

S3. GEOGRAPHY DEP'T NOTES.

REST OF AFRICA.

GEOGRAPHY

Code: 273/2, Paper 2

PART I : THE REST OF AFRICA.

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TOPIC II: AFRICA's CLIMATE.

Climate: is the average weather condition of a given place studied over a long period of time approximately between 30 and 35 years.

Climate of a place involves the study of weather elements.

Weather: is the daily condition of the atmosphere studied and recorded through the weather elements for a short period of time.

Elements of weather	Instruments
1. Temperature	1. Maximum and mini- mum thermometer.
2. Rainfall	2. Rain gauge
3. Cloud cover	3. Eye
4. Sunshine	4. Sunshine recorder
5. Humidity	5. Hygrometer
6. Wind	6. Wind vane
7. Atmospheric pressure	7. Barometer

FACTORS AFFECTING CLIMATE OF A PLACE

- a) Relief,
- b) Vegetation,
- c) Proximity to large water bodies,
- d) Altitude,
- e) Migration of the sun,
- f) Latitudes,
- g) Inter tropical convergence zone (ITCZ),
- h) Influence of prevailing winds,
- i) Influence of ocean currents.

Migration of the sun

The sun is the main source of heat for a given place on the earth's surface. The amount of heat received in any place on the surface of the earth depends on the great extent to the angle of inclination.

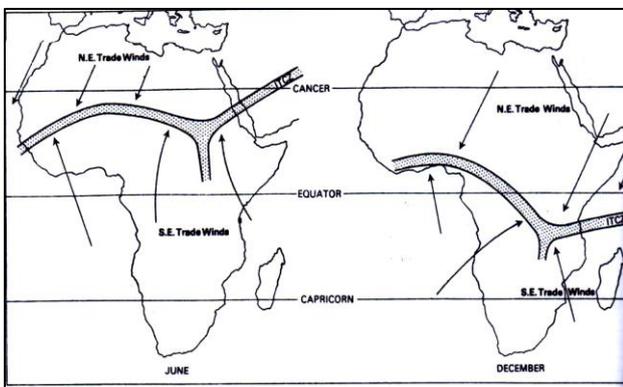
Effects of migration of the sun on weather.

The migration of the overhead sun between the tropics of Capricorn through the equator and tropic of cancer results into ITCZ (Inter Tropical Convergence Zone) conditions that include:

- Winter conditions include; Cool temperatures and dry / unreliable rainfall from the area where the sun migrated from.
- When the sun over heads at the Tropic of cancer in the northern hemisphere the land becomes hotter (warm) than it is in the southern hemisphere (Tropic of Capricorn) i.e. temperatures are hot at the Northern hemisphere and cool at the southern hemisphere.
- Heavy rainfall conditions are experienced in Northern Hemisphere where the sun is overhead and dry conditions in the southern hemisphere where the sun has migrated.

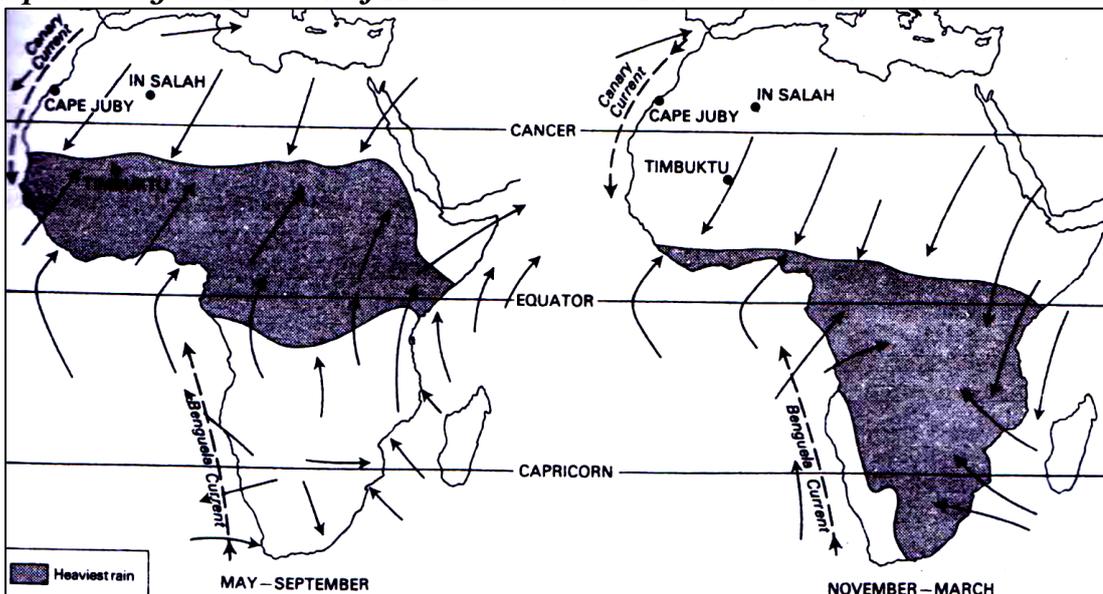
ITCZ also exists when the sun is overhead the Equator and the following conditions are experienced in the region;

- Hot temperatures,
- High evaporation rates.
- Dense cloud covers in the sky.
- Heavy rainfall.
- Low pressure (doldrums).
- The condition attracts the wind systems to blow towards the equator. (*Winds move from high concentration to low concentrated area*).
- Heavy rainfall is received here compared to areas far away from the Equator.



Position of ITCZ (June and December)

Map showing the Position of ITCZ and climatic zones in the Northern and southern hemisphere.



Latitudinal location on an area

Africa is crossed by three major latitudes, i.e. the Tropic of Cancer, Capricorn and the Equator.

Over 3¼ of landmass are within the tropics which means, hot temperatures are experienced all the year around.

However, areas near the Equator do experience hot temperatures and receive rainfall throughout the year than the other in the same areas; where temperature has been modified by the altitude.

This means that areas along the Equator have different climate in terms of temperature and Rainfall.

Nearness to water bodies:

The position of the land and sea on earth presents unequal relationship between the land and sea. Land experiences Temperature changes much faster than the sea (Water bodies).

During the day landmass do get heated faster than the sea and evaporation takes place on the land, while a high pressure zone is experienced on the sea with air masses moving towards the land surface.

Influence of the prevailing winds;

Prevailing winds are named according to areas they originate from basing on the compass direction. Africa is influenced by four main wind systems these include;

- a) **SETS: South Eastern Trades winds.**
- b) **SWETS: South Western Trades winds.**
- c) **NETS: North Eastern Trades winds.**
- d) **Hamattan winds.**

AFRICA: POSITION OF PREVAILING WINDS.



The South West Trade winds originate from the South West parts of Africa all the way from the Atlantic Ocean onto the Interior West Africa countries and masses. They carry moisture to that cause heavy rainfall to the coastal areas.

