the production of hydro-electric power at the station.

Solution

- ❖ Removal of these weeds from the river.
- ❖ Treating the weeds with chemicals.

Problems in the transmission of energy at the station

a) Interference from vegetation

- ❖ Tall trees sometimes break and fall on the power lines. This is a common problem during the rainy season.

Solution

- ❖ Felling the trees that are close to power lines.

b) Vandalism

- ❖ People vandalize transformers to get oil. This leads to persistent power outages (blackouts).

Solutions

- ❖ Civic education on the dangers of damaging electricity equipment.
- ❖ Stiff punishment on the people found vandalizing transformers.
- ❖ Community policing to tighten security of transformers.

Problems of use of energy

a) Blackouts

- ❖ Blackouts are common especially during the rainy seasons due to blockage of turbines.
- ❖ Blackouts are also common when the water level in Shire River fluctuates.

Solutions

- ❖ Increasing voltage by increasing generation sites.
- ❖ Importation of power from other countries such as Mozambique.
- ❖ Afforestation and re-forestation to ensure normal rainfall patterns. This reduces the problem of water fluctuation in Shire River.

b) High voltage that causes accidents

- ❖ This can damage the electrical appliances in the homes and industries.

Solutions

- ❖ Use of adapters that control power flow when using electrical appliances.
- ❖ Plugging off electrical appliances when electricity is off.

TOPIC 21: MINERALS

- It is chemical compound that forms the basis of rocks and occurs in the earth's crust.

EXAMPLES OF MINERALS

- ❖ Copper
- ❖ Tin
- ❖ Lead
- ❖ Gold

- ◆ Aluminium
- ◆ Uranium

❖ Take note that uranium is mined in Karonga district.

REASONS FOR AN INCREASE IN MINING ACTIVITIES IN MALAWI

- ✓ The discovery of many mining sites in Malawi between 1984 and 1985 by the Geological Survey Department and the UNDP.
- ✓ Various mining activities take place on a small scale and large scale.
- ✓ Government and international support given to the mining activities.

Minerals and where they are mined in Malawi

AREA	MINERAL
Karonga	Uranium
Rumphi	Coal, rare earth
Mzimba	Gemstones, rare earth
Salima	Gold
Mulanje	Bauxite (not mined)
Mchinji	Black granite
Phalombe	Salt
Chimwadzuli Hill (in Nctheu)	Gemstones
Ekwendeni	Stone aggregates

CHARACTERISTICS OF MINERALS

- a) They occur naturally.
- b) They are inorganic. This means that they are not alive and were never alive.
- c) They are in solid form.
- d) They have an orderly internal structure. The atoms that make them are found in a regular, repeating and orderly manner.
- e) They have a regular chemical composition.

TYPES OF MINERALS

- ❖ Metallic minerals
- ❖ Non-metallic minerals

a) Metallic minerals

❖ These are minerals that contain metal in them.

Groups of metallic minerals

i. **Ferrous minerals:** These are rich in iron, they are dark in colour and are heavy.

Examples of ferrous minerals

- ✓ Nickel
- ✓ Platinum
- ✓ Iron
- ✓ Chromite

ii. **Non-ferrous minerals:** These do not contain iron, but have metals.

Examples of non-ferrous minerals

- ✓ Aluminium
- ✓ Copper
- ✓ Tin
- ✓ Manganese

b) Non-metallic minerals

- ◆ These do not contain metals.

Examples of non-metallic minerals

- ✓ Phosphate
- ✓ Salt

FORMATION OF MINERALS

a) Crystallization from a melt

- ❖ Igneous intrusions contain hot mineral-rich fluids, which have different densities. When magma cools, heavier minerals in it sink and crystalize at the bottom of the rocks to form an ore.

b) Sedimentation of weathered rock materials

- ❖ These may also contain insoluble mineral elements which accumulate over time in alluvial deposits in flood plains or ocean floors, forming a mineral ore.

c) Metamorphic processes

- ❖ High temperature and pressure applied to the existing rocks make the mineral more mobile, forming new combinations. This may lead to the formation of a mineral ore.

d) Solution

- ❖ Leaching of solutions may wash down minerals to the sub-soil where they become concentrated to form a mineral ore.

- ❖ Evaporation of fluids from solutions may also lead to the formation of a mineral ore.

USES OF SOME MINERALS

MINERALS	USES
Aluminium	Aluminium foil, cosmetics, beverage cans, deodorants, hand lotion, cooking pots
Copper	Wire, pipes, cooking pots, brass, pennies, etc.
Gold	Dentistry, jewellery, computers, electrons etc.
Iron	Cosmetics, hair dye, steel, wrought iron
Nickel	Nickel coins, stainless steel. Alnico magnets, sheet rocks etc.
Zinc	Sun block, fertilizer cosmetic dandruff shampoo, pennies, galvanized metal, etc.
Phosphate	Fertilizer, dish washing detergents, laundry detergents

ECONOMIC IMPORTANCE OF MINERALS

- 1) They lead to the growth of towns.
- 2) They are a source of income to the government through taxation.
- 3) They promote trade.
- 4) They have led to the growth of secondary industries that process the minerals into different products.
- 5) They are a source of raw materials for making various things such as fertilizers.
- 6) Minerals such as coal are used as a source of energy in homes and industries.
- 7) Some minerals are used in the construction industry such as silica.

TOPIC 22: FISHING IN MALAWI

- ❖ Fishing means the catching of all aquatic animals from water bodies for food or for sale.

HUMAN ACTIVITIES THAT DESTROY FISH RESOURCES

a) Water pollution

- ❖ This results from dumping of home and industrial wastes into water bodies. This leads to the death of aquatic species including fish.

Solutions

- ❖ Civic education to people working in industries to avoid dumping industrial wastes into water bodies.
- ❖ Treating all the poisonous wastes before discharging them into water bodies.
- ❖ Legislation that protects water bodies from pollution.
- ❖ Stiff punishment on offenders found polluting water bodies.

b) Overfishing

- ❖ People catch fish using poisonous herbs.
- ❖ People catch fish during the breeding seasons.

- ❖ People catch fish using nets that have small mesh.

Solutions

- ❖ Civic education to people on the negative effects of overfishing.
- ❖ Using the quota system to control the amount of fish caught in a year.
- ❖ The use of Village Beach Committees (VBC's) to monitor the regulations during the closed seasons.
- ❖ Observing the closed season to allow the fish breed.
- ❖ Fishing using nets that have large mesh.

c) Poor fishing methods

- ❖ People catch fish using poisonous herbs.
- ❖ People catch fish using nets that have small mesh.

