

WORK BOOK IN PHYSICAL GEOGRAPHY

THE LITHOSPHERE

Define the term “lithosphere”

This refers to the solid outer most layer of the earth, surrounding the mesosphere

What two differences can be noticed between the continental crust and the oceanic crust?

The differences between continental crust and oceanic crust are as follows:

- i. *The continental crust is **the upper part** which forms continents while as the oceanic crust is the **lower part** which forms oceans.*
- ii. *The continental crust is made up of **Granitic rocks**, these rocks are rich in Silica (Si) and Aluminum (Al) hence the layer is also called **SIAL**. This is in contrast with the oceanic crust which is made up of **Basaltic** rocks. Such rocks are rich in Silica (Si) and Magnesium (Ma) hence the oceanic crust is also called (**SIMA**).*

Describe the characteristics of the following:

(a) Core (b) Mantle (c) crust

The characteristics of the core

- a. *It is mainly made up of Iron (Fe) and Nickel (Ni) hence it is called **NIFE***
- b. *It is the most interior layer of the earth, which is also called **Barysphere***
- c. *It is divided into outer core and inner core*
- d. *It experiences the highest temperature of about 1972°C and subjected to high pressure*
- e. *It is the source of gravitational force*

The characteristics of the mantle are as follows:

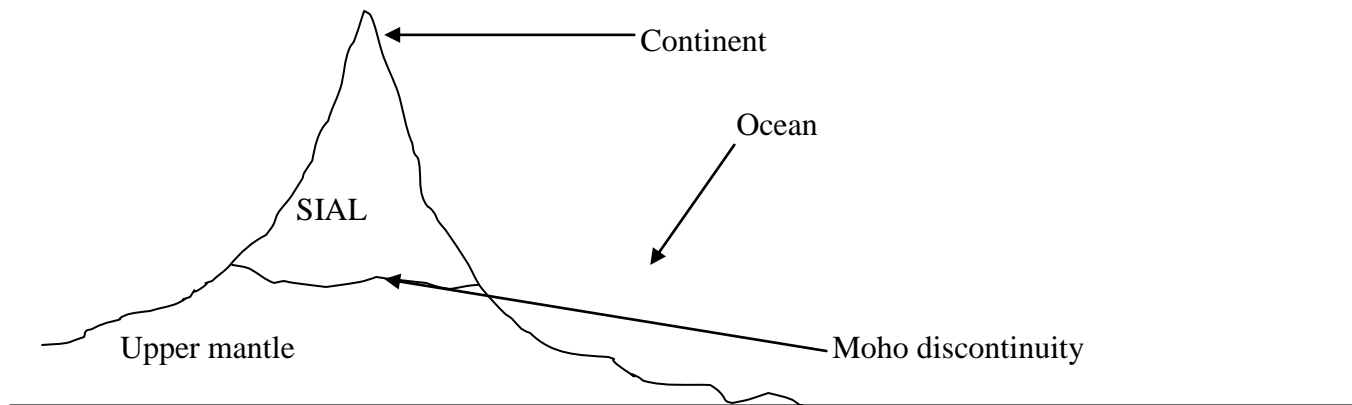
- a. *It is part of the earth which is found between the core and the crust*
- b. *It is one of the largest layers about 2900 Km thick*
- c. *There are a lot of convection currents in terms of the movement of materials. Such movements are responsible for plate motion.*
- d. *It is made up of dense rocks which are rich in Olivine and silicate minerals*
- e. *It is Mainly made up of magma which is capable of flowing especially in the upper part*

The characteristics of the lithosphere or the crust are as follows:-

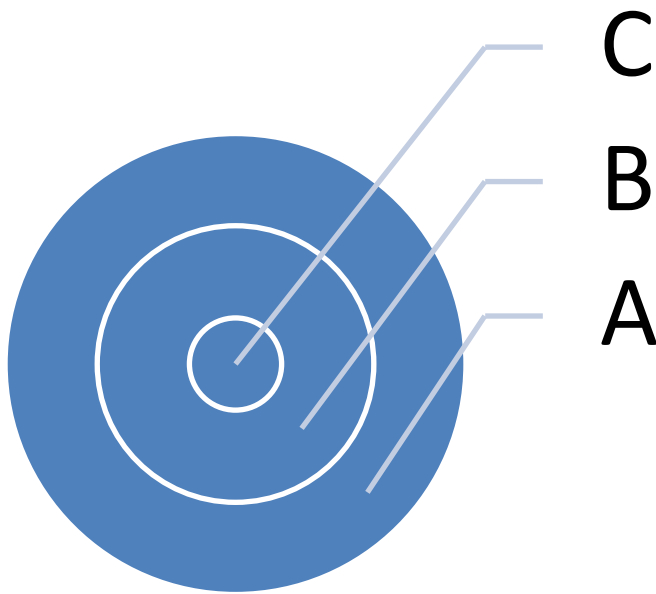
- a. It is made up of two parts namely, the continental or upper crust and the oceanic or lower crust
- b. It is the solid outermost layer which surrounds the mantle of the earth
- c. It is separated from the mantle by a boundary called Moho discontinuity
- d. It is the thinnest layer ranging from 5 Km to 48 Km in thickness
- e. It consists of thin, loose layer known as soil.

With the help of a diagram, explain the term “isostasy”

This is the process whereby continental crust appears as if it is floating on the oceanic crust. This happens because the granitic rocks which are rich in Silica and alumina that make up the continental crust are less dense with an average density of 2.7g/cm^3 . The basaltic rocks that are rich in silica and Magnesium which make up the oceanic crust are heavier with an average density of 3.0 g/cm^3 . Since the continental crust or SIAL is lighter than the oceanic crust (SIMA), the continents can be said to be “floating” on a sea of denser SIMA. The diagram below shows this.



Study the figure below and answer the questions that follow



Name the Zones marked A,B, and C

A= Lithosphere or crust

B= Mesosphere or mantle

C= Barysphere or crust

Why does B float on C?

This is because part C is very dense and metallic since it has a large density than B, it is able to support part B making as if is floating on C.

State the names given to the boundaries between A and B; B and C

A and B = *Moho discontinuity*

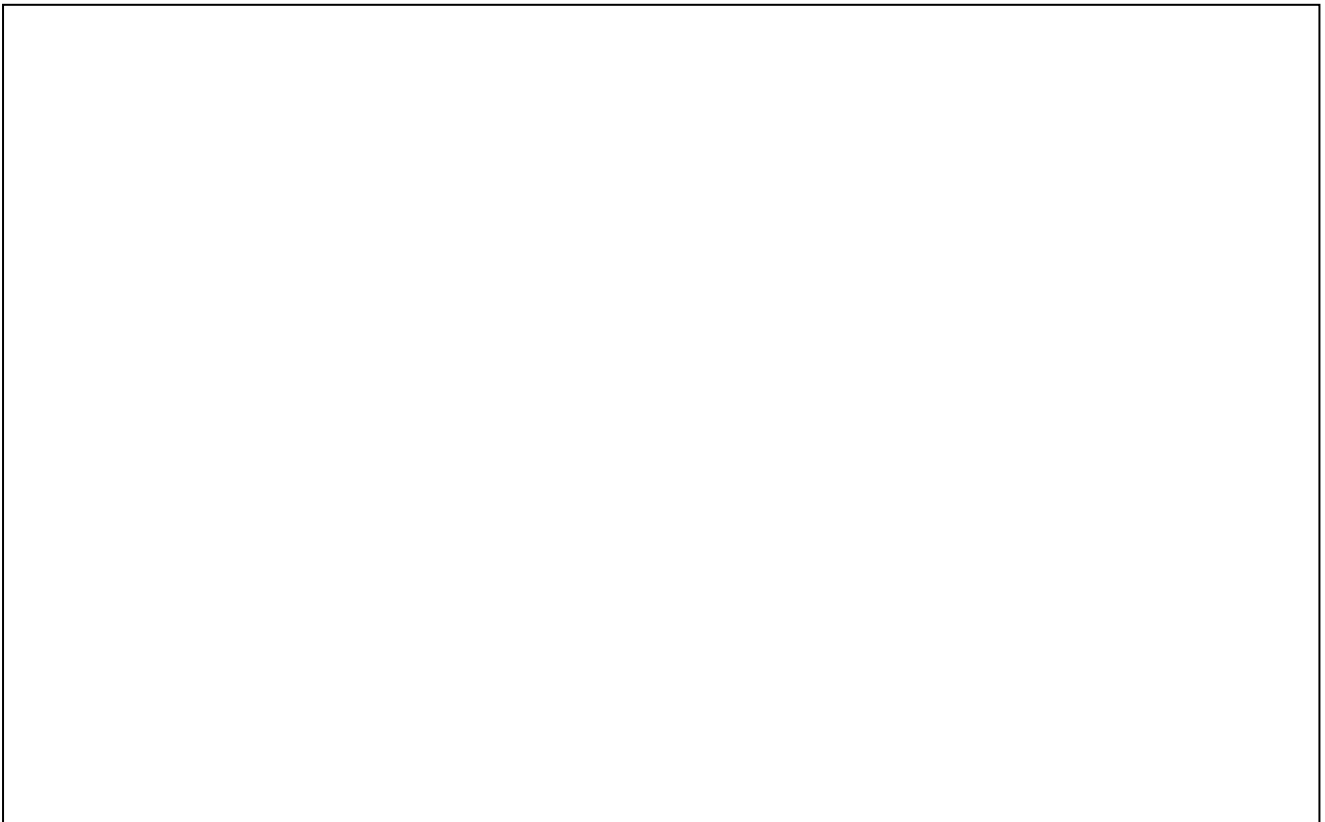
B and C = *Gutenberg discontinuity*

Explain two characteristics of part labeled B

- i. *It is very warm and voluminous covering about 82.5% of the earth's volume*
- ii. *It is kept in plastic state by heat and pressure*
- iii. *Movements of materials are conventional*

Draw and label the internal structure of the earth (5) (1993) (2001) (2005)

The internal structure of the earth is made up of three main parts namely the crust which is also called Lithosphere, the mantle which is also called the mesosphere and the core which is also called the barysphere. The crust is the outermost and the thinnest layer, the mantle is the middle and the largest layer, the core is the innermost layer. Between the layers are boundaries. The diagram below shows the internal structure of the earth.



Which part of the internal structure of the earth contains continents? (2001) (1 mark)

The upper part, also called continental crust

How important is the mantle in relation to the crust (2001) (1 mark)

- i. As the mantle is denser than the crust, it supports the crust*

- ii. *It provides magma which when flows to the crust results into the formation of many features such as volcanic mountains.*

Mention the two minerals that are found in the inner most layer of the internal structure of the earth (2005)

- i. *Iron (Fe)*
- ii. *Nickel (Ni)*

Explain why most parts of the internal part of the earth is in a liquid state (2005) (2 marks)

This is due to high temperatures and high pressure. The combination of the two melt the rocks, turning them to molten materials called magma, which is a semi- liquid state

The core is made up of two main parts, the inner core and the outer core. Why is it that the outer core is in a liquid state while the inner core in a solid state? (3 marks)

The inner core is made up of materials with a very high melting point. Thus, even the temperature is very high in the inner core; the materials are still in a solid state because such materials require even a higher temperature for them to melt. This makes materials in the inner core still to be in a solid state. In contrast, materials that are found in the outer core require a lower melting point. This makes the temperature experienced to be enough to melt the rocks which then appear in a semi molten or liquid state.

CONTINENTAL DRIFT THEORY

Describe Wagner continental drift theory

This is the theory which explains about the movement of continents. The theory explains that at one point in time, the earth was made up of a single supper continent called Pangea. This Pangea was surrounded by a big ocean called Panthalasa. The theory goes on to say that, suddenly the Pangea split into the northern land mass called Lauresia and the southern landmass called Gondwanaland. Furthermore, these landmasses drifted gradually changing their positions. The last stages involved north America joining to South America, India moving away from Australia and joining to Asia while Australia remained as island. The person who put forward this theory was a German scientist called Alfred Wegner.

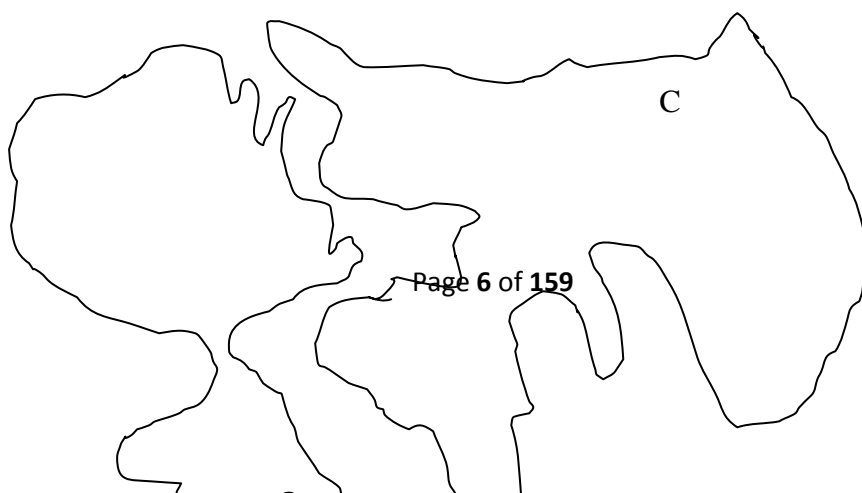
What evidence could you look for to prove that continents have drifted across the earth?(2006)

- i. *The southern continents fit in a jig-saw puzzle, that is, they can be easily fit if brought together. For example, the continent of Africa and South America. This shows that the continents were at first joined together*
- ii. *Magnetism of ancient rocks (paleomagnetism) indicates that the continents were once a single continent. Rocks are magnetized in the direction of the magnetic north when solidifying. All ancient rocks on all continents show similar magnetism pattern.*
- iii. *There is almost identical geological sequence of rock layers in south Africa, Deccan plateau (India), plateau of south America and Antarctica*
- iv. *West African rocks and those of Brazil are similar in age structure*
- v. *Fossilized trees in Antarctica show that the land mass might have experienced climatic conditions different from those of today. The present day Antarctica is frozen and covered with ice.*
- vi. *Folded mountain ranges of Argentina are similar in structure and age to the folded cape ranges of South Africa.*

Why do you think it would be difficult for many people to believe wegners theory of continental drift, explain three points?

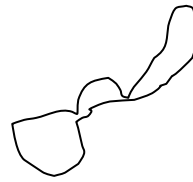
- i. *The theory does not explain what happened so that the Pangea should break apart. It does not really explain what caused the drifting process*
- ii. *The position of the magnetic poles seems to have wondered all over the earth. A path of a apparent polar wondering measured in North America was different from that in Europe*
- iii. *Fossils of plants might have been spread throughout the drifted continents by wind or ocean currents and not by the drifting process*
- iv. *Similar shapes in the coastlines are as a result of water erosion that shapes them the way they are, and not that at first were joined together*
- v. *The separation of the continents has been strongly opposed on physical grounds.*

The figure below shows continents trying to move to various positions



B

A



What name is given to the process that has moved them to that present positions today

It is called continental drift

What feature is formed between continents A and B as they split apart?

It is a mid-Atlantic Ocean ridge

PLATE TECTONIC THEORY

Define the term crustal plates

These are rigid slab-like structures that make up the lithosphere

With examples give two main types of plates

- i. *Continental plates, examples include North American plate, African plate, South American plate, Eurasian plate*
- ii. *Oceanic plates. Examples include the Pacific plate; the Arctic plate*

Explain two differences between these two main types of plates

- i. *Oceanic plates form the oceanic floor while as continental plates contain continents or landmasses*
- ii. *Oceanic plates are denser because they contain heavier basaltic rocks,. This is in contrast with the continental plates which are lighter because they contain granitic rocks which are lighter.*

Study the figure below which show the plates of the earth's crust and answer the questions that follow:



1. Name the plates A-I

A= Eurasian plate

F= African plate

B= Caribbean plate

G= North American plate

C= Nazca plate

H= south American plate

D= Phillipine plate

I= Pacific plate

E= Australian plate

2. Name the ridges marked K,L and M

K= Mid Atlantic ocean ridge

L= Mid Indian ocean ridge

M= Mid pacific ocean ridge

3. Mention two geological processes that usually take place at ridge marked K

- i. Sea floor spreading as the materials upwell from the mantle*
- ii. Oceanic volcanic eruption as magma comes out as a result of the divergent boundary*
- iii. Earthquakes which are triggered by the materials when they upwell from the ground*

4. What drives the movement of plates across the surface?

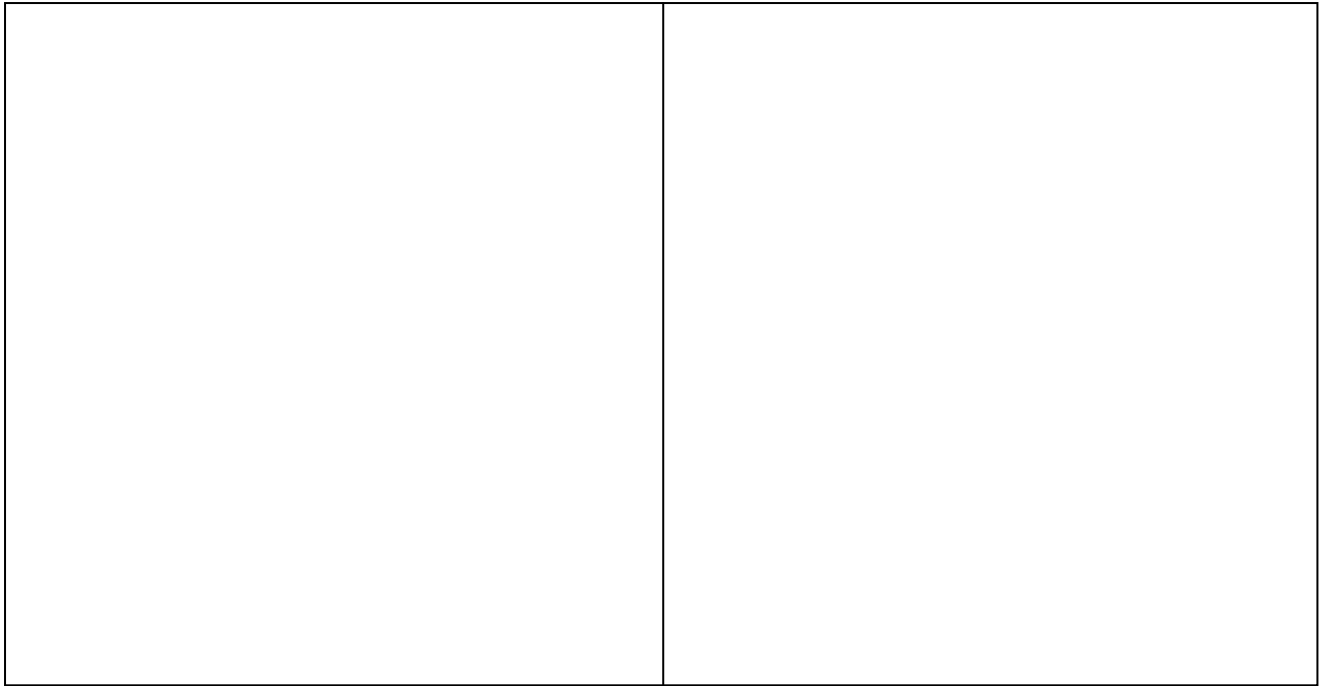
Convectional currents that operate within the upper part of the mantle cause plate motion. These convection currents operate laterally and cause the plates to break apart, diverge or collide. The diagram below shows this cause of plate motion.



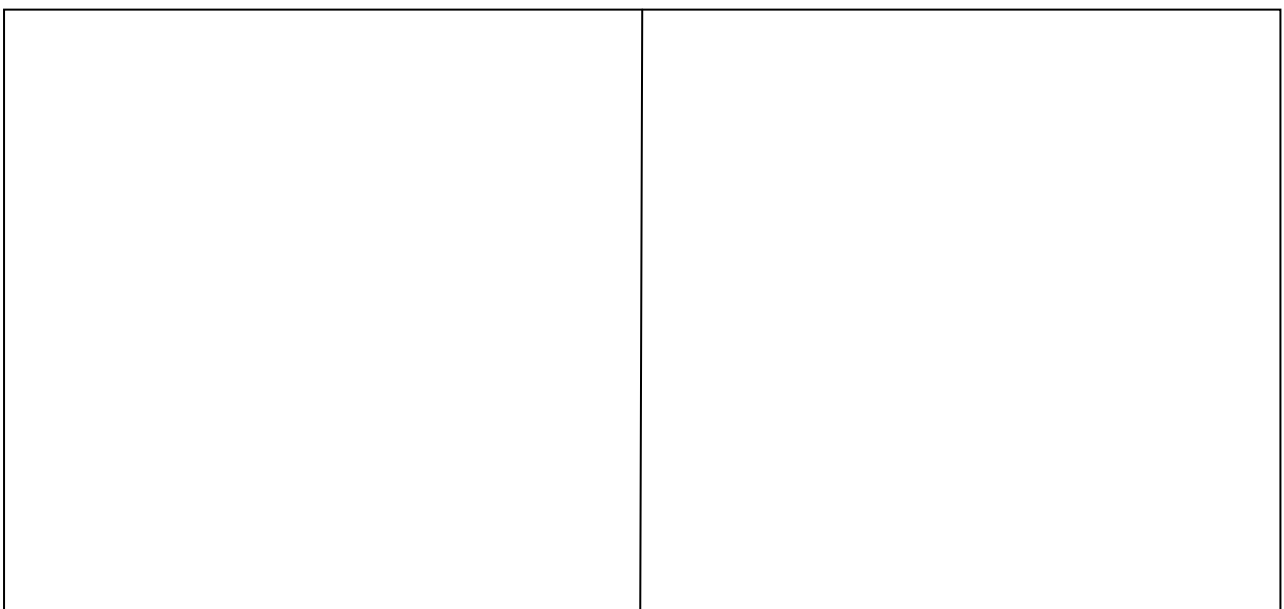
How do crustal plates contribute to the formation of the following features:

- a) **Oceanic or submarine ridges**
- b) **Fold mountains**
- c) **Volcanoes**
- d) **Trenches**

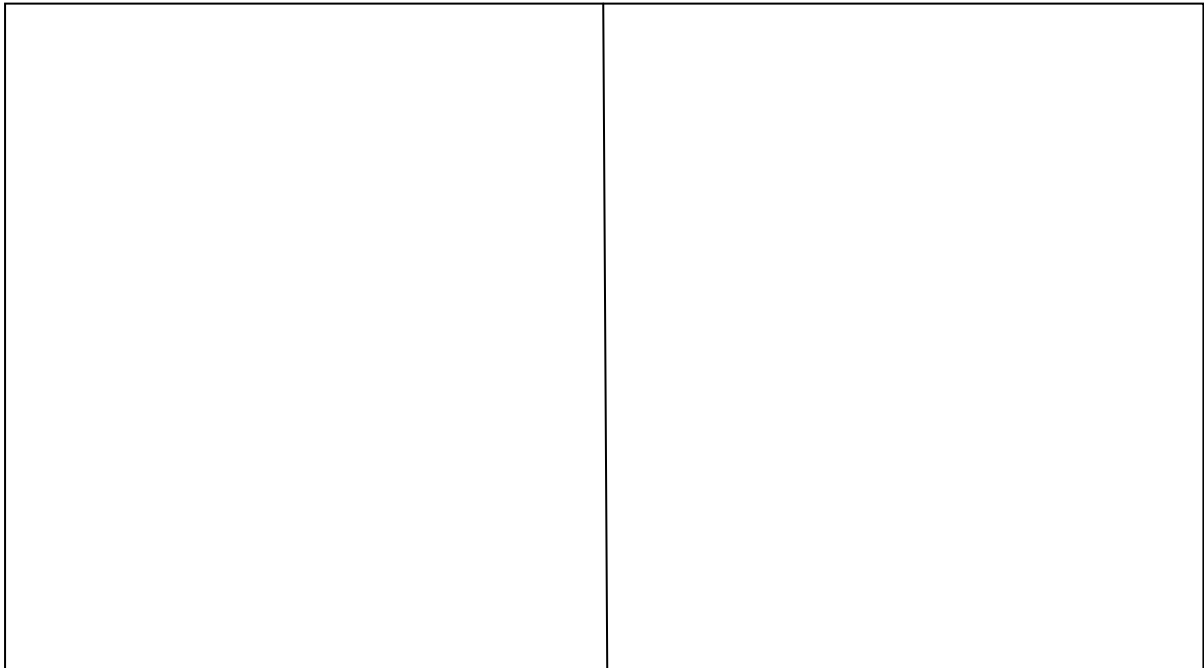
A. Tectonic activities lead to the formation of many features. One of such feature is the formation of the **oceanic ridges**. These are ridges which are formed under the water or oceans. They are formed when plates move away from each other in a so called divergent boundary. In this boundary, the crust between the plates breaks forcing the magma out to the surface of the seafloor. The magma then spreads out in a new crust in a ridge form. Examples of such ridges are the mid Atlantic, mid Indian and mid Pacific Ocean ridges which do not rise above the level of the oceans. The diagram below shows how the mid marine ridges are formed:



B. Oceanic Island is another feature formed through tectonic activity. Oceanic islands rise above the level of the water. They can either form through compressional forces or tensional forces. When formed through compressional, the crust becomes folded up as the plates move towards each other. The fold rises above the level of the water and form an island. The diagram below shows this:



level of the water. Magma then produces above the surface of the water and finally cools and solidifies to form a volcanic island. The diagram below shows this:



C. Tectonic activities contribute to the formation of volcanoes. Rocks under the earth's crust are subjected to high temperatures and pressure. The combination of these two make rocks to melt and turn semi molten materials called magma. When plates move away from each other in a divergent boundary a vent is left. This makes magma to flow through on to the earth surface, building come shaped mounds called volcanoes.

Volcanoes also form in convergent boundaries. When plates collide, one dives under the other. The plate that dives is subjected to very high temperatures and melts to become magma. This magma then rises through the cracks produced in collision and form volcanoes. Furthermore, the plate that dives, disturbs the magma which is already there. This makes the magma to be squeezed and to rise through the cracks thereby forming volcanoes.

D. Another important result of tectonic activity is the formation of oceanic trenches. Oceanic trenches are the deepest parts of an ocean. These are mainly formed in the convergent boundaries where plates move towards each other. When this happens one plate is forced to dive under the other. For example, if it is continental and oceanic, the oceanic plate dives under the continental as it is denser. This happens in the subduction zone where by the margins of the oceanic

plates are bent down into the mantle as the continental plate “rides up” over them. This causes an ocean deep which is called a trench. Examples of trenches include Peru, Java, Marianas, and Tonga. The diagram below shows trench and volcano being formed in the convergent boundary.



E. Tectonic activity also results into the formation of earthquakes. These are vibrations produced in the earth’s crust. These usually occur in plate boundaries such as convergent, divergent and transform or tear. The force created during plate motion makes the land to shake.

What is meant by each of the following terms :

- a) Subduction**
- b) Constructive plate boundary**
- c) Destructive plate boundary**

Subduction: *This is an area in the convergent boundary where one plate dives under the other. This usually happens when the collision is between oceanic plate and continental plate. Being denser, the oceanic plate dives under the continental plate.*

Constructive plate boundary: *this is a diverging plate boundary whereby plates separate or move away from each other. It is known as constructive because when plates separate, new crust is formed through the upwelling of materials from the mantle.*

Destructive plate boundary: *the boundary whereby plates move towards each other and collide. It is also called convergent boundary. It is referred to as destructive because when plates collide, part of the crust is destroyed especially when one plate dives under the other.*

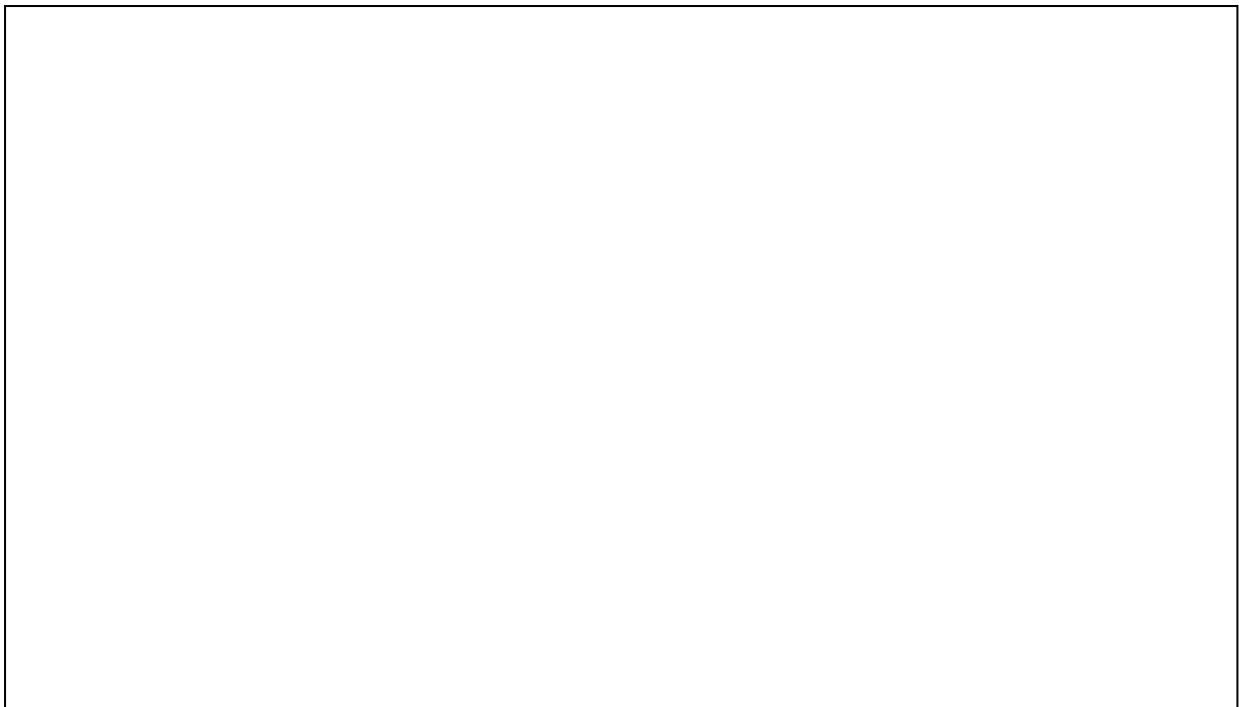
Explain why British earthquakes are very rare and of low intensity, while Japanese earthquakes are common and are often very destructive?

Earthquakes are mainly associated with plate margins. British earthquakes are rare and of low intensity because Britain is far from the plate margins. In contrast, Japan lies within the convergent boundary where a lot of force is generated. This makes Japanese earthquakes to be common and very destructive.

Explain the reason why the Andes mountain suffer from explosive volcanic activity and powerful, deep focus earthquakes

This is because the Andes lie in the convergent boundary between the Nazca plate and the South American plate. This makes the area to experience a lot of earthquakes and volcanoes which are as a result of the convergent boundary

Study the map below which shows the ages volcanoes in million years in the Atlantic ocean and answer the questions that follow



What happens to the age of volcanoes as you move away from the mid Atlantic ridge?

The volcanoes tend to increase in the age as someone moves away from the mid-Atlantic Ocean ridge.

Explain why this pattern develop

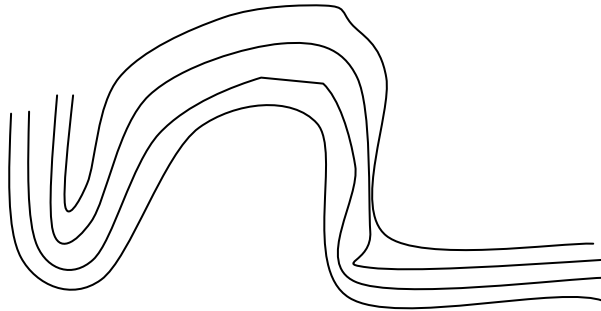
This shows that very close to the ridge, volcanoes take place frequently as a result of the separation of plates than far from the mid oceanic ridge.

MOUNTAIN BUILDING PROCESSES

What is a fold?

This is a bend in the crust caused by expression forces exerted by the earth movements.

Below is a diagram of a fold. What name is given to parts labeled A, B and C



The following are the names:

A= Anticline

B= Limb

C= Syncline

With the aid of a diagrams describe the following types of folds:

- a) An asymmetrical fold**
 - b) An over fold**
 - c) An over thrust fold**
- a.** *An asymmetrical fold is a type of a fold whereby one limb is steeper than the other⁴. This happens when compression forces on one side are greater than the other side. The diagram below shows this:*

- b. *An over fold is a type of a fold whereby one limb is pushed over the other. This is caused by the application of more compression force on asymmetrical fold, with more force from one side than the other.*

- c. *An over thrust fold, also called thrust fold is a type of a fold in which there is a line of fracture. In addition, the limb of the fold is thrust forward over the other limb and there is the displacement or rock layer.*

Explain the following terms:

- i. **Orogenesis**
 - ii. **Epeirogenic**
 - iii. **Orogenic**
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- i. **Orogenesis** *is the term used to describe all the processes involved in the building of mountains.*
 - ii. **Epeirogenic** *is the vertical movement of the earth's crust*

- iii. **Orogenic:** *movements done in the earth's crust. It involves the horizontal or lateral movements in the earth's crust.*

What are the effects of the following movements in the earth's crust:-

a. Epeirogenic movements

These are vertical movements of the earth's crust. These mainly cause rift valleys and block mountains. The land sinks downwards.

b. Orogenic movements

These are horizontal or lateral movements. These are responsible for mountain buildings such as Fold Mountains, volcanoes.

With the aid of a labeled diagram describe how mountains are formed

Fold mountains consist of masses of folded sedimentary rocks with a thickness of over 12 Km. these mountains are formed in convergent plate boundaries. In these boundaries, plates move towards each other, collide, a temporally sea known as a geosynclines is formed. Erosion takes place on the sides of the continents and deposition takes place in a geosynclines. Due to the movement of plates, the area between the plates becomes folded up. This is also as a result of the formation of sedimentary rocks which then bend upwards. In the formation of such mountains, earthquakes and volcanoes also form. Examples of mountains formed in this way are the Rockies in North America. These were formed when the Pacific plate collide with the Indo-Australian plate; the Atlas in North Africa, formed when the Africa plate collided with the Eurasian plate, the Andes in South America, formed when the Nazca Collide with the South American plate.

The diagrams below show how in general Fold Mountains are formed.

	<p><i>In this stage the continental blocks move towards each other through compression force. Plates collide and produce a temporally sea called a geosynclines. Deposition takes place.</i></p>
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	<i>As the continental blocks approach each other, the sedimentary rocks are folded and pushed up.</i>
	<i>The folded, uplifted sedimentary rocks now form lofty mountains, and volcanic activity often violent, takes place.</i>

NOTE: questions such as describe how the Himalayas, Rockies, Atlas, Andes, Alps were formed. Such questions require similar information about the formation of Fold Mountains with similar diagrams. The only difference is that the exact plates are supposed to be mentioned in the explanation. For example, when explaining about how the Rockies were formed, plates like Pacific and North America have to be mentioned.

State three characteristics of young fold mountains

- i. *They are associated with volcanoes and volcanic intrusions like Batholiths. This is because the collision of plates makes magma to rise and form volcanoes or solidify with the crust forming intrusive features.*
- ii. *They are long and high as they were formed through orogenic movements of plates.*
- iii. *They contain rich minerals such as gold, tin, copper and petroleum.*
- iv. *They are generally found on the western continental margins. This is because such western margins are the ones which experience convergent boundaries which contribute to the formation of Fold Mountains.*

State three influences of young fold mountains

- i. *They often act as climatic barriers. Regions on one side of the mountain have entirely different climate from that of the other side. For instance, to the west of Rockies, in the coastland of British Columbia have mild winters, warm summers and rain throughout the year while to the east of Rockies, the Prairies have cold winters, hot summers and there is maximum rain in summer. This is because of the Rockies which act as a barrier.*
- ii. *They often receive heavy rains and or snow which may give rise to important rivers. Such rivers may be used for irrigation and production of electricity.*

Examples of such rivers include Ganges in India for irrigation and Mississippi in North America for electricity.