Hamattan winds originate from the Alps region of West Europe. They are only dry and cold winds. They cause little or no rain fall on the landmass of North Africa. Its effects may lead to the afternoon and the early morning's rains on the areas near to the Mediterranean Sea.

The South East Trade winds carry the moisture from the Indian Ocean where they come from and drop it on the Interior of Africa. These winds bring in Rainfall. They are responsible for heavy rain fall received along Natal province and other parts of the East African Coast.

The North East Trade winds originate from the North East Africa parts of the continent coming from Asia Continent through Arabian Desert to the Red Sea and they proceed to the whole of Africa.

These winds are forced to rise over the Ethiopian Highlands and form Relief rainfall on the wind ward side. Winds that proceed to the leeward side of the highland lead to desert conditions in the Northern parts of Kenya, Somalia, North Eastern Uganda and Sudan because they carry no moisture to the Northern parts of Africa.

These winds are partly responsible for the dry conditions and low temperatures during night on the Sahara deserts.

Influence of ocean currents.

An ocean current is the movement of the mass of water within the ocean.

Ocean currents are normally warm or cool. Therefore, are named according to the conditions of the temperature.

Ocean currents are set in motion by wind system and reduce force.

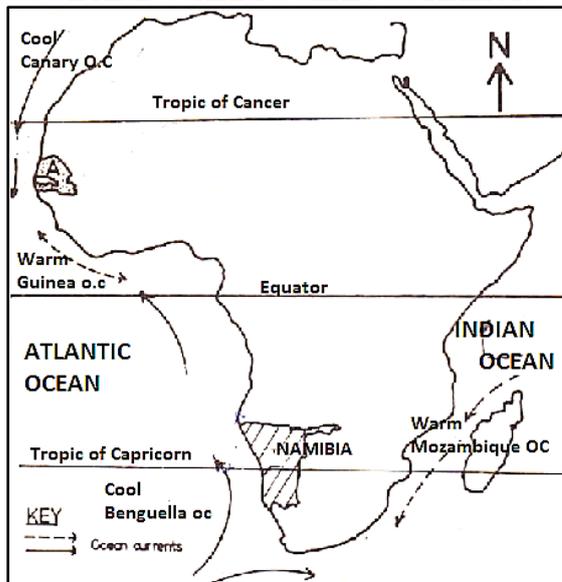
Ocean currents are cold /cool or warm.

Cold ocean currents originate from the cold parts of the world. (Polar region).

CHARACTERISTICS OF OCEAN CURRENTS.

- a) They have a specific direction of flow. Cold ocean currents move from Polar Regions towards the Equator while Warm ocean currents move from Equator towards the polar region.
- b) Ocean currents carry specific temperatures with them. Warm ocean currents carry warm temperatures towards the polar region. While the cold ocean currents carry the cold temperatures towards the Equator.
- c) Ocean currents move in the clockwise direction in the Northern Hemisphere except the warm guinea currents which are anti-clockwise in the Southern Hemisphere due to earth movements.
- d) Warm ocean currents are always located on the Eastern side of the continent except the guinea warm currents. While cold currents are found on the western side of the continent.
- e) Cold ocean currents induce condensation on the ground surface forming fog. (Lower clouds) and dry winds desert condition.
- f) Warm ocean currents are moist and induce evaporation, cloud formation and rainfall.

COOL AND WARM OCEAN CURRENTS



Causes of ocean currents.

1. **Effect of prevailing winds;** tend to drift water in the ocean from one place to another e.g. the south west trade winds influence the flow of the cool Benguella ocean currents towards Equator.
2. **Temperature differences;** causes the oceanic currents, the winds consequently cause convection currents to set up that drive the warm water of the equatorial climate towards the polar. Warm equatorial waters are less dense than polar.
3. **Rotation of the earth**
causes defective falls over the ocean currents known as the Coriolis force that causes the ocean currents to flow clockwise in the southern hemisphere.
4. **Salinity**
refers how much salt content is in water. Water with high salinity flows to areas of low salinity and vice versa leading to ocean currents.
5. **Nature of coasts**
Coastal configuration and presence of sub marine ridges can also cause currents in ocean both north and south equatorial currents are reflected in north and south respectively to the shape of the coast.

6. Tides;

The sun and the moon exert gravitation and attraction on the earth's surface this refers to rolling and following motions to develop on water of large oceans result into movement of ocean currents.

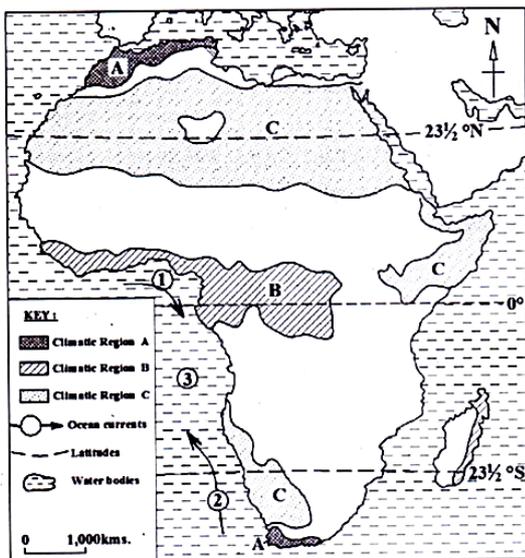
Effects of ocean currents on the Climate of Africa.

- Warm ocean currents, raises temperatures of adjacent areas e.g. Warm Mozambique currents at Natal coast of South East Africa.
- Warm Ocean currents bring in high humidity to the adjacent coastal areas.
- Warm ocean currents cause heavy rainfall to the adjacent coasts of West Africa and the Natal province of Republic of South Africa.
- Cold ocean current to cool temperatures of adjacent areas because they act as heat traps and warmth of crossing over winds.
- Cold Ocean currents are associated with cold and dry climatic conditions e.g. aridity in an area.
- Cold ocean currents result into lower ground clouds because moisture is reduced to condense the surface of earth.
- Cold ocean currents limit the amount of humidity in the atmosphere of the adjacent coast.
- There is low cloud cover /clear blue sky at areas near cold ocean currents.
- Cold ocean currents are associated with desert conditions on the adjacent coast and dry winds.

ECONOMIC IMPORTANCE OF OCEAN CURRENTS.

- Fishing is carried out along the coast washed by cold ocean currents which favor the growth of planktons e.g. fishing grounds at the coast of Cape Agulhas, morocco fishing grounds which borders cold ocean currents.
- Plantation farming is carried out at coasts bordering warm ocean currents e.g. natal sugar plantations in South Africa.
- Palm oil growing and rubber on West African coast due to warm Guinea currents that bring heavy rainfall to the adjacent coast.
- Pastoralism is practiced along the coast bordering cold ocean currents due to arid conditions e.g. the Fulani of the Sahel in Morocco, the Hottentots of Namibia.
- Forestry is done along the coast bordering warm ocean currents e.g. Equatorial rain forests bordering warm guinea currency favours lumbering.
- Growing of coral reefs leading to mining on the east African coast bordering the warm Mozambique currents has boosted the cement and tourism industry in the region.