Solutions

- ❖ Fishing using nets that have large mesh.
- ❖ Civic education to people on the negative effects of overfishing and use of poisonous herbs when fishing.

d) Water hyacinth (*namasipuni*)

- ❖ These plants lead to the suffocation of fish in water bodies since they use a lot of oxygen that would have been used by the fish.

Solution

- ❖ Removal of water hyacinth from the water bodies.

e) Destruction of the Fishing Grounds

- This problem comes in because most fishing grounds are also used for other purposes, such as recreational activities and sporting activities.

f) Lack of Fish Management Skills

- Many people do not know how to manage and conserve fish. As a result, a lot of fish go bad and wasted.

g) Indiscriminate Fishing

- This is the catching of immature fish because fishermen use nets with small mesh.
- Fish are also caught during their breeding seasons.

h) Deforestation

- Loss of forest cover has increased the rate at which soil erosion takes place and the subsequent siltation of water bodies, and the degradation of fishing grounds.

i) Climate Change

- Rising global temperatures have disturbed the normal patterns of ocean currents and the upwelling of cold water that supply nutrients to the surface waters.
- It also promotes the drying up of fresh water sources due to decreased rainfall. All these have resulted in the shrinking of the fishing grounds.

GENERAL SOLUTIONS TO THE PROBLEMS FACING THE FISHING INDUSTRY

- ❖ Restocking over-fished waters.
- ❖ Awareness campaigns (civic education) to sensitize people on the bad effects of misusing fish resources.
- ❖ Use of nets with big mesh when catching fish to allow young fish grow.
- ❖ Enactment and enforcement of laws that protect water bodies from pollution.

- ❖ Relocating the fish from highly populated areas to over-fished waters.
- ❖ Removal of all poisonous and harmful chemicals from industrial waste before it is discharged into the rivers and seas.
- ❖ Imposing tough measures on those that catch small fish by fining them.
- ❖ Fish farming to reduce the increasing demand of fish from natural lakes and rivers.
- ❖ Having a closed season to allow fish breed. A closed season is when fishing on the major lakes, oceans and rivers is suspended during some months of the year.
- ❖ Enforcement of international law conventions to protect fish in fishing grounds.

MAJOR FISHING GROUNDS OF MALAWI

- ✓ The southern tip of Lake Malawi, around Mangochi.
- ✓ Lake Chirwa
- ✓ Lake Malombe
- ✓ Likoma Island
- ✓ Salima (in Lake Malawi)
- ✓ Nkhotakota (in Lake Malawi)
- ✓ Lower Shire areas

FACTORS INFLUENCING THE LOCATION AND DISTRIBUTION OF FISHING GROUNDS

a) Growth of planktons

- ✓ These are microscopic plants on which the fish feed. All areas with plenty of planktons have a lot of fish.

b) Warm water

- ✓ Fish are cold-blooded animals, they need an optimum temperature of about 20°C for them to breed and survive well.

c) Shallow water

- ✓ Shallow water on the continental shelves allows sunlight to penetrate and enable planktons to make their own food and grow abundantly.

SPECIES OF FISH CAUGHT IN MALAWI

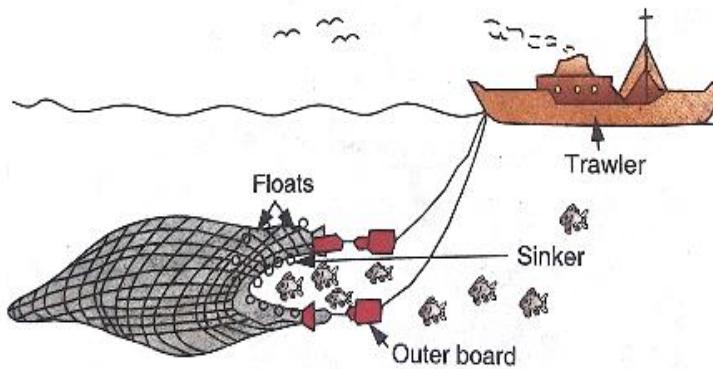
- ◆ Chambo fish
- ◆ Nchila fish
- ◆ Utaka fish
- ◆ Matemba fish
- ◆ Cat fish (mlamba)
- ◆ Sanjika fish
- ◆ Mcheni fish

MAIN METHODS OF FISHING

- i. Trawl nets
- ii. Drift nets
- iii. Seine nets

I. TRAWL NETS

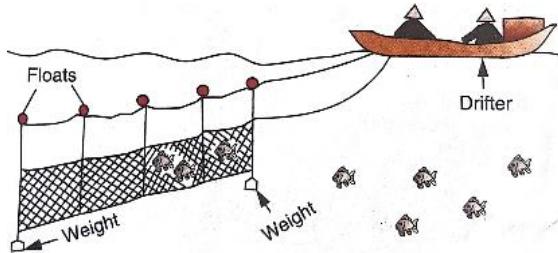
This type of net has a conical shape which is open at the base. The mouth is kept wide open by a system of floats on the top part and weights at the bottom. The fish is caught by dragging the net along the sea bed by trawlers. These nets are used to catch **demersal fish**.



A Trawl Net

II. DRIFT NETS

These nets are hanged vertically in the water because they are weighted along the bottom edge and supported along the top edge by floats. Fish are caught by their gills in the mesh of the nets as they try to swim across. These nets are used to catch **pelagic fish**.



Drift Net

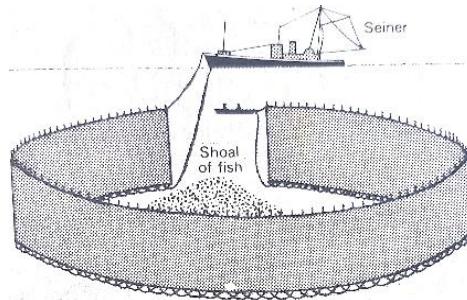
III. SEINE NETS

- There are two types of Seine nets, these are: **Pulse Seine** nets and **Haul Seine netting**.

i. Pulse Seine Nets

These nets are pulled by their ends to surround a shoal (where fish are in large numbers) of fish. These nets are stretched between two fishing boats. As the net fills with fish, ships move close together to enclose the fish.

- ❖ Sometimes they are pulled by two fishermen with one end attached to a small boat. These are similar to drift nets, and are used to catch **pelagic fish**.