- iii. Some contain minerals such as Copper, Gold, Tin in Bolivia. Such minerals are mined and put into productive use.*
- iv. Are heavy forested and thus, they are sources of valuable timber resources. For example, western Rockies which has coniferous soft woods and foothills of Himalayas which have teak.*
- v. They act as barriers to transport and communication as it is difficult and expensive to construct roads, railway lines, telephone links through them*

NOTE: the above factors can also stand for the question which says “explain the effects of the mountain building processes”

With the aid of well labeled diagrams, explain how Block mountains were formed

Block mountains were formed through both tensional and compression forces. A piece of land is subjected to many faults or cracks. These are produced as a result of the land being pulled apart. When this happens, two blocks on the sides goes downwards leaving the middle block to remain behind. The middle block that stands up forms a block mountain or horst. Below is a diagram

	<p><i>In this diagram, tensional forces pull the land apart. Cracks develop on this piece of land</i></p>
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	<p><i>The blocks subside leaving one block to remain and form a Block Mountain</i></p>
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Block Mountains are also produced through compression forces. In this, the land becomes folded and cracks are produced. The blocks outside the cracks are pushed up and rise in a reverse or thrust fault. The two blocks from Block Mountains later on the raised blocks may be worn down through erosion. The diagram below shows this:

	<p><i>Compression forces acting on a piece of land and cracks develop.</i></p>
	<p><i>In this diagram, the blocks outside the faults rise to form the Block mountains. It should be noted that the gap formed creates a rift valley. The sides of the blocks are then subjected to erosion.</i></p>

NOTE: this diagram also explains the formation of rift valleys by compression forces.

Give four examples of Block Mountains in the world.

- *Vosges in Europe*
- *Hunsruck in Europe*
- *Black forest mountain in Europe*
- *Ruwenzori mountain (mountain of the moon) in East Africa*

What are the two characteristics of Block Mountains

- i. *The faulted side is very steep*
- ii. *Usually long especially when formed along the rift valley*
- iii. *The side facing away from the faulted side is generally less steep.*

What do you understand by the term fault

This is the breaking of the earth's crust as a result of tensional and compression forces

What is a fault

This is a break in the rocks produced by either tensional or compression force

Draw and label two types of faults

A fault is a break in the rocks of the crust. Faults are caused by either tensional or compression forces. There are three main types of faults namely normal or dip-slip fault, reverse or thrust fault and shear or trans-current fault.

	<i>This is a normal fault. It is caused by tensional forces. One block is pushed downwards and is called a down throw</i>
	<i>This is caused by compression force. Rocks layers from one side is pushed upwards.</i>

Why is faulting important: give two reasons

- i. *Faulting permits ore-forming chemical solution to rise along fault planes.*
- ii. *Faulting results into the formation of valleys. These form broad lowlands, providing rich agricultural land, for example between Vosges and Black forest block mountain.*
- iii. *Situated along the faulting are hot springs which are utilized in healing*
- iv. *Results into the formation of Block mountains of which apart from providing rich agricultural soils, offer tourism to the areas, contain valuable timber for furniture and help to bring rainfall to the areas whereby acting as source of river.*

What are the two negative influence of faulting

- i. *Fault scraps may form topographic barriers across which it is difficult to build roads and railways*
- ii. *As the earth's crust is torn apart, faults are associated with volcanoes and earthquakes which kill people and destroy property*

With the aid of a well labeled diagram, explain how the residual mountains were formed.

These are mountains which were formed as a result of denudation processes. In this over the years weaker parts of the earth are removed by agents of water, wind and ice. The more resistant rocks or parts remain behind and stand out as a mountain. The diagram below show how residual mountains were formed.

	<i>In the diagram the original level over 200 million years was at (a).</i>
	<i>Due to the removal of less resistant rocks, the level has been reduced to present level leaving more resistant to stand as a mountain</i>

NOTE: residual mountains are also called Circum- denudation or circum- Erosion Mountains

Give three examples of Residual mountains

- *Monadock in USA*
- *Scottish Highlands*
- *Scandinavian highlands*
- *Mulanje mountain in Malawi*
- *Zomba mountain in Malawi*
- *Vipya plateau in Malawi*

NOTE: sometimes question will come in form of an example. For instance, **describe how Mulanje Mountain was formed.**

Give three denudation processes which reduce the size of Block Mountains (6) (2001)

- i. *Weathering: this is the process whereby the block mountain is exposed to weakening agents. It is being attacked and weakened and broken down due to changes in temperature, roots of trees and rain water.*
- ii. *Erosion: whereby the broken pieces are removed from the original place to another different place*
- iii. *Deposition in which the carried materials or sediments are left in another area by the help of running water, wind and ice*

How is a mountain such as Fujiyama of Japan formed

Fujiyama is an example of a volcanic mountain. These mountains after the materials ejected from fissures inside the earth's surface solidify on the earth's surface. These materials include molten lava, volcanic bombs, cinders, ashes, dust and liquid mud. These materials fall around the vent in successive layers, building up a volcanic cone. Volcanic mountains such as Fujiyama are also called mountains of accumulation. This is because they are formed due to the piling up of materials from the earth's crust on to the earth's surface.

NOTE: when the question requires a diagram that of a volcano should be shown.

Give three other examples of volcanic mountains apart from Fujiyama in Japan

- *Mount Mayon in Phillipines*
- *Mount Merapi in Sumatra*
- *Mount Agung in Bali*
- *Mount Hood in USA*
- *Mount Kilimanjaro in Tanzania*
- *Mount Kenya in Kenya*

Give three characteristics of volcanic mountains such as Fuji in Japan

- i. *They are frequently of great height*
- ii. *They are symmetrical in shape*
- iii. *They are steep sided*
- iv. *They tend to occur in isolated peaks*

What are the two differences between Kilimanjaro and Ruwenzori mountains

- i. *Mount Kilimanjaro is a volcanic mountain formed through the accumulation of material such as molten lava, volcanic bombs, cinder and ashes on to the earth's surface from the ground. This is not the same with mount Ruwenzori which is a block mountain formed through the elevation of part of the earth's surface.*
- ii. *Kilimanjaro is of great height while as Ruwenzori is generally long*

What do you understand by the term diastrophism

This is the process which involves the folding and faulting of the lithosphere rocks

TYPE OF MOUNTAIN	PROCESSES INVOLVED	EXAMPLES
Fold mountains	A	Himalaya
B	denudation	C

Block mountains	D	Ruwenzori
E	volcanicity	Kilimanjaro

- A. Folding process*
- B. Residual mountain*
- C. Mulanje mountain*

- D. Tensional/compression*
- E. Volcanic*

NOTE: the information above provides four types of mountains, the processes involved and examples

VOLCANISM/ VOLCANICITY

What do you understand by the term volcanism

This refers to all various ways by which molten rock and gases are forced into the earth's crust and out on to its surface

What is the difference between magma and lava

Magma is the molten or semi-fluid materials formed through the melting of rocks through high temperature and pressure while lava is when magma reaches the surface, solidifies and loses its gases.

What are three characteristics of acid lavas

- i. They are highly viscous with a high melting point*
- ii. They are light colored*
- iii. They have a high percentage of silica*
- iv. They flow slowly and seldom travel far before solidifying*
- v. They have steep sided cones*

What the three characteristics of basic lavas

- i. Are very hot about 1000⁰C*
- ii. They are highly fluid with a speed of 16-48Km/hr*
- iii. They are dark colored like basalt*
- iv. They flow quickly are very explosive*

What are the effects of basic lavas

- i. They affect extensive areas, spreading out as thin sheets over great distances before they solidify*
- ii. The resultant volcano is gently sloping with a wide diameter and forms flattened shield or dome*

What are the effects of acid lavas

- i. It results in land explosion, throwing out many volcanic bombs or pyroclasts. This is because the accumulation of lava in the vent obstructs the flow of the out pouring lava.*

- ii. *This is why these lavas are very violent. The lavas are so vicious that they can form a spine or plug*
- iii. *They form a cone which is steep sided.*

Give two conditions that contributes to the formation of intrusive volcanic features

- i. *The strength of the rocks above the magma. When such rocks are hard prevent magma form rising to the top.*
- ii. *The pressure of magma if its very low, it cannot reach the top surface. This makes it to cool and solidify within the crust.*

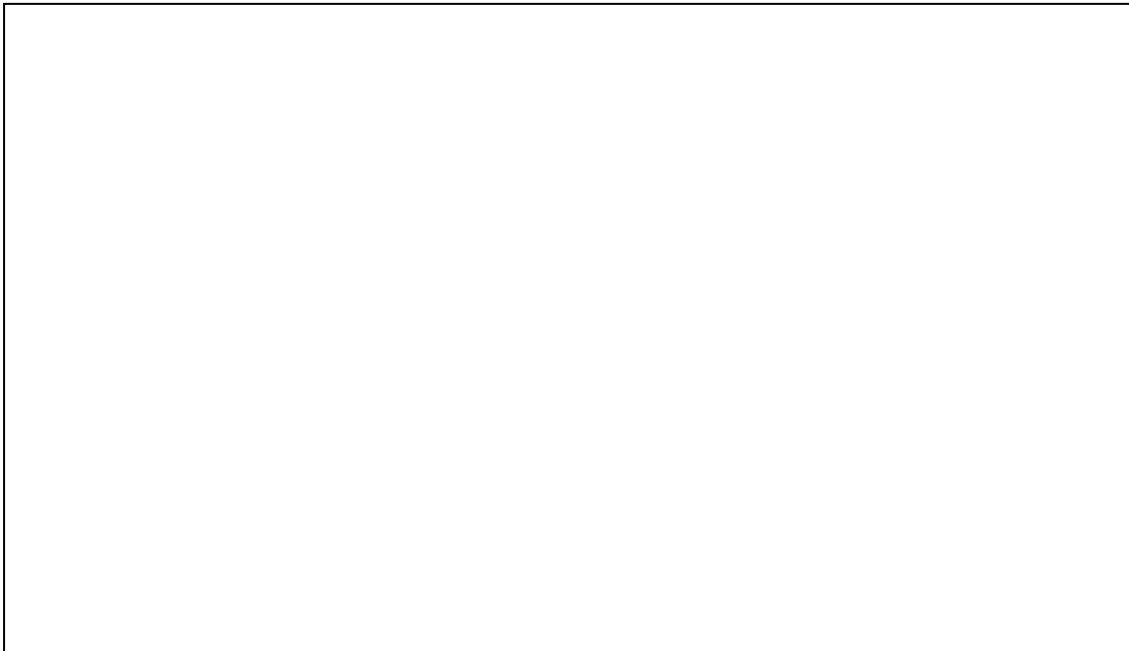
With the aid of a well labeled diagram, describe the features formed by volcanic activity when magma fails to reach the surface.

*When magma fails to reach the surface it forms intrusive feature. Examples include **batholiths** which is a very large mass of magma which accumulates in the crust forming the root or core of a mountain. Batholiths are made up of granite and are only exposed by the agents of denudation.*

*The other intrusive feature is **laccoliths**. This is a mass of magma which flat based and dome shaped top fed by a pipe from a batholiths.*

*The **dyke** is another intrusive feature. This is a mass of magma that cuts across the bedding planes. When they resist erosion, they stand up as a wall. Sometimes they give rise to waterfalls.*

*A **sill** is another important intrusive feature. This is a feature formed when a sheet of magma lies along a bedding plane. The diagram below shows intrusive features formed by volcanism.*



2. laccoliths
3. Sill
4. Dyke

NOTE: A= lava flow is an extrusive feature

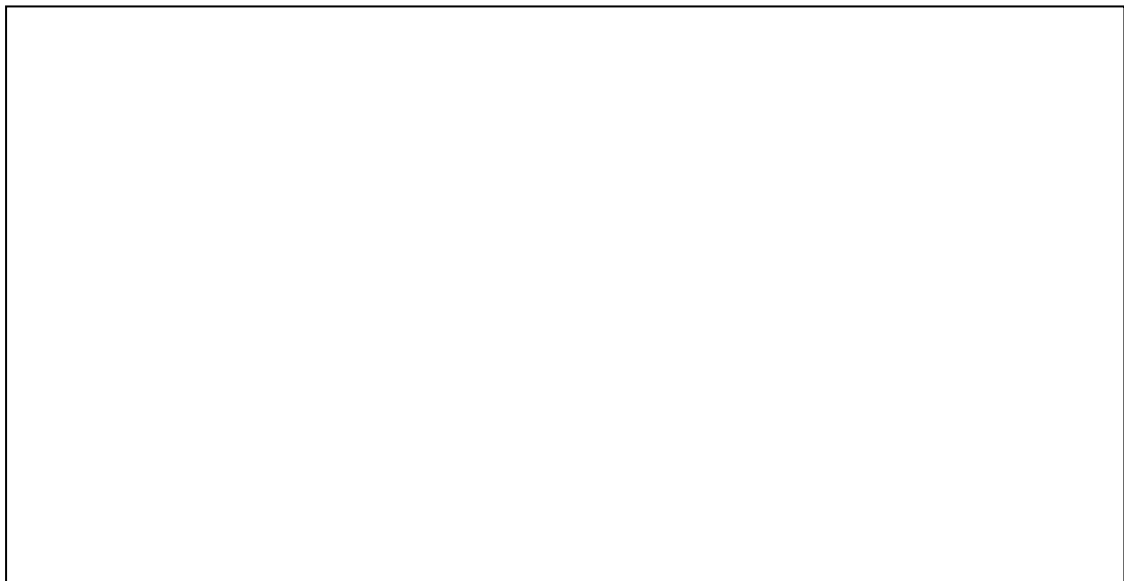
B= a volcano which is an extrusive feature

Explain the meaning of active, dormant and extinct volcanoes

- *Active volcano is that volcano that erupts frequently or at least when they have erupted within recent times*
- *Dormant volcano is a sleeping volcano that has been known to erupt and show signs of possible eruption in future*
- *Extinct volcanoes are those that have not erupted at all in historic times but retain the features of volcanoes.*

Draw a large annotated diagram to show the structure of a typical volcano.

A volcano is a large cone shaped formed on the earth's crust due to the accumulation of materials from the ground. The following are the most important parts of the volcano. A crater, a vent, pipe, dyke and layers of lava, ash or cinders. The diagram below shows a volcano and its parts.



Explain how the volcano you have drawn is formed

It is formed when materials such as magma, volcanic bomb, cinders, ashes and liquid mud collect in the magma chambers under the ground. Magma in this chamber becomes under pressure and finds a way out through the cracks produced in the earth's crust. Materials then escape through the vent on to the earth's surface, building up a cone shaped mound which is called a volcano.

How do an earth quake play part in the volcanic eruption

Earthquakes make the ground to shake. Such vibrations apart from just disturbing the magma under the ground, they also make the earth to develop faults or cracks. Such cracks act as passages through which magma moves on to the earth's surface and form cone shaped mounds called volcanoes.

List the different substances that are emitted during the eruption

- *Volcanic bomb*
- *Cinders*
- *Ashes*
- *Dust*
- *Molten lava*
- *Gases*

Give any two examples of volcanic features in Malawi

- i. *Hot springs at Mphizi- Chiweta in Rumphi district. These show that rocks are heated by the interior forces like magma which in turn heat up water that moves out in form of a river*
- ii. *Mulanje Mountain has a trace of igneous intrusions especially around the area where bauxite has been prospected. Igneous are rocks formed through volcanicity.*

Name one major region which has active volcanoes.

The circum- pacific ring of fire, an area encircling the Pacific ocean with a lot of volcanoes and earthquakes.

Explain three constructive effects of volcanoes

- i. *Some lava outpourings have weathered to give rise to fertile soils which are of agricultural value. For example, the western part of the Deccan plateaus in India, the plains around Etna.*
- ii. *Volcanic activity sometimes results in the formation of precious stones and materials. For example, Diamonds of Kimberly, Copper deposits of Sudbury in Canada.*
- iii. *Source geo –thermal power. Some hot springs are utilized for heating and supply of hot water to buildings in New Zealand and Iceland.*
- iv. *It also enhances tourism because volcanoes give rise to scenic features of great beauty*

Explain two destructive effects of volcanism

- i. *Some eruptions cause loss of life. For example that of Krakatau, Mount Pelee where over 20,000 people were killed*

- ii. *Some eruption cause great damage to property burying them with ashes. Infrastructure such as bridges, roads, cities are buried in ashes and destroyed. For example the Vesuvius which buried Herculaneum and Pompeii cities with ash.*

Why is rescue work generally so difficult following a volcanic eruption

Some volcanic eruption contains basic lava which is highly fluid. This makes the lava to move very fast and cover large areas. In addition, some eruption is accompanied by lots of force which give rise to earthquakes. These further destroy a lot of property especially buildings that fall down.

Suggest two reasons for the frequency of earth quakes and tremors in areas associated with volcanic activity (2002)

- i. *Volcanic eruption break rocks in the earth's crust. The displacement of such rocks after being broken cause the ground to shake hence earthquakes and tremors.*
- ii. *Volcanic eruption is accompanied by a lot of force. This is generated when materials from the ground move out. This force makes the ground to shake thereby producing earthquakes and tremors.*

Explain the precautionary measures you would suggest for people living in areas associated with volcanic activity (2002)

- i. *Following the historical information about the occurrence of volcanoes in the area. When the historical map shows that the volcano is about to happen, people should move out of the area*
- ii. *Measuring the occurrence of earthquakes. Earthquakes can indicate the occurrence of a volcano*
- iii. *Keeping building materials, food stuffs in storage so as for them to be used as soon as a volcano occurs.*
- iv. *Listening to weather forecast. When there is a possibility of a volcano, people to move out of the area*

Describe how Caldera lakes are formed (2005)

These lakes are formed on top of a volcano after a volcanic eruption; the mouth of a volcano called a crater is blown off by the last flowing magma. This creates a large depression an top of a volcano called a Caldera. Water then collects on this part and forms a lake called a Caldera. The diagram below shows this



- 1. Study the figure below of the world map, showing volcanic areas and lava plateau and answer the questions that follow (1193) (2000) (1975)**



- a. Name the lava plateau marked A-J**

- A.** *Columbian and snake river plateau*
- B.** *Parana lava plateau*
- C.** *Patagonian lava plateau*
- D.** *Icelandic lava plateau*

- E.** *Ethiopian highlands*
- F.** *Drakensburg*
- G.** *Siberian plateau*
- H.** *Deccan plateau*
- I.** *Mongolian plateau*
- J.** *Kimberley plateau*

b. Name the volcanic mountains marked 1-6

- | | |
|-----------------------------------|--|
| 1. <i>Mauna Loa</i> | 7. <i>Pelee</i> |
| 2. <i>Cotopaxi</i> | 8. <i>Popocatepetl</i> |
| 3. <i>Vesuvius</i> | 9. <i>Etna</i> |
| 4. <i>Kilimanjaro</i> | 10. <i>Mt. St. Helens</i> |
| 5. <i>Krakatau</i> | 11. <i>Helga fell (Iceland)</i> |
| 6. <i>Fujiyama or Fuji</i> | |

Name the fold mountains marked P, Q, R, S and T

P= Rockies

Q= Andes

R= Alps

S= Atlas

T= Himalayas

Account for the distribution of volcanoes, earthquakes and fold mountains on the map above.

Fold mountains were formed within the earthquake and volcanic zones in the so called the pacific ring of fire as the map shows. This happens because the formation of Fold Mountains, volcanoes and earthquakes are associated with plate boundaries. All these features are found in the same area as they follow plate boundaries. In such plate boundaries there is the movement of the crust which eventually contributes to the formation of Fold Mountains, volcanoes and earthquakes.

The picture below shows geologic activity taking place. Study it and answer the question that follows (1990)

What activity is taking place in the photograph

This is volcanic eruption or volcanicity

Name three areas, one in Africa, Europe and America, experiencing this activity.

Africa= Kilimanjaro in Tanzania

Europe= Vesuvius around the Mediterranean sea

America= Rockies in North America

Describe the formation of the landform shown in the picture (describe how a volcano is formed pages behind)

Explain three benefits and one disadvantages of occurrence of the landform shown in the picture for human life and settlement

(Constructive and destructive effects of volcanism)

EARTHQUAKES

What do the following terms mean

i. Earthquake

This is the sudden earth movements or vibrations in the earth's crust

ii. Focus

This is the point at which an earthquake originates under the ground

iii. Epicenter

It is the point on the earth's surface immediately above the focus. It is a place where the shock waves first hit the surface.

Describe two causes of earth quakes

- i. Volcanic eruptions in which the movement of molten rock below or on the earth's crusts which intern is caused by the movements of tectonic plates*
- ii. Converging movement of tectonic plates which generate a lot of force that cause the ground to shake*
- iii. One tectonic plate sliding over or past another plate along the line of fault.*

Suggest why the “pacific ring of fire” is so called?

This is an area full of volcanoes and earthquakes encircling the Pacific ocean, especially in plate boundaries.

Mention three main areas where the majority of earthquakes occur

- i. The mid oceanic ridges*
- ii. Oceanic deeps and volcanic islands*

iii. *The regions of crustal compression*

Explain briefly for the occurrence of earth quakes in the above named areas

These places are in the plate margins. In such places, the movement of plate occurs. Such movements of plates trigger vibrations which are called earthquakes.

Describe three effects of earthquakes (2005) (6)

- i. *They cause tidal waves called tsunami. These break the coastal areas destroying people and property as they originate from oceans.*
- ii. *They cause landslides which bury people's property an infrastructure such as bridges, roads and railways with sand.*
- iii. *They cause vertical and lateral displacement of parts of the crust.*
- iv. *Cause fires which destroy cities.*

Copy out and complete the following paragraph using the word supplied in the list below:-

Earthquakes occur when two A try to move past each other in different directions. This normally occurs at a B or a C plate boundary. The rocks are put under a grea deal of D and start to E. eventually, when the stress is too great, the rocks suddenly break along a F. energy in the form of G H radiates out in all directions, causing the ground to I.

Bend, shake, seismic waves, slipping, fault line, plate, destructive

- A. *Plate*
- B. *Slipping*
- C. *Destructive*
- D. *Stress*
- E. *Bend*
- F. *Fault line*
- G. *Seismic*
- H. *Waves*
- I. *Shake*

In earth quakes what are the uses of the following:-

- i. **Seismograph**
An instrument which measures the intensity o an earthquake, through recording its vibrations
- ii. **Richter scale**
Used for measuring the total amount of energy released by an earthquake.

What do you understand by the following in connection with earthquakes:-

- i. **Seismic waves**
These are vibrations produced by an earthquake which cause destruction as they radiate outwards from the epicenter
- ii. **Magnitude**
This refers to the total amount of energy released by an earthquake which in turn is measured by using a Richter scale.

What is the difference between primary effects and secondary effects of an earthquake

Primary effects are the immediate damage caused by an earthquake where as secondary effects are often effects of the earthquakes

Give two examples of primary effects of earthquakes

- i. *Collapsing of buildings such as houses*
- ii. *Destruction of roads*
- iii. *Destruction of bridges*

Give two examples of secondary effects of an earthquake

- i. *Causes fire as earthquakes destroy gas pipes and electric cables causing fire to spread. This fire may destroy cities.*
- ii. *Cause tidal waves known as tsunami these usually happen when an earthquake has its focus in seas and oceans. These huge tidal waves destroy houses close to the sea and ships at anchor. For example on 26th December 2004, a tsunami happened across Asian countries of Indonesia, India, and China leaving many people homeless while 300,000 died.*
- iii. *Landslides especially in steep river- valleys and areas of weak sand and clays. In 1970 an earth quake of magnitude 7.8 in Peru caused a huge landslide high in the Andes Mountains which killed 20,000 people.*
- iv. *Diseases and famine. Fresh water supplies are often cut off due to burst water pipes. Typhoid fever and cholera can spread easily, especially in large cities cut off from medical supplies by damaged communications.*

Why are earthquakes likely to be more dangerous in less developed (LDC) countries than developed countries like Japan

- i. *Many less developed countries cannot afford early warning systems or evacuation plans than developed countries*
- ii. *Houses in many developed countries are built up with strong structures than can withstand earthquakes. In less developed countries, the houses are made up of poor structures that are easily destroyed*
- iii. *Relief after an earthquake in less developed countries is a problem. Basic necessities such as food, clothes, medicine become a problem to less developed countries is not a problem.*

What is it that earthquakes cause a lot of destruction in more populated area such as cities

- i. *Houses are close together with power lines that apart from destruction to the buildings, fir can easily spread and difficult to be extinguished*
- ii. *Diseases are spread more quickly in more populated areas.*

ROCKS

Define the term rock

It refers to any naturally formed aggregate of mineral particles whether hard or soft.

Give three important minerals that rocks contain

- i. *Quartz which is sometimes called Silica. this is a compound of Silicon and oxygen and is a very common mineral*
- ii. *Felspars which are compounds of Potassium, sodium, calcium*
- iii. *Micas which are compounds of Potassium, magnesium, silicon and aluminum.*

Explain how the following groups of rocks were formed, and for each group give at least two examples (1996) (1986) (2001)

i. Sedimentary rocks

These are rocks which were formed through the collection of sediments. They are formed through the collection of clastic sediments, non clastic sediments and organic sediments when transported, deposited, compacted and lithified. Examples of sedimentary rocks are conglomerate, Breccias, sandstone, shale, Limestone

ii. Igneous rocks

These are rocks formed through the cooling and solidification of molten material called magma. Those formed after magma solidifies and cools on the earth's surface are called volcanic or extrusive while those formed within the earth's crust are called intrusive.

Examples include granite, diorite, gabbro, basalt, andesine, peridotite, punice and scoria.

iii. Metamorphic rocks

These are rocks which are originally igneous or sedimentary but have changed into character and appearance due to application of intense heat, pressure, water and air.

Examples include: slate, schist, phyllite, gneiss, quartzite and serpentine.

Mention three characteristics of each group of rocks motioned above

i. Characteristics of sedimentary rocks:

- *They occur in layers, that is, they are stratified*
- *They contain fossils, that is, they are fossilized*
- *They are non-crystalline, that is, they do not contain crystals*
- *They are generally soft rocks.*

ii. Characteristics of igneous rocks

- *They are crystalline in nature, that is, they form crystals*
- *They are not stratified thus they do not occur in layers*
- *The rocks are non fossiliferous, that is, they do not contain fossils*

iii. Characteristics of metamorphic rocks

- They do not contain fossils
- They are generally very hard rocks
- Minerals are arranged in bands of layers in a process called foliation

Which group of rocks mentioned above:-

i. Is not stratified, and why

Igneous rocks because these rocks are formed through the cooling and solidification of magma which takes place almost within the same time, making them not to form layers.

ii. Contain fossils, and how

Sedimentary rocks because the fossils are carried together with the sediments during transportation. When such sediments are deposited by the action of wind, water and ice, fossils of plants and animals are deposited together, compacted and lithified together with sediments. This makes remains of plants and animals to appear in the sedimentary rocks.

what difference can be noticed in terms of crystals between Gabbro and Basalt

Gabbro would develop large crystals while basalt would develop small crystals

Give a reason for your answer in (b)

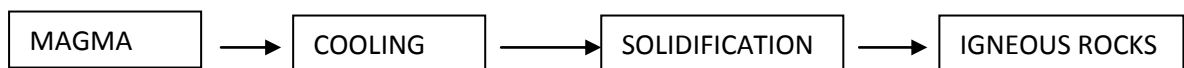
Gabbro cools and solidifies within the earth's crust. This makes cooling to take place very slowly, which result into large crystals to develop as crystals have a lot of time to grow into large ones. Basalt solidifies on the earth's surface where cooling takes place very fast. This fast cooling result into small crystals because the crystals are deprived of enough time to grow into large ones.

What determines the size of the mineral grains of an igneous rock

It is determined by the rate at which cooling takes place. Fast cooling produces small crystals while slow cooling produces large crystals.

with the use of a flow diagram show how igneous rocks were formed

Igneous rocks are those formed through the cooling and solidification of magma. The flow diagram below shows this:-



Explain the role played by the following in the formation of metamorphic rocks

- Heat:** *this causes the minerals to recrystallise*
- Pressure:** *this changes or alters the rock structure*
- Water:** *dissolves some rock minerals and deposits other minerals thereby changing the composition of the rock*

- iv. **Air:** *Move through the pores and come into contact with different rock elements changing its composition*

put each of the following rocks into the appropriate classes

- i. Conglomerate = *sedimentary rock*
- ii. Gneiss = *metamorphic rock*
- iii. Marble = *metamorphic rock*
- iv. Scoria = *extrusive igneous rock*
- v. Shale = *sedimentary rock*
- vi. Gabbro = *intrusive igneous rock*
- vii. Serpentine = *metamorphic rock*
- viii. Siltstone = *sedimentary rock*

what happens to the following rocks when they have been metamorphosed

- a. limestone = *changes to a metamorphic rock called marble*
- b. granite = *changes to a metamorphic rock Gneiss*
- c. Conglomerate = *changes to a metamorphic rock Gneiss*
- d. Shale = *changes to a metamorphic rock called slate or phyllite*
- e. Siltstone = *changes to a metamorphic rock called Schist, or slate or phyllite*
- f. Basalt = *changes to a metamorphic rock called serpentine*
- g. Sandstone = *changes to a metamorphic rock called Quartzite*

Describe how sedimentary rocks are chemically formed, with the help of at least two examples

These are sedimentary rocks formed through the precipitation of minerals, which were dissolved in water. With the help of evaporation of water especially in shallow seas, minerals remain behind, collect, compacts and lithify to form chemically sedimentary rocks

Examples of chemically formed include:

- | | |
|----------|---------------------|
| - Borax | - Nitrate |
| - Potash | - Certain limestone |
| - Gypsum | - Rock salt |

Explain how organically sedimentary rocks were formed with atleast two examples

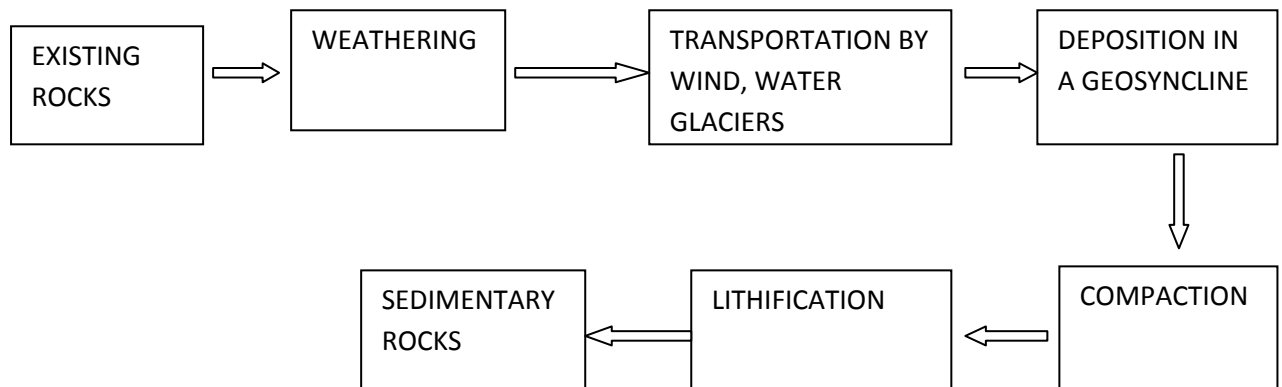
These are rocks formed from the remains of plants and animals. Those formed from the remains of plants are called carbonaceous while those formed from the remains of animal are called calcareous

Examples of such rocks are:

- | | |
|-------------------------------|-------------------------------|
| i. chalk formed from animals | iii. peat formed from plants |
| ii. coral formed from animals | iv. coal formed from plants |
| | v. lignite formed from plants |

With the help of a flow diagram, explain mechanical sedimentary rocks were formed

These are rocks formed through the collection of clastic sediments. This kind of sedimentary rocks are formed from the existing rocks, which are exposed to weathering agents where they break into small particles called the sediments. The sediments are then transported by water, wind, and ice. The sediments are then deposited in geosynclines, which are seas and oceans bordering the continents. The sediments in the geosynclines are compacted or cemented together. The sediments are then lithified in which water and heat help to bake the sediments to turn into sedimentary rocks. The flow diagram below shows this:



Examples of mechanically sedimentary rocks are

- conglomerate
- Breccias
- Sandstone
- Shale
- Siltstone
- Loess
- Maraine
- Mudstone
- Clay

describe the ways in which a sediment can turn into a hard sedimentary rock
(as above)

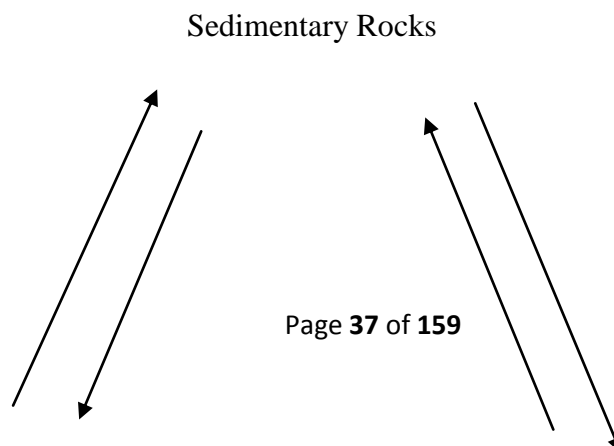
Explain the following terms in the study of rocks:

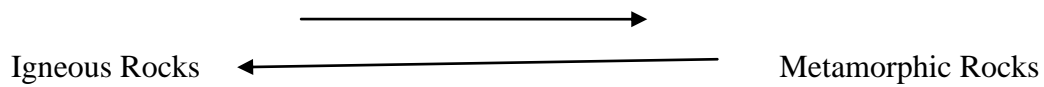
- a. **Metamorphism:** - the process through which other rocks whether sedimentary or igneous turn into metamorphic rocks through the application of intense heat, pressure, water and air.

- b. **Metasomatism:-** *this is the type of metamorphism by which gases play important role of entering the pores of a rock and change it to a metamorphic rock*
- c. **Foliation:-** *this is a term given to all metamorphism in metamorphic rocks*
- d. **Metasediment:-** *this is a term given to all metamorphic rocks derived from sedimentary rocks*
- e. **Dynamic metamorphism:-** *the term given to the type of metamorphism in which pressure plays a great role*
- f. **Thermo or contact metamorphism:-** *the type of metamorphism in which heat plays important role to change the rocks into metamorphic.*
- g. **Regional metamorphism:-** *the type of metamorphism that combines heat and pressure and operates over a very large area*
- h. **Hydrogenic rocks:-** *these are rocks which are formed in water especially sedimentary rocks*
- i. **Stratification:** *The terms given to the arrangement of layers in sedimentary rocks, this appears to be in form of lines. This happens because the layers are arranged in different times under different environments with different sizes of sediments.*

With the aid of a diagram describe the rock cycle

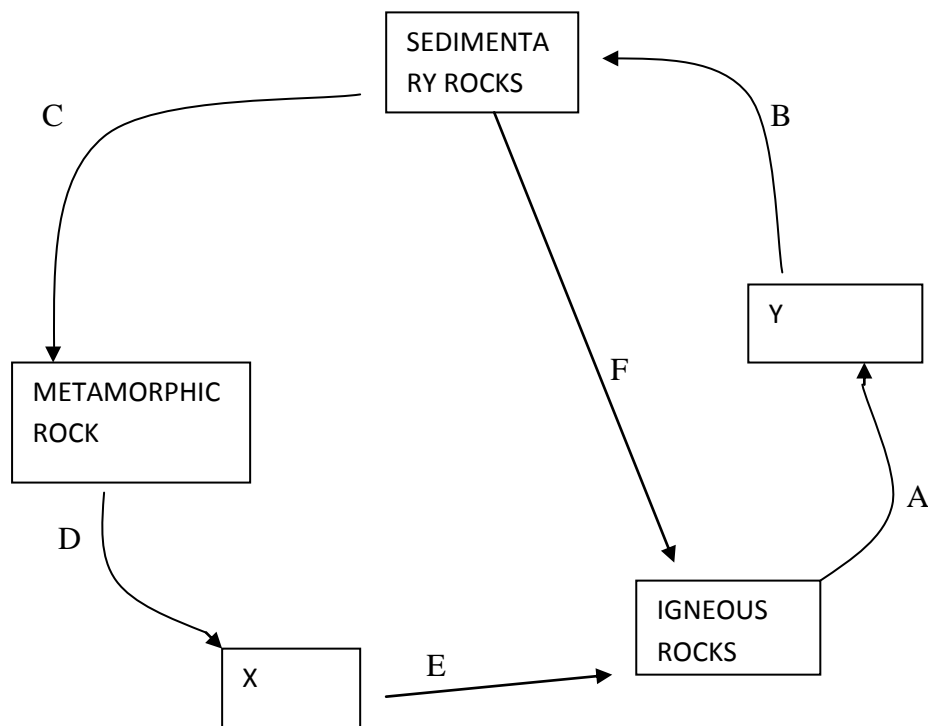
The rock cycle describes the change of a rock from one kind to another under different conditions. Changes that take place beneath the earth's surface are due to high temperature and pressure, while on the surface, weathering is the most important. Sedimentary rocks if buried under the ground melt due to high temperature and pressure, and turn to igneous rocks often cooling. These igneous rocks are subjected to further heat, pressure and water change to metamorphic rocks. The metamorphic rocks can be uplifted and weathered to form sediments, which later form sedimentary rocks.