Study figure 1, map of Africa provided and answer the questions that



- (a) Name the:
- (i) climatic regions marked A, B and C. (03 marks)
 - (ii) warm ocean current marked 1. (01 mark)
 - (iii) cold ocean current marked 2. (01 mark)
 - (iv) water body marked 3. (01 mark)
- (b) Describe the characteristics of either warm ocean current marked 1 or cold ocean current marked 2. (06 marks)
- (c) With examples, explain the effects of ocean currents on the climate of Africa. (08 marks)
- (d) Outline the disadvantages of living either in climatic region marked B or climatic region marked C. (05 marks)

Relief

Relief is the general description of the landscape. Relief of an area is measured in meters above sea level.

The general landscape is either low, a slope, flat or high i.e. it has valleys, flat lowlands, plateaus, steep slopes, mountains or highlands, etc.

Influence of Relief on climate.

When moist winds blow across water bodies, forests and are in contact with mountain areas or highland, these winds are forced to rise up, and reach a condensations level and form clouds which fall as relief rainfall on the windward side. As the winds cross through above the mountains (highlands) to the other side (Leeward side) they become dry leading to drought.

When winds reach higher elevation up the mountains they condense because of the effect of altitude (*the*

Higher you go the cooler it becomes) the winds have lost much of its temperatures into the atmosphere. They condense and become heavy clouds that eventually fall as rains.

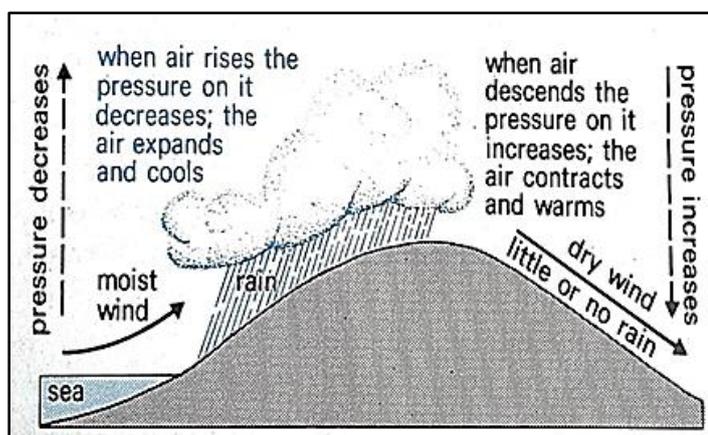
As it falls winds are warmed from the ground surface. Warm air holds moisture such that it loses at higher levels, when it reaches the leeward sides it is dry and absorbs moisture and leaves the place in a dry condition.

Lowland areas do not provide barriers to moving winds since they are flat landscapes, winds just pass and carry along it any moisture present. They are drier lands in most cases e.g. Sahara Desert

Characteristics of Relief rainfall:

- It is often heavy on the wind ward side of the highlands
- It occurs as a result of the ascent of moisture laden air over a highland
- It involves prolonged periods of rain or precipitation
- It occurs in proximity to highlands Occasional thunderstorms and hail are common.

Diagram to represent the effect of relief on formation of Relief rainfall.



Other forms of rainfall formed due to effect of relief:

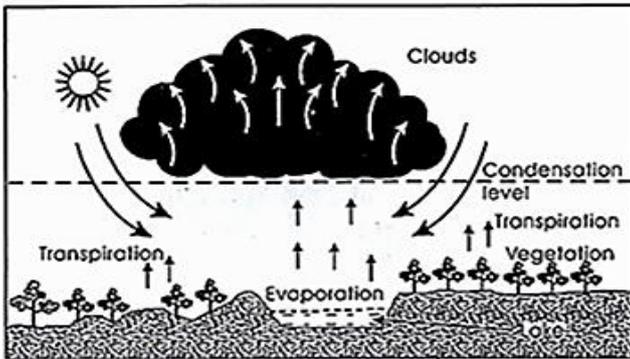
Convictional rainfall:

Is caused by strong heating of the land by solar radiation which sets up rising air currents (convection currents).

It is the characteristic of the Tropical regions and Equatorial regions. Rainfall occurs in afternoons when temperature and humidity are at their maximum. It is often accompanied by lightning and thunderstorm with very heavy rainfall in a short time.

Characteristics of Convictional rainfall:

- It is experienced in areas with intense heating
- It is associated with prolonged rains covering a wide area.
- It is mainly received in the afternoons.
- Lightning and thunderstorms are so common.
- It involves heavy showers.
- It occurs during summer in the mid latitudes.



Convictional rainfall.

Frontal (Cyclonic) Rainfall.

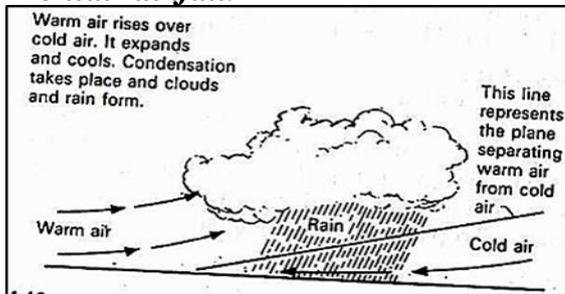
It is a type of rainfall which occurs when two air masses of different characteristics meet at a front. The warm air mass is forced to rise over the cold dense air mass which descends at front. Warm moist air rises and cools at an adiabatic lapse rate until when the condensation level is reached. Condensation occurs to form clouds which eventually release water droplets called frontal rainfall.

Characteristics of Frontal Rainfall.

- It is experienced along fronts such as the Inter tropical convergence zone (I.T.C.Z) where trade winds meet.
- It involves heavy showers covering small local areas.

It lasts for only a few hours It involves violent thunderstorms

Frontal rainfall.