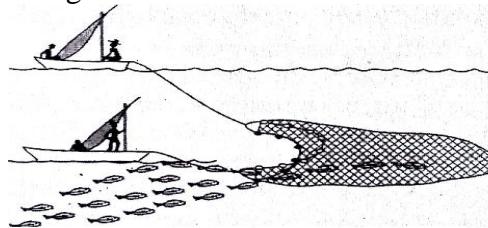


Pulse Seine Net

ii. Haul Seine Netting

These are nets having an oval mouth with a conical shape. These nets are stretched between two fishing boats. As the net fills with fish, the boats move close together to enclose the fish.

- They are used for catching **demersal fish**.



Haul Seine Net

OTHER FISHING METHODS

① Basket method

- ❖ These are oval or round nets which are attached to one or two handles. They are commonly used by fishermen along Shire River, Lake Malombe and Lake Chirwa.



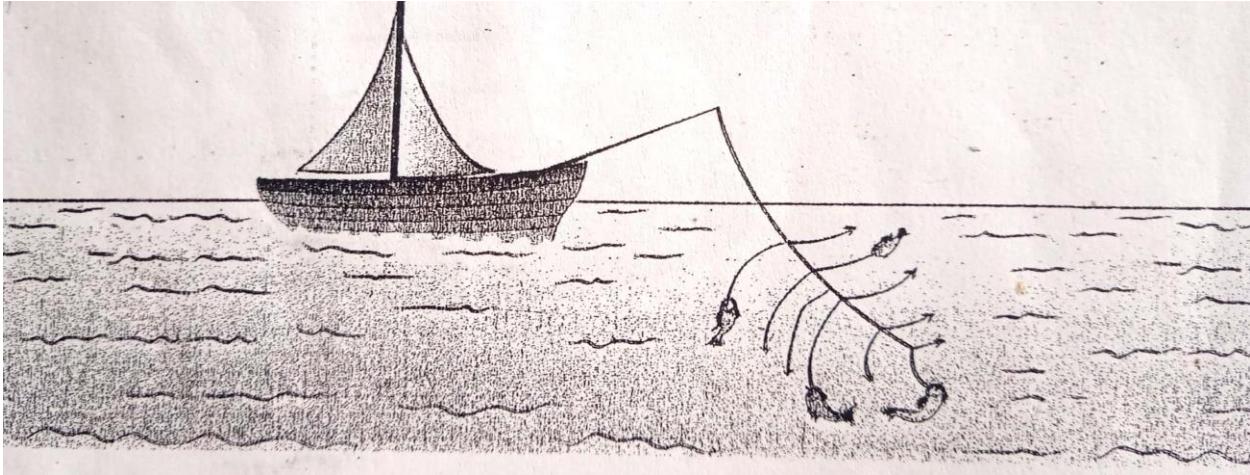
A Fishing Basket

② Fish traps

- ✓ These use weaved baskets containing baits inside. The traps are lowered into the shallow coastal waters and left for one or two days before they are hauled up. Supporting poles are used where water moves at high speed.

③ Fishing Lines

- ✓ The lines may carry hundreds of baited hooks, and are trailed by fishing vessels.
- ✓ Sometimes fishermen leave the lines to catch fish the whole night.



Fishing Lines

④ Harpooning

- ✓ This method is used to catch large fish that swim near to the surface. The fishermen fire (with a gun) barbed spears (harpoons), attached to the fishing vessel by a line. When the harpoon is fired into the target, the barbed points become firmly anchored into its flesh, enabling the people to drag the fish to the ship.

REASON WHY THE FISHING INDUSTRY IS ALSO CALLED THE “ROBBER INDUSTRY”

- The rate at which the fish are caught does not balance with the rate at which they replace themselves (through breeding).

OR

- More fish are caught than the rate at which they replace themselves through breeding.
- ☛ This problem has been worsened by rapid population growth, which increases demand for fish.

PRESERVING FISH

- ◆ Preserving fish means using various methods to keep fish fresh for a long time.

WAYS OF PRESERVING FISH

1) Freezing

- ◆ Fish can be frozen in a refrigerator to prevent them from going bad.

2) Drying

- ◆ This is where fish are dried in the sun to prevent them from rotting.

3) Salting

- ◆ Salting serves two purposes.

☛ The first is to improve the taste of the fish.

☛ It also helps prevent the fish from going bad.

4) Firing or smoking

- ◆ This reduces the moisture content in the fish, and therefore, prevents the fish from rotting.

ECONOMIC IMPORTANCE OF FISH IN MALAWI

- ☛ It is a source of income for many people after selling.
- ☛ It is a source of foreign exchange earnings after being sold.
- ☛ Fish are used for tourist attraction.
- ☛ Fishing creates employment for many people.

- ☛ It has led to the growth of other related small-scale industries such as the boat industry.
- ☛ Provision of government revenue through taxation.

OTHER IMPORTANCE OF FISH

- ☛ Fish are used as a raw material for making various products such as fertilizer.
- ☛ Fish are a source of variable food. They are a source of proteins.
- ☛ They are used as a source of medicine.

WAYS OF CONSERVING FISH

- 1) Fish farming**
 - ❖ This helps to reduce the demand and pressure on fish resources from the natural water bodies such as lakes and rivers.
- 2) Observing the closed season**
 - ❖ This is where fishing in major water bodies is suspended for some months to allow the fish breed.
 - ❖ This is enforced with the help of Village Beach Committees (VBC's) that were put in place by the government of Malawi.
- 3) Use of the quota system when fishing**
 - ❖ This limits the amount of fish to be caught from water bodies in a year to avoid over fishing.
- 4) Use of nets that have large mesh**
 - ❖ This ensures that only large fish are caught that cannot go through the mesh, while at the same time allowing the small, immature fish to go through the mesh and be caught when they mature.
- 5) Civic education (awareness campaigns) on the dangers of overfishing, controlling rapid population growth and on the importance of conserving fish.**
 - ❖ The messages can focus on the negative effects of fishing using poisonous herbs such as *Katupe*.
 - ❖ Controlling rapid population growth helps to reduce the demand and pressure on fish resources from natural water bodies.

TOPIC 23: INDUSTRIES IN MALAWI

INDUSTRY

- ◆ These are places where raw materials are changed into finished products.

MANUFACTURING

- ◆ This is a process whereby raw materials are changed into finished products that can be used.

CLASSES (TYPES) OF INDUSTRIES

- Primary industries
- Secondary industries
- Tertiary industries
- Cottage industries

PRIMARY INDUSTRIES

- ☛ These are industries that are concerned with the production, collection and extraction of raw materials from the environment.