NOTE: With a diagram, describe how granite rock can be turned into slate and later sandstone (this question requires the knowledge of the rock cycle)

Study the rock cycle below and answer the questions that follow



1. what is the importance of stages:

- a. **X**= it forms magma which acts as a raw material in the formation of igneous rocks through cooling and solidification
- b. **Y** = provides small particles known as sediments which when deposited, compacted and lithified forms sedimentary rocks.

2. what is the processes that take place in stages

A = weathering

B = transportation, deposition, compaction and lithification

C = intense heat, great pressure, water and air

D = melting

E = cooling and solidification

F = melting, cooling and solidification

Explain two roles played by wind, water and ice in the formation of sedimentary rocks

1. *in weathering process, these help to weaken the rocks which are then broken into small particles known as sediments*
2. *These agents help to transport the sediments to an area where they are deposited. In this deposition area in geosynclines is where compaction and lithification take place in order to form sedimentary rocks*

Mention two economic importance of rocks (2008) (2001) (1993) (1996) (1986)

- a. *Rocks weather to give fertile soils which are used for the cultivation of crops, for example tea on the foot of Mulanje mountain*
- b. *clay, a sedimentary rock is used in brick making*
- c. *Limestone, a sedimentary rock is used in the production of cement. In Malawi limestone is found at Balaka as the deposits at Chingalume are depleted*
- d. *Coal, a sedimentary rock is used in thermal power production. Coal in Malawi is mined at Mchenga coal Mine in Rumphi district*
- e. *Some rocks contain aquifers, which store water. Boreholes are then sunk to get this water to be used*
- f. *Rocks such as gravel are used in the construction of certain crops e.g. potash, Gypsum, nitrates and Borax.*

give two reasons why igneous rocks do not contain fossils

- g. *As the rocks are formed through the cooling and solidification of magma, the fossils are burnt during the melting process.*
- h. *Such rocks are formed far below the crust where fossils cannot be found*

Why are fossils likely to be found in Shale and sandstone and not granite

Shale and sandstone are sedimentary rocks formed through the collection of sediments. Such rocks are likely to have fossils because during the transportation of sediments by the action of water and wind, fossils are transported together. The fossils are then deposited with sedimentary rocks. Granite as an igneous rock was formed through the melting, cooling and solidification of magma. In this process, the rock cannot contain fossils because the fossils are burnt up with the great heat.

THE HYDROSPHERE

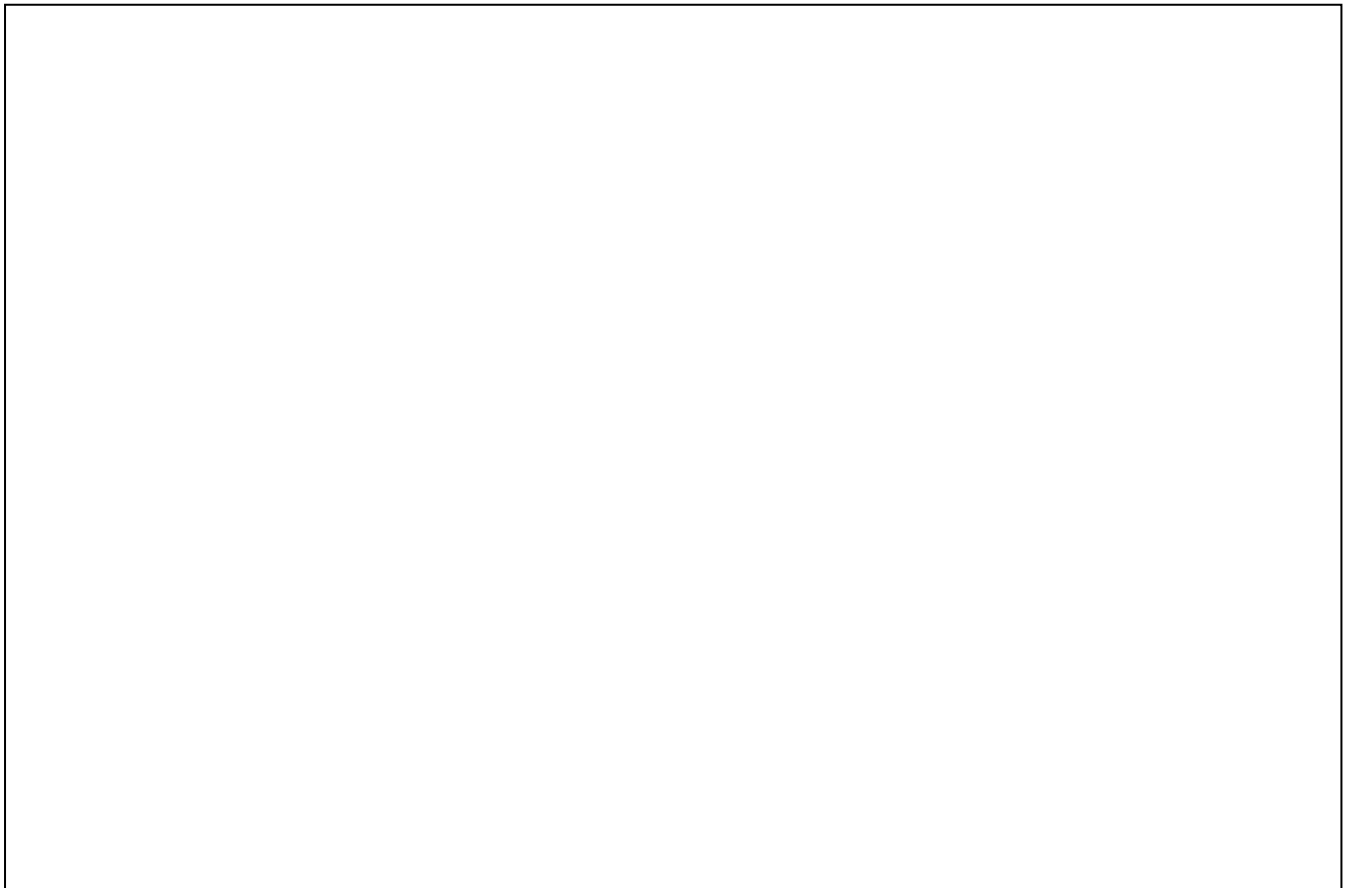
Define the term hydrosphere (2006)

This is part of the earth, which is composed of water masses such as lakes, rivers, oceans, seas and dams.

NOTE: The hydrosphere covers about 70% of the earth's surface

Draw a clearly labeled diagram to illustrate the hydrological cycle (1993) (1986) (1997) (2002) (2007)

The hydrological cycle refers to an endless circulation of water between the earth's surface and the atmosphere. The system includes processes such as evaporation, transportation, condensation and capillary attraction. The diagram below shows this:-



1. Describe how the hydrological cycle that you have drawn works 919986) (1997) (1998) (2005)

The hydrological cycle starts with the presence of solar energy. This makes water to evaporate on both land and water masses. It also makes vegetation to lose water in form of vapor in a process called transpiration. The combined loss of vapor from both vegetation and land and water masses is referred to as evapo-transpiration.

Water vapor in the atmosphere loses its temperature as temperature decreases with altitude, and become cooled. The vapor then cools below its dew point which is also known as adiabatically cooling. Tiny droplets then start to form in a process called condensation.

The tiny droplets then combine to form clouds. The clouds become very heavy to float in the atmosphere and fall to the ground through the process called precipitation. This precipitation takes the forms of rain, fog, snow, hail, drizzle and sleet.

On the earth's surface, two processes take place namely infiltration and runoff. Infiltration is the process whereby water soaks into the soil. Runoff is the water that flows on the earth's surface joining lakes, rivers. This water then evaporates into the atmosphere.

Water that soaks into the ground move side ways in a horizontal in a process called percolation to join the ground water. This underground water through capillary attraction is absorbed by roots of trees and eventually transpires to complete the circulation and restarting the hydrological cycle.

NOTE: The underlined words are the main features of the water cycle, which must be present in the explanation

Dew or morning mist is not a form of precipitation because it forms on the earth's surface following a decrease in temperature towards sunset as vapor fails to rise up into the atmosphere.

Give three reasons why it is important to maintain the hydrological cycle (1997) (1993)

- a. water is used for domestic and industrial services*
- b. it serves as habitat for aquatic animals such as fish, hippos and crocodiles*
- c. lakes and rivers are often popular tourist attraction centre because water is a source of natural beauty of the environment*
- d. water stored in dams is used to produce hydroelectric power*
- e. it provides a means of communication by ship or boat*
- f. water is the basis for the sporting activities such as swimming and skiing*

Explain human activities that can disturb the hydrological cycle

- a. *Air pollution through the release of nitrous carbon dioxide and chlorofluorocarbons. These attack the ozone layer making it to have holes. The result is that ultraviolet rays from the sun such as gamma rays, x-rays and infrared move to the earth's surface causing global warming. This global warming tampers with the hydrological cycle in the sense that it affects rainfall pattern resulting in heavy rains or no rains in others.*
- b. *Through the wanton cutting down of trees without replacing them which is called deforestation. When trees are cut down, the rate of transpiration is relatively reduced. This brings about the shortage of water vapor that forms very small clouds. The result is that there is little rain throughout as the rate of transpiration is reduced.*
- c. *Application of chemicals in water bodies such as rivers, lakes, oceans and seas. This slows down the rate of evaporation inefficient. Small clouds are formed and this brings little rainfall.*
- d. *Poor farming practices, also disturbs the water cycle. Examples of such practices are cultivating along steep slopes, overstocking, overgrazing and setting bush fires. These apart from reducing vegetation, encourage erosion, which have negative impact on the circulation of water within the hydrological cycle as a system.*
- e. *The acid rain also disturbs the water cycle. Acids, which remain in the air, are carried by rain to the ground. The acid rain destroys the leaves of the vegetation hence transpiration rate is affected negatively as the number of stomata decreases.*

Suggest problems that are likely to be faced by nations as a result of the disturbance of the hydrological cycle

- g. *Drought conditions, making crops to wilt and dry up. This brings famine*
- h. *Heavy rainfall which results into flooding that destroys fields, homes and causes extensive erosion of fertile soils*
- i. *Many waterborne diseases caused by bacteria or parasites living in water because of untimely rains.*
- j. *The little available water can be polluted by people resulting into outbreak of many diseases such as cholera*

Suggest three ways in which the hydrological cycle can be maintained

- k. *By practicing afforestation and reforestation. This helps to maintain the water cycle in that the planted trees increase the rate of transpiration. This makes a lot of water vapor to be present in the atmosphere forming heavy clouds, eventually heavy rainfall results.*
- l. *Avoidance of use of devices that release dangerous gases called chlorofluorocarbons (CFCs) into the atmosphere. This will make the ozone layer to be maintained which in turn prevents strong rays such as gamma rays, x rays and infra red from reaching the earth's surface and cause global warming. This will reverse the unusual distribution of rainfall and bring back the usual one.*
- m. *Avoidance of use of emissions of various elements or compounds into the atmosphere such as carbon dioxide, Sulphur and nitrogen when such are avoided, chemical reactions that bring acid rain will not take place.*
- n. *Use of good farming methods, which ensures full protection of vegetation from destruction. This will make a lot of vapor to be released through this vegetation.*
- o. *Conservation of water catchments areas. When water catchments areas are conserved, the rate of evaporation from those water masses is increased, thus will in turn also increase the number of tiny water droplets that will form. The result will be a big and heavy cloud, which will bring heavy rain.*
- p. *Weather forecasting. Listening to weather bulletin if there is a possibility of heavy rainfall, then to be prepared for measures that can reduce flooding of water if there will drought conditions, planting crops, which are drought resistant.*

Give three examples of natural resources which should be maintained in order to maintain the water cycle

- q. *Water which when evaporates or is absorbed by trees turns into vapor that form clouds and come down as rain.*
- r. *Vegetation: apart from protecting the soil, it transpires and adds vapor to the atmosphere contributing to the formation of clouds.*
- s. *Soil, which supports vegetation*

OCEAN CURRENTS

What is the difference between an ocean current and a drift

an ocean current is a large mass of surface water that circulates in regular patterns around the oceans while as a drift is an ocean current that is primarily caused by the prevailing winds.

Why are some ocean currents warm and others cold

This happens because of the difference in the originality. Warm ocean currents are those regions with higher temperatures while as Cold Ocean currents are those that flow from towards equatorial regions.

How are ocean currents caused by the following factors:

a. Temperature

The temperature in the equatorial regions is higher while that of the Polar Regions is lower. Warm equatorial water move slowly along the surface pole wards while the heavier cold waters of the Polar Regions creep slowly along the bottom of the sea equator wards. This type of movement creates friction that causes an ocean current as warm water moves on top of cold water.

b. planetary winds

When planetary winds blow over the ocean, surface water is pushed in one direction creating a regular pattern of movement of large masses of water around the ocean.

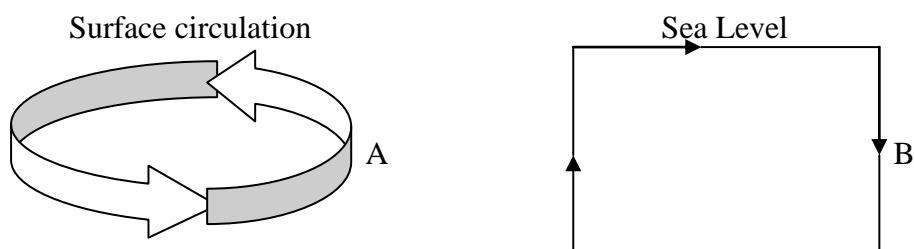
c. . Rotation of the Earth

When the earth is rotating, it creates a force known as a coriolis force, which pushes surface water of an ocean in one direction and this creating an ocean current.

d. Salinity

Water of high salinity that is with high concentration of salts is denser as compared to water of low salinity, which is lighter. Therefore, water of high salinity will sink because it is denser while that of low salinity will move on top of high saline water because it is lighter. This type of movement creates frictions that eventually trigger an ocean current.

Study the diagram below which shows ocean current patterns and answer the questions that follow:



What name is given to the circulation marked A and B

A= *Gyrotic circulation*

B= *Convective ocean current circulation*

State two causes of pattern A

- i. prevailing winds*
- ii. earth rotation*

State two causes of pattern B

- a. temperature*
- b. salinity*

Study the map of the world below which shows location of ocean currents and answer the questions that follow (1990) (1997)



1. Name the ocean currents marked A, B, H, D, F

A= west Australian current

B= Kuro Siwo current

D= North Pacific current

H= Benguela current

F= Canaries

What impact does each of the following currents have:-

1. current G

- *as a warm current it brings heavy rainfall to the coastal area after picking up moisture from the oceans*
- *it also encourages fishing along the coast of Uruguay and Argentina*

2. The meeting of current C and B in the area

- *Since C is a cold ocean current while B is a warm current. The meeting of the two creates a major fishing ground. This happens because when these two meet, there is precipitation of minerals which facilitates the growth of micro-scopic plants called planktons which are food for fish*
- *The meeting of the two creates fogs which impeded visibility and can consequently lead to loss and capsizing of ships*

What is the cause of the upwelling of water in the areas shaded on the map

The movement of cold ocean currents causes this from the Polar Regions. When such ocean currents move from the Polar Regions, they creep under the surface since they are denser. As such, currents approach the tropical regions; they become heated and start going up from the bottom as they lose density. This is exactly that makes water to up well as the currents appear on the surface waters.

Why does ocean current F change direction seasonally

This happens due to the apparent movement of the sun that brings about differences in terms of pressure that in turn drives the current towards a certain direction. For example, in June the sun appears to be overhead in the northern part, which then attains a low pressure. The current then move from the southern part which is a high pressure area to the northern part. In the month of December, the sun appears to be overhead in the southern part. This makes the southern [art to develop a low pressure. The current then changes direction from the north to the south as the north develops a high-pressure area.

Explain four factors that influence the direction of ocean currents as shown on the map above (1990) (1997)

- ***The shape of continents:*** *Landmasses obstruct and divert a current. For example, the shape of the southern Chile makes the Peruvian current to flow following the land coast going northwards.*
- ***Rotation of the earth:*** *This makes ocean currents to deflect to the right in the northern hemisphere and to the left in the southern hemisphere from their normal courses. For example, the Mozambique warm ocean current deflects to the left*

encircling Madagasca as a result of the earth's rotation which brings coriolis force into effect.

- **Wind direction:** *The direction taken by the planetary winds is the same direction taken by an ocean current in that particular area. For example, the flow of the north Atlantic drift follows the planetary winds*
- **Temperature** *also influences the direction of an ocean current. Equatorial regions have a high temperature while polar areas have low temperatures. Warm ocean currents flow towards the Polar Regions as it is a warm current while as canaries flow from the Polar Regions towards the equator as it is a cold ocean current.*

Examine with specific examples two negative effects of ocean currents (1997)

- a. *Cold ocean current from Polar Regions distribute coldness to the tropics influencing a particular type of climate. For example, the coast of Namibia where fogs are common.*
- b. *Cold ocean currents do not bring rainfall to the neighboring landmasses. This is because they do not absorb moisture. This makes them to be responsible for the existence of deserts. For example, the canaries are responsible for the formation of the Sahara desert, the Benguela for the Kalahari Desert, Peruvian for the Atacama desert.*
- c. *On shipping the currents have two negative effects:*
 - a) *Ocean currents increase the height of tides and can make ship loading and off-loading difficult, not to mention about capsizing and loss of goods.*
 - b) *The meeting of cold and warm ocean currents creates fogs that impedes visibility and can consequently lead to loss and capsizing of ships. Examples of such areas include the new Founder land where the Labrador tend to meet the North Atlantic drift, off the coast of Japan where the Kamchatika meets the Kurosiwo.*

Explain any two beneficial effects of ocean currents on human activities (2006)

- a. *Warm ocean currents distribute heat from the tropics to the poles. This help to melt ice thereby making some ports to be used throughout the year as they are ice-free. For example, the Vancouver port is ice free in winter because of the North-Pacific warm ocean current.*
- b. *On climate, warm ocean currents bring rains to the coastal areas. This is because they are able to pick up moisture over the oceans and bring heavy rainfall to the coastland. For example, the Mozambique warm oceans current bring rainfall to the coast of East Africa.*

- c. *On fishing, the meeting of the cold and warm ocean currents creates major fishing grounds. This happens because such a meeting encourages the precipitation of minerals that facilitate the growth of microscopic plants called planktons, which are food for fish. For instance, the western Pacific grounds where the Kamchatka meets Kuroshio, the Northwestern Atlantic where the Labrador and North Atlantic Drift creates the fishing ground.*
- d. *On shipping, ships sail following the direction of currents as they flow hence easing their movements, less fuel which reduces expenses and transit time.*

Name two warm ocean currents of the North Atlantic and any two cold ocean currents of the North Pacific

- e. ***Warm ocean currents of North Atlantic***
 - *Gulf stream*
 - *North Atlantic drift*
- f. ***Cold ocean currents of North Pacific***
 - *Californian cold current*
 - *Kamchatka cold current*

On the map provided above shade and name two areas, which are usually foggy for most of the year.

Shade the areas where a warm ocean current meets with a cold ocean current.

Examples of such areas:

- g. *Off the coast of New Foundland where the Labrador and east Tronland meets the North Atlantic Drift*
- h. *North West Pacific, off the coast of Japan where the Kamchatka meets Kuroshio*
- i. *North east pacific where the North Pacific warm ocean current meets the Californian cold Ocean current*

**Study the figure below, which shows part of the world and ocean currents
Diagram**



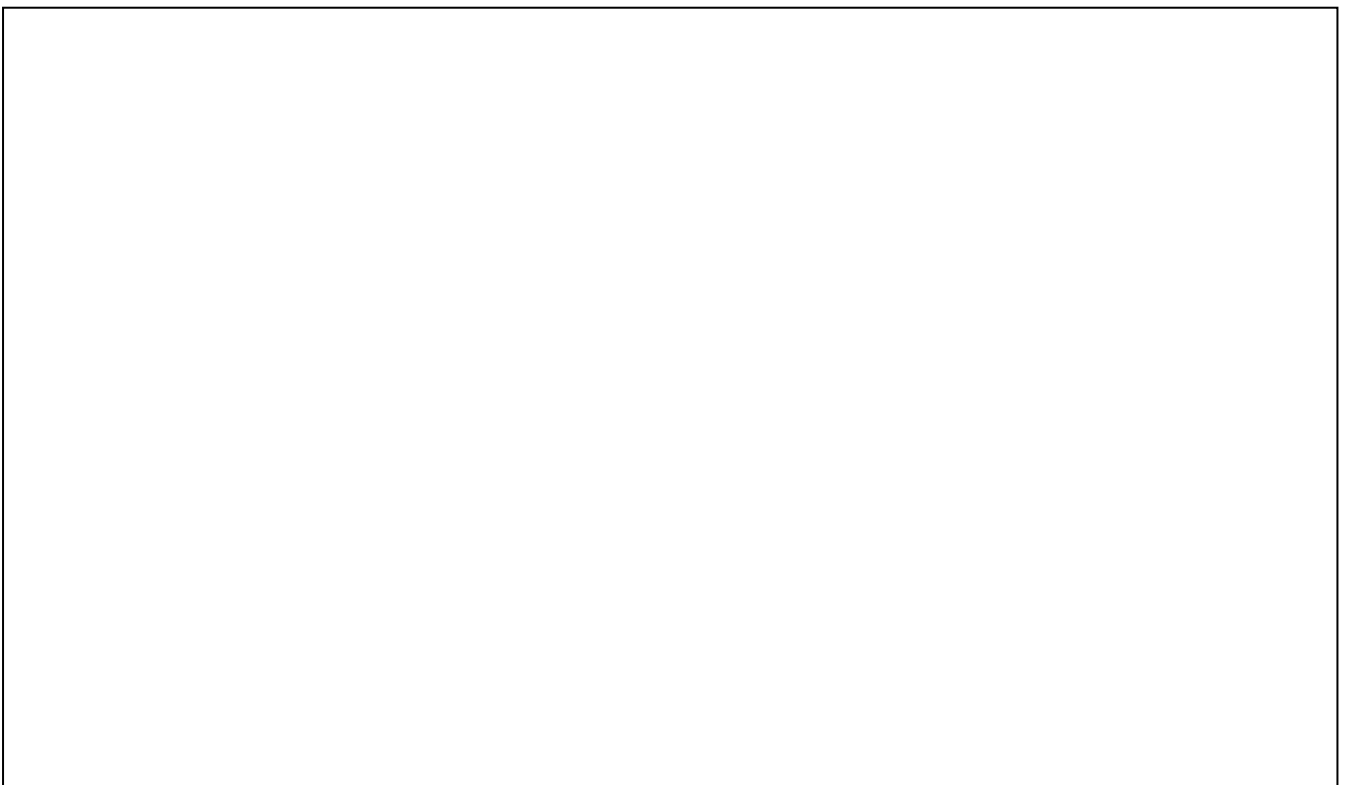
3. What aspect of weather is likely to develop in the area marked A

Fogs are likely to develop in the area. This is because there is the meeting of Gulf Stream that is a warm currents and the esast Green land which is a cold current. The westerly winds carry warm air from the Gulf stream when then meets the cold air from the east Greenland.

4. State two beneficial effects of the cold ocean currents

- a. As they creep under the water surfaces from the polar region, when approaching the tropics, they up well. This help in the development of fishing grounds because they help to stir up minerals for planktons.*
- b. Help to reduce the high tropical temperatures especially in summer*

Study the figure below which shows a map of southern Africa showing cloud cover and answer



5. Describe the variations in cloud cover in the region

The eastern part of southern Africa contain rain bringing clouds while as the western part of the Southern Africa contain fine weather clouds.

6. Suggest why there are these variations

- i. *A warm ocean current influences the eastern part. Being a warm current, it brings heavy rainfall to the coastal areas. This is in contrast with the western coast, which is under the influence of a cold current. This does not bring a lot of rainfall to the area, hence fine weather clouds.*
- ii. *The existence of the Drakensberg Mountain acts as a barrier. The rain that is brought by the warm current, very little can reach the western part as the area appears to be in the rain shadow area due to the existence of the mountains.*

7. With aid of a diagram, explain how ocean currents are caused by temperature variations between polar regions and tropics (see convective circulation)

8. Nain and Glasgow are on the same latitude of 56°N . explain with the aid of a large sketch map, why Nain has a lower mean January temperature of -21.6°C while Glasgow has 3.9°C (14) (1996)

Nain is in North America while Glasgow is in Britain which is an island in the Atlantic Ocean. Since these lie in the same latitude of 56°N , are supposed to have almost the same temperature on average. There must be a factor that brings about the differences in temperatures. This is what the work below will explain.



According to the sketch above, both towns really lie within the same latitude 56°N . The town of Nain has a lower temperature of -21°C because it is under the influence of the Labrador cold current. Being a cold current, with the low temperatures obtained from the Polar Regions, the current lowers the temperature of Nain. The situation with Glasgow is different. The town is influenced by the North Atlantic Drift warm ocean current. Being a warm ocean current, it helps to raise the temperature of the town with the tropical heat hence 3.9°C .

ATMOSPHERIC PRESSURE

what is air pressure

This is the force exerted by the atmospheric air on the earth's surface.

Define the term pressure gradient

This mean the rate at which the atmospheric pressure changes horizontally in a certain direction on the earth's surface

In a pressure gradient explain what it means when:

a. The isobars are close together

It means the gradient is steep and air is quickly drained that is, the movement of wind is very great or fast.

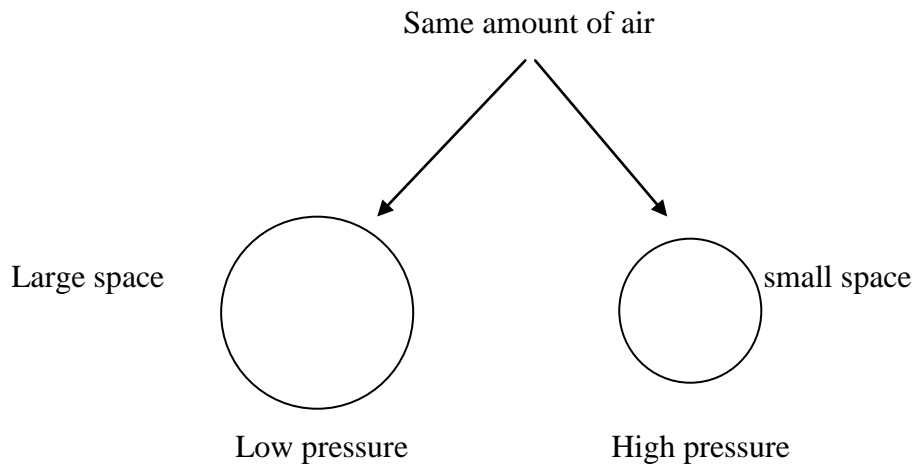
b. The isobars are far apart

It means the gradient is slight and wind speed is low

With the help of a diagram, explain the effect of volume on air pressure

When the volume is small, air pressure increases. This is because air molecules are concentrated in a small space. This makes the air molecules to push out with a lot of force which in turn increases pressure. Conversely, when the volume is increased, air pressure becomes low. This is because the space becomes large and air molecules have a lot of room. This makes them to

push out with less force which in turn lowers the pressure. The diagram below shows this



Explain why:

- a. The air pressure is higher at higher latitudes than at low latitudes**

High latitudes are those that are from the temperate regions to the Polar Regions especially along 90° North or South of the equator. Low latitudes are those that are closer to the equator especially within the tropics. Air pressure is higher at high latitudes because the temperature in such areas is very low as the sun appears to be very far from them. This low temperature makes air to be concentrated in a small area as it contracts. This makes it to push out with a lot of force. Pressure at low latitudes is low because such places experiences high temperature. This heats up the air which then rises and occupies large volume. This in turn reduces pressure as the molecules cannot push out with a lot of force.

- b. The air pressure is generally low at high altitudes than at low altitudes**

Altitude is the height above the same level. High altitude areas are those like on top of mountains while low altitude areas are like those along the sea level. Air pressure is low at high altitude like on top of mountains because in such places there are few columns of air. This makes air to push out with little force thereby lowering the pressure. The air pressure is generally high at low altitude areas like along the

sea level because such places support many columns of air. If the columns of air are many, it makes air to push out with a lot of force. This in turn increases air pressure.

c. The same quantity of air exerted different in different volume

Small volume makes the air to be concentrated in a small area. This makes it to push out with a lot of force which in turn increases air pressure. Large volume makes air molecules to be spread far apart. This makes it to push out with little force and the pressure is reduced. Same quantity of air exerted differently, when the volume changes.

Explain why:

a. There is low pressure along the equator

This is due to temperature. As the temperature is high along the equator, it makes air to be heated up and rise. When this happens, the air occupies a large volume which makes pressure to be low as the air pushes out with little force.

b. There is high pressure along the latitudes

High latitudes are those 30° North or South of the equator. These areas have high pressure because the air that escapes from the equator as a result of temperature crosses these parallels, which are smaller. Being smaller than the equator, air is concentrated in a small volume. This makes the air to push out with a lot of force which increases air pressure.

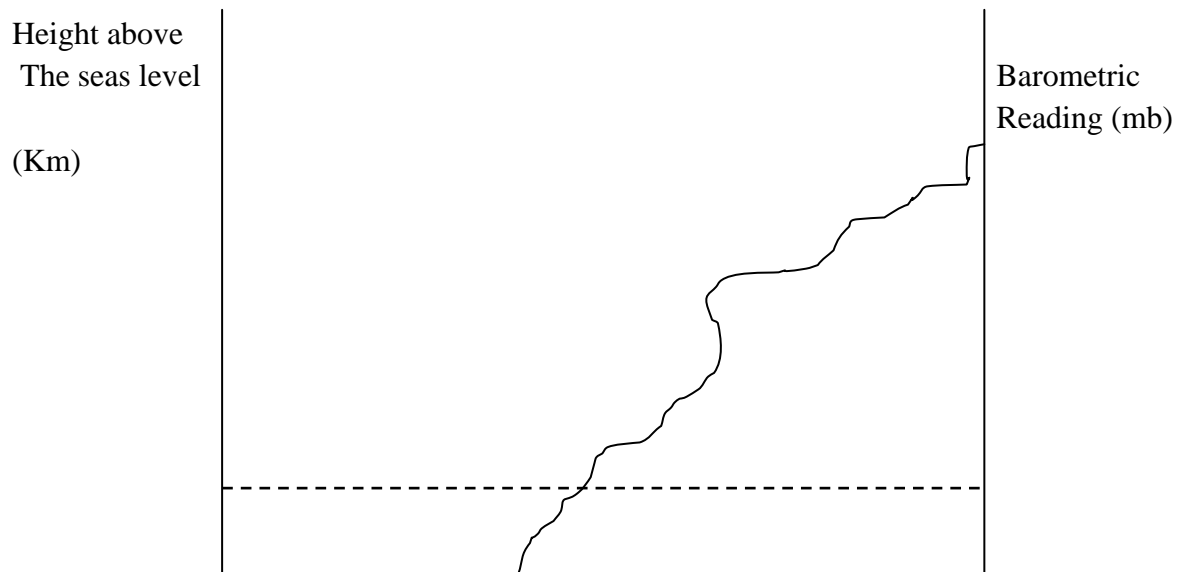
c. There is low pressure along 60° latitude despite the fact that it is 6660Km from the equator and only 3330Km from the pole.

This is a temperate low pressure 60° North or South of the equator. This develops a low pressure because the air that moves from the Polar Regions due to rotation of the earth crosses a parallel which is longer. This makes air to be spread far apart along 60° N or S of the equator as the air is spread apart as a result of an increase in volume, the air pushes out with little force hence low pressure even if it is closer to the polar region.

d. There is high pressure at the poles

The poles, 90° north or south of Africa have small space which makes air to be squeezed thereby increasing pressure. Not only this, but also the factor of temperature. The temperature is very low in these regions. This makes air to contract and push out with a lot of force which increases pressure.

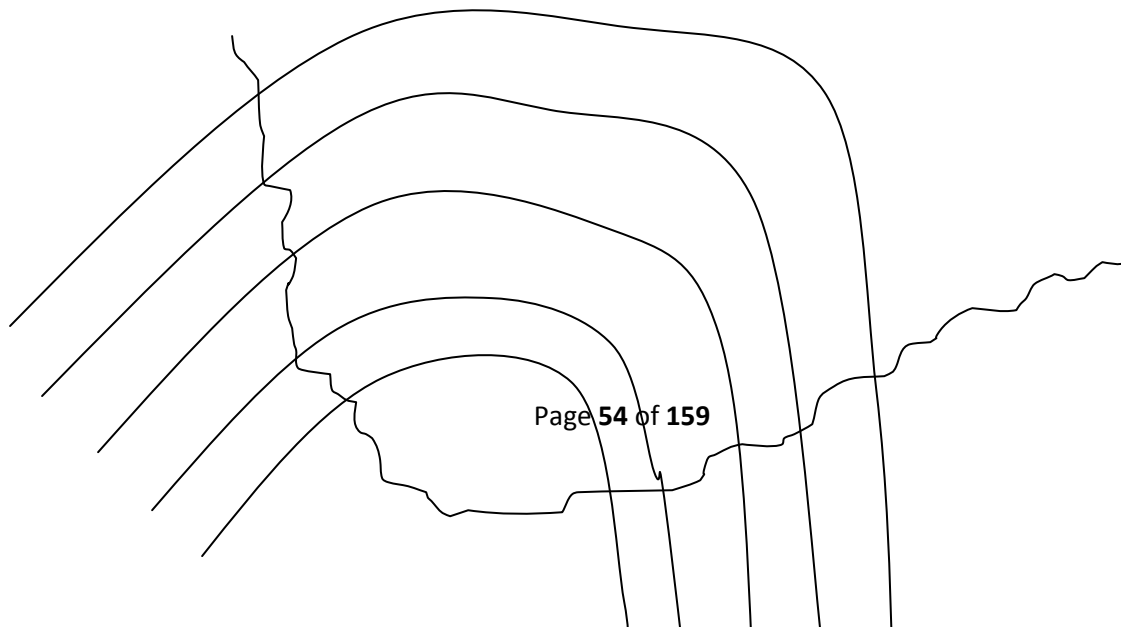
Study the figure below which show the relationship between air pressure and altitude (1995)

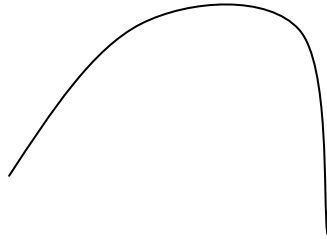


Explain the relationship shown above with reasons

As the altitude increases, pressure decreases. For example at sea level the pressure is 760 millibars, at Y is 506 millibars which is at 2 Km, at \$km the pressure is 352millibars at 8 Km the pressure is 298 millibars. This shows that as the altitude increases, pressure decreases. This is because at a low altitude the air supports large columns of air which exerts a lot of force. As the altitude increases the columns of air decreases. This makes air pressure to be reduced as less force is exerted.

The figure below is a synoptic map of southern Africa. Use it to answer the questions that follow (2002)





Calculate the pressure gradient

$$980\text{mb} - 976\text{ mb} = 004$$

What instrument was used to arrive at the readings shown on the map

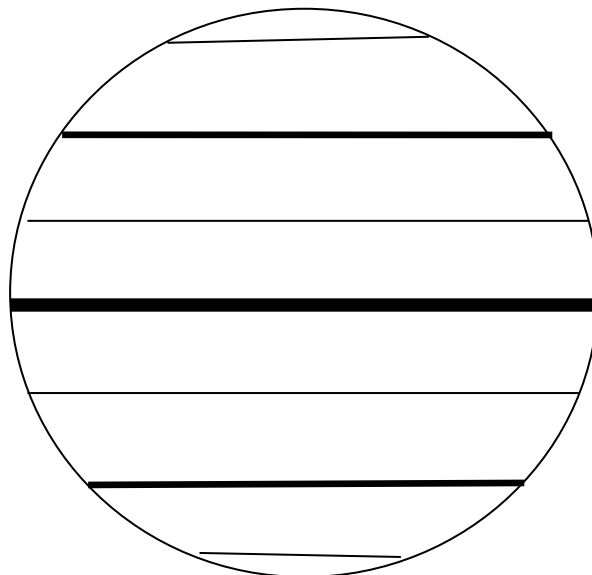
Barometer

On the map itself indicate the wind direction

Wind move from a high-pressure area to a low pressure. The arrow on the map should come from outside which is a high pressure area to inside which is a low pressure area ie



The figure below represents the earth. On the diagram itself: (1997)



a. Locate and name the main pressure belts (4)

As shown above. The first thing should be to give degrees north or south of the equator. Then the next should be to locate and name the doldrums, horse latitudes, temperate latitudes and the polar latitudes.

b. Using arrows, locate and name the wind systems (4)

Winds which should be indicated are the-

- a. *Trade winds* which blow the horse latitude towards the Doldrums
- b. *The westerlies* which blow from horse latitudes towards the temperate low pressure
- c. *The polar winds* which blow the polar regions towards the temperate

- It should be known that the winds blow from high-pressure belts towards low-pressure belts.
- It should also be known that under the Coriolis force, winds deflect to the right in the northern hemisphere and to the left in the southern hemisphere.
- The winds are then known after the deflection. For example, south East polar, north westerly, northeast polar, south westerly, north east trades and south east trades.