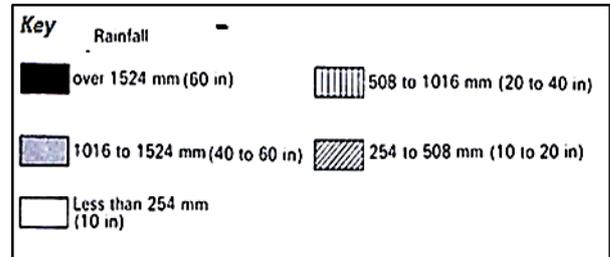
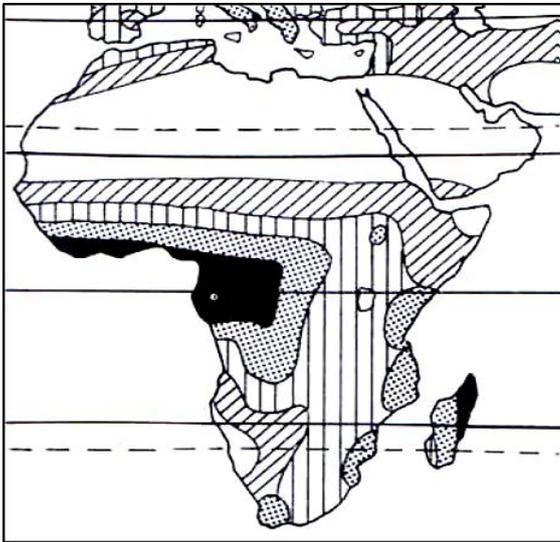
Sample question: UNEB 2006

Qn 1

- a) Draw a sketch map of Africa and on it mark and name areas which receive mean annual rainfall of;
- (i) over 2000mm
 - (ii) 1000mm

- (iii) less than 500mm.
- b) Describe the factors which have led to:
- (i) high mean annual rainfall in areas named in (a) (i) above.
 - (ii) low mean annual rainfall in areas named in (a) (iii) above.
- c) Explain the influence of rainfall on human activities in areas marked in (a) above.
- d) Outline the problems faced by people living in areas receiving annual rainfall of over 2000mm in Africa.

Africa: climate regions of areas with mean annual rainfall of ; over 2000mm, 1000mm and less than 500mm.



b) (i) Factors which have led to high mean annual rainfall in areas named in (a) (i) above. This is 2000mm at Equatorial climate regions.

- Proximity to the Equator which causes double maxima rainfall due to influence of the inter-tropical convergence zone.
- Proximity to warm ocean currents e.g. the Guinea Ocean current which brings moist on-shore winds to west African coast.
- Proximity to large water bodies like oceans; Atlantic Ocean and Indian Ocean that lead to influence of land and sea breeze.
- Presence of trade winds e.g. the NE, SE and SW which blow on show causing rainfall.
- Existence of dense, thick Equatorial and tropical rainforests that are always humid cause convectional rainfall.
- Existence of many patches of highlands which lead to formation of Relief rainfall, e.g. Drakensburg in South Africa and Ethiopian highlands.
- Apparent movement of the sun which leads to high evaporation rates causing convectional rainfall.

(iii) Low mean annual rainfall in areas named in (a) (iii) above.

This are semi and desert areas.

- Presences of cold ocean currents e.g. cold canary and cool Benguela which cause dry climate in South and West Africa.
- Continentality effect i.e. area being far away from large water bodies due to interior location in the continent.
- Limited vegetation covers in some areas Namibia and the Sahara.
- Leeward location of the areas from rain bearing winds.
- Influences of some trade winds e.g. the NE trade winds that blow from Arabian Desert are dry towards Africa.

c) Explain the influence of rainfall on human activities in areas marked in (a) above

(i) Influence of heavy rainfall. (Equatorial lands) over 2000mm

- Heavy rainfall throughout the year supports the growth of tropical rain forests leading to forestry in the area.
- Heavy rainfall received throughout the year support the growth of perennial crops like rubber, cocoa, coffee, oil palm, etc.
- The double maxima received encourages double cropping (two seasons of farming) of annual crops.
- Heavy rainfall encourages growth of forests as habitats for wildlife to promote the development of tourism.
- There lead to destruction of roads, farmlands, due to boggy conditions and floods.
- It encourages severe soil erosion and leaching leading to development of infertile soils.
- Encourages rapid growth of destructive pests and diseases that affect crop production.
- Leads to rapid growth of weeds which is expensive to maintain by farmers.

ii) Influence of moderate rainfall on human activities in the area. (Savanna lands) 500 – 1000mm.

- Areas of moderate rainfall receive single rainfall peak which lead to cultivation of annual crops like beans, maize, etc.
- Animal rearing take place due to existing abundant pastures in savanna lands encouraged by rainfall.
- Moderate rainfall encourages wildlife conservation leading to the development of tourism.

(iii) Influence of low mean annual rainfall on human activities. (Semi and desert areas).

Below 500mm.

- Low annual rainfall supports pastoralism especially nomadic pastoralism in Sahel areas, Sahara and Namib Desert areas.
- Encourages cultivation of drought resistant crops like millet, sorghum, maize and vegetables.
- Promote bee keeping in areas of unreliable rainfall i.e. Apiary.
- Encourage wildlife conservation in areas with unreliable rainfall for development of tourism.
- Shortage of surface water and pasture during dry seasons leading to death of animals.
- Prevalence of destructive pests and diseases e.g. locusts invasion in Niger.
- It promotes pastoral communities e.g. the Fulani and other Pastoral tribes.

d) Outline the problems faced by people living in areas receiving mean annual rainfall of over 2000mm in Africa.

- Rapid growth of vegetation leading to high costs of clearance and increased inaccessibility.
- Flooding in lowland areas due to numerous rivers destroying life and property.
- Landslides are common in areas of heavy rainfall.
- Transport difficulties due to muddy roads as a result of heavy rainfall wash away bridges.
- Boggy conditions encourage rapid growth of weeds lead to high costs of clearance.
- High incidence of destructive pests and diseases that destroy crops.
- Heavy leaching lead to low soil fertility.
- Presence of dangerous wild animals and vermin in the thick vegetation may lead to threat, death of people and destruction of people's crops.
- Attract a high population density leading to land fragmentation.
- Thunder storms and lightening are associated to heavy rainfall in these areas that is destructive to people's lives and their livestock.
- Severe soil erosion due to heavy running water from high relief region to lowlands areas during rains.

CLIMATIC REGIONS OF AFRICA.

In Africa there are various climatic regions which include the following;

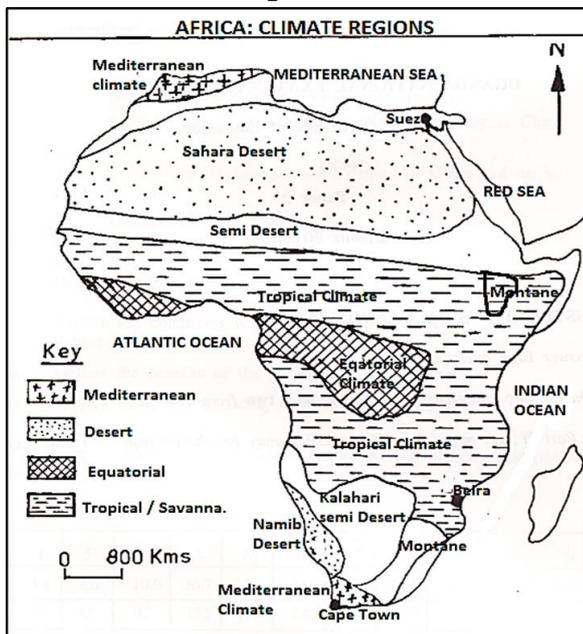
- a) Equatorial climate,
- b) Tropical climate,
- c) Arid / desert climate,
- d) Semi- desert margins,
- e) Mediterranean climate,
- f) Montane climatic belt,
- g) Sub- tropical climate.