EXAMPLES OF PRIMARY INDUSTRIES

- Farming
- Fishing
- Mining and quarrying
- Hunting
- Forestry

SECONDARY INDUSTRIES

- ☛ These are industries that process raw materials into finished products.

EXAMPLES OF SECONDARY INDUSTRIES

- ❖ Bread making
- ❖ Cement manufacturing
- ❖ Soap making
- ❖ Fruit canning
- ❖ Sugar refining
- ❖ Cigarette making

TERTIARY INDUSTRIES

- ☞ These are industries that are concerned with the provision and distribution of services to the general public.
- ☞ They are also called service industries because they are concerned with the provision of services and needs of the people.

EXAMPLES OF TERTIARY INDUSTRIES

- Nursing
- Teaching
- Banking
- Provision of water by water boards
- Provision of electricity by electricity supply commissions
- Provision of postal services

COTTAGE INDUSTRIES

- ☞ These are small-scale industries that are run by members of the same family or by cooperatives.
- ☞ They are also called *craft industries*.

EXAMPLES OF COTTAGE INDUSTRIES

- ◆ Pot making
- ◆ Basket weaving
- ◆ Wood carving
- ◆ Boat making

CHARACTERISTICS OF COTTAGE INDUSTRIES

- ❖ Creation of products and services is home-based.
- ❖ They require little capital.
- ❖ They are located in both urban and rural areas.
- ❖ Labour is easily available.
- ❖ Market for the products made is locally available.
- ❖ Most products are cheap and easily accessible.

FACTORS THAT INFLUENCE THE LOCATION OF AN INDUSTRY

- a) Government policies
- b) Raw materials
- c) Transport
- d) Labour
- e) Power supply
- f) Presence of markets

a) GOVERNMENT POLICIES

- ◆ Good government policies such as charging low taxes on the owners of industries can attract many investors to create industries in a certain country.
- ◆ Sometimes the government provides capital part of the capital to the investors. This again can encourage industries to be located in an area.

b) RAW MATERIALS

- ◆ Industries that require large quantities of raw materials need to be located close to areas where the raw materials are produced. For example tea and sugar making industries are located in areas where the raw materials (tea and sugar canes) are grown.

c) TRANSPORT

- ◆ Transport in terms of roads or railway lines is needed for easy transportation of raw materials from their points of production to the factories, and transportation of finished products from the factories to the markets.

d) LABOUR

- ◆ Industries are mostly located in areas that have high population densities in order to have an easy access to abundant and cheap labour.

e) POWER SUPPLY

- ◆ Industries need to be located in areas that are close to where power plants are located. This is the case since heavy machines in the industries require a lot of power for them to function. This is the reason why most industries in Malawi are located in Blantyre and Lilongwe since these areas are close to Nkula and Tedzani hydro-electric power plants.

f) MARKET

- ◆ Production of goods that are highly perishable need to done in areas that are close to large markets for fast sales. Some of these products could include eggs, bread, milk, fruits, etc.
- ◆ Production of heavy products also need to done in areas close large markets in order to reduce the transport costs.

g) WATER SUPPLY

- ◆ Water is important in every industry since it is used as a solvent in beverage and chemical industries, for cleaning raw materials and for cooling machines. This is the reason why most industries are located close to water bodies such as Shire River.

LOCATION OF MAJOR INDUSTRIES IN MALAWI

BLANTYRE	LILONGWE	MZUZU
<ul style="list-style-type: none">☛ Makata (heavy industries)☛ Ginnery Corner☛ Maselema (light industries)☛ Limbe (heavy industries)☛ Chirimba (light industries)☛ South Lunzu☛ Maone☛ Chitawira	<ul style="list-style-type: none">☛ Kanengo (heavy & light)☛ Area 50☛ Area 51	<ul style="list-style-type: none">☛ Luwinga☛ Near Masasa☛ Sonda

CHARACTERISTICS OF LIGHT INDUSTRIES

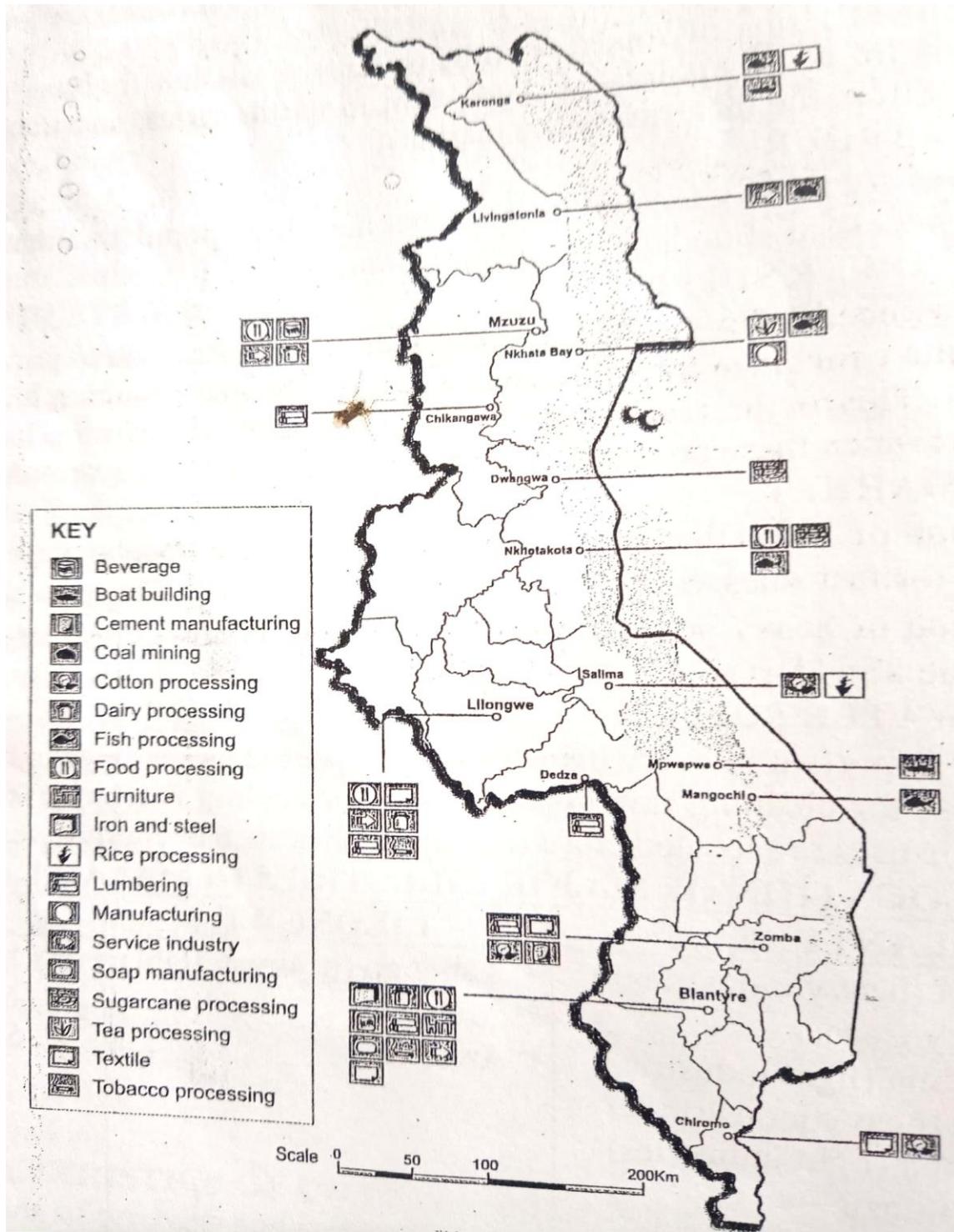
- a) Use of small machines.
- b) Require less power.
- c) They cause little pollution to the environment.