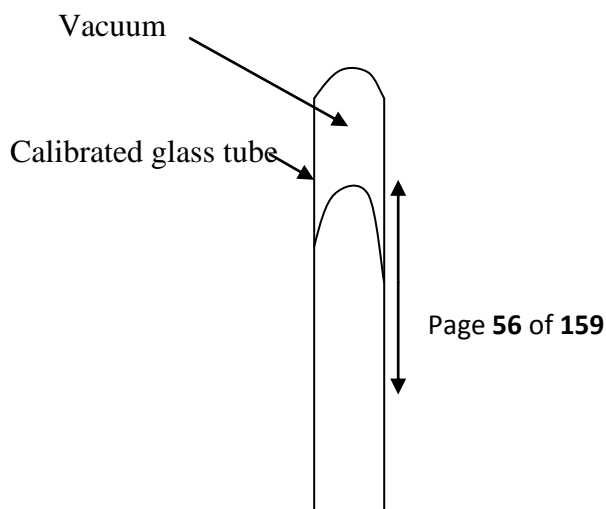
Draw a stationary globe. On it insert and label any two of each of the following in the southern hemisphere

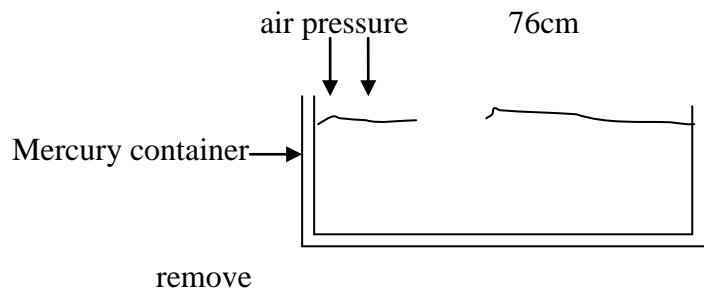
- a. Pressure belts
- b. Prevailing winds (7 marks) (2007)

Requires the answers as the above question

Draw a labeled diagram to show the main parts of a mercury barometer (1989) (2004)

A mercury barometer is an instrument which is used for measuring atmospheric pressure. It has the following important parts: calibrated glass tube, vacuum, mercury, container that contains mercury and indicates of air pressure. The diagram shows these parts.





NOTE: When drawing neatness is required and the pointing and naming of the parts should be accurate enough in order to get all marks. It should be known that, test tubes, water should be far from this diagram.

Describe how the barometer you have drawn works

When the air pressure is high, a lot of force is exerted on the mercury in the container. This makes the mercury in the container to go down and rise in the glass tube whereby recording high pressure on the calibrated glass tube. When the air pressure is low, little force is exerted on the mercury in the container. This makes the mercury in the glass tube to go down and low air pressure is read off on the calibrated glass tube.

What is lapse rate (19989)

This means the change of temperature, which decreases uniformly at the rate of 6.4°C per 1000m, with an increase in altitude

Study the table below and answer the questions that follow

Height in Meters	Pressure in Millibars	Temperature
5000	606	-9
3000	717	7
1500	842	16
Sea level	1012	25

Calculate

- i. **The pressure change from sea level to 5000 meters**

Sea level = 1012

5000m = 606

*Pressure change = $1012 - 606$ millibars
= 406 millibars*

- ii. **The temperature change from 5000meters to 3000 meters**

$$\begin{aligned}
 5000 \text{ meters} &= -9^{\circ}\text{C} \\
 3000 \text{ meters} &= 7^{\circ}\text{C} \\
 \text{Temperature change} &= -9 - 7 \\
 &= -16^{\circ}\text{C}
 \end{aligned}$$

What is the relationship between

a. Altitude and pressure (2 marks)

When altitude increases pressure decreases. For example, in the table at sea level the pressure is 1012 and at 3000 meters the pressure is 717 millibars and at 5000 meters, the pressure is 606 millibars. This shows that air increase in altitude makes pressure to decrease.

b. Pressure and temperature

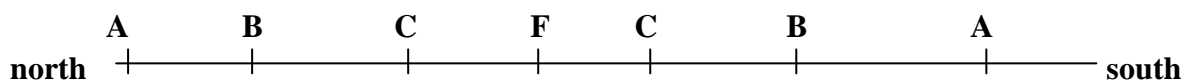
When pressure decreases temperature also decreases. For example, at sea level, according to the table, the pressure is 1012 millibars while temperature is 25°C . At 5000 meters, pressure is 606 millibars and temperature is -9°C . This clearly shows that when air pressure decreases, temperature also decreases.

Give reasons for the above relationships (6 marks)

When altitude increases, pressure decreases because an increase in altitude makes the column of air to be reduced. For example, at sea level the air pressure is high because the place supports a large column of air. This in turn makes air push out which a lot of force thereby increasing pressure. At the highest altitude such as a mountain, there are few columns of air. This makes air to push up with little force thereby lowering the pressure. Consequently, an increase in altitude lowers air pressure.

When pressure decreases temperature also decreases. This occurs because when air pressure decreases, the molecules does not push out with a lot of force and they are apart. This makes friction between molecules to be reduced as they are far apart. This in turn lowers the temperature as less heat is produced from the intermolecular friction. Therefore, when pressure decreases temperature decreases.

Study the figure below that shows the main belts of the earth and answer the questions that follow.



90°

30°

60°

Name the latitudes at B,C and F

B = 60° temperature low pressure belt

C = 30° Horse latitude high pressure belt (sub-tropical)

F = 0° Doldrums low pressure belt or the equator

Explain why air pressure is high at C

This is because the air that comes from F as a result of temperature which is higher, crosses parallel which are shorter in length. This makes the air to occupy a small volume and push out with a lot of force. This in turn makes air pressure to increase.

Explain why air pressure at F is always low

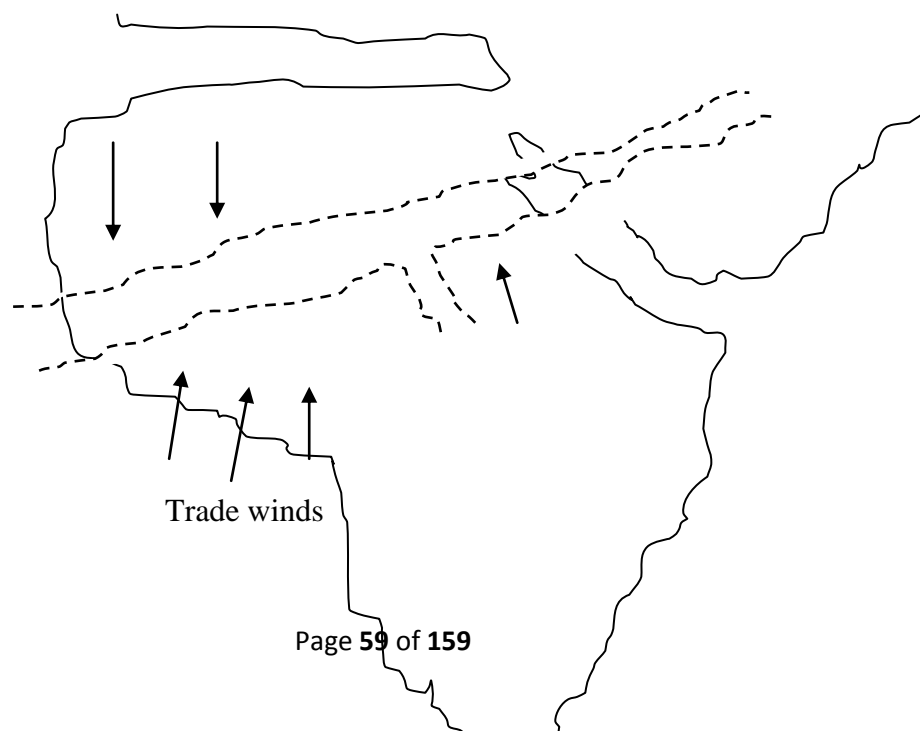
This is because along F, the temperature is always high, as the sun appears to be shining direct. This heats up the air, which then expands and rises. This makes air to occupy a large volume after rising and exert little force. This consequently reduces pressure.

What causes low pressure at B despite the fact that it is closer to A than F

Air that escapes from A as a result of the rotation of the earth, obviously is thrown to B. but at B the latitude is longer and the air occupies large space. This makes the pressure to be reduced because the air pushes out with little force, hence low pressure even if it is closer to area A which is a high pressure region.

Study the map of Africa below and answer the questions that follow

Substitute with scanned



Suggest the month of the year in North Africa in the diagram

June

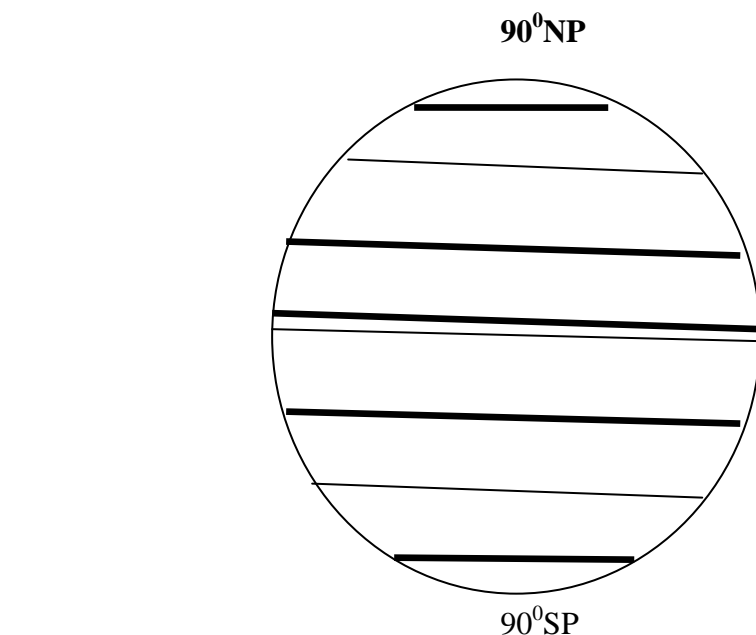
What is the season in Malawi from the diagram it is cool dry season

It is cool dry season

What would be the direction of the ITCZ if the sun moved to the southern hemisphere

The ITCZ would move to the Southern Hemisphere too as a result of high temperature. In addition, the development of low pressure following the apparent movement of the sun.

Study the globe below which shows high pressure and low pressure belts and answer the questions which follow (1983)



==== High pressure

_____ Low pressure

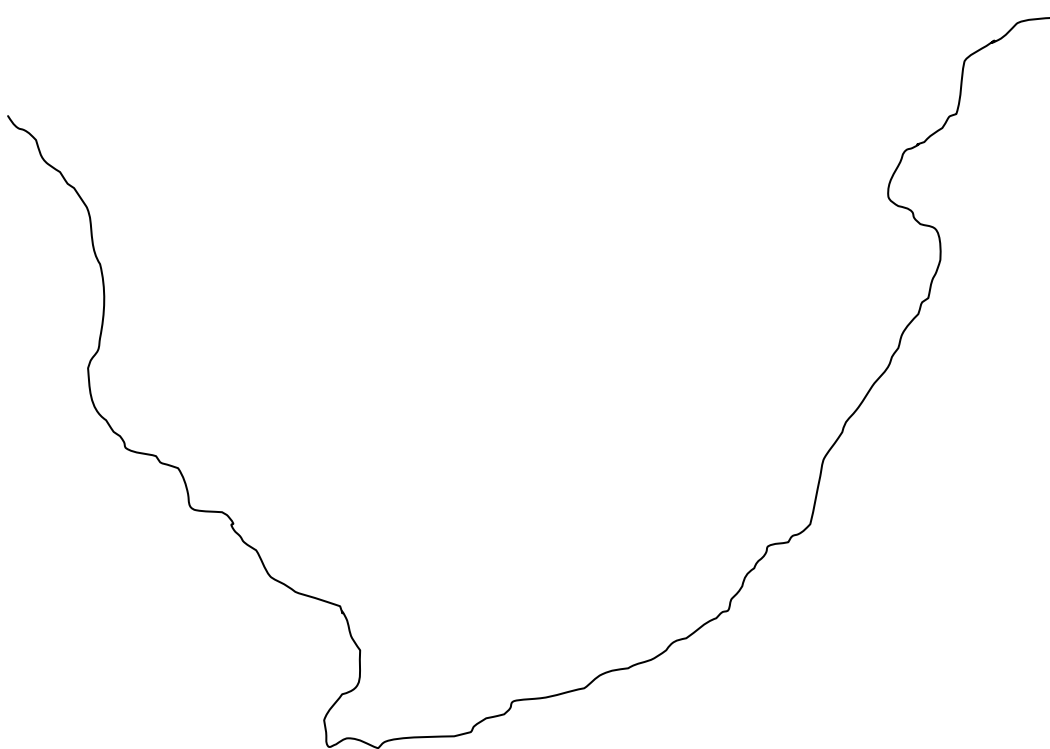
Explain why there is a high pressure belt on the 30° latitudes where it is close to the equator and a low pressure belt on the 60° latitudes close to the poles(8)

Check the above questions on air pressure for answers

What is the significance of the movement of pressure belt on the globe in relation to the season and winds (2002) (4)

The movement of pressure belt is because of the apparent movement of the sun. This in turn brings a change in terms of pressure. A change in pressure determines the type of season to be experienced and the movement of winds. For example, when the sun appears to be in the northern hemisphere, a low pressure is developed while southern hemisphere, a high pressure develops. Then wind moves from the southern hemisphere, which is a high-pressure region to the Northern hemisphere which is a low-pressure region. Such winds after crossing the seas collect moisture and heavy rainfall occurs. Consequently, the southern hemisphere where the wind comes experiences a different season as a result of the shifting of the pressure belt.

Study the figure below which shows the modified pressure reading for southern Africa (1993)

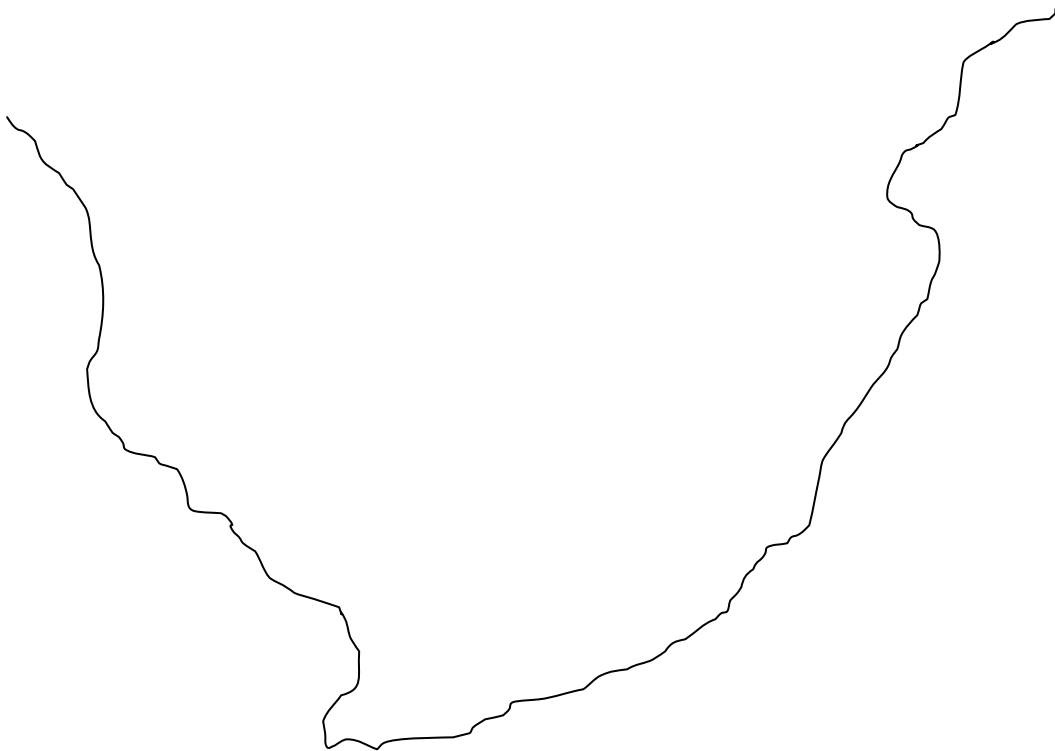


Draw lines joining places with the same atmospheric pressure

Look overleaf. The following are the important steps:

- Find the pressure gradient
- Establish where the high pressure is, that is, where the highest number is found, is it at the center or outside
- Check the numbers before joining the places with the same pressure

- The lines should cross each other but should just move very close
- Don't jump any number



Key
H= high pressure
→ = wind direction

What are these lines called

Isobars

What would be the force of wind when these lines are close to each other

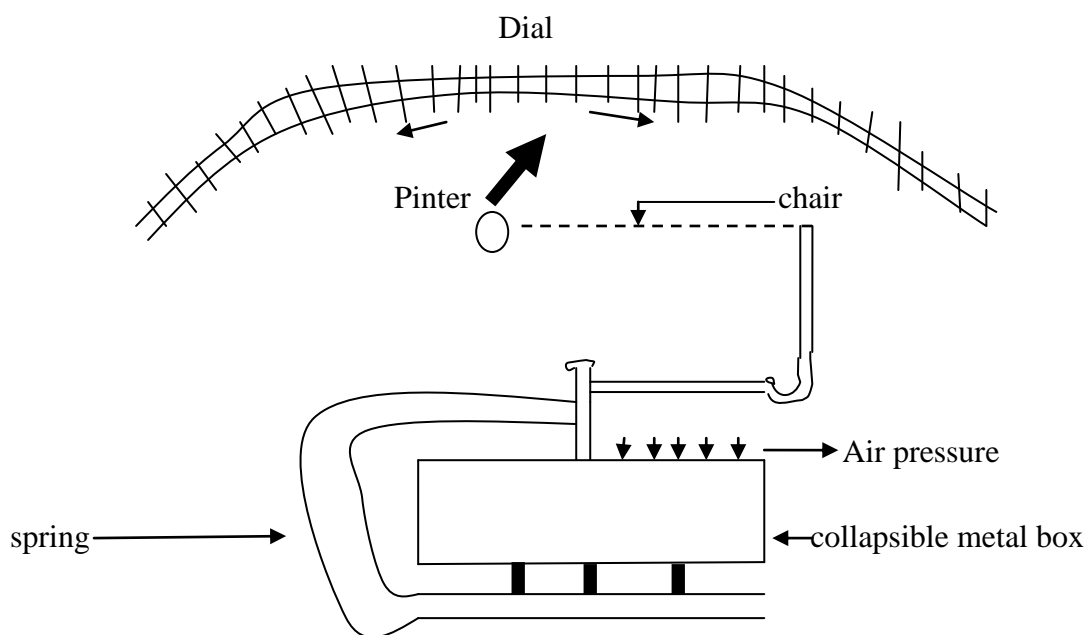
It means there is a fast change of pressure from one area to another, and the gradient is steep and the movement of wind is great or fast.

On the map itself insert H over an area of high pressure and point wind direction

On the map above, the arrow should come from inside. This is because the highest number is at the center that is 1034 while the lowest is outside that is 1026. The arrow should be pointing outside as wind moves from a high-pressure region to a low-pressure area. Provide a key beside the map to show an area of high pressure and wind direction

With the aid of a diagram describe how an aneroid Barometer works (8) (2002)

An aneroid barometer is an instrument which is used for measuring air pressure. The instrument consists of the following important parts, Collapsible metal box with very little air inside, a spring, a system of levers which includes the chain, indicator or pointer and a graduated scale. The diagram below shows these parts which make up an aneroid barometer.



When the air pressure is high, air applies force on the collapsible metal box which then goes inwards. This makes the spring to contract. When the spring contracts, it pulls on a system of levers which in turn pulls a chain. The chain drives the pointer to the right hand side indicating high pressure.

When the atmospheric pressure is low, little force is applied on the collapsible metal box. This makes the lid to go upwards, the spring to relax, making a system of levers to drive the pointer to the left hand side indicating low pressure.

What two differences can be noticed between a mercury barometer and an aneroid barometer?

- a. A mercury barometer uses mercury in its operations while an aneroid uses the collapsible metal box and a system of levers.*
- b. A mercury barometer, measurements are obtained in either centimeters or millimeters and converted to millibars while as an aneroid, readings are obtained straight into millibars.*

What two advantages can a mercury barometer have over an aneroid barometer

- a. The mercury barometer is very accurate as compared to an aneroid barometer*
- b. A mercury screen while an aneroid cannot read well in a Stevenson screen*

What two disadvantages can a mercury barometer have

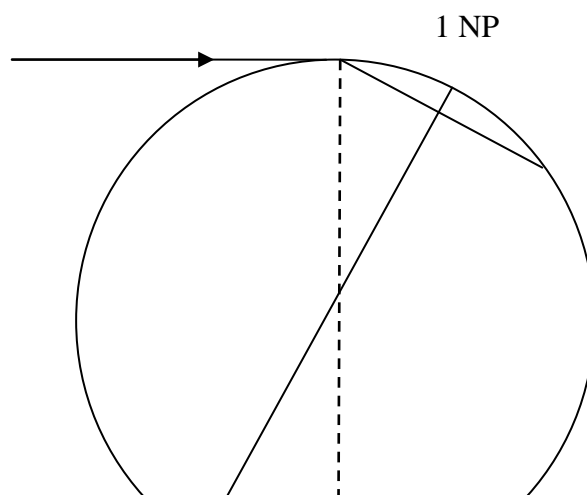
- a. It is very heavy and cumbersome, that is, it is difficult for it to be carried from one point to another*
- b. A mercury barometer is not good for outdoor measurements*
- c. It only requires mercury for it to measure air pressure and no any other liquid.*

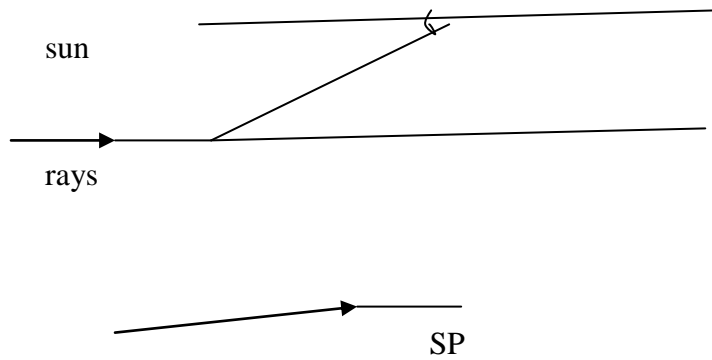
ATMOSPHERE ROTATION, REVOLUTION AND SEASONS

Define the following terms:

- a. **Aphelion:** the point along the orbit when planets such as earth becomes farthest from the sun*
- b. **Perihelion:** the point along the orbit when planets such as earth become closest to the sun.*

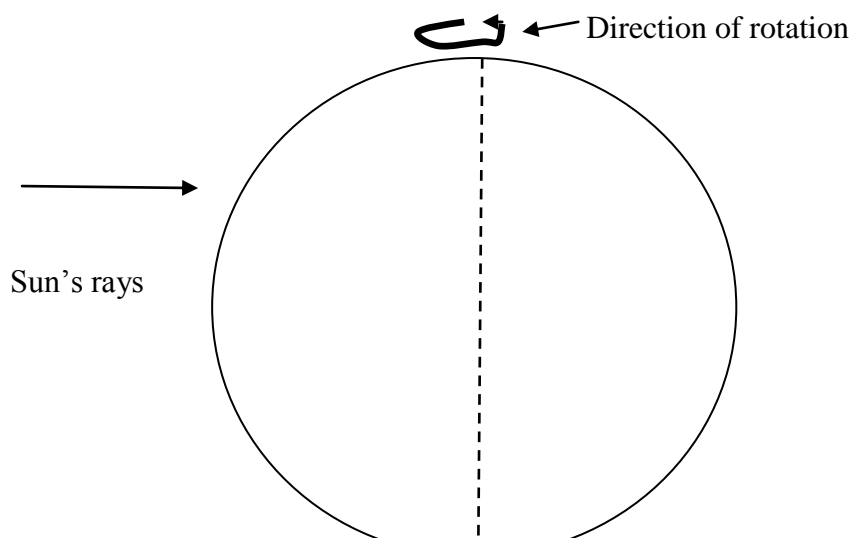
The circle below represents the earth with rays of light from the sun (1982)
replace





1. For which date is the diagram correct
22nd December
2. Name the lines A,B,C and D,
A= Arctic Circle
B= equator
C= tropic of Capricorn
Circle of Illumination
3. On which two dates would the sun be directly overhead on line B
21st March and 23rd September
4. Referring to the numbers 1-4 in the figure above, give the number of a place, at which:
 - a. The sun is below the horizon all day
 - b. Day light and darkness are both 12 hours long explain the alternation of day and night (S)

Day and night are caused by the movement of the earth on its own axis once is 24 hours. This makes one part of the earth to face the sun and the other part to be away from the sun. The part that faces the sun receives light and is termed as a day. The other half which is away from the sun is in darkness and is termed as night. The diagram below shows this alternation of day and night.





When the earth rotates from west to east, the part that was in the darkness will face the sun and will become day and that which was in the light will be away from light and will be termed as night.

Describe the characteristics of the following types of seasons:

a. Summer

- *Associated with high temperatures*
- *associated with heavy rainfall as a result of the development of low pressure that make winds to converge in the area*
- *associated with longer day hours and shorter night hours*

b. Winter

- *Associated with low temperatures, as the sun appears to be very far from the area. This makes the rays to reach the earth in a slanting position, which reduces the temperature.*
- *Long night hours and short day hours*
- *Very little rainfall*

c. Autumn

- *Characterized by decreasing temperature as the winter approaches*
- *Characterized by reducing rainfall*
- *Reducing day length and increasing night length, as the winter approaches*

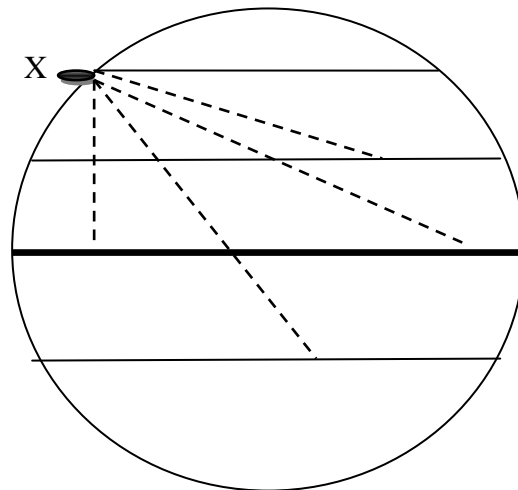
d. Spring

- *Rising temperature as the summer approaches*
- *Some rainfall which increases when summer approaches*
- *Increasing day length and decreasing night length*

Mention three seasons experiencing in Malawi and their months when such seasons are experienced.

- a. *Hot, Wet season which is experienced from November to April. This is so called because during this time, the temperatures are high and there is rainfall. This happens because the sun appears to be in the Southern hemisphere along the tropic of Capricorn. Malawi lies in the Southern hemisphere.*
- b. *Cool, Dry season which is experienced from May to July. During this time, the temperatures are low, with dry conditions as the sun drifts to the northern hemisphere. The drizzles experienced over Shire highlands are as a result of the diverging South East trade winds, which then become the Chiperon winds.*
- c. *Hot, dry season, experienced from August to October where temperatures start to rise and dry conditions are experienced. There is no rainfall this time because the low pressure is not fully developed.*

Study the figure below which shows the position of the sun at different times of latitude marked A, B, C and D for a town located at point X and answer the question that follow: (1992)



Name the four seasons that will be experienced at X as the sun is overhead at points A,B,C and D respectively

A= summer

B= autumn

C= winter

D= spring

Give reasons for the characteristics of the above seasons

A= summer. *As the place is in the northern hemisphere, at A is the tropic of Cancer. This means, the sun will appear to be shining direct. Over A which will in turn bring characteristics such as high temperature, heavy rainfall, longer day hours and shorter night hours. This happens because the sun appears to be over the tropic of Cancer $23\frac{1}{2}^{\circ}\text{N}$*

B= Autumn: *as the sun appears to come back from the northern hemisphere and heading southern hemisphere, temperatures will start to decrease, rainfall starts to be reduced, hours of daylight start to decrease while hours of night starts to increase. This happens because winter season approaches.*

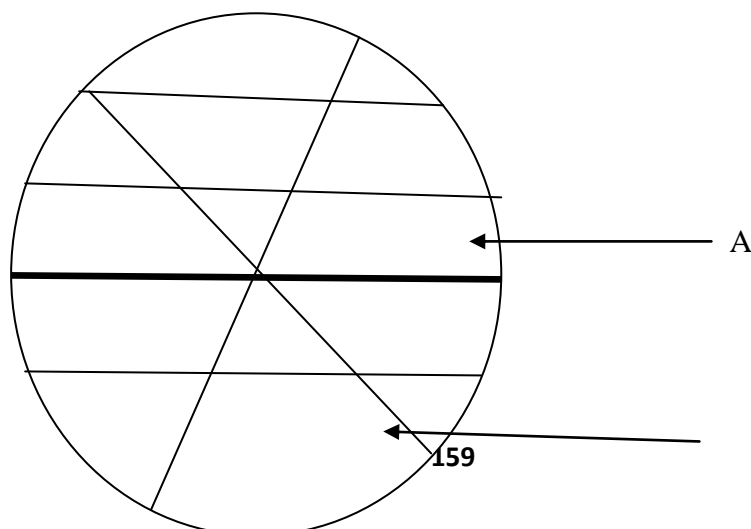
C= winter: *latitude along which C lies is the tropic of Capricorn. But place X is in the northern hemisphere. The place X will experience winter season with very low temperatures, little rainfall, long night hours and short day hours. These happen because the sun appears to be far from X such that rays reach the place in a slanting position.*

D= Spring: *which experiences an increase in the day hours and a decrease in the night hours, an increase in temperature and an increase in the season is just about to start as the sun returns to the tropic of Cancer $23\frac{1}{2}^{\circ}$ North*

Which areas would not experience the overhead sun (3)

These are the North Pole and the south pole because the sun appears to be very far from such places

Study the figure below and answer the question that follows:



B

5. State the seasons experienced at A

- a. *Hot, wet season*
- b. *Cool Dry season*
- c. *Hot dry season*

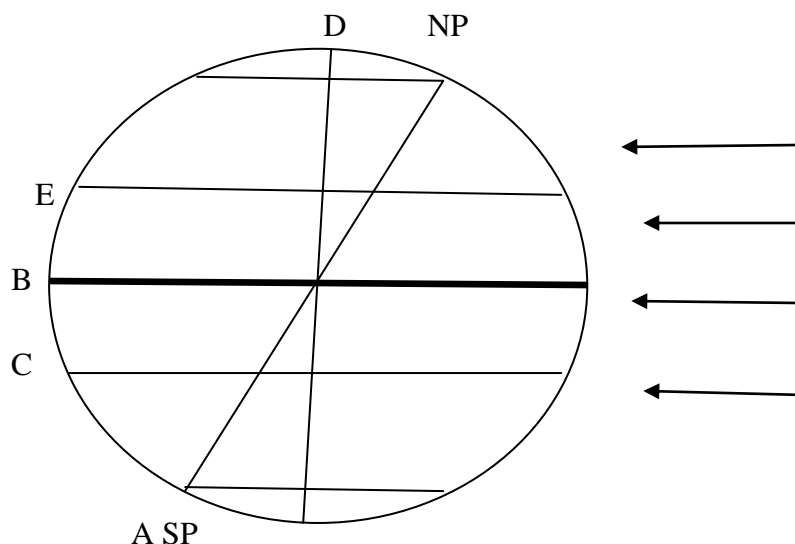
6. State the four seasons experienced in B

- a. *Summer*
- b. *Autumn*
- c. *Spring*

Explain why seasons experienced at A are somehow different from seasons experienced in B

This is due to the differences in terms of latitudinal location. In A which can be described as the tropics, temperature changes little such that what is described as cold in the temperate, in the tropics it is cool. The amount of rainfall varies greatly in the tropics than that in B which can be the temperate region these two factors separates the two named regions in terms of climates.

Study the diagram below and answer the questions that follow:-



Name the lines marked A,B,E,D

A= the Antarctic Circle

B= the Equator

E= the tropic of Cancer
D= Circle of illumination

When is the sun overhead line marked C

22nd December

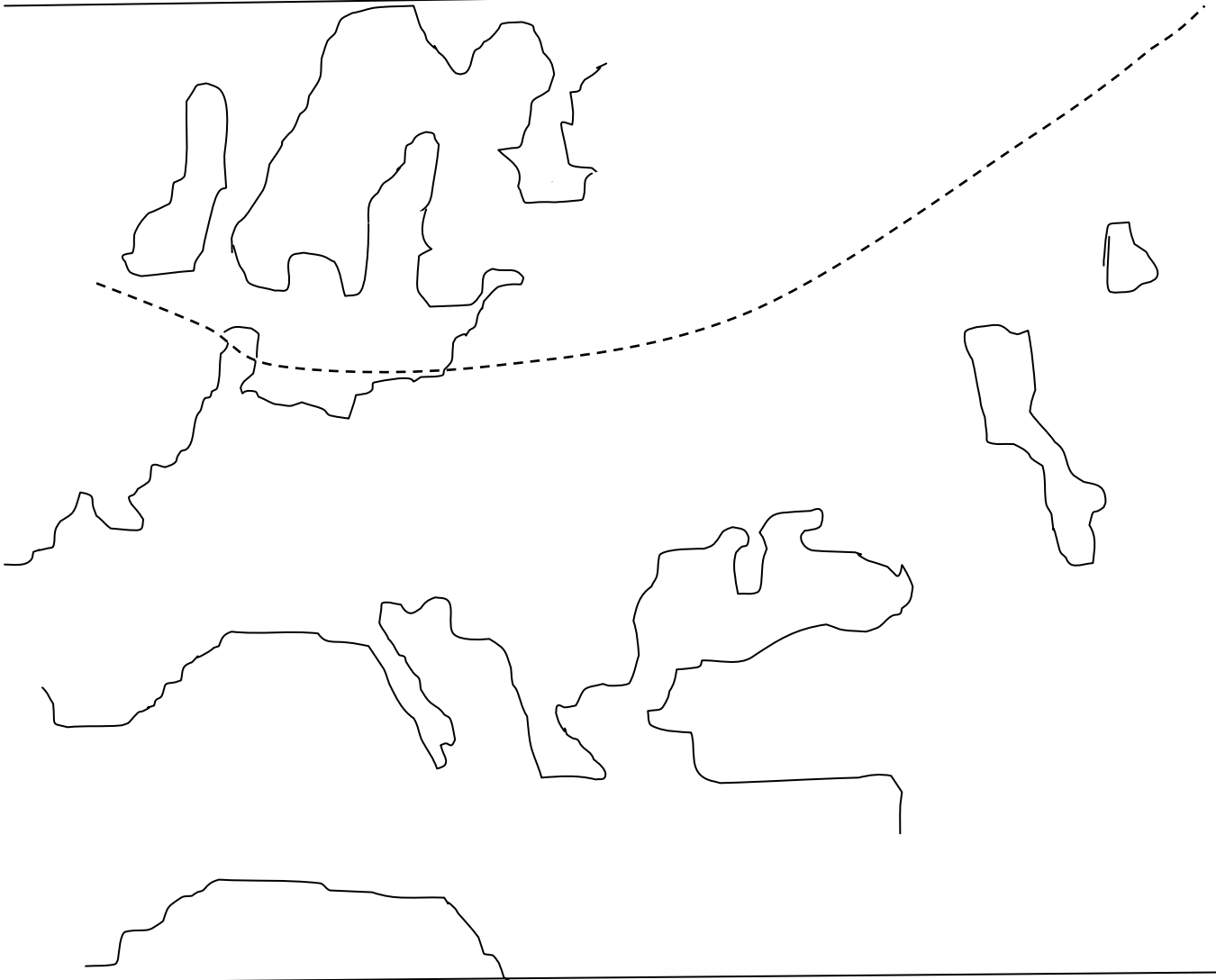
When the sun is overhead line C, what season is in to the north of line E

It is winter season

When the sun is overhead line E, what season is it in Malawi

It is cool dry season

Study the figure below which is followed by the temperature data. Using these two, answer the questions that follow (1992)



Towns	Valencia	London	Berlin	Kiev	Orenburg
July max	15 ⁰ C	16 ⁰ C	19 ⁰ C	20 ⁰ C	22 ⁰ C
January max	7 ⁰ C	4 ⁰ C	-1 ⁰ C	-6 ⁰ C	-16 ⁰ C

Describe the temperature changes between Valencia and Orenburg in Summer (2)

These towns are along 50⁰N. They experience summer in the month of July when the sun appears to be overhead along the tropic of Cancer 23¹/2⁰N. According to the table, temperatures between Valencia and Orenburg increases as the distance increases from the coast to inland. For example, Valencia has 15⁰C, while Orenburg which is inland has a higher temperature of 22⁰C. This clearly shows, the increase in temperature as the distance increases from the coast going inland.