EQUATORIAL CLIMATE:

Equatorial climate extends to the following countries in Africa;

Countries covered by the Congo basin, central Africa republic, the guinea coast, Equatorial Guinea, Gabon, Southern Nigeria, Benin, Ghana, Togo, Cameroon Ivory coast, and Southern Sudan etc.

QN. Draw the sketch map of Africa and on it mark the above climatic regions;



Factors that have influenced the characteristics of equatorial climate.

- Movement of the overhead sun along the tropics of Cancer, Capricorn and equator, during this period these areas do experience; warm temperature, heavy rainfall, thick cloud cover in the skies and high humidity.
- Presence of dense vegetation cover, which encourages evapo-transpiration in a way recharge the winds and atmosphere with water vapor that rise to form convectional rainfall.
- Location along the latitude Equator, an area of doldrums, hot temperatures and rainfall.
- Relief, equatorial areas are located on lowland areas which are associated to hot temperatures.
- Adjacent to the warm Guinea ocean currents that raise the temperature and moisture content to the areas of the adjacent coastal lands of West Africa and Central African countries.
- Existence of numerous water bodies which help to recharge the moving winds on landmass adjacent to lakes, oceans or rivers through Lake Breeze and land breeze. Eventually these winds shall fall as convectional rains.
- Presence of a low pressure belt and hot temperatures in the Equatorial areas contribute to the Equatorial climate.
- Prevailing winds attracted to Low pressure belt e.g. NETS, SETS, and SWETS etc. are forced to rise to form Convectional Rains.

Characteristics equatorial climate.

- Experience heavy rainfall above 1800mm per year for areas adjacent to Equator and 1000 mm to areas far from Equator.
- Equatorial areas receive rainfall throughout the year / wet throughout the year.
- The region experiences double maxima (two rainfall peaks twice a year) whenever the sun is overhead equator on 21st, March and 21st, September each year.
- Experience convectional type of rainfall caused by convergence of NETS, SETS & SWETS or effects of ITCZ.
- Rain is experienced in afternoons and Morning hours with lightening.
- Receive a high mean annual temperature is 27°C.
- Receive hot and evenly distributed Temperatures throughout the year.
- Experience a small temperature range of less than 3°C and diurnal temperature.
- The equatorial areas are hot and wet throughout the year.
- Experience equinox i.e. equal days and equal nights.
- Areas experience a dense cloud cover in the sky.

Economic activities carried out in the Equatorial lands.

- Lumbering in the Rainforests in the countries like; Gabon, Congo, CAR, Ghana and Benin.
- Plantation farming is practiced mainly the growing of Cocoa, Rubber, Palm Oil, etc.
- Hunting and gathering of fruits from the forest.
- Fishing from rivers e.g. R. Congo, R. Volta, Niger delta, R. Ogooue, etc.
- Industrialization, mainly, sawmills for wood products, boat building, agro-processing industries, manufacturing of household products, etc.
- Tourism in the rainforests and harvesting of raw materials for art and craft industry promoted by the tourist sector.
- Mining of minerals oil mining in Nigeria, iron ore and manganese in Gabon, aluminum in Ghana, Copper and Gold in copper Belt of Zaire, etc.

Activity:

Study the table below showing climatic statistics of;

(i) Libreville – Gabon:

Months	J	F	M	A	M	J	J	A	S	O	N	D
Temp °c	30	31	31	30	29	28	27	27	28	29	30	30
Rain (mm)	250	250	325	300	213	25	25	25	100	275	380	200

Source: Minns W.J. A Geography of Africa, New Edition Pg 37.

- a) Draw a suitable graph to represent the information on the table above.
- b) Calculate the;
- (i) Mean Annual Rainfall (MAR)
 - (ii) Mean Monthly Rainfall (MMR)
 - (iii) Mean Annual Temperature (MAT).
 - (iv) Annual Temperature Range. (ATR)

c) Describe the characteristics of the climate at the station.

(i) Mean Annual Rainfall

= Total Rainfall for 12 months

1 year

$$= \frac{250+250+325+300+213+25+25+125+100+275+380+200}{1}$$

$$= 2368\text{mm}$$

(ii) Mean Monthly Rainfall (MMR)

= Total rainfall for 12 months.

$$= \frac{250+250+325+300+213+25+25+125+100+275+380+200}{12}$$

$$= \frac{2368}{12} = 197.33\text{mm}$$

Mean Annual Temperature

= Total Temperature for 12 months

$$= \frac{30+31+31+30+29+28+27+27+28+29+30+30}{12}$$

$$= \frac{350}{12} = 29.17^{\circ}\text{c}$$

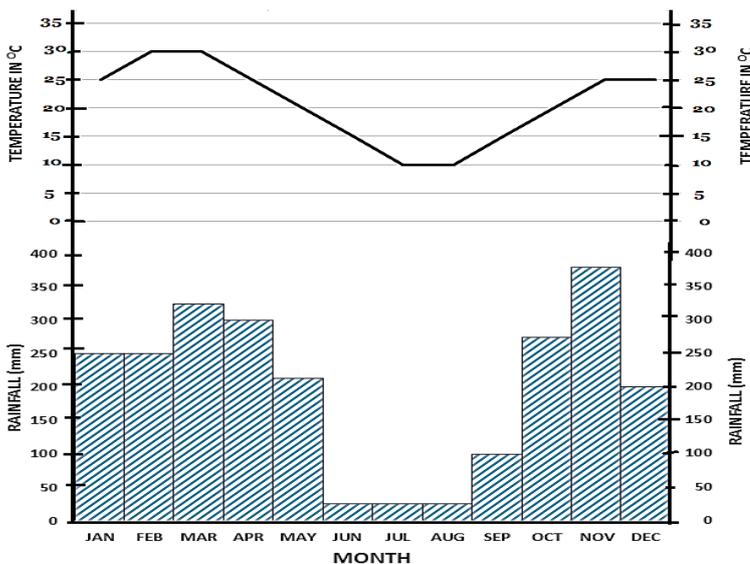
(iv) Annual Temperature Range

= (Hottest – coolest)

$$= 31 - 27 = 4^{\circ}\text{c}$$

NB: all answers should have units i.e. Rainfall in mm, Temperature in °c

A COMBINED BAR AND LINE GRAPH SHOWING CLIMATE OF LIBREVILLE, GABON.



c) Characteristics of the climate at the station:

- Experience hot temperatures about 27°C to 31°C throughout the year.
- The annual range of temperature for the station is small of 4°C.
- Temperature is almost uniformly distributed throughout the year.
- The mean annual temperature received in the station is 29.17°C.
- The station is hot and wet in most months of the year.
- Experience double maxima of rainfall in March and April, the October and November.
- Receives a high mean annual rainfall of 2368mm a year which is heavy.
- The station receives rainfall throughout the year.
- The hottest months in the year is December to April with temperatures from 30°C to 31°C.