CHARACTERISTICS OF HEAVY INDUSTRIES

- a) Use of big machines.
- b) They require a lot of power for them to function.
- c) They cause a lot of pollution to the environment.

IMPORTANCE OF INDUSTRIES TO THE ECONOMY OF MALAWI

- ❖ Provision of employment to the people.
- ❖ Source of government revenue through taxation.
- ❖ They are a source of foreign exchange earnings to the government after exports.
- ❖ It promotes the development of skills for the people who work there.
- ❖ Promotion of infrastructural development such as good roads, railways and schools.
- ❖ It promotes trade in the area through the production and selling of goods.



Location of Some Industries in Malawi

TOPIC 24: TOURISM IN MALAWI

TOURISM

- ❖ This is an industry that involves the movement of people from one place to the other both locally or internationally to see places of interest.

TOURIST

- ❖ This is a person who visits areas of interest for leisure.

EXCURSIONISTS

- ❖ These are travelers who stay for less than 24 hours away from their home.
- Tourism involves interaction between the tourists and the indigenous (local) populations. The cultures of the two groups are different.

ASSIMILATION (ACCULTURATION OR ACCOMMODATION)

- It refers to the process and the results of interaction between groups with different cultures. (*Tourists and indigenous or local people*).
- Assimilation is also called **Acculturation or Accommodation**

DEMONSTRATION EFFECT

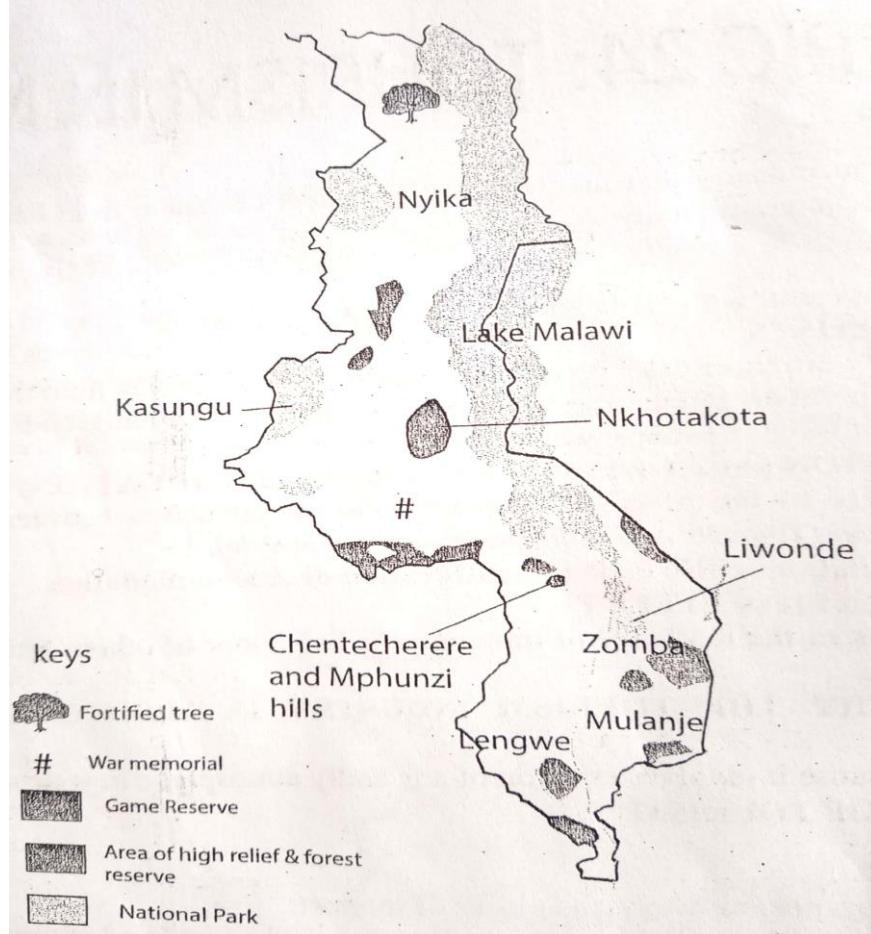
- It refers to the tendency of imitating the behaviour of others and assimilating it as one's own.

REASON WHY THE TOURISM INDUSTRY IS ALSO CALLED HOSPITALITY INDUSTRY

- It is because it involves creation of a friendly atmosphere in welcoming the tourists.

ELEMENTS OF TOURISM

- **Tourists**
 - ☛ This is a person who visits places of interest.
 - ☛ The tourists must have good health and should be inclined to travel.
- **Tourist generating regions**
 - ☛ These are places where tourists come from.
- **Transit routes**
 - ☛ These are routes used by tourists to visit places of interest.
- **Tourist destinations (attractions)**
 - ☛ These are targeted places of interest. Places may be visited for their physical, cultural, historical or recreational service attractions.