Describe the temperature changes between the same stations in winter (2)

As the towns are in the Northern Hemisphere, January is the winter in the area. According to the table, temperature decreases away from the coast, that is, as the distance increases in land from the coast, temperature decreases. For example, Valencia has 7⁰C, London, 4⁰C, Berlin -1⁰C, Kiev 16⁰C and Orenburg has the lowest -16⁰C. This clearly shows that as the distance increases from the coast, temperature decreases.

Give an account of why there are these changes in both summer and winter

In summer temperature increases as the distance increases from the coast. This is because summers become hotter or inland, since the land absorb heat faster and release it faster too. As the wind blow from the oceans to the land, it cools some of the towns along the coast. Such winds do not usually reach inland hence higher temperatures are inland.

In winter temperatures decrease with an increase in the distance from the coast. This happens because in winter, the land loses heat faster. Since water absorbs heat slowly in winter, water becomes warmer than the land. Warm air that blows towards the land are responsible for the increase in temperature along the coast. Such warm air does not reach towns which are far from the coast, hence lower temperatures experienced in towns far from the coast.

In which direction does the earth move during revolution (2005)

It moves in an anticlockwise direction

Name the season that is experienced in south Africa at cape Town when the earth is overhead at each of the following latitudes

a. Tropic of Cancer

Winter season as South Africa lies in the southern hemisphere and the tropic of cancer in the northern hemisphere. This makes South Africa to receive weak slanting rays of the sun, hence winter season

b. Tropic of Capricorn

Summer season as the tropic of Capricorn is in the southern hemisphere and South Africa also in the southern hemisphere. This makes the sun as if it shines direct to South Africa, with high temperature and an increase in the hours of day light than hours of night.

c. Equator

Autumn as the sun is on its way to the tropic of cancer where winter will be experienced in South Africa.

Define the term Solstice(2008)

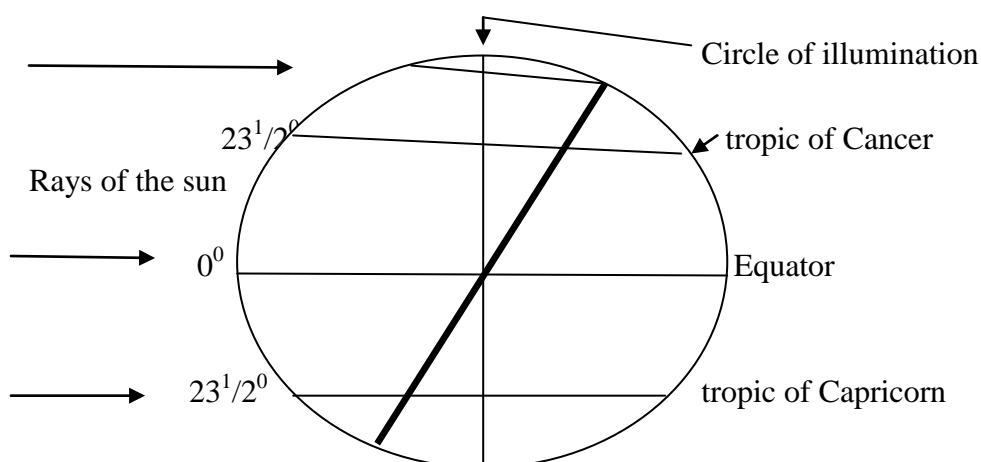
This refers to the time when the sun appears to be stopping temporarily over the tropics of cancer and the tropic of Capricorn in its apparent northward and southward movement.

Identify the date when the summer solstice is experienced in the northern hemisphere

It is 21st June

With the aid of a well labeled diagram, show the position of the earth in relation to the sun during the summer solstice in the Southern hemisphere and the major latitudes of the earth (2008) (8)

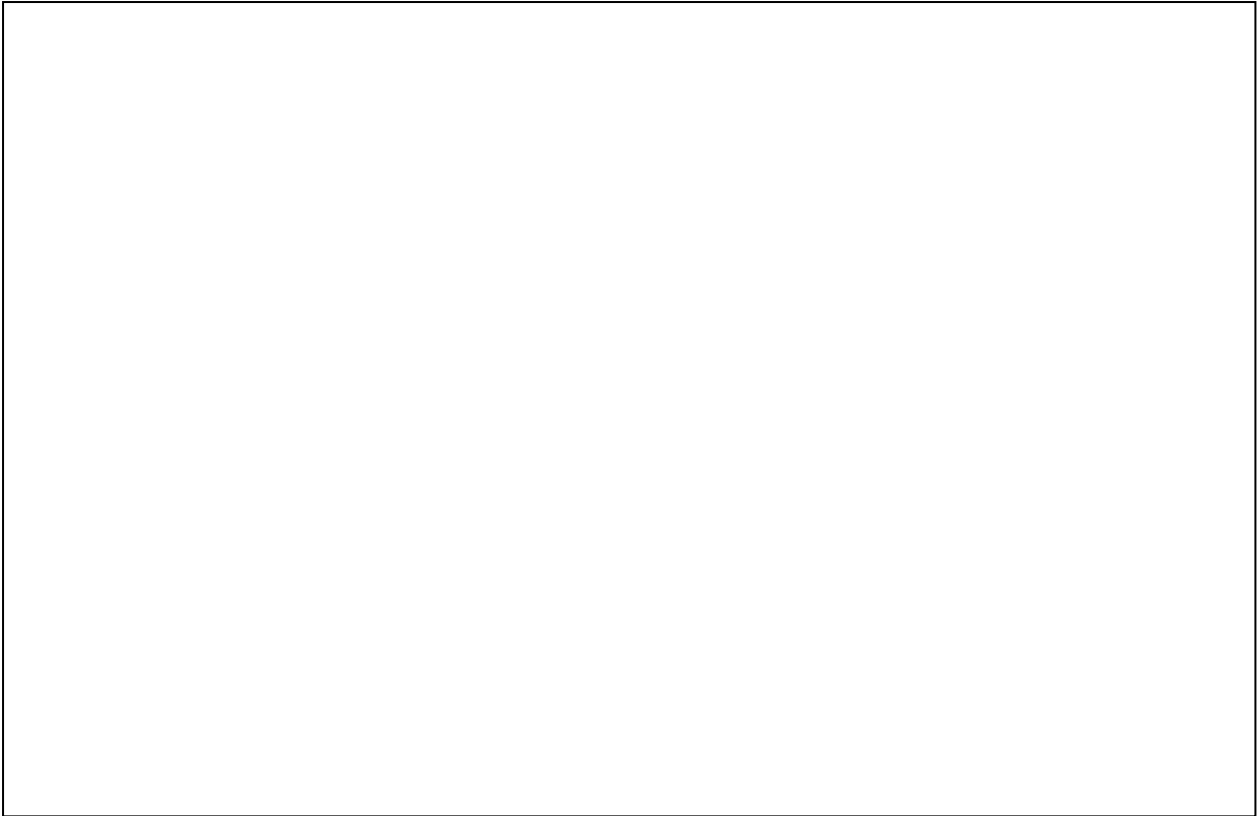
Summer solstice in the southern hemisphere happens on 23rd December. During this time the sun appears to be overhead along the tropic of Capricorn 23¹/2⁰ S. in other words, the southern hemisphere tilts towards the sun where it experiences long hours of day light and short hours of night, and an increase in temperature as the sun appears to be shining direct. The diagram below shows the position of the earth in relation to the sun on 22nd December



5. Study the figure below which shows the position of the earth in relation to the sun during 21st June.



- a. On the same diagram provided below, insert
- i. The sun's rays showing where the noon day sun is overhead on 21st June (2)
 - ii. The line dividing the night from day and shade the area experiencing night



Compare the length of day at Philadelphia and Valdivia on 21st June (2)

Philadelphia will experience long hours of day light and short hours of night while, as Valdivia will experience short hours of daylight and long hours of night.

Account for the difference (4)

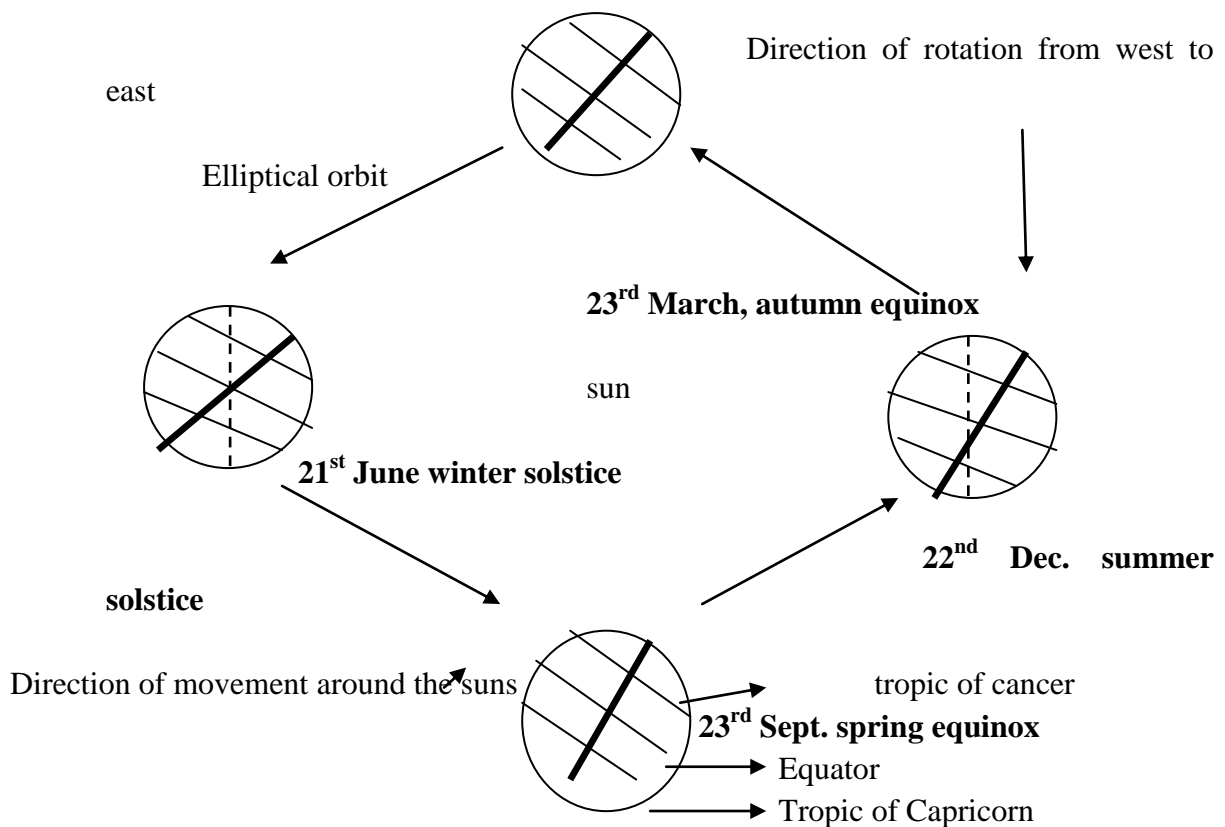
Philadelphia will experience long hours of day light and short hours of night because it is now summer in the area. As the place lies in the northern hemisphere, it receives direct rays from the sun since the northern hemisphere has tilted towards the sun, thereby receiving direct and more rays from the sun. Valdivia, being in the southern hemisphere has tilted away from the sun. This means Valdivia experiences winter with short hours of day light and long hours of night. This happens because the place receives slanting and acute rays of the sun, making it to appear as if it is far from the sun.

Draw a diagram to illustrate the revolution of the earth around the sun by showing the position of the earth at the two equinoxes and the two solstices. On your diagram insert the following

- i. The path or orbit
- ii. An arrow showing the direction of the earth movement along the orbit
- iii. An arrow to show the direction of the earth rotation at one position of the earth
- iv. The equator and the two tropics
- v. The date at each position.

Revolution of the earth is the movement of the earth around the sun once in $365\frac{1}{4}$ days or 366 days. The earth moves around the sun along its orbit. The earth moves in an anticlockwise direction around the sun while rotating on its own axis from west to east, once in 24 hours. The earth in its revolution appears on the equinoxes twice that are on 21st March and 23rd September. It appears on the solstices twice, on 21st June or 23rd June and 22nd December.

21st June is summer solstice in the Northern hemisphere and winter solstice in the southern hemisphere. 22nd December is the summer solstice in southern hemisphere and winter solstice in the northern hemisphere. The diagram below shows these:-



The diagram above shows the revolution of the earth around the sun in the southern hemisphere. If it were in the northern hemisphere 21st June would be summer, 23rd September would be autumn, 22nd December would be winter and 23rd March would be spring with everything not changing.

6. Show how the earth revolution causes varying length of day and night at different times of the year (7) (2001)

This question requires similar information and diagram as above only that an emphasis should be on explaining that in summer days are longer and nights are shorter and in winter nights are longer and days are shorter and explaining the reason behind longer days and shorter nights or shorter days and longer nights.

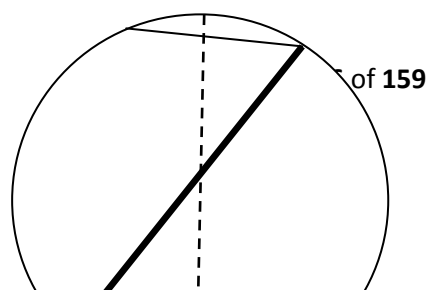
Mention the latitude where the effect of earth revolution on the length of the day is not experienced. Give a reason for your answer (3) 2000

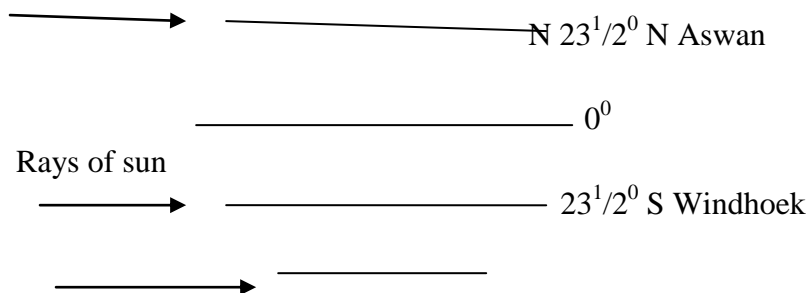
It is the equator. This is because it cuts the earth into two equal halves in addition to the fact that the area has the largest diameter. These facts result into fair distribution of rays of the sun and therefore length of the day not experienced.

With the aid of diagrams, compare the variation in the length of the day at Aswan 23¹/₂⁰N and that of Windhoek 23¹/₂⁰ S between 22nd December and 21st June (10) 2000

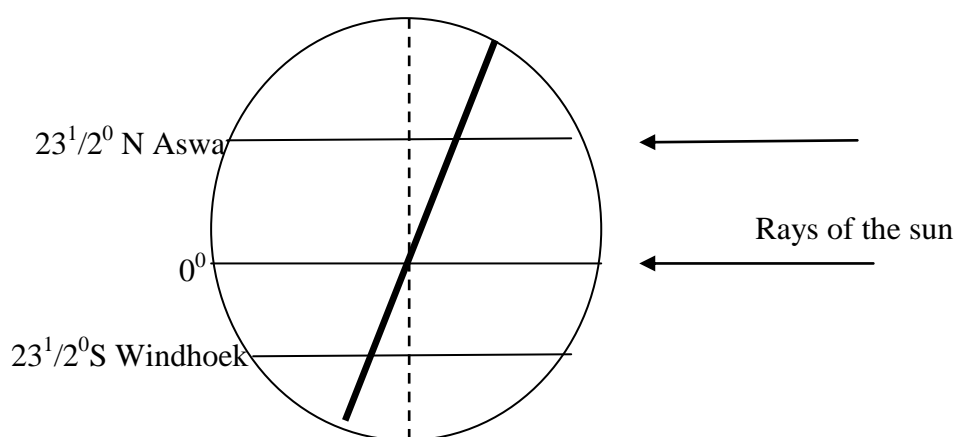
Aswan 23¹/₂⁰N is in North Africa and in the Northern hemisphere. Windhoek is in the southern hemisphere. The two places have different length of day and night within a year. On 22nd December, Windhoek experiences summer. It will have longer day hours and shorter nights. This happens because the sun appears to be overhead along the tropic of Capricorn 23¹/₂⁰ S, where Windhoek is found. Thus direct rays will be experienced at Windhoek with longer and warmer days, at the same time, on December 22nd, Aswan experiences winter. Aswan will have longer nights hours and short day hours which is in contrast to Windhoek. This happens because Aswan being in the northern hemisphere appears to be very far from the sun. With this, it receives weak slanting rays of the sun, hence winter.

On 21st June, Aswan enters summer with longer days and shorter nights as the sun appear to be overhead along the tropic of Cancer 23¹/₂⁰ N, where Aswan is found. At the same time, Windhoek enters winter as it is in the southern hemisphere and therefore far from the sun. The diagram below shows this:





Position of the earth in relation to the sun on 22nd December. It should be noted that the rays strike the earth at 23¹/2⁰ S. this makes Windhoek to experience summer and Aswan to experience winter.



This diagram above shows the position of the earth in relation to the sun on June 21st. the rays of the sun strike direct at 23¹/2⁰ N. This makes Aswan to experience summer with longer days and Windhoek to experience winter with shorter days.

Give a date when the two places (Windhoek and Aswan) above are likely to have no variations in the length of the day

It is 23rd September or 23rd March as the sun appears to shine direct over the equator

What are seasons?

These are periods of the year which are characterized by special climatic conditions such as dryness, wetness, hotness and coldness.

Mention two causes of seasons

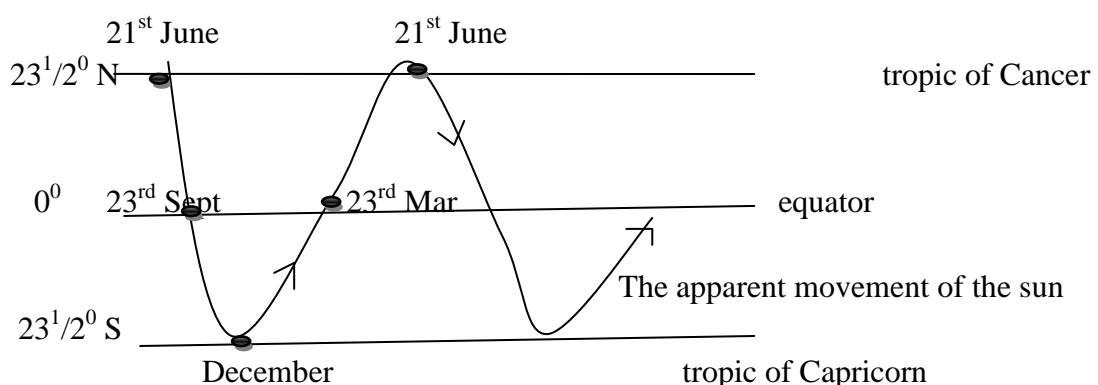
- i. The tilting of the earth to its axis at angle of 66¹/2⁰
- ii. The revolution of the earth around the sun

How does each of these above contribute to the occurrence of seasons?

- i. **The tilting of the earth's axis at an angle of $66\frac{1}{2}^{\circ}$.** The earth's axis doesn't stick straight up from the orbital plane. It tilts about $23\frac{1}{2}^{\circ}$ from the straight up position and $66\frac{1}{2}^{\circ}$ from the orbital plane. this tilt and the earth's motion around the sun causes the change of seasons. This causes seasons in that part of the earth tilts towards the sun and the other part away from the sun. for example, on 21st June, the northern hemisphere tilts towards the sun and experiences summer with longer days and warmer conditions, while the southern hemisphere tilts away from the sun and experiences winter with short days and colder conditions. From 22nd December to 21st march, the northern hemisphere is tilted away from the sun and experiences winter. Within the same period, the southern hemisphere experiences summer as it is tilted towards the sun.

NOTE: when the question requires an illustration, draw that of the revolution of the earth around the sun, with dates and seasons.

- ii. **The revolution of the earth or apparent movement of the sun is the other cause.** In a year, the sun appears to be moving between the tropic of Cancer $23\frac{1}{2}^{\circ}$ N, the equator 0° and the Tropic of Capricorn $23\frac{1}{2}^{\circ}$ S. This in turn brings the unequal distribution of light and temperature which brings about different seasons. The sun appears to be overhead along the tropic of Cancer $23\frac{1}{2}^{\circ}$ N. thus the northern hemisphere has summer solstice on this day while the southern hemisphere has its shortest day and longest night- winter solstice. The sun then appears to be overhead at the tropic of Capricorn in the southern hemisphere. Thus, the southern hemisphere experiences summer and northern hemisphere winter. The diagram below shows the apparent movement of the sun.



The sun appears to be overhead on the equator on 21st March and 23rd September of each year. The length of the days and the nights are equal. These two days (21st march and 23rd September) are called equinoxes.

Apart from seasons, give two other results of the revolution of the earth around the sun and its inclination of its axis.

- i. *changes in the midday sun's altitude at different times of the year*
- i. *Varying lengths of day and night at different times of the year.*

Apart from days and nights, give other three things that would happen should the earth stop rotating on its own axis

- i. *There would be no difference of 1 hour between two meridians which are 15^0 apart*
- ii. *There would be no deflection of winds and ocean currents as the coriolis force would not exist*
- iii. *There would be no daily rising and falling of the tides.*

LATITUDES, LONGITUDES, GREAT CIRCLES AND CIRCULATION OF TIME

Define the following terms:-

i. Longitudes

These are angular distances measured in degree east or west of the prime meridian (0^0)

ii. Latitudes

These are angular distances of a place on the earth's surface north or south of the equator measured in degrees from the center of the earth.

Give three characteristics of latitudes

- i. *They are always parallel to each other, that is why they are also called "parallels"*
- ii. *They run from east to west intersecting longitudes at right angles*
- iii. *They decrease in length as they approach the polar regions*
- iv. *They appear to be small circles except the equator which is great circle.*

Give three examples of latitudes

- i. *The tropic of Cancer ($23\frac{1}{2}^0N$)*
- ii. *The tropic of Capricorn ($23\frac{1}{2}^0S$)*
- iii. *The Arctic Circle ($66\frac{1}{2}^0N$)*
- iv. *The Antarctic circle ($66\frac{1}{2}^0s$)*

A cyclist is at a certain town 32^0 south of the equator. How far is it from the equator?

$$\begin{aligned}
 \text{Since } 1^0 &= 111\text{Km} \\
 \text{Therefore } 32^0 &= \frac{32^0 \times 111 \text{ Km}}{1^0} \\
 &= (32 \times 111) \text{ Km} \\
 &= \underline{3552 \text{ Km}}
 \end{aligned}$$

NOTE: when calculating the distance using latitude from the equator, it is important to remember the following:

There are 180° North or South of the Equator and the surface distance between the South Pole and the North Pole is 20,000Km.

Therefore to find the length of a latitude

$$\frac{(20,000 \times 1^{\circ})}{180^{\circ}} = \underline{111\text{Km or } 112\text{Km}}$$

Therefore, there are 111Km or 112Km between any two degrees of latitude.

At equator 0° the distance is 110 Km, at 45° is 111Km and at the poles is 111.7 Km and the average is taken as 111Km

A tourist visits a game reserve at latitude 54 degrees 30 seconds. How far is it from the equator?

$$1^{\circ} = 60 \text{ seconds or } 1^{\circ} = 60'$$

$$1^{\circ} = 111 \text{ Km}$$

$$54^{\circ} 30' = 111 \times 54.5$$

$$= 6049.5\text{Km}$$

$$= 6050 \text{ Km}$$

It is = 6050 Km from the equator

Find the local time of a place 60°W if the time at Greenwich (0°) is 6:00 p.m

$$\text{Time at Greenwich } (0^{\circ}) = 6:00 \text{ pm}$$

$$\text{Longitude of a place} = 60^{\circ}\text{W}$$

$$\text{Time difference} = 60^{\circ}/15^{\circ}$$

$$= 4\text{hrs}$$

$$\text{Time at } 60^{\circ}\text{W} = 6:00 - 4 \text{ hrs}$$

$$= \underline{2:00 \text{ pm}}$$

What would be the time at town B which is 30°E of town A. when time at town A is 3Pm

$$\text{Time at A} = 3\text{pm}$$

$$\text{Longitude of town B} = 30^{\circ}\text{E}$$

$$\text{Time difference} = 30^{\circ}/15^{\circ}$$

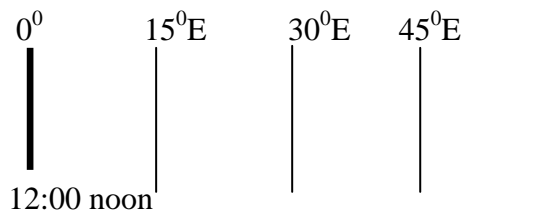
$$= 2\text{hrs}$$

$$\text{Time at town B } 30^{\circ}\text{E} = 3:00 + 2$$

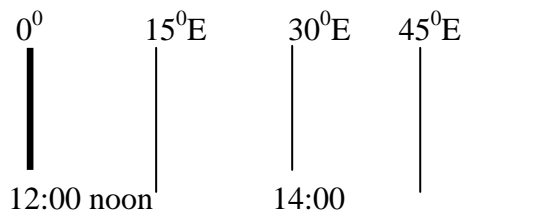
$$= 5:00\text{pm}$$

Or $= 17:00 \text{ hrs}$

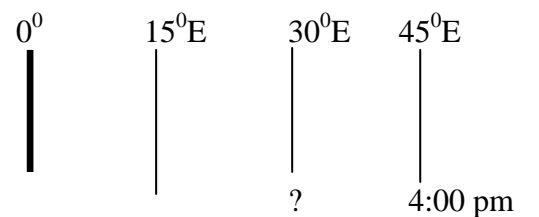
What will be the time at 30^0E if the time is 12:00 noon at 0^0 longitude



$$\begin{aligned}
 \text{Longitude of a place} &= 30^0\text{E} \\
 \text{Time at Greenwich} &= 12 \text{ noon} \\
 \text{Time difference in hours} &= 30/15 \\
 &= 2\text{hrs} \\
 \text{Longitude of a place} &= 30^0\text{E} \\
 &= 12:00 + 2\text{hrs} \\
 &= \underline{14:00}
 \end{aligned}$$



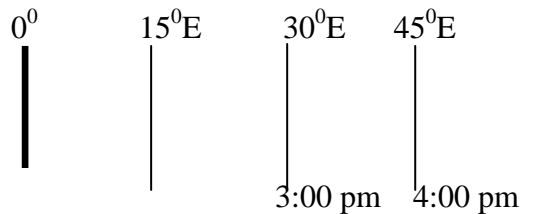
Calculate the time at 30^0E if the time is 4:00 pm at 45^0E



$$\begin{aligned}
 \text{Longitude of a place} &= 30^0\text{E} \\
 \text{Time at } 45^0\text{E} &= 4:00\text{pm} \\
 \text{Difference in longitude} &= 45^0 - 30^0 \\
 &= 15^0 \\
 \text{Time difference} &= 15^0/15^0 \\
 &= 1\text{hr}
 \end{aligned}$$

$$\begin{aligned}
 \text{Time at } 30^{\circ}\text{E} &= 4:00 \text{ pm} - 1 \text{ hr} \\
 &= \underline{3:00 \text{ pm}}
 \end{aligned}$$

Diagrammatically



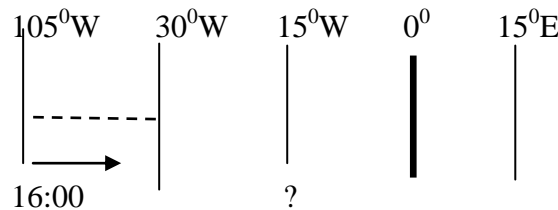
Calculate the time at X whose longitude is 45°W when the time at Q 73°E is 14 hrs or 2:00 pm

$$\begin{aligned}
 \text{Longitude of a place} &= 45^{\circ}\text{W} \\
 \text{Time at longitude q } 73^{\circ}\text{E} &= 14 \text{ hrs} \\
 \text{Difference in longitude} &= 45^{\circ}\text{E} - 0^{\circ} + 73^{\circ}\text{W} \\
 &\text{(Since one place is to east and another to the west)} \\
 &= 45^{\circ}\text{E} - 0^{\circ} + 73^{\circ}\text{W} \\
 &= 118^{\circ} \\
 \text{Time difference} &= 118^{\circ}/15^{\circ} \\
 &= 7\text{hrs } 13^{\circ} \\
 &= 13/15 \times 60 \text{ (to find minutes } 1^{\circ} = 60') \\
 \text{Therefore time} &= 52 \text{ minutes} \\
 \text{Time at } 45^{\circ}\text{W} &= 14:00 - 7:52 \\
 &= 6:08 \\
 \text{Time at } 45^{\circ}\text{W} &= 6:08 \\
 &\text{(note 52 minutes are subtracted from 60 minutes that make } 1^{\circ})
 \end{aligned}$$

What is the time at 15°W when the time at 105°W is 16:00 hrs

$$\begin{aligned}
 \text{Longitude of a place} &= 15^{\circ}\text{W} \\
 \text{Time at } 105^{\circ}\text{W} &= 16:00 \\
 \text{Difference in longitude} &= 105^{\circ} - 15^{\circ}\text{W} \\
 &= 90^{\circ} \\
 \text{Time difference} &= 90^{\circ}/15^{\circ} \\
 &= 6\text{hrs} \\
 \text{Time at } 15^{\circ}\text{W} &= 6:00 + 6\text{hrs} \\
 &= 12:00 \text{ noon}
 \end{aligned}$$

NOTE: time is added because it is from a higher degree to a lower degree even if it is in the west.



Therefore, time at 15°W = 12:00 noon

Calculate the time in New York 75°W when it is 18 hrs in Sydney, Australia 150°E

*Difference between longitudes between two places = $75^{\circ} - 0^{\circ} + 150^{\circ}$
(since one place is to the east and the other to the west, the Greenwich (0°) must be reached first)*

$$= 225^{\circ}$$

Difference in time

$$= 225^{\circ}/15^{\circ}$$

$$= 15\text{hrs}$$

Time in New York

$$= 18:00 - 15\text{ hrs}$$

$$= 3:00\text{ am}$$

Subtraction is done due to the movement from a higher to lower degree

Suppose a Malawian football team is playing Ghana in Accra (0°) and the game is scheduled for 3:00 Pm Ghanaian time. What time will be in Malawi (35°E) at the kick off?

$$\text{Time at Ghana } (0^{\circ}) = 3:00\text{pm}$$

$$\text{Longitude of Malawi} = 35^{\circ}\text{E}$$

$$\text{Time difference} = 35^{\circ}/15^{\circ}$$

$$= 2\text{hrs } 33\text{ minutes}$$

$$\text{Malawi } 35^{\circ}\text{E} = 3:00 + 2:33\text{ hrs}$$

$$= 5:33\text{ pm}$$

A football match between Malawi and Ghana kicks off in Accra, Ghana (0°) at 5:00 pm local time. What will it be in Malawi, 30°E ? show your working (1992)

$$\text{Time in Ghana } (0^{\circ}) = 5:00\text{ pm}$$

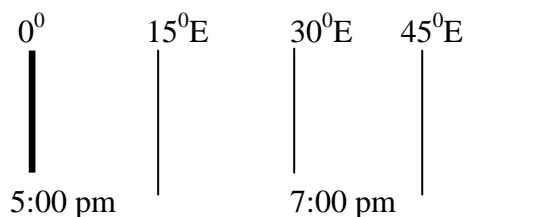
$$\text{Longitude of Malawi} = 30^{\circ}\text{E}$$

$$\text{Time difference} = 30^{\circ}/15^{\circ}$$

$$= 2\text{hrs}$$

$$\text{Since Malawi is to the east} = 5:00\text{pm} + 2\text{ hrs}$$

$$= 19:00$$



1. A football match will be played in town N which is along the Prime meridian (0°). It will start at 10pm. Calculate the time at which people in Town P 50°W and town Q 20°E should switch on their televisions to watch this football match (6 marks) 2008

Since town N is along the prime meridian it is (0°)

Time at town N (0°) = 10 pm

Longitude of town P = 50°W

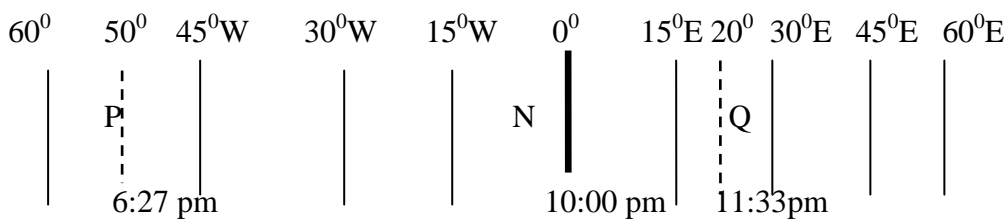
Time difference = $50^{\circ}/15^{\circ}$
= 3:33hrs

Since P is to the west of N = 10:00 pm – 3:33hrs
= 6.27 pm

Longitude of town Q = 20°E
= $20^{\circ}/15^{\circ}$
= 1:33 hrs

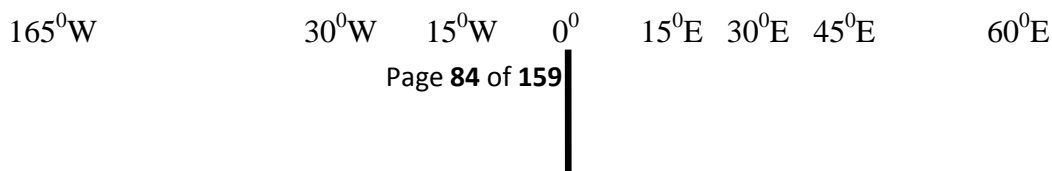
Since the town is to the east = 10: pm + 1:33 pm
= 11:33 pm

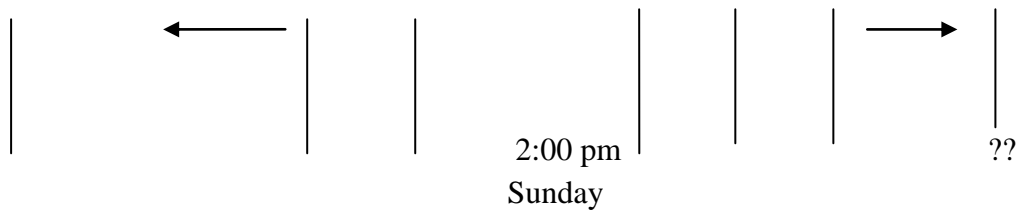
Therefore town P must switch the television at 6:27 pm while town Q at 11:33 pm



2. Suppose an international football match is to be held in Accra, Ghana (0°) and is scheduled to start at 2: pm on Sunday, 28th January 2001. Imagine that contesters will come from country A (165°W) and country B (180°E). Calculate the time date and day when the listeners in each of the two countries can tune in their radios for the start of the match (10).