Problems faced by people living in the equatorial lands.

- Boggy conditions have led to transport difficulty on underdeveloped muddy road transport network.
- High inconvenience for air transport as a result of invisibility over equatorial rainforests sometimes causing plane crash.
- Severe soil erosion due to heavy rains throughout the year.
- Soils are heavily leached due to heavy rains; this causes much soil exhaustion and on bare soils.
- Dangerous wild animals in the rain forests and rivers are a threat to farmer’s crops and human lives.
- Political instability or insecurity due to constant rebel activities carried out by rebels who turned rainforests as their hideouts e.g. LRA in CAR.
- Shortage of land for agriculture and settlement because much of the land is under rainforests which is restricted for forest conservation.
- People are infected with diseases from vectors like poisonous insects, snake bites, mosquitoes, tsetse flies etc.

Outline the steps being taken to solve the problems faced by people living in equatorial lands.

- Construction of all-weather roads and railways resistant to heavy rains and improve the radar system to air transport.
- Construction of hospitals and health centers as treatment for people infected with diseases from poisonous insects, snake bites, mosquitoes, tsetse flies, etc.
- Employing game rangers to gazette dangerous animals in the forests to conservation units.
- Deployment of peace keeping forces by UN to push out rebels from the forests, e.g. the UN forces in D.R. Congo.

Guidelines on how to describe the characteristics of a climate of station a using climate statistics in a table.

- Make a study on the table provided and observe carefully the rainfall and temperature rows.
- Using the following statements, describe the characteristics with much emphasis on adjectives used in description of elements of weather.

Examples are:

- The station experiences hot temperatures throughout the year (if the temperatures are above 20°C for all months)
- The station receives cool /warm temperatures in the months of (name the months with the temperatures between 10°C – 19°C).
- The hottest months of the station is by °C. (name the months with temperatures above 20°C)
- The station receives heavy rainfall in the months of by (Name the months and state the figure).
- The station receives rainfall (wet) throughout the year. (If the rainfall in each month is above 50mm).
- The station receives little / dry / no rainfall in the months of (Name the months from the table when rainfall received is less than 50mm or not received at all).
- The wettest months of the station is by..... mm. (name the months from the table).
- The station receives a mean annual rainfall of mm. (calculate and state it)
- The station experiences a double maxima or two rainfall peaks. (Name the period/months).
- The area receives one rainfall regime / peak in the months of (Name the period).
- The station is hot and wet (if all the months are wet and hot with rainfall above 50mm and temperatures are above 20°C throughout).
- The area is wet and dry (if some months receive rainfall above 50mm).
- The station is hot and dry when rainfall received in some months if little or not at all). Etc.

TROPICAL CLIMATE.

(Savanna climate)

- This climate falls within the transition zone between equatorial climate and the semi desert climate.
- It covers the parts of West Africa, the North East Africa, the Central Africa, that is to say countries like Zambia, Mozambique, Zimbabwe, Karoo in South Africa, Northern parts of Nigeria, Burkina Faso, parts of Niger, parts of Chad.

Factors / conditions that influence the characteristics of tropical climate.

- Influence of the ITCZ as the sun over heads the latitudes of tropic of cancer and tropic of Capricorn which increase temperatures, high evaporation rates, a low pressure zone on land surface and eventually heavy rainfall.
- Influence of the prevailing winds that are attracted by a low pressure zone located in the tropics e.g. the South East prevailing winds from Indian Ocean or the South West winds from the Atlantic Ocean do lead to hot temperatures and heavy rainfall formation.
- Latitudinal location. Location between the tropic of cancer and tropic of Capricorn which experience the effects of ITCZ, hot temperatures throughout and low pressure.
- Savanna lands are partly near large water bodies like the Atlantic Ocean and Indian Ocean; these areas experience the effects of Lake Breeze and land breeze that modify climate.
- Proximity to deserts like Sahara and Namib, areas that have scanty vegetation cover, dry winds and extremely hot sunshine lead to dry savanna lands.
- The effect of dense vegetation covers to areas nearer the equatorial climate, lead to evapo-transpiration to modify the climate by recharging moving winds with moisture.
- Human activities which involve; clearing of vegetation and accelerating soil erosion through traditional farming methods; Pastoralism, over grazing, deforestation etc. lead to the growth of secondary vegetation and affect the original climate.
- Effect of relief: High Mountains influence dry conditions on the lee ward side and also low land areas experience hot temperatures and have no effect on moving moist winds to cause rain fall in the savanna.

Characteristics of savanna climate/ Tropical climate

- Summers experience hot temperatures throughout the year well over 20°C to 30°C.
- High mean annual rainfall is experienced in summers and the amount varies with its nearness to the equator where it is up to 1270 to 1500mm p.a. and up to 380mm p.a. towards the desert margins.
- Winters are warm with temperature up to 15°C.
- Little or no rainfall is received in winters.
- Experience convectional type of rainfall because heated air rise and is cooled adiabatically in summers.
- There is low relative humidity during winter (dry season) and it gets higher during summer (wet) season.
- There is one dry season and one wet season received in a year.
- The diurnal temperature range is high about 8 °C.
- The annual temperature range is low of between 6°C to 8°C.
- Rainfall has a mono model or single peak- single maxima i.e. falling between June to August in the northern hemisphere and between November to February in the Southern Hemisphere.
- Rainfall received is accompanied in thunder storms and lightening.
- Rain fall is unreliable in some cases due to amount received and it falls.
- Experience strong prevailing winds that cross flat lands of savanna zones.
- Mild humidity is experienced during winter and high of about 80% in summer.
- Experience plenty of sun shine throughout the year.

Economic activities carried by people living in savanna climate.

- a) Encourage arable farming e.g. cultivation of crops (subsistence farming) like maize, sorghum, millet, etc.
- b) Commercial farming mainly growing of crops like cotton, tobacco, coffee, sisal, fruits, etc. purposely for income.
- c) Pastoralism i.e. rearing of animals like cattle, goats, donkeys by the Fulani groups of West Africa, who grazes on the extensive savanna grasslands (practice Nomadism).
- d) Bee keeping is practiced in the range lands for income, with the help of existing flowering plants for nectar.
- e) Lumbering of large tree trunks from the woodlands mainly trees near equatorial lands.
- f) Tourism in the game Parks, game reserves and sanctuaries mainly found in the tropical climate / savanna range lands.

- g) Mining of minerals e.g. copper in the Zambia – Zaire copper belt, gold and Diamonds in South Africa, coal in Zimbabwe, etc.
- h) Charcoal burning in the savanna range lands for sale to urban areas to earn income.
- i) Hunting of wild animals e.g. Antelopes, Buffalo, rats, etc. for bush meat in the woodlands.