Some Tourist Attraction Centres in Malawi

AREAS THAT ATTRACT A LOT OF TOURISTS IN MALAWI

- a) Lakeshore areas
- b) National parks
- c) Game reserves
- d) Historical sites
- e) High plateau areas
- f) Nature sanctuaries

TOURIST SERVICE	PLACE
Angling	☞ Lake Malawi (around Mangochi, Nkhatabay, Salima, etc)
Mountaineering	☞ Mulanje Mountain ☞ Zomba mountain ☞ Muchiru hills
Game viewing	☞ Nyika National Park ☞ Vwaza Game Reserve ☞ Lilongwe Nature Sanctuary ☞ Kasungu National Park ☞ Liwonde National Park ☞ Nkhotakota Game Reserve
Historical site	☞ Zomba war memorial ☞ Nkhatabay war memorial

FACTORS THAT PROMOTE TOURISM IN MALAWI

- a) Culture
- b) Accessibility
- c) Attractive scenery
- d) Good climate
- e) Politics

a) CULTURE

- ◆ This is the way of life for a group of people.
- ◆ Malawi has a lot of elements of culture in terms of traditional dances such as beni, vimbusa, etc. Malawi is also well known for welcoming visitors warmly, this is the reason why it is referred to as “The Warm Heart of Africa”. All these attract tourists.

b) ACCESSIBILITY

- ◆ Malawi is highly accessible by international tourists due to the presence of Chileka International Airport and Kamuzu International Airport. There are also numerous local transport routes that promote tourist mobility when in Malawi.

c) ATTRACTIVE SCENERY

- ◆ Malawi has attractive natural resources such as Lake Malawi, beautiful game in national parks, game reserves and nature sanctuaries, mountains such as Mulanje, beaches and evergreen vegetation. All these attract tourists.

d) GOOD CLIMATE

- ◆ Malawi experiences warm summers and mild winters. Summers are experienced when America and Europe that are in the northern hemisphere experience winters, with very low temperatures and snow. Winters are experienced when the northern hemisphere experiences summer. They find Malawi an ideal place as a tourist destination during these seasons.

e) POLITICS

- ◆ Malawi is politically peaceful and stable. This attracts tourists to visit places of interest.
- ◆ In addition, there is also political will to develop the industry by establishment of national parks and game reserves, and also provision of good accommodation such as the construction of a five-star hotel in Lilongwe.

IMPACTS OF TOURISM

Positive impacts/effects (advantages) of tourism in Malawi

1. Creation of employment for the people.
2. Source of foreign exchange earnings.
3. It promotes international relations.
4. It promotes social and cultural interactions.
5. It promotes development by encouraging the construction of infrastructure such as good roads, airports, hotels, etc.
6. Source of government revenue through taxation.
7. Promotion of small-scale industries such as art and craft.

Negative impacts/effects (disadvantages) of tourism in Malawi

1. Employment is seasonal.
2. Erosion of local culture and traditional values.
3. Stiff competition on the market from other countries in the region such as Kenya and South Africa.
4. Most hotels are owned by foreigners, so profits go overseas.
5. Inadequate infrastructure in the areas of interest.
6. Inadequate capital to fully develop the tourism industry.
7. Most local people cannot afford tourist facilities since they are expensive, so the facilities are underutilized.
8. Poaching reduces the population of game. This reduces the number of tourists coming to Malawi.

CHALLENGES FACING THE TOURISM INDUSTRY IN MALAWI AND THEIR SOLUTIONS

a) Tropical diseases such as malaria

- ◆ This is a serious problem in lakeshore areas and in game reserves and national parks.

Solutions

- ◆ Use of treated mosquito nets when sleeping.
- ◆ Use of mosquito repellants.
- ◆ Cutting tall grass short in tourist accommodations.

b) Poor and insufficient accommodation

- ◆ Hotels, motels, lodges and rest houses are not sufficient in tourist destinations.
- ◆ Where these accommodations are available, they are not in good conditions. This makes tourists not to like visiting Malawi.

Solution

- ◆ Construction of many hotels, motels, lodges and rest houses of international standards.

c) Waterborne diseases such as bilharzia

- ◆ Bilharzia is spread by snails, and this is a common problem in lakeshore areas that are preferred tourist destination.

Solution

- ◆ People should avoid urinating and defecating in water bodies such as lakes and rivers.

d) Inaccessibility and high cost of visiting Malawi from other countries

- ◆ Many roads leading to tourist destinations in Malawi are very poor and impassable. This is a serious problem during the rainy season.

- ◆ Air fares from other countries to Malawi are more expensive than the air fares from the same regions to other countries in Africa.

Solutions

- ◆ Improving roads to tourist destination by graveling them or making them to be tar-marked.
- ◆ Reduce the air fares from tourist generating regions to Malawi.

e) Poor management

- ◆ Most hotels are poorly managed, and tourist destination places are poorly managed. For example deforestation and poaching still takes place in game reserves and national parks.

Solutions

- ◆ Civic education to the people living close to tourist destination places on the importance of caring for these destination places.
- ◆ Proper waste disposal to avoid polluting water bodies.
- ◆ Legislation and enforcement of laws that protect natural resources such as vegetation, animals and water.

f) Poor communication

- ◆ Poor phone networks.
- ◆ Poor internet coverage.
- ◆ Slow internet.
- ◆ Internet and communication rates are very expensive.

Solutions

- ◆ Maintaining communication lines such as telephone.
- ◆ Reduce internet fares.
- ◆ Increase internet coverage.

g) Lack of political will to develop the industry

- ◆ Less is done by the government to develop the tourism industry.

Solution

- ◆ There should be political will to develop the tourism industry. This can be done by increasing budgetary allocation to the ministry of tourism in order to address the problems facing the tourism industry.

TOPIC 25: COMMUNICATION IN MALAWI

COMMUNICATION

- It refers to the exchange of messages and words.

TYPES (MEANS) OF COMMUNICATION IN MALAWI

- a) Audio communication
- b) Audio-visual communication
- c) Written communication

a) AUDIO COMMUNICATION

- This is verbal or spoken messages passed from one person to the other.

Examples of audio means of communication

- Cell phone (mobile phone)
- Radio
- Telephones

b) AUDIO-VISUAL COMMUNICATION

- This is a means of communication that involves both audio and visual means.

- The person receiving the messages will be able to hear the sound and see the images at the same time.

Examples of audio-visual communication

- Television
- Face-to-face conversations
- Watching a live match
- Video-calling

c) WRITTEN COMMUNICATION

- This is just the use of written messages.

Examples of written communication

- Fax
- Letters
- Telex
- Telegrams
- News papers
- Text messages

ADVANTAGES OF AUDIO COMMUNICATION

- Questions can be asked and answered immediately.
- Immediate and direct feedback is given.
- Receivers can sense the sender's sincerity.
- It is more persuasive form of communication.
- It enables people to interact more frequently.
- There is speed and efficiency in delivering routine messages.