Using the diagram to solve the problem



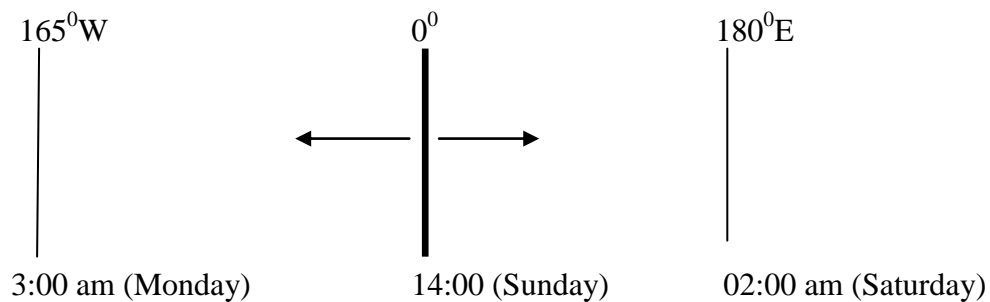


Time at Accra, Ghana $= 14:00$
Longitude of place A $= 165^{\circ}W$
Time difference in hours $= 165^{\circ}/15^{\circ}$
 $= 11 \text{ hrs}$
Place A is to the west $= 14:00 - 11:00$
 $= 3:00 \text{ am}$

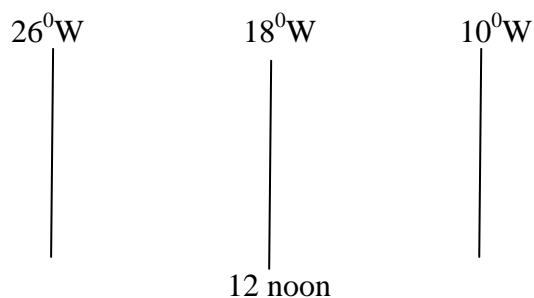
Country A should switch on their radios on 29th January, Monday 3:00 am

Longitude of country B $= 180^{\circ}E$
Time difference in hours $= 180^{\circ}/15^{\circ}$
 $= 12 \text{ hrs}$
Since the country is to the east $= 14:00 + 12 \text{ hrs}$
 $= 26:00$
 $= 26:00 - 0:00 \text{ as it passes midnight}$
 $= 02:00 \text{ hrs}$

Country B would listen to the match on 29th January, Saturday 02:00 am 2001



Given that at 18⁰W time is 12 noon, what is the time at 10⁰W and 26⁰W?



i. Time at 10⁰W

$$\begin{aligned}\text{Difference in location} &= 18^{\circ} - 10^{\circ} \\ &= 8^{\circ}\end{aligned}$$

$$\begin{aligned}\text{Time difference} &= 4 \times 8^{\circ} \\ &= 32 \text{ minutes}\end{aligned}$$

Add 32 minutes to the time at 18°W to find time at 10°W because 10°W lies to the east of 18°W . This shows that time at 10°W is 32 minutes afternoon that is 12:32 pm

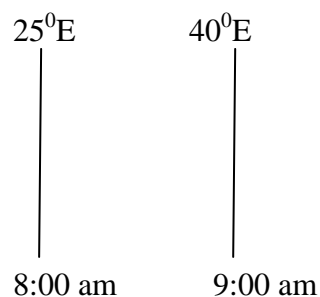
ii. Time at 26°W

$$\begin{aligned}\text{Difference in location} &= 26^{\circ} - 18^{\circ} \\ &= 8^{\circ} \\ &= 32 \text{ minutes}\end{aligned}$$

Subtract 32 minutes from the time at 18°W to find time at 26°W because 26° lies to the west of 18°W . this shows that time at 26° is before noon, that is 11:28 am.

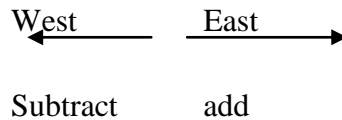
NOTE THE FOLLOWING WHEN CALCULATING LOCAL TIME FROM THE GREENWICH MEAN TIME (GMT)

- Different place located on different longitudes or meridians have different local times at any given time.
- Two places located on two longitudes 15° apart have time difference of one hour

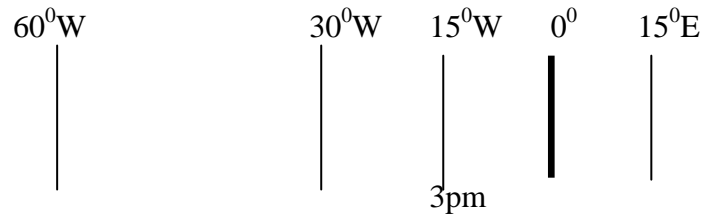


- The earth completes its rotation in 24 hours therefore in 1 hour the earth turns $360/24 = 15^{\circ}$
- Longitudes are therefore located 15° apart
- Going towards the east time is added while towards the west is subtracted. This is because the earth rotates from west to east. This means that the east sees the sun first and west later. Therefore time should be calculated from the Greenwich Meridian or prime Meridian (0°) either going eastwards or westwards. Time is ahead of the Greenwich meridian when going eastwards and behind the Greenwich meridian going westwards.

0°



- When it is **2 pm** along longitude 0^0 , to the east it is after this time but to the west it is before this time. To find time at a place to the East of longitude 0^0 , time difference should be worked out first between that place and longitude 0^0 . To the west time is subtract from the time along longitude 0^0 . For example



It is 3pm along 15^0 W. What are the times for other longitudes? The longitudes are spaced 15^0 a part or 1 hour apart.

- i. To find time for longitude 0^0 add 1 hour to the time for longitude 15^0 W because 0^0 lies to the east of 15^0 W. The time along 0^0 longitude is (3+1) pm or 4Pm.
- ii. To find time for longitude 30^0 W subtract 1 hour from the time for longitude 15^0 W because going westwards time is subtracted so the time at 30^0 W is (3-1) pm or 2 pm.
- iii. What is the time at longitude 60^0 W when time at 15^0 W is 3 pm.

$$\begin{aligned}
 \text{Difference in location} &= 60^0 - 15^0 \\
 &= 45^0 \\
 \text{Time difference} &= 45/15 \\
 &= 3 \text{ hrs} \\
 \text{Time at } 60^0\text{W} &= (3-3) \text{ pm} \\
 &= 0 \\
 &= 12 \text{ noon}
 \end{aligned}$$

- In 1 hour the earth turns 15^0 of longitude. This means that every 4 minutes the earth turns 1^0 of longitude (1 hr = 60 minutes)

$$\begin{aligned}
 &= 60/15 \\
 &= 4 \text{ minutes}
 \end{aligned}$$

Journalist leaves a village at longitude 105^0 west at 10:00 am arrives at a certain island at 2:00 hrs. At which longitude is he at this time.

Working:

The longitude is ahead of the prime meridian, therefore time will be added

$$\begin{aligned}\text{Time difference} &= 0^0 - 105^0 \\ &= 105^0 \\ \text{Time difference} &= 105^0 / 15^0 \\ &= 7 \text{ hrs} \\ \text{Time at } 105^0 &= 10:00 \text{ am}\end{aligned}$$

The time is ahead of GMT

$$\begin{aligned}&= 7 \text{ hrs} + 10:00 \text{ am} \\ &= 17:00 \text{ hrs}\end{aligned}$$

Difference in time with that of an island

$$\begin{aligned}20: &- 17 \text{ hrs} \\ &= 3 \text{ hrs} \\ \text{If } 1 \text{ hr} &= 15^0 \\ 3 \text{ hrs} &= 3 \times 15^0 \\ &= 45^0\end{aligned}$$

The journalist will be at longitude 45^0 east

A tourist leaves a historical site at 5:00 pm at a longitude 45^0 E of the Greenwich meridian. At what time does he arrives at longitude 150^0 W of prime meridian?

$$\begin{aligned}\text{Difference in longitude} &= 45^0 - 0^0 + 150^0 \text{W} \\ \text{One place is to the east and the other to the west} &= 195^0 \\ \text{Time difference} &= 195^0 / 15^0 \\ &= 13 \text{ hrs}\end{aligned}$$

$$\begin{aligned}\text{Longitude required to find time} &= 150^0 \text{W} \\ \text{Since the place is to the west, time must be subtracted} &17:00 - 13:00 \text{ hrs} \\ &= 4:00\end{aligned}$$

Therefore, the tourist arrives at longitude 150^0 W of the Prime meridian at 4:00 am

Calculate the longitude of a place whose time is 24hrs when the time at $6 30^0$ E is 15 hrs

$$\begin{aligned}\text{Time difference between the two places} &= 24:00 - 15:00 \text{ hrs} \\ &= 9 \text{ hrs} \\ \text{If } 1 \text{ hr} &= 15^0 \\ 9 \text{ hrs} &= 15 \times 9 \\ &= 135^0 \\ 30^0 \text{ E} &= 135^0 + 30^0\end{aligned}$$

$$=165^0E$$

Longitude of a place is 165^0E

What is the longitude of a place G whose time is 2:00 am Sunday when the time at 30^0W is 22:00 hrs (10pm) on Saturday

$$\begin{aligned} \text{Time at longitude G} &= 2:00 \text{ am} \\ \text{Time at } 30^0W &= 22:00 \text{ hrs} \\ \text{Difference in time} &= 24:00 - 22:00 + 2\text{hrs} \\ \text{The time has past midnight} &= 2\text{hrs} + 2\text{hrs} \\ &= 4\text{hrs} \\ \text{If 1 hr} &= 15^0 \\ 4 \text{ hrs} &= 15 \times 4 \\ &= 60^0 \end{aligned}$$

Since the time shows two days involved and the degrees show that both the west and the east of the prime meridian are involved, a different approach is used

$$\begin{aligned} 60^0 + 0^0 - 30^0 \text{ (these are } 30^0W) \\ = 30^0E \end{aligned}$$

Calculate the longitude of a place whose time is 8: 00 am. The time of another place found at longitude 120^0W is 4 am.

$$\begin{aligned} \text{Difference in times given} &= 8-4 \\ &= 4 \text{ hrs} \\ \text{If 1 hr} &= 15^0 \\ 4\text{hrs} &= 15 \times 4 \\ &= 60^0 \end{aligned}$$

$$\text{Longitude of a place} = 120^0 - 60^0$$

(Because it is from a higher longitude to a lower longitude towards the prime meridian)

WEATHER INSTRUMENTS

Clearly state what do you understand by the following terms:

i. Humidity

This is the amount of water vapor in the air

ii. Precipitation

This is the falling of all frozen and liquid forms of water from the atmosphere to the earth's surface. It involves rain, fog, snow, hail, drizzle and sleet.

iii. Atmospheric pressure

This is the force exerted by air on to the earth's surface

All weather stations have a Stevenson screen:

i. Describe its structure

It is a box found in all weather stations. It is put 121cm above the ground, painted white in order to reflect light, made up of louvers on all sides in order to allow air to circulate. The roof is made up of double boarding to prevent the sun's heat from reaching the inside of the screen.

ii. Name the instruments it contains

- | | | |
|-------------------------|---|-------------------|
| a. Wet bulb thermometer | } | Hygrometer |
| b. Dry bulb thermometer | | |
| c. Minimum thermometer | } | Six's thermometer |
| d. Maximum thermometer | | |
| e. Mercury barometer | | |

iii. Briefly describe the nature of its location

It has to be located in an open place where the air is free to circulate. It should be away from trees and buildings as these would block the elements of weather to be measured. It should be put at a height of 121 cm or 1.2 m from the ground. This is done in order to protect it from being knocked down by cars in addition to allowing free circulation of air below.

Carefully, explain the meanings of the following terms

i. Mean daily temperature

This is the average of maximum and minimum temperatures recorded in a day or 24 hours. It is found by adding the minimum and maximum temperature of the day and then halved. For example,

Maximum 31⁰C

Minimum 29⁰C

$$\begin{aligned} \text{Mean daily (diurnal) temperature} &= \frac{31 + 29^0\text{c}}{2} \\ &= 30^0\text{C} \end{aligned}$$

ii. Diurnal temperature range

This is the difference between maximum and minimum temperature recorded in a day or in 24 hours. It is also called the daily temperature range, calculated by subtracting the minimum temperature for a day from the maximum temperature for a day. For example

Maximum 31⁰C

Minimum 29°C

$$\begin{aligned}\text{Daily temperature range} &= 31 - 29^{\circ}\text{C} \\ &= 2^{\circ}\text{C}\end{aligned}$$

iii. Mean monthly temperature

This is the sum of mean daily temperatures for one month divided by the number of days in that month

$$= \frac{\text{sum of daily temperature for 1 month}}{\text{Number of days in a month}}$$

iv. Mean annual temperature

This is the sum of mean monthly temperatures for one year divided by the total number of months in a year

$$= \frac{\text{sum of mean monthly temperatures for 1 year}}{12}$$

v. Mean annual range of temperature

This is the difference between the highest mean monthly temperature and the lowest mean monthly temperatures in a year.

$$= \text{highest mean monthly temp} - \text{lowest mean monthly temp.}$$

vi. Relative humidity

This is the ratio or relationship between the actual amount of water vapor in a given volume of air and the amount which it can hold at a given temperature

vii. Absolute humidity

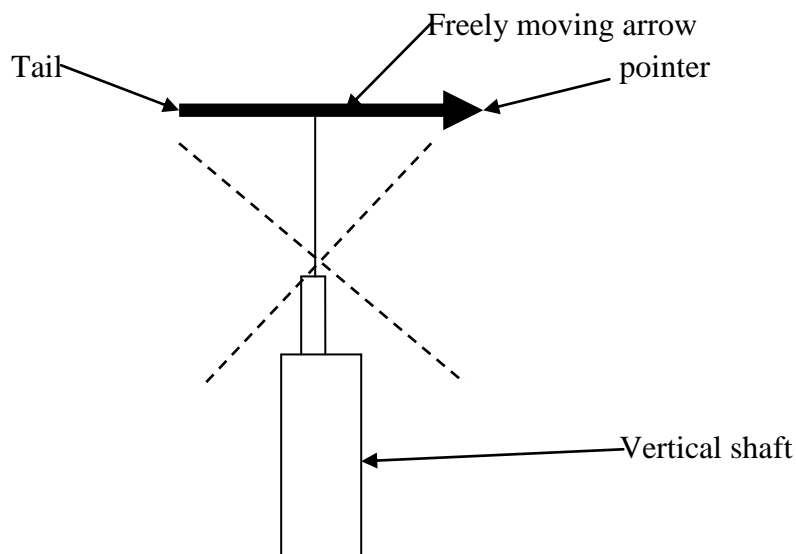
This is the actual amount of water vapor in the air at a particular time

A weather station contains the following instruments: wind vane, six's thermometer and a hygrometer:

Draw diagrams, label the instruments and explain how they are used to weather records.

i. A wind vane

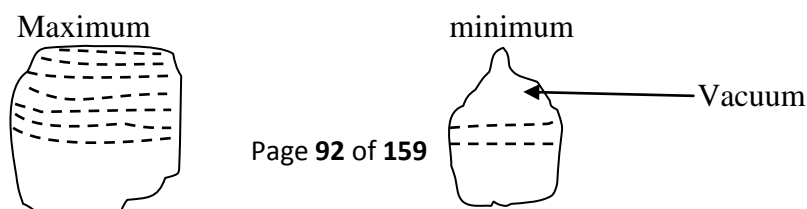
A wind vane is an instrument, which is used for indicating the direction of wind. It consists of a horizontal rotating arm pivoted on a vertical shaft. The rotating arm has a tail at one end and a pointer at the other. Below the rotating arm there is a fixed framework indicating the cardinal points of a compass. The important cardinal points are North (N), South (S), West (W) and East (E). although not shown in the wind vane, there are other important directions between the cardinal points such as North East (NE), North West (NW), South East (SE) and South West (SW). The diagram below shows a wind vane

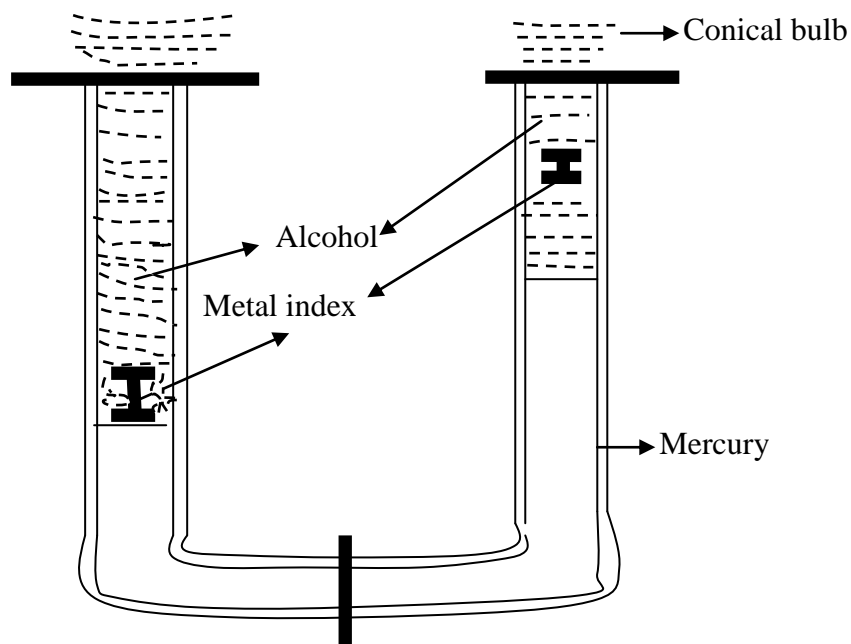


When the wind blows, the arm swings until the pointer faces the wind. When the wind blows from the north, the pointer points to the north. When the wind blows from the east the pointer points east. In whatever direction the wind blows from, the pointer points there. In the diagram above, the wind is blowing from Northeast. Such wind can be called the North Easterly wind.

ii. The Six's thermometer

This is a combination of maximum and minimum thermometer. It is used for measuring the temperature of the day in degrees Celsius. It consists of the two limbs, the left hand limb that records the minimum temperature and the right hand limb, which records the maximum temperature of the day. Both limbs contain alcohol, mercury and a metal index. At the top of the right hand limb there is an empty space called a Vacuum. The diagram below shows a six's thermometer.





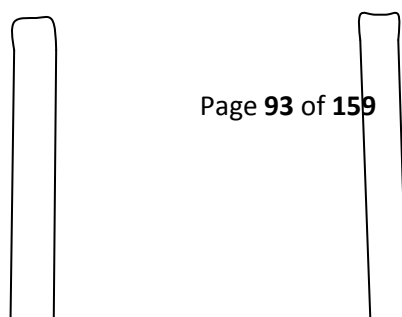
When the temperature rises, the alcohol in the left-hand limb expands and pushes the mercury down the left-hand limb and up the right hand limb. The alcohol in this limb also heats up and part of it is vaporized and occupies the space in the bulb called vacuum. The maximum temperature is read from the scale on the right hand limb but at the bottom of the metal index. In the diagram above, the maximum temperature is 20°C.

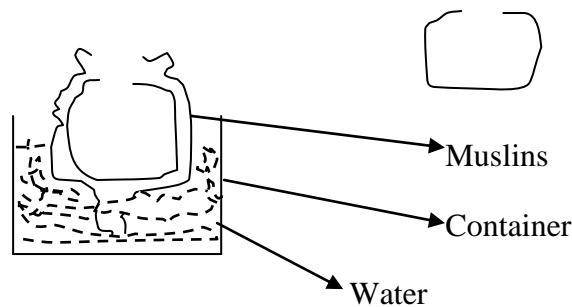
When the temperature falls, the alcohol in the left- hand limb contracts and some of the alcohol vapor in the conical bulb liquefies. This causes the mercury to flow from the right-hand limb to the left. Read from the scale on the left hand limb but at the top of the metal index. In the diagram above, the minimum temperature is 10°C.

To reset the thermometer, a magnet is used to pull the metal indices to mercury level. The movement of the alcohol does not make the metal indices to move. The mercury moves these.

iii. The Hygrometer

This is an instrument, which is used for measuring the amount of water vapor in the air. It consists of two thermometers, the wet bulb and dry bulb thermometer. The wet bulb thermometer's base is wrapped in thin muslin, which dips into a small container of water. The dry bulb thermometer has no muslin. Both thermometers contain mercury. The diagram below shows the hygrometer.





The hygrometer measures humidity through the use of wet and dry bulb thermometer and the special tables prepared. When temperature rises, that is, when air is not saturated, moisture evaporates from the muslin or cloth, which in turn cools the wet bulb. Mercury in the wet bulb contracts when evaporation is taking place. Temperature is therefore lowered in the wet bulb by this evaporation. But the dry bulb is not affected in any way by the evaporating water.

When the air saturated, that is, full of moisture, no evaporation takes place from the muslin. The two thermometers then show the same reading as the dry bulb cannot also rise. The differences in temperature readings of the two thermometers are used to determine relative humidity using special tables. Generally when the two thermometers read the same, the air is saturated, when the difference in the readings of the two thermometers is small, it means that relative humidity is high and when the difference in the reading from the two thermometers is large, it means that relative humidity is low.

Briefly explain the meaning of each of the following statements:

- a) A Stevenson screen should be at least 1.2 meters above the surface, its sides should be louvered and it should be painted white**

A Stevenson screen, a weather instrument box has to be placed at 1.2 meters in order to allow free circulation of air and to make it visible enough so that a car should not knock it down. Its sides should be louvered in order to allow air to flow in and out easily in addition to preventing direct sunlight into the screen. It should be painted

white in order to reflect sunlight which would destroy the instruments inside should it be allowed.

b) A six's thermometer is a combination of maximum and minimum thermometers

This is a combination of maximum and minimum thermometer. These are joined together in a u- shaped tube. The maximum measures the highest temperature of the day and the minimum measures the lowest temperature of the day.

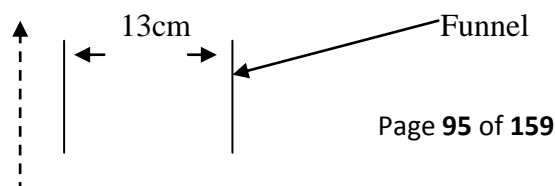
c) When the air is saturated wet and dry bulb thermometer should read the same

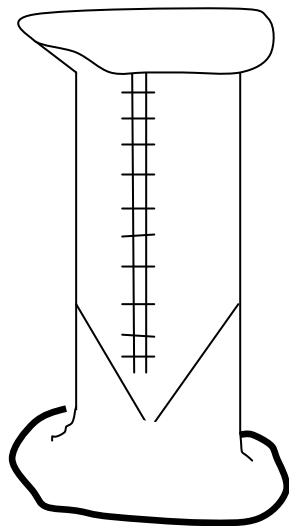
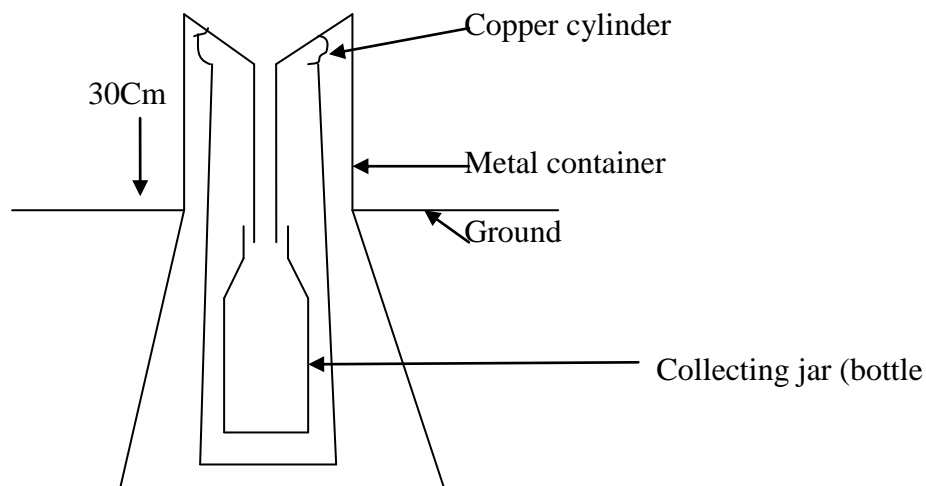
When the air is saturated, it means there is a lot of water vapor in the atmosphere. This makes water not to evaporate from the muslin or cloth in order to cool the wet bulb. The dry bulb also does not rise, as the mercury is not heated up for it to rise. The result is that the two thermometers read the same or there is no difference. This is interpreted as 100% and air is saturated.

1. Describe and name the instrument that is used for measuring rainfall

Rainfall is measured by using an instrument called a Rain gauge. A Rain gauge consists of a rainwater-collecting jar, metal container, a funnel and a separate measuring cylinder. The collecting jar is below the ground level in order to prevent evaporation of water after being collected. The diagram below shows a rain gauge.

Diagram.





Measuring cylinder

When rainfalls, the funnel collects the rainwater drops and directs them into the jar. The water in the jar is then carefully poured into the measuring cylinder, and the amount is read off on the side of the measuring cylinder at an eye level. Rainfall is measured in millimeters (mm) the rain gauge should at least be 30Cm above the ground in order to avoid splashing. The instruments should be sited well away from tall buildings, high trees and other objects, which would shelter it. This can help avoid wrong readings due to in splashing of raindrops form tree leaves or roofs of buildings

Define the following terms:

- i. **Isotherms:** *these are line on a map joining all places of equal temperature readings*
- ii. **Isohyets:** *lines drawn joining places of equal rainfall amounts on the paper*
- iii. **Isohels:** *a line drawn through places with same duration of sunlight*
- iv. **Isoneph:** *a line drawn on a map joining places having equal cloudiness over a certain period of time*
- v. **Isobar:** *a line joining places of the same air pressure on the paper*
- vi. **Anemograph:** *this is a self recording anemometer, recording the speed of wind in Km/hr*
- vii. **Psychrometer:** *this is a more accurate instrument for measuring humidity apart from hygrometer.*

What instrument would you use to measure each of the following:

- i. **Wind velocity** = *cup anemometer*
- ii. **Relative humidity**= *hygrometer*
- iii. **Atmospheric pressure**= *Barometer*
- iv. **Sunshine**= *Campbell sunshine recorder*
- v. **Wind direction**= *wind vane*

Explain two reasons why weather stations are important (1993)

Weather stations give weather reports, which are important in the following areas:

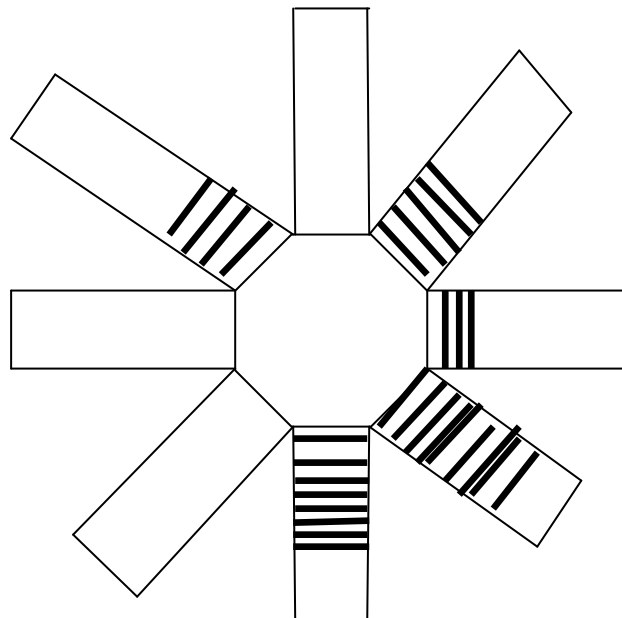
- *The direction of wind tend to control the pattern of trade routes especially in shipping*
- *Help farmers to prepare for their seasons in the cultivation of crops*

- Temperature, humidity and rainfall may either promote or discourage certain pests and diseases which may destroy crops and animals.
- The safety of modern air travel is tied to accurate weather conditions and records from ground stations.

At a weather station in Malawi in a certain month, there were 7 days of mwesta, 10 days of Southeast winds, 3 days of East winds, 5 days of North east winds and 4 days of north west winds. 4 days were calm.

draw a wind rose recording the wind frequency and explain how it is done (6) (1995)

a wind rose is an instrument used for recording the direction of prevailing winds of a place, over a period of one month. It consists of eight compass directions

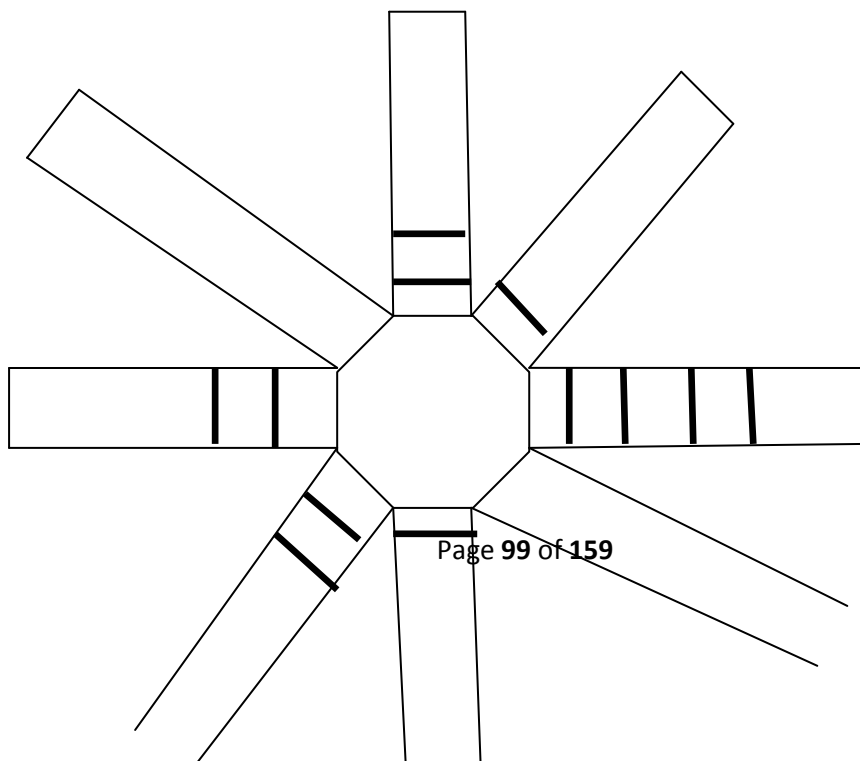


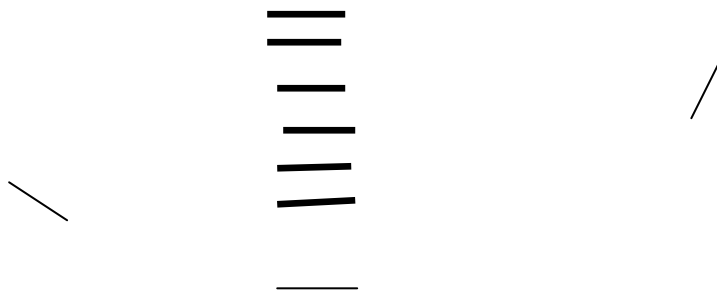
When the wind direction has been obtained, a line is drawn on the cardinal point from which the wind blew. The cardinal point with the largest number of lines represents the direction of the prevailing wind for that month. For example in the wind rose drawn, most of the wind came from southeast as it has the highest frequency. The place had the south easterly prevailing winds. The number of calm days when the wind did not blow is indicated at the center. In the diagram above, 4 days were calm days. Sometimes instead of indicating lines dates are recorded when the wind blew.

The following wind directions were recorded at a weather station for the month of September. Use the information to draw a wind rose.

DATE	DIRECTION	DATE	DIRECTION	DATE	DIRECTION
1	NE	11	NW	21	-
2	S	12	NW	22	S
3	-	13	NW	23	S
4	S	14	S	24	E
5	N	15	-	25	W
6	W	16	-	26	NW
7	E	17	S	27	E
8	SW	18	-	28	NW
9	-	19	E	29	SW
10	S	20	N	30	-

A wind rose is an instrument which is used for recording the direction of wind. It has eight main cardinal points. The **date is recorded** on the rectangle representing the cardinal point from which the wind blew. The number of **days when the wind did not blow are written on the center**. The diagram below represents the wind rose for the month of September.





In this wind rose, south had the largest number of frequencies. In the month of September, the southerly wind blew most. There were seven days when the wind did not blow strongly so as to be noticed. The days are on 3rd, 9th, 15th, 16th, 18th, 19th, and 30th, of September. The days are counted and recorded on the center. 7 which is at the center represents these seven calm days.

The table below shows wind direction frequencies for Zungu town (2007)

Compass direction	N	S	E	W	NE	NW	SE	SW	CALM
frequency	5	3	4	3	7	2	2	1	3

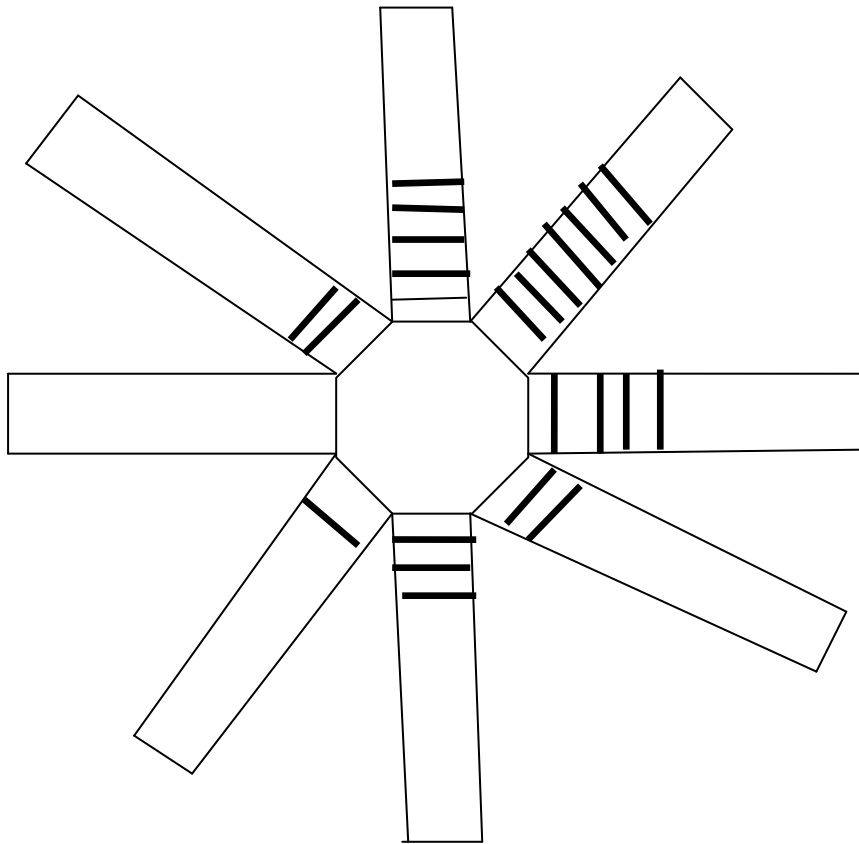
2. State any two instruments which are to collect the data in the table (2) (2007)

- Wind vane
- Wind sock
- Weather cock

3. Prepare a wind rose for the data

A wind rose is an instrument used for recording the direction of wind. It consists of eight rectangular shaped polygons. Each represents one cardinal point. The side

which the highest frequency represents the direction of the prevailing wind for that month below is a diagram of a wind rose for Zungu town.



According to the figure above, the wind blew most from North east and it is called the north easterly wind. This is because Northeast has the highest frequency. The number inscribed in the center, 3, represents the number of calm days when the wind did not blow with, a lot of force to determine its direction.

PREVAILING WINDS

Give three characteristics of the trade winds

- *Trade winds tread or follow a regular pattern. This is because the word “trade” comes from Saxon word “tredan” which means tread or follow a regular path.*
- *They blow from the Horse latitudes high-pressure belts towards the Doldrums low-pressure belt from both north and south.*
- *They are deflected to the right to become the north east trade winds in the northern hemisphere and to the left to become the South east trade winds in the southern hemisphere*
- *They sometimes contain depressions or cyclones.*

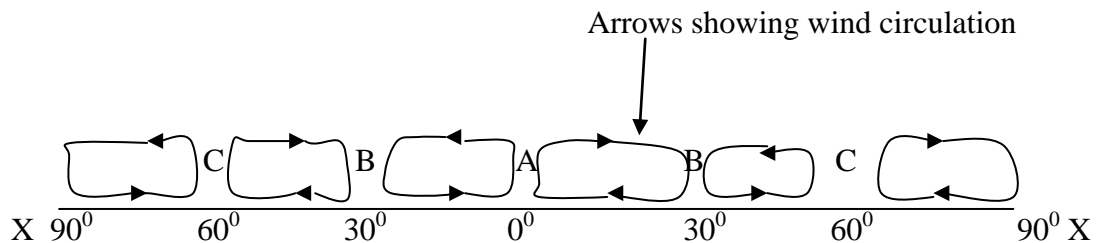
What is the importance of westerly winds give two reasons.

- *Good belts for long distance flying trans- oceanic and transcontinental aeroplanes use the belts. The vessels and aeroplanes move fast in the direction of the westerlies, saving time and fuel.*
- *In the Mediterranean climate, the westerlies help to bring rainfall in winter.*

What are the two problems brought by the westerly winds

- *Once in a while, the area is plagued by tropical storms called hurricane or typhoons. These cause a lot of destruction to buildings and often kill people.*
- *When ships sail against them, the journeys become slow and a lot of fuel is used. There is also a danger of ships capsizing especially true in the southern hemisphere and regularity throughout the year over roaring forties or furious fifties or screaming sixties. The speed of aeroplanes is also reduced while fuel is increased due to strong head winds.*

Study the figure below and answer the questions that follow



Complete the diagram to show wind circulation in the world.