Problems faced by people living in savannah lands.

- Bush burning during the dry season by the pastoralists and tourists lead to growth secondary vegetation.
- Prevalence of pests like tsetse flies etc. and diseases do affect man and his animals.
- Poaching in the game parks by hunters and pastoralists.
- Soil erosion during dry and wet seasons due to primitive methods of farming and other human practices on the environment e.g. clearing of vegetation for farming.
- Soil exhaustion due to monoculture practice by commercial farmers, etc.
- Land conflicts over struggle for land.
- Cattle rustling by pastoral communities.
- Attacks from wild animals which go past the game parks and reserves.

Sample Question:

Study the table below showing climatic statistics and answer the questions that follow.

a) (i) **Harare – Zimbabwe.**

Months	J	F	M	A	M	J	J	A	S	O	N	D
Temp °c	24	23	22	21	20	18	17	18	20	23	24	24
Rainfall(mm)	200	175	100	25	20					50	100	175

Source: Africa by Minns Pg 36

Kano – Nigeria.

Months	J	F	M	A	M	J	J	A	S	O	N	D
Temp °c	22	24	27	32	31	27	26	25	26	26	25	23
Rainfall(mm)				25	75	125	200	150	50	25		

Source: Africa by Minns

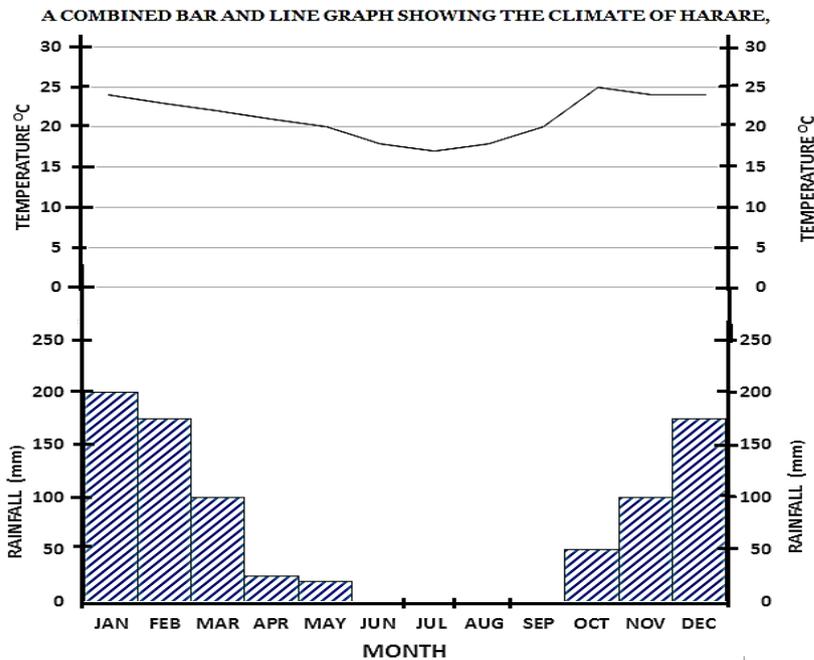
ii) KAYES – Mali.

Months	J	F	M	A	M	J	J	A	S	O	N	D
Temp °c	25	27	32	35	36	33	28	27	27	26	26	25
Rain fall(mm)					25	100	200	200	150	50	10	5

Source: Africa by Minns Pg 36

Activity

- a) Draw a suitable graph to represent the information on the table above.
- b) Calculate the;
 - i) Mean Annual Rainfall (MAR)
 - ii) Mean Monthly Rainfall (MMR)
 - iii) Mean Annual Temperature (MAT).
 - iv) Annual Temperature Range. (ATR)
- c) Describe the characteristics of the climate at the station.



Note that:

-Both vertical axes should be drawn labeled.

- Scale should be marked on both vertical axes for temperature and rainfall on both vertical axes.
- Bars for rainfall should be shaded each one alone not combining.
- Marking Months on horizontal axes should be done in the mid points NOT at the end.
- Plotting temperature line graph should be done using mid-points.

b) (i) The Mean Annual Rainfall;

$$= \frac{\text{Total Rainfall in a year}}{1 \text{ year}}$$

$$= \frac{200+175+100+25+20+50+100+175}{1}$$

$$= 845\text{mm.}$$

(ii) Mean Monthly Rainfall.

$$= \frac{\text{Total Rainfall in 12 months}}{12}$$

$$= \frac{200+175+100+25+20+50+100+175}{12}$$

$$= \frac{845}{12} = 70.41\text{mm}$$

(iii) Mean Annual Temperature;

$$= \frac{\text{Total Temperature for 12 Months}}{12}$$

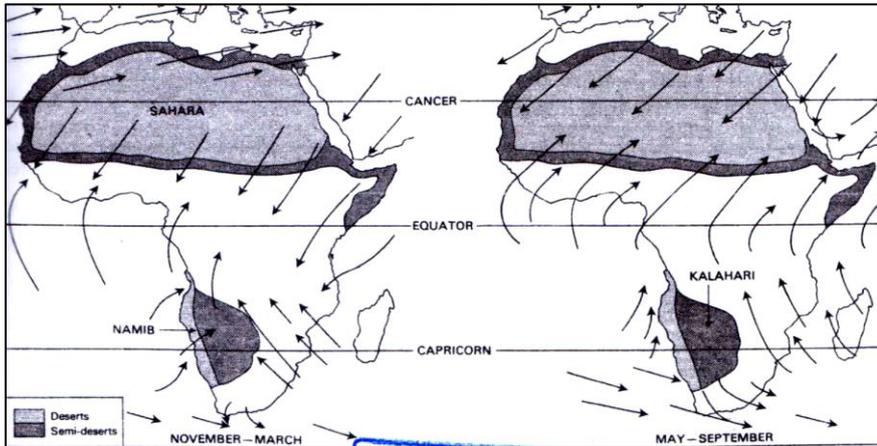
$$= \frac{24+23+22+21+20+18+17+18+20+23+24+24}{12}$$

$$= \frac{219}{12} = 18.25^{\circ}\text{C}$$

DESERT CLIMATE.

There are two types of deserts in Africa:

- a) Hot Continental interior deserts - Sahara Desert.
- b) The coastal deserts of western margins or Marine deserts: Namib Desert in Namibia.



Characteristics of Desert Climate;

Describe the characteristics of a semi – arid or arid climate.

- a) Experience high evaporation rates due to hot temperatures from excessive sunshine during day.
- b) Experience little rainfall of less than 250mm per annum / no rainfall at all for many months a year.
- c) Experience hot and dry conditions throughout the year.
- d) Experience strong winds blowing or wind storms which are generally dry.
- e) High diurnal temperature range of over 25°C.
- f) High annual temperature range between 13°C at the desert margins up to 30°C to 58°C in the interior of the desert.
- g) Low humidity throughout the year.
- h) Very cold nights.
- i) Very hot days.
- j) Experience little / cloudless skies.