DISADVANTAGES OF AUDIO COMMUNICATION

- It sometimes leads to statements of regret.
- There are no permanent records.

ADVANTAGES OF AUDIO-VISUAL COMMUNICATION

- It is more effective.
- Messages can be recorded for future reference.
- The people communicating can know the feedback from each other quickly.
- The full communication is received sent.

DISADVANTAGES OF AUDIO-VISUAL COMMUNICATION

- It is not suitable for confidential information.
- It promotes moral decay through pornographic programmes.
- It may be difficult to understand nonverbal clues such as facial expressions.
- Sometimes the messages are not age-specific, such as on television.

ADVANTAGES OF WRITTEN COMMUNICATION

- ☞ Messages can be revised before sending.
- ☞ Permanent records can be saved.
- ☞ The message stays the same even if relayed by different people.
- ☞ The receiver has more time to analyze the message.
- ☞ It helps people to interact more frequently.

DISADVANTAGES OF WRITTEN COMMUNICATION

- ☞ There is no immediate feedback. For example those sent through post offices.
- ☞ The receiver may not understand parts of the message.
- ☞ Messages may take a long time to reach the recipients.
- ☞ It promotes moral decay through pornographic videos or pictures on the internet.

IMPORTANCE OF COMMUNICATION TO MALAWI

- ❖ It promotes unity and cooperation.
- ❖ It helps in the education sector for teachers and students to find necessary information.
- ❖ It promotes businesses and enhance economic development.
- ❖ It is used in conflict resolution.
- ❖ It promotes entertainment.

PROBLEMS OF COMMUNICATION IN MALAWI

- a) Poor infrastructure leading to problems such as poor internet connections.
- b) Lack of maintenance of telephone and internet lines.
- c) Moral and cultural decay as people would like to put into practice what they see on the internet.
- d) Vandalism communication facilities such as internet and telephone lines.

WAYS OF REDUCING COMMUNICATION PROBLEMS

- a) Civic education on the importance of protecting communication facilities.
- b) Proper use of revenue collected to develop the communication sector fully.
- c) Regular maintenance of communication facilities when they break down.

TOPIC 26: TRANSPORT IN MALAWI

TRANSPORT

- ❖ It is the movement of goods and people from one place to the other.

TYPE OF TRANSPORT IN MALAWI

- 1) Road transport
- 2) Railway transport
- 3) Water transport
- 4) Air transport

a) ROAD TRANSPORT



ADVANTAGES OF ROAD TRANSPORT

- ◆ It is cheap over short distances.
- ◆ They can be constructed almost anywhere.
- ◆ They are convenient over short distances.
- ◆ They form direct links between producers and consumers.

DISADVANTAGES OF ROAD TRANSPORT

- ◆ It is expensive to construct and maintain roads.
- ◆ Cars carry small quantities of goods.
- ◆ They cause noise and air pollution.

b) RAILWAY TRANSPORT



ADVANTAGES OF RAILWAY TRANSPORT

- ◆ Railway transport is faster over long distances, especially in rich countries such as Japan.
- ◆ They carry bulky goods at once.
- ◆ They are cheaper over longer distances for bulky.

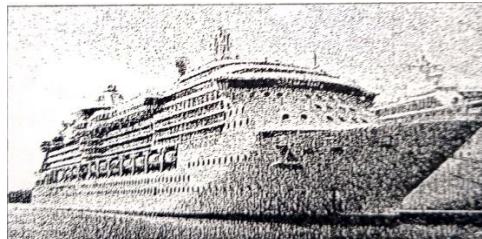
DISADVANTAGES OF RAILWAY TRANSPORT

- ◆ They cause noise pollution.
- ◆ Railways only follow flat areas.
- ◆ They are mainly limited to intercity passengers and freight.
- ◆ It is expensive to construct and maintain railway lines and new signaling.

EXAMPLES OF RAILWAY LINES IN MALAWI

- 1) From Salima via Blantyre, Chiromo, Nsanje to Beira in Mozambique.
- 2) From Zambia via Mchinji and Lilongwe to Salima.
- 3) From Nkaya in Balaka through Liwonde to Nacala in Mozambique.

c) WATER TRANSPORT



ADVANTAGES OF WATER TRANSPORT

- ❖ It is the cheapest means of transport.
- ❖ It offers good comfort.
- ❖ It carries bulky goods at once.
- ❖ There is little congestion.

DISADVANTAGES OF WATER TRANSPORT

- ❖ It is very slow.
- ❖ It is affected by bad weather such as fogs, snow and storms.
- ❖ It is expensive to construct and maintain the ports.
- ❖ Ship piracy leads to loss of lives and property.

Examples of ports (Jetties) in Malawi

- ❖ Chipoka
- ❖ Nkhatabay
- ❖ Chilumba

d) AIR TRANSPORT

ADVANTAGES OF AIR TRANSPORT

- ✓ It is comfortable over long distances.
- ✓ It is the fastest mode of transport.
- ✓ There is no congestion in the air ways.
- ✓ It is relatively cheap over long distances with bulky goods.

DISADVANTAGES OF AIR TRANSPORT

- ✓ It is very expensive.
- ✓ It is affected by weather such as fogs.
- ✓ There is no flexibility of routes.
- ✓ It carries limited goods at once.
- ✓ It causes noise and air pollution.
- ✓ There are heavy losses in property and lives when a plane crushes.

MAIN TRANSPORT ROUTES IN MALAWI

- a) **THE NORTHERN CORRIDOR**
 - ✓ It connects Malawi to Dar-es-Salaam in Tanzania and the Arab world.
 - ✓ It uses water transport via Lake Malawi and later on land by railway and road and again water transport after Dar-es-Salaam.
- b) **THE NACARA CORRIDOR**
 - ✓ It connects Mozambique, Malawi and Zambia by railway line.
 - ✓ It starts from Mchinji in Malawi, via Salima, Chipoka, Nkaya and Nayuchi. It diverts at Nkaya to Mozambique through Cuamba and Nampula.
 - ✓ Another one from Nkaya goes down the lower shire via Utale, Lilangwe, Nansadi Makande, Luchenza, Khonjeni, Sandama, Sankuleni, Bangula and Nsanje to Beira in Mozambique.
- c) **THE MWANZA (NYAMAPANDA) ROUTE**
 - ✓ It connects Malawi, Mozambique, Zimbabwe and South Africa via Mwanza border between Malawi and Mozambique, Nyamapanda in Mozambique, Buluwayo in Zimbabwe and Built Bridge in South Africa.
- d) **THE MCHINJI (CHIPATA) ROUTE**
 - ✓ It connects Malawi and Zambia by road transport.
 - ✓ It passes through Mchinji border and goes to Chipata in Zambia.