Indicate by arrows. It should be known that wind moves from a high pressure area to a low-pressure area. First, take note of the pressure belts, and then using arrows show the direction as above.

Why does wind blow from B to A on the surface of the earth

This is because B is a high-pressure belt and A is a low pressure belt. This makes wind to blow from B, a high pressure belt to A, a low pressure region on the surface of the earth

Explain why wind blows from A to B on the upper atmosphere

After rising on A, the wind meets colder atmospheric layers of the earth since temperature decreases with increase in altitude in the troposphere. This makes the rising air to be cooled, becoming more dense. As it is heavier in the upper atmosphere, it then sinks back to B, hence wind moving from A to B in the upper atmosphere.

Explain general characteristics of the prevailing winds.

- *Move from high-pressure belts to low pressure belts. For example, the trade winds move from high-pressure belts of horse latitudes and blow to the Doldrums low-pressure belt.*
- *They deflect to the right hand side in the northern hemisphere and to the left in the southern hemisphere.*

What are the characteristics of westerly winds. Mention any three (6) (1997)

- *They blow from the horse latitude high-pressure belt to temperate low-pressure belt.*
- *They are deflected to the right to become the south westerly in the northern hemisphere and to the left to become the north westerlies in the southern hemisphere*
- *They are both variable in both direction and strength*
- *They contain depressions or cyclones.*

Of what importance are trade winds, mention any two (4)

- *As they move from the horse latitude towards the doldrums low pressure belt, they bring heavy convectional rainfall. This makes areas along the equator to experience a lot of rainfall.*
- *Good for sailing vessels and aero planes which follow the direction of the trade winds. This saves time and fuel.*

What names are given to the following prevailing winds after deflecting in the southern hemisphere

- **Trade winds** = *South East trade winds*
- **Westerlies** = *north westerly winds*
- **Polar winds** = *south east polar winds*

What do you understand by the term prevailing winds

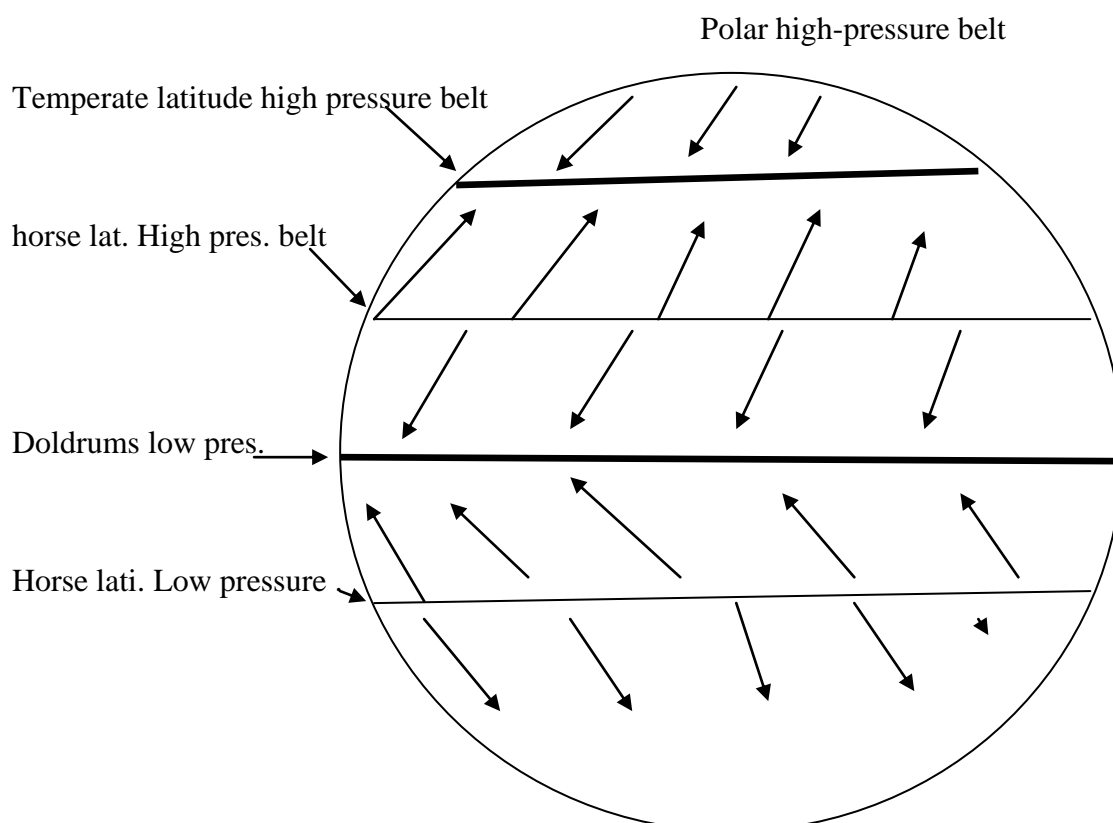
These are winds that blow more often than any other type of wind on the globe.

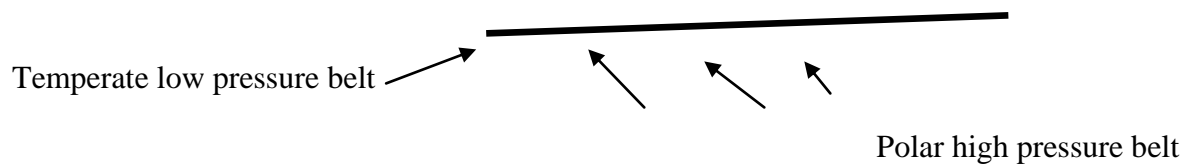
Illustrate the global pattern of the following with a diagram

a. Prevailing winds (6)

b. Pressure belts (8)

Prevailing winds are those that blow more often than any other type on the globe. The most important prevailing winds are the polar, trades and westerly. On the globe, prevailing wind blow from high pressure belts such as the horse latitudes, the polar high pressure, towards the low-pressure belts such as the temperate low pressure and the Doldrums low-pressure belt. The globe below illustrates the prevailing winds with Coriolis force into effect.





After deflection, the winds acquire new names such as northeast polar, southeast trade winds, north westerlies.

Explain why:-

1. Winds do not blow directly towards the poles or the equator (1987)

This is due to rotation of the earth, which makes Coriolis force to be in effect. This force makes winds to deflect to the right in the northern hemisphere and to the left in the southern hemisphere. This makes winds not to blow direct towards either the poles or the equator.

2. Wind belts shift that position latitudinally

Wind belts are because of pressure belts which in turn occur because of the position of the sun. When the sun appears to move whether to the northern hemisphere or to the southern hemisphere, it brings about differences in terms of pressure. This difference creates pressure belts. For instance, when the sun appears to be in the northern hemisphere, there is high temperature. This creates a low pressure. Wind then moves from the high-pressure belts in the southern hemisphere to the northern hemisphere. This brings about changes in wind belts because when the sun will appear to be in the southern hemisphere, a low pressure will be created while the northern hemisphere will have a high pressure. This makes wind to move from the northern hemisphere to the southern hemisphere.

LOCAL WINDS

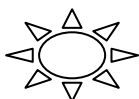
mention two general characteristics of local winds

- *They affect only limited areas and blow for short periods of time.*
- *They are named after the local names in areas where they exist*
- *They are caused by the immediate influences of the surrounding topography or relief*
- *They moderate unpleasant and unhealthy weather conditions hence called “doctor winds”*

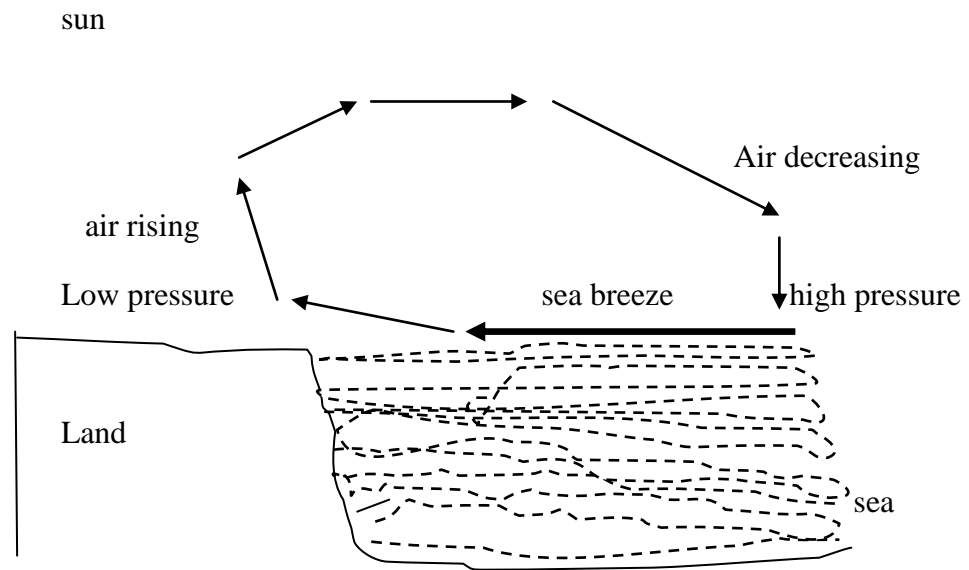
With the aid of well labeled diagrams, explain how land and sea breezes occur(8) 2007 (1997)

Land and seas breezes refer to the general movement of air between the land and the sea. Differential heating of land and water masses, which in turn bring differences in terms of pressure, causes Land and sea breezes. Differences in terms of pressure drive the wind in a particular direction.

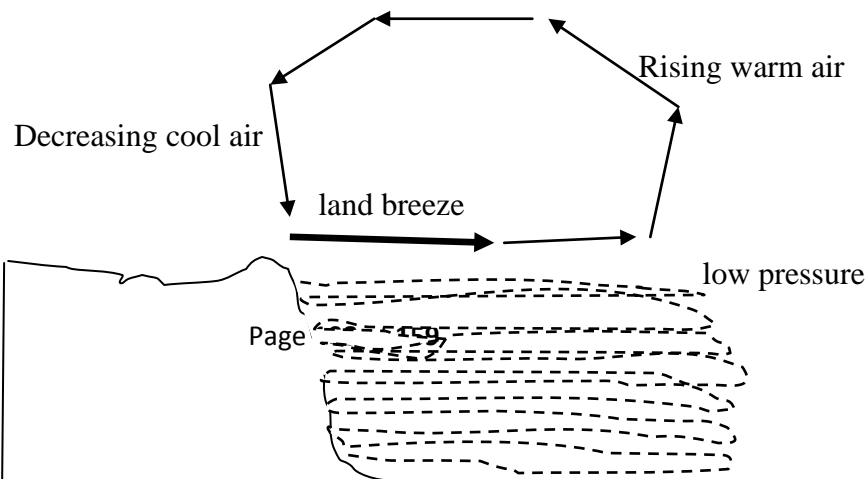
A sea breeze happens during the day where by air moves from the sea to develop a high pressure while the land a low pressure. Air then moves from the sea which is a high-pressure area towards the land which is a low-pressure area. The air on the land rises and moves upwards. Upon rising, it meets colder layers in the upper atmosphere making the air to become cold



too. This makes the rising air to decrease over the sea thereby completing a circulation. The diagram below shows a sea breeze.



A land breeze happens at night whereby the air moves from the land. Towards the sea. This happens because at night, the land loses heat faster and become very cold,. This makes the land to develop a high pressure. In contrast, the sea uses heat slowly and at night becomes warm. This makes the sea to develop a low-pressure air then moves from the land towards the sea. Air on the sea rises since it is warm after rising; it meets colder upper atmospheric layers. Such rising air then becomes cold due to decreasing temperatures in the air. Then the air becomes cold, heavier and descends back to the land completing a circulation. The diagram below shows a land breeze with the moon indicating that it happens at night.



High pressure

Land

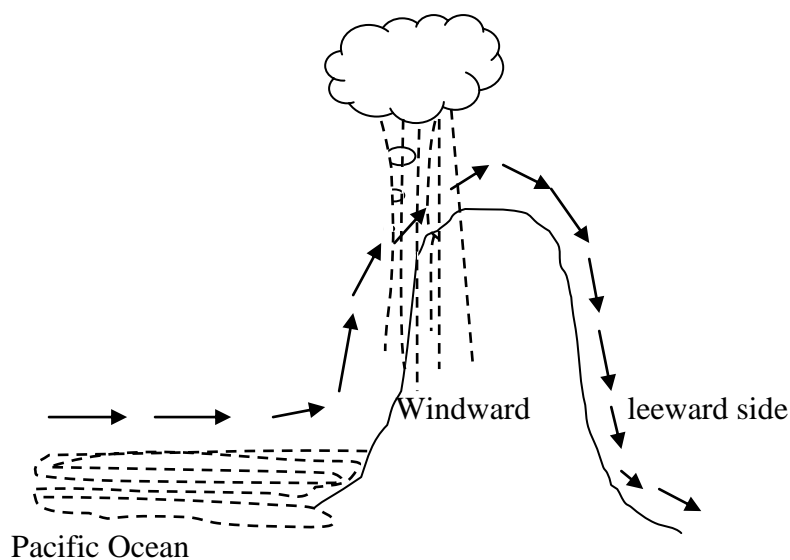
sea

Describe the influence of land and sea breezes on local weather.

- *In summer seas, breezes have a cooling effect on coastal areas. This adds to the attraction of the shore zone as a recreation facility.*
- *In the tropics, sea and land breezes can blow quite strongly. Fishermen take advantage of land breezes and sail out with them. They return the following morning with the sea breezes, complete with their catch (fish)*

With the aid of a diagram, explain how Chinook winds are formed

The Chinook winds originated from the Pacific ocean, ascends and descends the Rockies mountain in Canada and the united states of America.

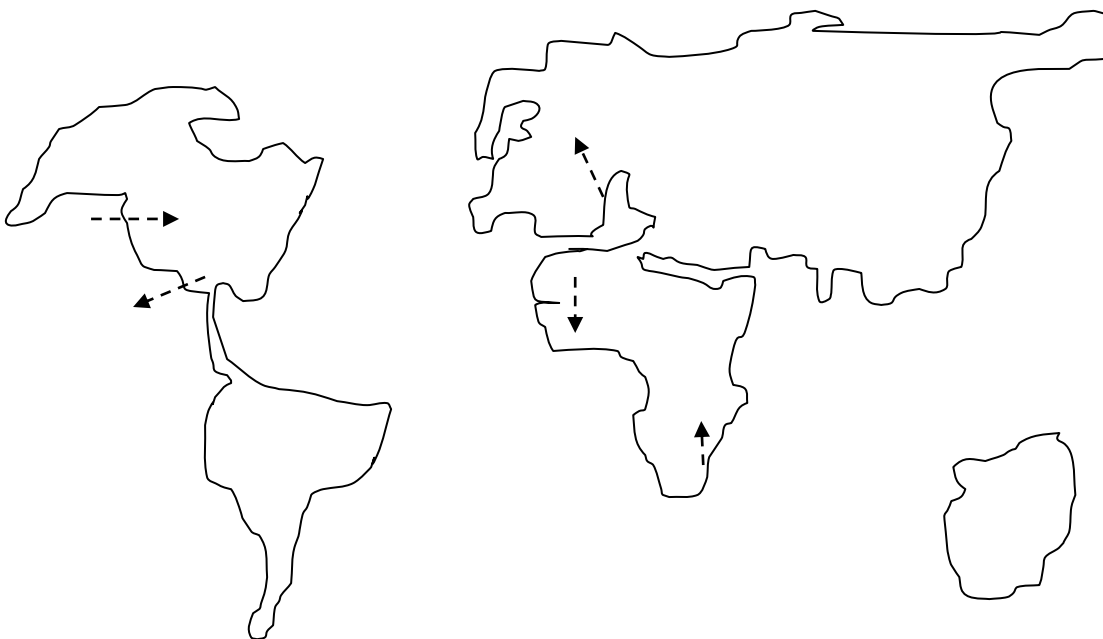


As the wind ascends the Rockies, it brings heavy rainfall to the windward side which faces the direction of the blowing Chinook winds.

What influence do the Chinook winds have on the eastern foothills of the Rockies (3)

*When descending the eastern part, the winds bring warm, raises temperature, sometimes by 19°C in 15 minutes and therefore it is capable of melting and drying up winter snow. This is why it is sometimes called “**snow water**”. It is thus of economics value, especially in pastoral regions ranging from southern Colorado in the united states to as far as Mackenzie River in Canada. The melting of the snow also help to cultivate wheat in the Canadian Prairies.*

The figure below shows the distribution of local winds. Study it and answer the questions that follow



Name the local winds which blow in the area marked A, B, C, D, and E

A= *Chinook*

B= *Harmattan*

C= *Fohn*

D= *Chiperon*

E= Santa Ana

On the same map insert an arrow indicating the direction of each of the local winds

On the map the arrow should point where the wind is going

How does the local wind which blow in an area marked D modify the weather of the area

- *It brings the persistent low clouds known as Stratus which can sometimes bring drizzles or rain showers in the area especially the southern part.*
- *It makes temperatures to be very low in the area with chilly conditions*

With the help of two examples explain why local winds are also called “doctor winds”

Some local winds moderate unpleasant and unhealthy weather conditions in the area where they blow, hence doctor winds. Examples of such winds are the Harmattan winds in West Africa from the Sahara desert. Although it is a hot, dry and dusty wind, splitting tree trunks and damaging crops such as Cocoa in the northern part, the Harmattan is called the doctor winds far Guinea coast. When it reaches Guinea coast, it provides a welcome relief from the moist heat for it is a cool wind to that area since it encourages evaporation hence cooling. Another example is the Chinook winds. After descending the Rockies on the eastern side, it raises temperature by 19°C in 15 minutes and melts and dries up winter snow. This has economic importance especially in the pastoral regions strong Chinook winds makes winters to be mild and pastures are available. Absence of Chinooks means a very cold winter and heavy losses of livestock.

How are some local winds such as Fohn associated with avalanches

An avalanche is a mass of snow and ice which slides rapidly down the mountain slope carrying with it thousands of tonnes of rocks. Local winds such as Chinook when they descend the leeward side, they raise temperatures by 8°C – 11°C. This makes snow to be melted and start to move and become an avalanche.

What is the difference between anabatic winds and katabatic winds

Anabatic winds are winds from the valley upwards rising mountain slopes. This happens when slopes are greatly heated by the sun making the air to move. In contrast, katabatic winds are those that blow from higher to lower regions under the influence of gravity e.g. Bora.

Mention two positive impacts of the Chinook winds in the area where it exists

- *It helps to bring rainfall to the western side of the Rockies as the winds from the Pacific rise the Rockies*
- *It helps to melt snow in the eastern side making pasture to grow for animals grazing and for the cultivation of wheat.*

Explain what causes chaperon winds

The chaperon wind is caused by the movement of the inter-tropical convergent zone (ITCZ) to the northern hemisphere between May and August. As the wind moves to the northern hemisphere, it deflects through Mozambique where it becomes Chiperon affecting mostly the southern part of Malawi especially the Shire highlands composed of Blantyre, Thyolo and Mulanje.

How does chaperon winds affects Malawi

- *It brings persistent low clouds known as status and drizzles or showers especially in the shire highlands*
- *It lowers the temperature such that cold conditions are experienced*
- *It brings Mwera wind on Lake Malawi*

What are the environmental importance of local winds

- *They affect the movement of pollutants such as pollution fumes far away from their sources.*
- *They moderate unpleasant and unhealthy weather conditions. For examples, they help to bring rainfall help to melt snow, thus being called “doctor winds”*
- *They exert a powerful stress on animals and plants, depending on whether they are dry and extremely hot or cold.*

What are the two differences between local winds and prevailing winds

- *Local winds are caused by the immediate influences of the surrounding topography or relief while prevailing winds are mainly caused by large scale global pressure systems*

- *Local winds affect small area while prevailing winds affect very large areas.*
- *Local winds are named after the local names in areas, which they exist while as prevailing winds, have global names such as trade winds, westerlies and polar winds.*

CYCLONES AND ANTICYCLONES

What is a cyclone (2006)

A system of wind rotating around a center of low pressure, turning clockwise in the southern hemisphere and anticlockwise in the northern hemisphere.

Name two types of cyclones (2000)

- Temperate cyclones also known as depressions
- Tropical cyclones

Explain two differences between depressions and tropical cyclones

- A tropical cyclone usually occurs in the tropics within the belt of trade winds while as a depression occurs in the temperate regions within the belt of Westerly winds
- A tropical cyclone is smaller in size while as a depression is larger in size
- A tropical cyclone is more violent accompanied by very strong winds as compared to a depression.

Using a well labeled diagram, explain the direction of wind in a cyclone in the southern hemisphere (2000)

A cyclone is a storm generated by a low atmosphere pressure system at the center. The isobars are closely spaced and they form a circular shape. As the low pressure is at the centre and high pressure outwards, winds move from outside which is a high pressure region to inside which is a low pressure region. The wind when going inside deflects to the left hand side as it is in the southern hemisphere. As the Coriolis force is in effect. This deflection makes the general circulation of air to be in a clockwise direction in the southern hemisphere.

Diagram

Give two conditions necessary for the development of a tropical cyclone

- Air must be blowing inwards towards the center and rising rapidly and cumulonimbus clouds must form to give heavy rains.

- There must be an inward flow of air in the upper level of the atmosphere
- An abundant source of warm, moist air of temperature of about 27°C near to the sea surface.

Why is it that cyclones do not develop in the regions between 0° and 5°N or S of the equator

Within 0° and 5° North or South of the equator, the coriolis force is very weak. This makes the deflection of winds to be weak also. as a result, it is very difficult for winds to circulate or swirl around a low pressure center in order to give rise to a cyclone

Give two similarities between a tropical cyclone and a depression

- They both circulate in an anticlockwise direction in the northern hemisphere and clockwise direction in the southern hemisphere
- They both have a low pressure at the center with air moving from outside to inside

State two general characteristics of tropical cyclones

- It originates over oceans and moves towards the landmasses
- Does not occur in the regions within about 5° of the equator due to weak coriolis force
- The rotation is clockwise in the southern hemisphere and anticlockwise in the northern hemisphere
- It is smaller than a depression

Study the figure below which shows the circulatory pattern of winds in a cyclone and answer the questions that follow:

Diagrams

Which of these diagrams represent wind patterns in a cyclone

It is A and B

Give a reason for your answer

The general circulation of air in a cyclone is in an anticlockwise direction in the northern hemisphere which is shown in A and in a clockwise direction in the southern hemisphere which is shown in B

Which of the diagram represent wind patterns in an anticyclone

It is C and D

Give a reason for your answer

The general circulation of air is in a clockwise direction in the northern hemisphere. This is shown in C and anticlockwise direction in the southern hemisphere which is shown in D.

Hurricanes often occur in the summer in the West Indies. Similar tropical cyclones also develop in other parts of the world. Name three other regions where they occur and say what names are given to these cyclones.

- In Australia they are called Willy-Willies
- In Madagascar they are called Cyclones
- In India around the Indian Ocean are called Cyclones
- In the China sea and around Japan in Asia they are called Typhoons

Explain the development of a tropical cyclone

Tropical cyclones develop in the tropics within the belt of trade winds. These develop when North East trade winds and south east trade meet along the inter- tropical front. Where they meet, one is uplifted over the other and its moisture produces heavy rainfall. These develop over oceans because air masses which have travelled over oceans have warm moist lower layer. The tropical cyclones die out when reaching the land because their supply of moist air is cut off completely.

Describe the weather associated with a tropical cyclone

- Development of gusty winds and thick clouds especially with the arrival of the vortex
- Very violent winds accompanied by heavy rainfall that often results into floods
- Calm conditions with the return of the eye

The figure below shows a section through tropical cyclone

Diagram

What different weather conditions can be noticed in A and B

In A which is annular conditions are experienced. This is because the sea has low pressure. In B which is the vortex, violent conditions with very strong winds can be noticed. This is because this is the area where the air rises as it moves on both sides towards the center.

The figure below shows the movement of a cyclone. Study it and answer the questions which follow

Diagrams

Describe how weather would change at X if the cyclone passed through the place (2000) (6 marks)

In **stage A**, the cyclone has not yet reached a place. Therefore at **X** the sky will be clear with some wispy cirrus clouds. The wind blows from south east.

In **stage B**, the warm front has just passed through the place **X** such that the place is between the cold front and the warm front. Wind changes direction from south east to south west. Temperature also rises as the place lies in the warm sector.

In **stage C**, which is the last, a cyclone has passed through a place. The place experiences some rain showers, the sky then clears as the wind blows from northwest.

What is the direction of wind at stage B

The wind changes direction from south east to South west.

Draw map of the world on this map show and name the following: Willy willies, Typhoons, Hurricanes and cyclones

When answering this question it is important to know where these tropical cyclones are found. It is important to start such a question in this way:

The Willy willies, typhoons, the cyclones, hurricanes are all the tropical cyclones existing in the belt of trade winds. They are known by different names in areas where they are found. The Willy willies exist off the coast of Queensland or Australia, the Hurricanes, in the Caribbean in west indies, typhoons in China sea in Asia and the cyclones off the coast of Madagascar and India.

Explain why anticyclones are associated with the following weather conditions:-

a. Dry conditions

This is because the descending air is warmed up as air pressure increases near the surface. The air does not contain moisture for condensation and precipitation to take place.

b. Little wind with little force

There is low pressure gradient showing that there is little difference in pressure over a wide area

c. Hot and sunny conditions

Long hours of daylight during which the sun shines from cloudless skies. The sun is also at a high angle in the sky for greater insolation.

d. Cold days in winter

Short hours of daylight from the weak winter sun shines from a low angle in the sky and insolation rates are low.

e. Frost especially on winter nights

Clear skies allow heat loss from the ground surface. At night, moisture in contact with the cold ground surface condenses into ice when the temperature falls below freezing point.

f. Fog mainly in winter

Clear skies allow heat loss from the ground surface at night; moisture in the air in contact with the cold ground surface condenses droplets of water form around tiny dust particles in the air which reduce visibility. This is what is called fog.

COMBINATION QUESTIONS

Explain the meaning of the following geographical terms:-

(a) Convectional rainfall

This is the type of rainfall which is characterized by thunder, lightning and anvil shaped clouds. It is accompanied by the rising heated air. The air rises in form of convection currents. The heated air rises with moisture which eventually cools to form big cumulonimbus anvil shaped clouds which then brings heavy rainfall especially in the afternoon.

(b) Land and sea breezes

These involve the circulation of the air between the land and the sea depending on the position of high and low pressure.

(c) International date lines:

This refers to a line at which the day is either lost or gained when crossed. It follows the longitude 180° east or west of the prime meridian.

(d) Tropical cyclone

This is a storm generated by a low atmosphere pressure system of air in which isobars on the map are circular in shape.

Explain why the following occur:

a. Tropical thunderstorms occur in the late afternoons

This happens because for tropical thunderstorms to occur it is as a result of intense heating of land and water masses by the solar energy in the morning hours. By the afternoon hours air with moisture has already risen. This contributes to thunderstorms especially in the tropics.

b. Rainfall is usually unevenly distributed over barriers

This is because mountains act as a stumbling block to the winds that blow towards them from the oceans, seas or lakes. This is very common in places where on-shore winds rise up over hilly or mountain regions lying at right angles to the direction of the wind. This contributes to unevenly distributed rainfall because rainfall usually falls on the windward side. This is the side of a mountain that faces the direction of the moist winds. In contrast, the leeward side receives very little or no rainfall at all. This is because this side faces away from the moist laden winds such that when the winds descend these mountain slopes they are cool and dry without moisture hence little or no rainfall.

c. The Mediterranean lowlands receive rainfall only in winter

This happens because the trade winds that blow in summer are off-shore. These are dry and give no rains. Rainfall is received in winter, because the on-shore westerly winds blow in winter. These since they are on-shore, they are moist laden and bring heavy cyclonic rainfall.

d. More rain falls in west Africa between 1st May and 31st October than 1st November and 30th April

This happens because between 1st May and 31st October the area comes under the influence of a low pressure belt. This happens because the sun appears to be overhead in the area. There is intense heating which reduces the pressure. Air then converges in the area such that air masses bring heavy rainfall. The place cannot experience more rainfall between 1st November and 30th April because it develops a high pressure. This is as a result of the sun being far from the area. This leads to no rainfall because air moves out of the region.

Carefully explain the meaning of the following:

a. Sea breezes are day winds and land breezes are night winds

Sea breeze deals with the circulation of air from the sea to the land. This happens because there is a high pressure developed over the sea as the sea absorbs heat slowly while there is a low pressure over the land as the land absorbs heat faster. Air then moves from the sea towards the land. It is known as day winds because the movement of air from the sea towards the land happens during the day time. In a land breeze air moves from the land to the sea. This happens because the land develops a high pressure after losing heat faster while the sea develops a low pressure after losing the heat slowly. Land breezes are known as night winds because the circulation of air from the land towards the sea happens at night.

b. Water surfaces gain and lose heat more slowly than land surfaces

Water is transparent and sun rays penetrate more deeply than they can on the land. In addition, more energy is required to heat a given amount of water than the same amount of soil due to the fact that the molecules of soil are closely arranged than those of water. Moreover, water moves which makes the heat to be distributed than the land which does not move. For these reasons, the land absorbs heat faster than water but the land also loses the heat absorbed faster than water.

c. Temperature decreases as altitude increases.

Low altitudes such as along the sea shores the temperature is high and the weather is warm while high altitude areas such as on top of the mountain, the temperature is lower and the weather is cool. Temperature really decreases with an increase in altitude as noticed above because, in low altitude the air is thick and contains a lot of dust particles and water vapor. These make the heat from the earth's surface to pass rapidly making the temperature to decrease and the weather to be cool. Thus temperature drops at the rate of 6.4°C for every 1000m rise in altitude.

Diagram

Draw a map of the world. On it shade and write with the letters

- a. **TC** over an area affect by tropical cyclones
- b. **SW** over a coastal area that experiences the South- westerlies
- c. **RA** over an area in Africa that has rainfall throughout the year
- d. **MW** over an area found in the southern hemisphere that has mild and wet winter, warm and dry summers.
- e. **DR** over an area with a great diurnal range of temperature.

Diagram

KEY

TC= tropical cyclones

SW= south westerly

RA= Rainfall throughout the year

DR= great diurnal ranmge of temeoprature

MW= mild and wet winters, warm and dry summers

NOTE:

TC areas experiencing Tropical cyclones. These should include areas where the **cyclones**, **typhoons**, **willy willies** and **hurricanes** are found.

RA rainfall throughout the year refers to an area with an equatorial climate

DR an area with a great diurnal temperature range is a place such as any desert like **Sahara, Kalahari**

MW a place that has mild and wet winters, warm and dry summers refers to a place with the **Mediterranean climate**

Explain why:

a. The Sahara desert does not experience much rainfall

- It lies outside the subtropical high pressure belt area. This area is not associated with rainfall because the air is descending, and such descending air is cool and dry without moisture, a condition not favourable for precipitation.
- The rain bearing trade winds are off-shore and the westerlies that are on-shore blow outside the desert limits, a condition which is not associated with heavy rainfall.
- It is affected by the canaries' cold ocean currents. This ocean current, being cold does not bring precipitation to the area as it does not absorb moisture.

b. The mid-latitudes experience cyclonic rainfall

Cyclonic rainfall is the type of rainfall which is formed when **two air masses** of different temperatures, that is, one warm and the other cold, meet. The result of this meeting is that warm air rises up over the cold air mass and it cools gradually to form a cloud which consequently brings about rainfall. This rainfall is experienced in **the mid-latitudes because in such an area is where warm air from the low latitudes meets cold air** from the high latitudes creating a boundary cold front, hence this rainfall also being called frontal.

Explain the following:

a. Extreme temperatures are experienced in the interior of temperature continents

Such places are in the interiors of continents such as North America, South America and Uresia. These places such as Saskatchewan in North America experience extreme temperatures because they are far from the coast. The warming influence of the oceans does not reach them. In fact when warm winds blow across the oceans, by the time such warm winds reach such interiors, they are very cool and dry which makes temperature to be very low.

b. The west coasts of the Southern continents roughly between latitudes 15° to 30° are extreme dry.

- Such areas are affected by the cold ocean currents. These do not bring precipitation because they are already dry and do not absorb moisture which can result into heavy rainfall.
- Such places experience off shore trade winds which cannot bring rainfall as the winds move out of the land. The descending air that follows is just very warm and dry, a condition that cannot bring precipitation.

Diagram

Explain one reason why the region marked X receives little rain

- Its located in land maked it to be on the leeward side from the coastal monsoon rains, hence little rainfall
- Located in an area where the winds are off-shore. The place is located along a horse latitude high pressure belt which send the winds out of the area. This makes the area to be dry as such winds do not bring precipitation.

Explain two reasons why winters are bitterly cold in the region marked B than that marked A

- The region marked A in winter has a warming influence from the sea. This happens because the sea loses heat slowly than the land such that in winter, the area marked B has severely winters as it is far from the warming influence of the sea as compared to A. in other words, in winter the land loses the heat faster which makes B to experience severe winters as it is inland.

- The place marked A is influenced by the North Pacific warm Ocean current. This helps to raise the temperatures of A. this warming influence decreases when going inland. This makes B to experience very cold conditions.

State two ocean currents which meet at the point marked M

- The north Atlantic Drift warm ocean current
- The cold Labrador ocean current

Explain the presence of fog in the area labeled N. give one point

Due to the flow of the Benguela cold ocean current which meets some warm air. This results into fog formation.

Explain one reason why diurnal temperature range is very high in the region labeled D

During the day, the sky is not covered with a lot of clouds. This makes temperatures to increase as a lot of sun rays reach the surface of the earth since it is a desert area. At night heat easily escapes as the sky is also not covered with cloud. This makes temperatures to be very low at night. The difference between day temperatures and night temperatures become very large, hence high diurnal temperature range.

Explain why vegetation of the region labeled K is dominated by mosses and lichens

The place experience very low temperatures which makes soil to be frozen for most parts of the year. This makes vegetation not to grow apart from simple lichens and mosses with stunted growth.

CLIMATE AND VEGETATION

Study the data below which shows the climatic statistics for a certain station and answer the questions that follow

Table

Identify the type of climate for the station

It is a tropical continental or Sudan type of climate

Where is this type of climate developed?

Within the tropics between **5°** and **15°** North and South of the equator.

Describe any two characteristics of this climate

- Summers are hot with temperatures around **32°C**. Winters are cooler, with an annual temperature range of between **8°C** and **11°C**.
- Heavy **convictional rainfall in summer** while winters are usually **dry**
- Annual rainfall of between **762 mm** and **850 mm**
- In the northern hemisphere the **hot rainy** season is usually from **May to October**. The rest of the year is **cool and dry**. In the southern hemisphere the hot rainy season is from **November to April** and the rest of the year is cool and dry.

Explain any two factors which hinder economic development in the region

- The **unreliable** rainfall bringing about **drought** conditions bring famine to the area.
- Heavy summer rainfall results into **heavy leaching** of minerals. This does not only result into loss of soil fertility but also the formation of poor lateritic soils.
- Diseases and pests such as tsetse flies which do not favour animal rearing
- Poor communication in this climate

What type of vegetation is associated with this type of climate?

It is the tropical savanna vegetation

Give three characteristics of this kind of vegetation

- It has tall grass with scattered trees
- The trees are deciduous, that is they shed their leaves during drier parts of the year.
- Trees have long roots

- Most trees are umbrella in shape while some have thick trunks
- The grass dries up or remains dormant during the hot dry season

Give three examples of the trees found in this type of climate

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

Describe some characteristic features of some of the above vegetation that makes it to survive in this climate.

- **Baobab-** it has a very thick trunk. This is used for storing water during the rainy season. This stored water is used during the hot and dry season when the climate does not receive rainfall. It also shed some leaves during the hot dry season in order to reduce the excessive loss of water through transpiration
- **Acacias-** the trees are umbrella shaped that help to protect the roots from dryness. They have deep roots that get water from the lower horizons of the soil. They shed their leaves in hot, dry season in order to reduce transpiration
- **Elephant grass:** remains dormant by drying up in the hot dry season. It is also very tough and resistant to excessive transportation.

Table

Study the climatic statistics for a certain station below and answer the questions that follow

Identify the type of climate for the station

It is the warm temperature western margin also called the Mediterranean climate.

List any three characteristics of this type of climate

- It is a unique type of climate because it receives rainfall in **winter** when the westerly winds **blow on shore**
- **Off-shore** trade winds blow in **summer**. These are **dry** and give no rains
- Temperature range from **21⁰C** in summer to **10⁰C** or below in winter
- Receive **local winds** like Sirocco, Mistral, Bora
- The annual rainfall ranges from 500mm to **760 mm**. it rarely reaches **840mm**

In which hemisphere is the station located and gives a reason for your answer

It is in **the northern hemisphere**. This is because the climates receive rainfall in winter as a **result of the on shore westerly**. According to the table, the station receives rainfall **from November, December, and January to February**. During these months it is **winter in the northern hemisphere** as during the sametime it is **summer in the southern hemisphere**. During this time the sun appears to be overhead along the tropics of Capricorn in the southern hemisphere which then experiences summer. This means the northern hemisphere is in winter.

Suggest any two important agricultural activities or developments in this station.

- the region is important for fruit farming such as oranges, lemons, grapes and limes
- The region produce cereals such as wheat and barley
- The region produces vegetables
- The mountain pastures support sheep, goats and cattle

Give three examples of important industries that can be developed in this region

- Wine making industry due to the growing of grapes (viticulture) which are used in wine production.
- Flour milling due to the growing of barley and wheat. The flour is used for baking
- Fruit canning industry due to the growing of citrus fruits such as oranges and lemons
- Tourism industry since summer is warm and bright and winters are so mild and cool.

Study the climatic statistics of the table below for certain station

Table

Identify the type of climate for the station

It is the equatorial climate

Calculate the temperature range for the station

$$26^{\circ}\text{C} - 23^{\circ}\text{C} = 3^{\circ}\text{C}$$

Describe any four characteristics of this type of climate

- Heavy well distributed convectional rainfall of up to **2000mm** annually. Rainfall comes in the afternoon accompanied by thunder and lightning.
- There **are no definite seasons** because there is heavy rainfall and high temperatures throughout the year as a result of the low pressure in region.
- Small **temperature range** of between 1°C and 3°C with 26°C as the average daily temperatures.
- **Humidity** is always high.

Explain any two factors that hinder economic development in the region

- Excessive heat and high humidity affects the health of people negatively
- Prevalence of bacteria and insects pests such as tsetse flies. These attack people, animals and crops.
- Thickness of the vegetation makes clearing of the communication difficult and maintenance of the land difficult
- Due to heavy rainfall, there is rapid deterioration of the soil through leaching.

Give three examples of areas with such a climate

- The Amazon basin
- The Congo basin
- Guinea coast
- Philippines
- Indonesia
- Malaysia

What type of vegetation is associated with this type of climate?

It is tropical evergreen or rainforests vegetation

Describe any two characteristics features of this type of vegetation named above

- Contains a great variety of plants with thick vegetation.
- Trees are very tall with buttress roots forming a canopy which results into little undergrowth
- There is continuous growth of trees, that is, flowering, fruiting and shedding take place throughout the year.
- Most of the trees have broad leaves with luxurious growth
- Most trees are evergreen.

Give two examples of trees that are found in this vegetation

- Mahogany
- Ebony
- Rosewood
- Iron wood
- Greenheart
- Orchids

Of what two uses can be the trees named above

- Used for lumbering e.g. mahogany

- Used for sculpture e.g. ebony
- Used for poles

Study the tables A and B below which show the climate for two stations (1995)

Table

Table

Suggest a climate region for each of the weather stations

- Station A: hot equatorial climate
- Station B: hot tropical desert climate

State three differences of the climates of the weather stations (6 marks)

- Station **A** receives heavy rainfall, well distributed throughout the year while as station **B** receives very little rainfall, with some months being completely dry
- Station **A** is located in the southern hemisphere as it receives higher rainfall from November to March while station **B** is in the northern because the little rainfall it receives is in June, July and August.
- Station **A** has a very small temperature range of 1°C while station **B** has a large temperature range of 12°C

What type of rainfall is most likely to be experienced at both stations

Convectional rainfall, as a result of the heating and rising of air as a result of a low pressure.

Explain three ways in which the vegetation found at station B has adapted to the climatic conditions of the area (6 marks)

- They have thick leaves and stems to store water to be during driest months
- Have waxy leaves that prevent transpiration and also have tiny leaves
- They produce sleepy seeds which lie dormant when it is very dry and germinate when the water is available

- They grow roots that get to the depth to get water from the lower horizons of the soil

Give two examples of the vegetation found in station B

- Cacti
- Thorn bushes
- Date palms

Draw a diagrammatic representation of the type of vegetation that could be found in the climatic region of station A

Trees are very close and they are usually tall. The vegetation occurs in layers, upper layer, middle layer and the bottom layer. Since the vegetation forms a canopy, climbing plants such as lianas found their way to the top by climbing tall trees in search of sunlight. The tall trees are supported by buttress roots.

Diagram

Describe any three factors that could pose problems in the economic development of the region in which station A is found (6 Marks)

- Prevalence of pests and diseases. These attack people, animals and crops
- Heavy rainfall results into poor soils as a result of leaching
- Construction of roads is difficult due to problems in clearing the thick forests

Name the two areas, one in North America and one in South America, that have a Mediterranean type of climate (2 marks)

North America: California

South America: central Chile

Map

Explain and account for the following

The western margin of the northern continents between 30°N and 45°N receive most of the rain from on shore winds in winter

The western margin of the continents between 30°N and 45°N experience the Mediterranean type of climate. This is the only climate which receives rain in winter. This happens because the trade winds that blow in summer are off-shore and very dry. Such trade winds do not bring rainfall. Rainfall is brought in winter when the westerly winds are on-shore. This makes the area to receive rainfall in winter On-shore westerly winds.

The diurnal temperature range in the Sahara deserts is very large

The Sahara desert experience very high temperatures during the day. This is because the sky is short cloudless. This allows all the sunlight rays to reach the earth's surface without being obstructed which in turn makes temperatures to be high. At night the temperatures are very low and the weather is cool. This is because at night the heat that was absorbed escapes into the atmosphere easily. This is because at night the area is cloudless. The diurnal temperature refers to the temperatures of the day. Such a difference becomes large in the Sahara desert because day temperatures are very low. For example, the day temperature may reach 29°C while night temperatures may reach 10°C. The difference $29^{\circ}\text{C} - 10^{\circ}\text{C} = 19^{\circ}\text{C}$ is large.

Explain and account for the following

Hot deserts are usually located on the western deserts are usually on the western sides of the continents.

Deserts are region characterized by aridity and poor soils, due to the fact that precipitation is not only scarce but also rare. Such places are locate on the western sides of the continents because in such western sides is where most of cold ocean currents exist. Such cold ocean currents are responsible for the existence of such deserts because the cold ocean currents are dry without moisture. With this they do not bring precipitation to such western sides of the continents, making such continents to be characterized by aridity. For

example, the California cold current is responsible for the formation of the California desert, the Peruvian for the Atacama desert, both on the western side of the North America and South America respectively.

Name:

i. A region where rain falls all the year

Amazon basin, Congo basin, Malaysia, Indonesia, Guinea coast.

ii. A region where rain from June to September only

Ethiopia, Sudan

iii. A region where rain rarely falls

Sahara desert, Kalahari Desert, Atacama Desert

Draw an outline of map of South America and on it shade and name:-

- a. One region having an equatorial climate
- b. One region having a Mediterranean climate
- c. One region having a savanna climate

In South America the area which has equatorial climate is the Amazon basin, the central Chile has the Mediterranean while Venezuela and Brazil have the Savanna climate. This map below shows these places.

Map

Explain the following using relevant diagrams and sketch maps where possible

The Sahara desert receiving little or no rain

The Sahara desert lies along the subtropical high pressure. It therefore experiences off-shore trade winds which are dry and do not bring precipitation. In addition, the area is affected by the canaries' cold ocean current. Being a cold ocean current, it is dry without moisture and results into no rainfall upon reaching the area. The sketch map below shows this.

Map

Regions bordering the equatorial zone of Africa receive most of the rain throughout the year

Equatorial areas are those located between 0° and 5° north and south of the equator. This area really receives rainfall throughout the year. This is because the area experiences very high temperatures as a result of the sun striking the region at an angle of 90° . This high temperature makes pressure to be reduced. Thus the region experiences low pressure. This in turn makes the wind from the subtropical.

Desert plants are able to survive for long periods without water

Since deserts receive very little or no rainfall at all for a large part of the year, it is difficult for vegetation to grow as it is with some other climates. These desert plants that grow and survive have special characteristics that make them to survive. Such characteristics include developing long roots that take water at depth, have few or no leaves at all in order to survive and reduce the rate of transpiration, have thick trunks with succulent stems that help to keep water that is used during the critical driest months. In addition, the plants produce sleepy seeds that remain dormant during the dry months until little amount of water is when such seeds germinate.

Heavy fog frequently occurs over the waters around New Founder land

Fog usually forms when there is a meeting of a cold and warm ocean current. Fogs are therefore frequently formed in the New Foundland because of the meeting of the Labrador and east Greenland cold ocean currents with the North Atlantic warm ocean current.

Give three differences between the equatorial vegetation and the Savanna vegetation

- Equatorial vegetation or tropical rainforest has a continuous canopy while the savanna does not form a canopy because it has a lot of grass which is spiced by trees.
- Equatorial vegetation is dominated by very big trees while savanna vegetation is dominated by grass of about 2m tall.
- Growth, flowering and fruiting of trees is there all the time in the equatorial while savanna it is seasonal, especially in warm wet season.

- Trees in equatorial are evergreen while in savanna it is deciduous.

State two differences between an equatorial rainforest and a tropical monsoon forest (1986)

- Tropical rainforest vegetation has large numbers of species while in monsoon forest the species of animals and plants are in small numbers.
- Most of the trees in tropical monsoon forests are deciduous while most of the trees in the tropical rainforest are evergreen
- In tropical monsoon trees are at least sparsely spread while in the tropical rainforest trees are closely spaced
- In tropical rainforest vegetation, there is complete canopy. this makes little under growth while as in the tropical monsoon, there is denser underground because sunlight is able to reach the ground.

Explain why there is a difference in vegetation between the two (2) 1986

This is due to their differences in latitudinal location of the two areas, which in turn makes the two places to have differences in terms of temperature and rainfall. The equatorial vegetation is located in the region with high temperatures and rainfall throughout the year while as that of the monsoon receives most of the rains in summer when monsoon winds blow towards the area with winters being dry.

Why do both types of vegetation have tall trees? (1989)

Both are located within the tropics with higher temperatures and a lot of rainfall even if in the monsoon heavy rainfall is in summer. This makes trees to grow very tall.

Name three trees of commercial value found in each of the following:

Equatorial

- Mahogany, iron wood, rose wood, ebony and green heart

Tropical monsoon forest

- Teak, bamboo, Sal, sandal wood, eucalyptus and acacia

Coniferous forest

- Hemlock, spruce, pine and fir

The figure below shows map of Africa showing two different climatic regions. Use it to answer the questions that follow (2006)

Map

Identify the type of climate that is experienced in regions marked A and B

A= equatorial climate

B= tropical continental climate

Explain why the region marked B experiences rain from November to March and no rain from May to September (6 marks)

The region marked **B** is in the southern hemisphere. It receives rain in warm wet season as a result of the increase in the solar radiation which in turn makes pressure to be reduced. When **pressure is low**, winds from high pressure areas especially in oceans converge in the region. Such winds upon crossing the seas collect moisture which results into heavy rainfall. The mentioned areas receive rain from November to March because during this period the sun appears to be overhead in southern hemisphere over the tropic of Capricorn. This increases solar radiation and reduces pressure. Winds such as the south east trades, the north east trades and the congo air mass converge in the area. These results into heavy rainfall with the moisture collected. The area develops high pressure from May to September when the sun appears to be drifting to the northern hemisphere making the area to have off shore winds which are dry hence no rainfall between May and September.

Name the deserts labeled C and D

C= Sahara

D= Kalahari Desert

Explain two reasons why the deserts labeled C and D are dry

Influenced by the cold ocean currents which do not bring precipitation to such areas as the currents themselves are dry without moisture. For example C is influenced by the canaries cold current while D is influenced by the benguela ocean current.

The places experience the off shore winds as they lie within the horse latitude high pressure belts. Such winds are dry and do not bring precipitation to the areas hence dry places.

Explain why desert plants have each of the following characteristics:

Long and well spaced out roots

Such long roots help to get water from the lower horizons of th earth with the well spaced out roots searching water as the palces are very arid with shortage of moisture for plants to grow.

Few or no leaves at all

This help to reduce the excessive loss of water through transpiration as water is scarce in deserts. Having many leaves would encourage and increase the rate of transpiration which would make the plants to wilt as moisture is not enough.

Thick succulent storms

These help to keep water which is used during the drier months when there is a great need for this water.

Study map of the world below and answer the questions that follow 91992)

Map

Explain why:-

The area marked A experiences heavy rains in the months May to August (2 marks)

This area between May and August comes under the influence of the monsoon winds. Such winds blow on shore from the Indian Ocean. It happens because the sun appears to be overhead in the area, which makes temperature make pressure to decrease in area while over the oceans the pressure is high. Wind blows towards the area carrying moisture that results into heavy rainfall upon reaching the land.

The area marked B receives rainfall throughout the year

It is under the influence of the north Atlantic drift ocean current. Being a warm current brings moisture to the area which results into heavy rainfall.

The coastline marked C has ice-bound harbours in winter while that of D is ice-free

The coastline marked **C** is influenced by a cold ocean current known as Labrador. This lowers the temperature in the area which contributes to the existence of the ice. This is in contrast with the coastline marked **D** which is influenced by the North Pacific warm ocean current. Being a warm ocean current it melts the ice in the area thereby making it to be ice free.

The coastline marked E receives less than 250 mm of rain per annum

This area is influenced by a cold Peruvian ocean current. Being a cold ocean current it is dry and when it reaches the area, it does not result into a lot of rainfall hence 250mm per annum.

Day temperatures in the area marked F are much higher than those in G

During the day time, the place marked **F** does not have a lot of clouds. This allows a lot of sunlight energy to reach the earth's surface which increases temperatures. This is in contrast to the place marked **G** which is covered with a lot of clouds during the day. Such clouds reflect some of the sunlight rays back to the atmosphere. This consequently lowers the temperature during the day.

The area marked H experiences winter rains

The place experiences off-shore trade winds during summer. This makes the area not to receive rainfall in summer as it is the case with some other areas. In winter the place experiences on-shore westerly winds. These being on-shore bring a lot of rainfall to the area. Consequently the area experiences winter rains as a result of on-shore westerly winds.

Identify the type of climate found in the region marked S

This is the tropical continental climate also called tropical Sudan climate

Explain three ways in which the climate and vegetation of the area marked S is economically important, give one example drawn from Africa in each case.

- The climate favors the cultivation of plantation crops. For instance, the tea plantations in Malawi
- In some places, pastoralist is done especially in east Africa. For example the Masai tribe in Kenya and Tanzania
- It is a home of wild animals that is, it is also called a “big game country”, with the herbivores and carnivores dominating. This makes the area as a center of tourism. Thus, the place has a many national parks and game reserves like those in Malawi.

Explain three ways in which the physical environment of the area marked S limits economic development

- frequent drought is a serious problem which leads to shortage of water and famine
- torrential down pours of heavy rains cause leaching making the soil to lose fertility
- Existence of tropical diseases and pests such as tsetse flies that hamper animal farming.

Study the climatic statistics below for a certain station and answer the questions that follow:

Table

Suggest the type of climate for the station

Tundra climate

Calculate the temperature range for the station

$$8^{\circ}\text{C} - -40^{\circ}\text{C} = 48^{\circ}\text{C}$$

Describe any our characteristics of this type of climate

- the average temperature of the warmest month is below 10°C but above 0°C and temperature for the coldest month is between -29°C and -40°C
- large annual temperature of up to 50°C
- total annual precipitation is above 250mm
- Winters are long and severe with short warm summers. Winter nights are long with hardly any day light and summer days are long with hardly any night
- glei soils are main features of Tundra. These soils are formed under the influence poor drainage

Give three chief features of the vegetation found in this climate

- it has a variety of grass grows together with mosses, lichens and flowering plants such as bilberry and bearberry
- the grasses are short due to slow growth because of the very cold climate
- the grass is punctuated by very stunted growth of bushes

Describe any agricultural development associated with this type of climate that you know

Agricultural development is difficult because temperatures become very low such that the sub soil is permanently frozen (perma-frost)

Give two reasons that make the climate not to favour tall trees

- strong and intensely cold winds of winter make normal tree growth impossible
- The soils are permanently frozen.

Why is it that this climate is only found in the northern hemisphere?

This is because the northern hemisphere has a large land mass than the southern hemisphere which is mainly made up of water.

What do you understand by the term solifluction

This is a process through which a thick mud of melting water that flow down slope without breaking. On the surface is produced in the cold climates such as tundra.

Study the climatic data below and answer the questions that follow

Table

What name is given to the type of climate named above

It is cool temperate continental also called Siberian climate

Calculate the annual temperature range for the climate named above

$$20^{\circ}\text{C} - -19^{\circ}\text{C} = 39^{\circ}\text{C}$$

Give three characteristics of this climate named above

- Precipitation varies between **380mm** and **635mm** well distributed throughout the year with maximum in summer
- The annual temperature range is large such that sometimes it is more than **30°C**
- Bitterly cold winter of long duration and cool brief summer
- In winter the temperatures are so low that heavy snowfall is common, and rivers are frozen
- The highest temperatures are above **10°C** but below or around **20°C**.

Give two examples of countries with the climate named above

- Canada
- Union of soviet socialist republic (USSR) or common wealth of independent states (CIS) which were former Russian colonies

NOTE:- the climate is experienced only in the northern hemisphere from Alaska to Hudson Bay and from Sweden to Kamchatka Peninsula, with **60°N** as the outer limit.

What name is given to the vegetation found in the climate named above

Evergreen coniferous forest

Give three characteristics of the vegetation found in the climate named above

- Almost all conifers are evergreen
- The leaves are small, thick, leathery and needle –shaped to check excessive transpiration
- There is very little undergrowth
- Are conically shaped to survive the subarctic climate
- Trees grow at reasonable slow rate
- Trees have big area or mass of wood than leaves

Give two important activities done by the people in this climate shown above

- **Lumbering** as the most important activity. This is because the vegetation is mainly made up of soft wood
- Animal **trapping** as the climate has many fur-bearing animals such as the mink, beaver, muskrat, ermine and silver fox. These animals are hunted for **fur**.

Give three examples of trees that are found in the vegetation of climate named above

- Hemlock
- Spruce
- Pine
- Larch
- Fir

Give three examples of industries with their products that can be developed in this climate

- Saw milling industry, producing timber plywood, planks and hard boards
- Paper and pulp industry, producing paper, notebooks, very famous in the united states of America
- Fuel industry in which the soft wood is burnt as fuel for heating and cooking

- Industrial raw materials such as matches. Furniture, wood carvings, toys, crates and packing cases. The by-products of timber are used for making rayon, dyes, cosmetics, turpentine, varnishes and liquid resins.

Study the photographs of the vegetation types below and answer the questions that follow (1997)

Photos

Take note of the letters

Name the vegetation type shown by each photograph

- Tropical rainforest vegetation
- Temperate grassland

Suggest two countries outside Africa where each of the vegetation types is found

Amazon, Philippines, Indonesia, Malaysia, Australia.

NOTE: if the question would require examples from Africa

Congo, Guinea coast

Mention two areas in Malawi where the vegetation type shown by figure A is found

- Nkhata Bay
- Mulanje
- Thyolo

Give two reasons why the areas mentioned in the above are ideal for the growth of vegetation type A

- Such areas receive heavy rainfall well distributed that favours the growth of the vegetation.
- Experience high temperatures which favour the growth of the vegetation

From the evidence provided by the photographs:

What is the economic importance of the vegetation shown in B

- As it is treeless with very flat land, it can easily be used for the cultivation of cereal such as wheat in the prairies.
- Due to its flatness and as the fact that there tall grass, it is used for ranching such as cattle ranching in Argentina.

What are the two main characteristics of the vegetation type shown in B (2)

- Extensive area of grass without trees
- Grass occurs together with herds
- The grass becomes short moving towards the temperate desert areas

Give three factors which hinder agricultural developments in A

- Since it is densely forested, construction of roads and railways is difficult which brings the problem of communication can help to transport agricultural products.
- Thickness of the vegetation as seen from the picture make the clearing of the land for farming very difficult
- The way the vegetation appears, dangerous animals such as snakes can call it home. Such animals including pests such as tsetse flies can spread diseases to both people and animals.
- Thickness of the vegetation is as a result of heavy rainfall. Such rainfall usually wash the fertile soil away through leaching.

Why is the vegetation in B have the following:

Buttress roots- these help to support the tall tress

Dark green and leathery leaves- preventing the wilting during the hottest part of the day

Shining surface of the leaves- help to shed water quickly so that transpiration is not hindered

Study the photograph below of a vegetation type (1994)

Photo

Name the vegetation type depicted in the photograph

It is Xerophytes desert vegetation

Suggest the names of the plants labeled A and B in the Photograph

A= thorny or porcupine bushes

B= cacti/ cactus

From your knowledge suggest the latitudinal location of this type of vegetation

Located on the western sides of the continents between 15° and 30° North or South of the equator

Name any two areas in the Southern Hemisphere which have this type of vegetation

- Kalahari desert
- Namibia desert
- Atacama desert
- The great Australian desert

NOTE: if the vegetation would require in the northern hemisphere, **Mohave, Gobi, and Sahara** would be the prominent examples.

Explain any three ways in which plants are adapted to the temperature and precipitation conditions prevalent in the environment

- Have waxy and tiny leaves in order to prevent transpiration due to high temperatures
- Produce sleepy seeds that lie dormant during dry months and germinate when water is available
- Grow long and spreading searching roots in order to look for water under the ground as the water is scarce
- Have very thick and succulent stems which usually keep water

Name any two types of agricultural systems practiced in this type of environment

- Irrigation farming especially in oases. These are places where water flows on its own in deserts as a result of water table being closer to the surface. Wheat, dates, vegetables and fruits are grown.
- Pastoralism by nomadic tribes especially in the Sahara and the Arabian deserts. Sheep, cattle, goats are kept for meat and milk.

Explain two limiting factors that this type of environment has on agricultural development

- Very limited quantities and distribution of available fresh water to be used in irrigation
- Rainfall is very scarce to support the cultivation of crops
- The soils are very poor , composed of trees, not suitable for the cultivation of crops
- Very high temperatures make crops to wilt.

THE ENVIRONEMNT, DESERTIFICATION, WETLANDS, ENDANGERED SPECIES, CLIMATIC CHANGE

Define the word “ desertification”

This refers to the process that creates desert conditions by down grading the land surface

Why is desertification sometimes defined as “ creeping desert” (1992)

Because it is steady process that turns good and fertile land into a barren one usually as a result of human activities to the environment.

Explain any three causes of desertification in Africa (2002) (6 marks) (2007)

- The demand for wood for fire especially in developing countries. Trees and shrubs are removed making the soil to become vulnerable to erosion by wind and water. This downgrades the land.
- Over cultivation as a result of rapid population growth which results into increased pressure on farmland. This makes people to cultivate in marginal areas such as catchment areas, riverbanks which are more vulnerable to erosion and makes rivers to dry up easily.
- Having large numbers of livestock gathering in watery holes which leads to overgrazing and degradation of vegetation especially in pastoral nomadism
- Deforestation which is the felling and clearance of forest land for cultivation and settlement. The land is eventually left bare.

Outline four problems associate with desertification in Africa (2000) (2007)

- It disturbs the water cycle since the rate of transpiration is tampered with. This may lead to a series of drought and famine conditions as crops cannot be cultivated.

- Results into soil erosion, as the soil is left bare due to the removal of forests. This makes the soil to be degraded leading to low crop yields.
- Results into climatic change due to a lot of heat on the earth's surface
- As the ground is not protected it results into floods that destroy a lot of property and life.
- Prevents vegetation of various species of plants which eventually becomes extinct.

Suggest three solutions to some of the problems of desertification in Africa (2002)

- A forestation which involves the planting of trees where there were not trees. This apart from protecting the soil from erosion, it will make transpiration to take place normally.
- Reafforestation which is a tendency of planting trees where they have been cut down
- Controlling rapid population growth through good health measures. This will reduce the pressure on vegetation thus combating desertification.

How do the following ways help to control desertification?

Civic education: this sensitise opeople on the importance of managing the environment properly and the bad results of it. When people are aware, they will not do anything bad out of ignorance and this helps to control desertification

Proper land husbandry: by following good farming practices such as constructing ridges across the slope, avoiding overgrazing and over stocking, desertification is combated as the land is protected from erosion agents of water and wind.

Provision of alternative sources of energy such as solar, hydro and wind: this reduces pressure on vegetation as a reliable source of energy and in this way combats desertification especially in rural areas where people are not exposed to such alternative sources of energy but only depend on fuel wood.

State any three ways in which deforestation can be combated

- Aforestation
- Reafforestation
- Provision of alternative sources of energy such as hydro

- Civic educating campaigns on the importance of vegetation

Name three countries in west Africa where desertification is a serious problem 93) (1992)

Mali, Burkina Faso, Mauritania, Senegal (mostly in the Sahel region)

Describe the process of desertification

The process of desertification starts with the increase in human population. This creates the demand for land for settlement, cultivation and as source of energy. This then results into deforestation, over cultivation, over grazing and over stocking. This in turn results into soil erosion, climatic change, drought and eventually a desert.

Figure A and B on the next page shows the effects of desertification in the Sahel region of West Africa. Study the photographs and answer the questions that follow (1992)

Photos

Chech pp nwachukwu

State what you see of the natural vegetation in both photographs

The natural vegetation has been completely removed as no trees or grasses can be seen in the pictures except sand, and some small sticks which show that at first the place had some trees.

From evidence provided by the two photographs, describe two problems arising from desertification

The photographs show women carrying firewood and a cow lying dead. This shows that an increase in population puts pressure on the vegetation for fuel wood. This in turn result into deforestation, leaving the land bare as the picture shows. An increase in population creates a demand for meat. This contributes to overgrazing and over stocking. These results into shortage of grass for animals and water to drink, hence the death of animals as picture B shows.

Describe three human activities that might have led to the results of observed in the figures

- Having large numbers of livestock gathering in water places which contributes to overgrazing and overstocking as the picture B shows.
- The demand for wood for fire especially in developing countries. This puts pressure on trees such that at a climax, it becomes even possible for women to travel long distances in search of firewood in the tropical scorching heat as the picture A suggests.
- Climate change which is a direct consequences of human beings mismanaging the environment. This brings about drought conditions which are characterized by dry conditions as shown in the pictures A and B

Why is desertification becoming a threat in Malawi?

This is because the population is increasing rapidly in Malawi. This makes forests to be cleared for cultivation, settlements apart from fuel wood, which is definitely bringing desert conditions with floods, poor soils, erosion, death of animals such as cattle, difficulties in obtaining fuel wood as the possible signs.

ENDANGERED SPEIESC, WETLANDS

Define the term “endangered species”

This refers to the scarcity and extinction of certain plants and animals in the environment as a result of human activities.

Explain four ways in which species are endangered in the environment

- **Poor agricultural practices** such as shifting cultivation, pastoral nomadism, and making ridges along the slopes. These endanger wild and aquatic life species in the sense that they destroy the habitat for wild life like in the case of shifting cultivation that destroy the vegetation in which animals take refuge.
- **Deforestation** which refers to the wanton cutting down of trees without replacement. This endangers wild and aquatic species in that it encourages greater run off and large scale erosion which degrades and destroys the habitat for wild life.

- **Misuse of pesticides** which destroy the habitat and kill aquatic animals when discharged into water. Some chemicals when discharged in water kill aquatic life directly when poisonous or deny aquatic life of oxygen making them to suffocate and die.
- **Poor waste disposal** by industries and human beings. This may bring diseases which kill animals and plants
- **Disruption of the food chain.** Killing or getting rid of one or two species of living organisms affects the life expectancy of the others. This reduces and eventually leads to the extinction of plants and animals due to lack of food for them. For example, the removal of buffaloes in the environment can result into the extinction of lions which depend on buffaloes for food.
- **Over fishing** which refers to the catching of fish faster than that which can be replaced through reproduction. This result into the reduction and scarcity of some fish species like chambo which consequently leads to extinction.
- **Poaching** which refers to the illegal killing of animals especially in protected areas. This comes largely because of rapid population growth which can result into depletion or reduction and extinction of wild life.
- **Draining of marshes and swamps.** This destroys the habitat for marine species like crocodiles hippopotamus, fish, water birds like cormorant.

Explain how the following points endanger plants and animal species:

Genetic modification or hybridization

This is the cross breeding of two or more species in order to produce one. The produced specie takes the characteristics of these two or more species cross-bred. This endangers the plant or animal species in the sense that the such species replace the original species which then becomes vanished from the environment.

Introduction of the exotic species into local habitats

This endangers the species in the sense that the exotic, introduced species destroy and dominate the endemic species which eventually vanishes from the environment.

war

This tends to harvest species in unsustainable manner by over harvesting species due to lack of control.

Habitat destruction

This tends to quicken the disappearance of species by limiting space in which a species can be accommodated and nourished

Climate change

This tends to raise or lower temperatures, thus making adaptation of species very difficult and as a result the species die off completely

How are the following species endangered from the environment:

Trees:- through deforestation, harmful bushfires, mining, quarrying which completely removes trees.

Fish such as Tuna, cod and chambo

This is done through overfishing, destruction of fishing grounds, polluting water bodies and through fish piracy. These remove the species in water bodies such as rivers, lakes and seas.

Elephants: through poaching in game parks. Poachers look for tusks or ivory and to a lesser extent meat

Birds: through human settlement that destroy the habitat, predation, deforestation and harmful bushfires which even kill the young birds apart from destroying the food for the old ones. Some colorful birds are smuggled to outside.

Gorillas: encroachment into their habitat through opening gardens and settlements. Poaching whereby they are killed for their skins. Some are even smuggled to other countries to be used in the tourism industry.

Black rhinos: these are removed through poaching as the poachers target their horns which are then sold overseas and the whole body is just kept

Lions, leopards: these are poached for their skins which are sold overseas.

Buffaloes: these are poached for both meat and hides

Explain two ways in which wild and aquatic life species is of importance

- These promote tourism which in turn improves foreign exchange currency as tourists visit places of interest
- They are source of protein, calcium, and other nutrients which are important in the body of human beings
- Source of income to people. For instance, people go fishing and eventually find money
- They bring about an ecological balance.

Explain some of the ways in which the following can be conserved:

Aquatic species

- Protection of rare endangered species by establishing some strict rules. For example, those fishermen catching chambo fish, should be throwing it back in water because it is a rare and endangered specie
- Avoid over fishing by introducing a closed season whereby fishing is not allowed during the breeding season.
- Civic educating the people in the dangers of removing the aquatic life and the importance of conserving them.

Wild species

- Establishment of conservation areas such as forest reserves, national parks and game reserves.
- Catching game where they are facing extinction or overpopulation and relocating them elsewhere
- Civic educating the masses especially those around the protected areas on the importance of protected areas and the wild life contained.
- Harsh penalties for those who deliberately bend the rules for conserving wildlife. For example, poaches to get stiffer punishments so that others should learn a lesson from them.

Explain the importance of each of the following practices in the environment:-

Proper land husbandry

This helps to maintain the vegetation thereby preventing soil erosion that leads to silt built up and poor soil fertility

Maintaining crocodiles in their natural settings

This helps to maintain the food chain in the environment thereby making some species to survive in the environment.

Correct amount of greenhouse gases in the atmosphere

This makes the ozone layers not to be destroyed. When the ozone has not been destroyed, the gamma rays, the infrared and the X- rays would not reach the earth's thereby causing global warming. Global warming make some plant and animal species to become extinct.

WETLNADS

Define wetlands

This refers to swamps, marshes and bogs where water remains stagnant for a greater part of the year.

In what two ways can wetlands be important to society?

- They are habitat for birds, and endangered and threatened plant and fish species
- They beautify the environment, providing grounds where biological studies and recreational observation can take place.
- They are centers of tourism that bring much needed foreign currency to a country
- They produce life in that they provide feeding, spawning and nursery for fish

Explain two ways in which wetlands are a source of clean water (2006)

- Wetlands absorb and filter pollutants that would degrade rivers and lakes, thus providing clean water.
- Wetlands hold back the excess water that would cause flooding. This also help to clean up the water as the flooded water is not clean.

Describe the positive impact that wetlands have on global warming (2006)

Wetlands help to lock up carbon inform of peat and prevent it from entering the atmosphere as carbon dioxide, the main gas in global warming.

Draw a map of Malawi. On it locate and name two examples of wetlands

Map

Get it from phy geo

2. How can the following help to manage wetlands in Malawi:-

a. Government

The government can civic educate people living near and around wetlands on the importance of these areas. The government, apart from passing stringiest laws to protect such places, it can also teach people to control population growth which gives pressure on the land.

b. Individual

Individual's should avoid encroaching wetlands by not draining them. It is only knowledgeable people who are able to do so. This is where civic education becomes important.

c. Communities

Civic education should be done within the communities in addition to the communities joining hands in protecting the wetlands by ensuring that anyone found encroaching them is dealt with accordingly.

Give two examples of human activities that can threaten wetlands

- Draining them away for using the land for cultivation
- Constructing settlements in such important areas.
- Planting rice in wetlands
- Catching fish in such areas

Give two problems that the people living close to wetlands are likely to face

- Malarial problems as the wetlands act as breeding places for mosquitoes which transmit malaria

- Some animals which live in such places may destroy peoples crops. For example elephants in Vwaza marsh.

Suppose the government wants to drain all the wetlands. Suggest two problems that would be experienced as a result of this action by government

- Wetlands help in flood control. Swamps hold back water or run off, thus controlling floods. Removal of these would speed up the storm flow and results into flooding, destroying life and property. For example, the ndindi and elephant marshes in the lower shire help to reduce the occurrence of flooding.
- There would be the extinction of some plants and animals which use such places as habitats
- There would be a decline in the tourism industry. Some wetlands such as Vwaza marsh, Elephant marsh help to attract tourists. The much needed foreign currency generated through tourism would go down.
- It would increase the global warming. This is because the carbon locked up in form of peat in these area would release a lot of carbon dioxide, the main gas in global warming.

Explain the word “ climate change”

This is the change in the world climate due to human activities done to the environment

Explain two causes of climatic change

- Deforestation which is the wanton cutting down of trees for settlements and cultivation. This is due to rapid population growth. This results into the climatic change because the rate of transpiration is reduced leading to little or not rainfall.
- The release of gases such as carbon dioxide, methane and chloroflourocarbons (CFCs) from refrigerators. These do not only destroy the ozone layer thereby allowing ultraviolet rays to reach the earth, but also cause global warming as the stop the rays form going back into the atmosphere. This upsets normal trend of rainfall. High temperatures also disturb the condensation point as the dew point is not reached easily.

3. Explain why three effects of climate change (in what three ways is climatic change bad to the planet earth) (give three things that can be the signs to show that the climate has really changed)

- **Global warming:** this is the warming up of the earth due to inability of the heat to escape into the space. This is caused by the greenhouse gases such as carbon dioxide, methane and chlorofluro carbons. These gases cause global warming in the sense that they attack the ozone layer and destroy it. Rays from the sun such as the gamma rays, infrared rays and X-rays reach the earth. This increases the temperature. Apart from this, the gases trap the reflected rays from the earth and send them back, further increasing the temperature hence global warming. This apart from making some plant and animal species to die out, it affects evapotranspiration and condensation thereby tampering with the water cycle, bringing drought conditions or heavy rainfall that cause floods.
- It results into an increase in storm cyclones develop as a result of a low pressure. This low pressure develops as a result of temperature. Tropical storms such as the hurricanes, the cyclones and the Willy willies destroy property and infrastructure.
- Results into change in the direction of flow of ocean currents. Usually warm ocean currents from the Polar Regions. With increase in temperature the direction of such ocean currents change which results into the change in climate as ocean currents influence the climate of an area.
- The shrinking of the Antarctic Ice cap. The increase in temperature makes ice to melt in Polar Regions. This leads to flooding as the molten water gets into water masses.

Explain some three ways that the government can do in order to reduce the effects of climatic change

- Sensitization campaigns through world organizations and governments. Communities in different parts of the world should be civic educated on the problems of climate change.
- Avoidance of use of machines or activities that release dangerous gases such as chloroflorocarbons, methane and carbon dioxide. This will help to maintain the ozone layer and stop global warming.
- Avoidance of setting harmful bushfires. This adds a lot of carbon dioxide that contribute to global warming.

Explain three effects of global warming

- Hot areas become hotter which help in the spread of desertification
- The melting of glaciers that cause flooding especially in low lying areas such as Netherlands
- Spreading tropical diseases to the temperate regions

- Shifting climatic belts and vegetation types and in the process some plants and animals being lost forever.

Explain any two ways in which undisturbed climate in Malawi could act as a conservation measures for wildlife (2006) (4)

- It could not result into flooding that would destroy wildlife and property
- It could reduce the occurrence of drought that would lead into the death of and extinction of wildlife.

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