FACTORS THAT AFFECT THE DEVELOPMENT OF TRANSPORT ROUTES IN MALAWI

- a) **Relief of an area**
 - ✓ Flat areas promote construction of transport lines such as roads and railway lines while hilly areas discourage it.
- b) **Level of economic development**
 - ✓ Areas of high economic development have a lot of people and goods that increase the demand for railway and road transport.
- c) **Level of industrial development**
 - ✓ Industrialization increases the demand for railway and road transport to transport raw materials from points of production to factories and finished goods from factories to the markets.
- d) **Landlocked nature of a country**
 - ✓ The mode of transport will be determined by the transport system used by countries through which landlocked countries access the sea.
- e) **Government policies**
 - ✓ Good government policies on development of the transport system promotes construction of transport networks. But poor policies on the same discourage it.

THE ROLE OF TRANSPORT IN THE DEVELOPMENT OF MALAWI

- ✉ It promotes trade.
- ✉ It determines the spatial organization in terms of how towns, cities and villages are located.
- ✉ It determines the distribution of social services such as electricity and piped water.
- ✉ It promotes tourism in the country.
- ✉ It creates employment in the country.

PROBLEMS OF TRANSPORT IN MALAWI

- High cost of construction and maintenance of roads, railways and cars and trains.
- Poor relief discourages the construction of transport lines.
- Overloading in public transport.
- Corruption in law enforcement which increases accidents.
- Vandalism of road signs may mislead drivers and cause accidents.

WAYS OF REDUCING (MINIMISING) TRANSPORT PROBLEMS

- a) Civic education on the importance of protecting transport facilities such as road signs.
- b) Proper use of revenue collected to develop the transport sector fully.
- c) Regular maintenance of transport facilities when they break down such as road signs and bridges.

TOPIC 27: TRADE IN MALAWI

TERMINOLOGIES

- a) **TRADE**
 - ❖ It means the buying and selling of goods and services.
 - ❖ Trade that occurs within a country is called ***internal trade***.
 - ❖ Trade that takes place across borders is called ***international trade***.
- b) **IMPORTS**
 - ❖ These are goods and services that are bought from outside the country.
- c) **EXPORTS**
 - ❖ These are goods and services that are sold outside the country.
- d) **BALANCE OF TRADE**
 - ❖ This refers to the difference in value between goods that are imported and goods that are exported.

MAIN EXPORTS OF MALAWI (GOODS THAT MALAWI SELLS TO OTHER COUNTRIES)

- | | |
|-----------|------------------|
| ☞ Tobacco | ☞ Groundnuts |
| ☞ Tea | ☞ Beans and peas |
| ☞ Sugar | ☞ Textiles |
| ☞ Coffee | ☞ Craft |
| ☞ Cotton | |

MAIN IMPORTS OF MALAWI

- | | |
|------------|-------------|
| ☞ Petrol | ☞ Vehicles |
| ☞ Diesel | ☞ Machinery |
| ☞ Bitumen | ☞ Textiles |
| ☞ Paraffin | |

MALAWI'S TRADING PARTNERS

- | | |
|----------------------------------|----------------------------|
| ◆ South Africa | ◆ Japan |
| ◆ United States of America (USA) | ◆ Britain (United Kingdom) |
| ◆ Germany | ◆ Zimbabwe |
| ◆ Netherlands | ◆ Zambia |

IMPORTANCE OF TRADE TO MALAWI

- ☞ It increases foreign exchange earnings.
- ☞ It is a source of government revenue through taxation.
- ☞ Creation of employment in various business sectors.
- ☞ It leads to the growth of industries.
- ☞ It promotes specialization of commodities of certain goods.
- ☞ It promotes increased volume and variety of goods produced in the country.
- ☞ It promotes development of an area.
- ☞ It promotes regional and international cooperation.

BALANCE OF TRADE

- ◆ It refers to the money that remains after deducting what is spent on buying imports from the money found from exports.

TYPES OF BALANCE OF TRADE

- a) Positive balance of trade (favourable or surplus balance of trade)

b) Negative balance of trade (unfavourable balance of trade)

POSITIVE BALANCE OF TRADE

- ❖ This occurs when a country realizes more money after selling goods to other countries than it spends through buying commodities from other countries.

NEGATIVE BALANCE OF TRADE

- ❖ This occurs when a country receives less money after sales of goods to other countries than it spends on imported goods.

FACTORS THAT AFFECT THE BLANCE OF TRADE

1) The level of productivity in a country

- ◆ This improves the quality and quantity of commodities exported and contributes to positive balance of trade.

2) The degree of industrial productivity

- ◆ The higher the degree of industrial productivity the higher the amount of goods exported, and the lower the degree of industrial productivity the lower the amount of goods that are exported.

3) The level of economic development of a particular region

- ◆ The higher the level of economic development, the higher the amount of goods exported, and the lower the level of economic development the lower the amount of goods that are exported.

4) Political instability

- ◆ On the one hand, conflicts in a country leads to low production, and this leads to few goods that can be exported. On the other hand, peace and stability attracts investors that can increase production and exports of a country.

5) Natural disasters

- ◆ Natural disasters such as floods such as floods can negatively affect farming. This can lead to low agricultural produce, and low exports. Thus can in turn increase imports to support the increasing population.

6) Population growth

- ◆ This can increase imports as the goods produced in a country may not be enough to meet the needs of the population. This results in trade deficits.

7) Poverty

- ◆ If a country is very poor, its citizens cannot afford to buy a lot of goods produced in the local industries. This can makes the local industries to fail to expand. This leads to less exports as compared to imports.

8) Lack of political will

- ◆ If the country is not doing enough to create and expand the local industries, it may not produce enough for exports. That nation will likely import more than it can export.

PROBLEMS OF BALANCE OF TRADE IN MALAWI

- a) Foreign debts
- b) Shortage of foreign currency
- c) Dependence on foreign aid
- d) Unemployment

SOLUTIONS TO THE PROBLEMS OF BALANCE OF TRADE BETWEEN MALAWI AND ITS TRADING PARTNERS

- a) Joining regional trade groupings such as COMESA and SADC to have an access to free market that promotes free flow of goods and services. This can promote trade.
- b) Having good policies in place that can attract investors to create industries that can create jobs.

- c) Use of better methods of farming to improve the quality and quantity of agricultural produce for exports.
- d) Expanding the production of food crops to produce enough food for the country than depending on imports.