Factors that led to existence desert climate.

Qn: Explain the conditions that have led to the existence of desert type of climate.

- a) Location along the horse latitudes i.e. Tropic of cancer for Sahara Desert and Tropic of Capricorn for Namib Desert are regions of High Pressure belt where winds blow away causing arid conditions.
- b) Continentally i.e. absence of large water bodies within the interior of the continent e.g. the Sahara Desert.
- c) Location on the western sides of continents where the winds are off-shore leading to aridity.
- d) Rain shadow effects due to presence of the Ethiopian highlands and Drakensburg Mountains in South Africa.
- e) Presence of scanty vegetation that limits evapo-transpiration process that would lead to rainfall formation.
- f) On shore winds crossing the cool canary and cool Benguela ocean currents bring dry conditions and cool temperatures to the adjacent areas.
- g) Human activities e.g. bush burning; mining can cause greenhouse effects, deforestation, overgrazing etc. lead dry conditions and hot temperatures.

Economic activities in the desert lands.

- Nomadic Pastoralism; animal herding in scanty pasture for milk, blood and meat.
- Cultivation of drought resistant crops and fast maturing crops for food e.g. date palms.
- Tourism due to the spectacular landscape and desert landforms to generate foreign exchange.

- Mining of petroleum in Algeria and Libya, Sudan, Tungsten and diamonds in Namib Desert as well as salt in pans of Egypt; for export to earn foreign exchange and revenue to country.
- Irrigation farming e.g. in the Nile valley and around oases.
- Bee keeping in the semi-desert lands due to existing scanty flowering plants.
- Caravan trade and transport with help of camel and donkey across the sandy landscape.

Problems faced by people living on desert margins:

- a) Limited supply of surface water for livestock and human consumption.
- b) Shortage of pasture for livestock rearing leading to nomadic way of life.
- c) Infertile sandy soils which do not support agriculture or cultivation of crops lead to shortage of food.
- d) Low and unreliable rainfall limits the growth of crops and dense vegetation cover.
- e) Excessively hot temperatures during that day do not support human settlement and his animals.
- f) Very cold nights due to absence of cloud cover at night is not favorable for human life.
- g) Remoteness of some desert areas because of uneconomically viable production to encourage infrastructure development in these areas.
- h) Sparse population makes it difficult to provide social economic services to the people by government.
- i) Limited supply of food due to crop failure leading to severe famine, starvation, diseases and death.
- j) Sandstorms are very common lead to loss of lives and bronchial disease, eye problems, etc.

DESERTIFICATION.

This is a process by which land becomes increasingly dry until almost no vegetation grows on it, turning into a desert.

Desertification may mean a decline in the biological or economic productivity of the soil in arid and semiarid areas resulting from various factors, including human activities and variations in climate.

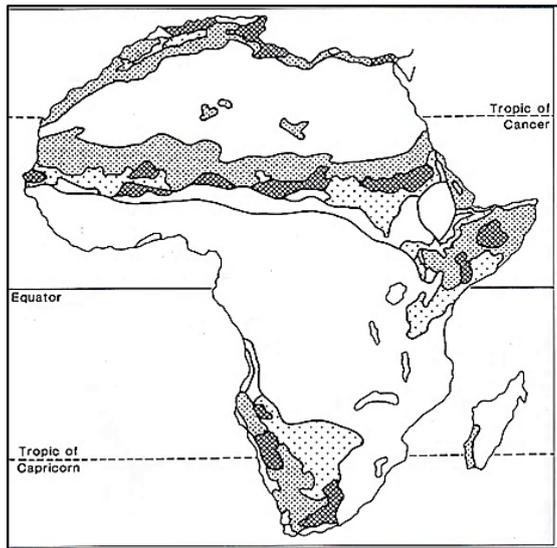
Desertification refers to the formation and expansion of degraded soil, not to the advancing movement of the current deserts.

Desertification occurs in cropland (both irrigated and non-irrigated), pasture, and woodlands. Loss of soil, deterioration of soil, and loss of natural vegetation all lead to desertification.

How human activities have led to Desertification.

- (i) **Industrialization** has led to discharge of carbon monoxide into the atmosphere causing the greenhouse gasses that latter increase the temperatures in the atmosphere and eventually drying of vegetation.
- (ii) **Burning of vegetation** as a traditional practice of the pastoralists to get new pasture germinates deprive moisture in soil.
- (iii) **Overgrazing** by the pastoralists reduce vegetation cover that would cause rain formation.
- (iv) **Deforestation**, trees are cut down for preparation of gardens to cultivate, firewood, building shelters, etc. leave land without vegetation to protect soil.
- (v) **Traditional farming practices** which lead to soil erosion, loss of soil fertility and eventually extensive loss of vegetation.
- (vi) **Swamp reclamation** will lead to loss of water bodies that would modify the climate by recharging the atmosphere with moisture.
- (vii) **Mining** in which much vegetation cover is lost in the process of excavating minerals and eventually loss of water vapor in the atmosphere.
- (viii) **Construction of infrastructure** to lay down roads, building, recreational facilities, etc. degrade the soil structures and accelerate loss of vegetation cover and moisture.

Desertification risk in arid and semi-arid Africa.



How Government Is Solving The Problems Affecting Arid And Semi-Arid Areas In Africa.

- a) Practice a forestation and re-a forestation or planting of trees to restore formation of rainfall.
- b) Government has legalized cutting down of trees and gazette forests to conserve trees.
- c) Construction of dams to introduce irrigation farming and water reservoirs for human consumption.
- d) Construction of boreholes and valley dams to provide water for animals and domestic uses in away reduce nomadic pastoralist movements and losses.
- e) Open up demonstration farms to teach natives, economically viable farming practices, e.g. ranching and horticulture.
- f) Introduce drought resistant and fast maturing crop species as a means to improve on food production.
- g) Donation of food to starving communities or food aid by World Food Program.
- h) Donations in form of medicine and building hospitals to treat people suffering from malnutrition.
- i) Public sensitization extended to the nomads on the need to reduce the size of herds and teach them effects of over stocking e.g. land degradation, etc.
- j) Alternative energy sources be introduced and intensified like solar energy, natural gas, for urban users in order to save trees.

Activity.

Study the table showing the climatic statistics of stations under desert climate and answer questions that follow.

(i) Walvis Bay – Namibian Coast - Desert

Months	J	F	M	A	M	J	J	A	S	O	N	D
Temp °c	18	19	19	18	17	16	16	14	15	17	18	17
Rain (mm)	3	3	7	3	-	-	-	-	-	-	-	3

Source: Africa by Minns Pg 32

ii) Cape Jury – Moroccan coast - Desert

Months	J	F	M	A	M	J	J	A	S	O	N	D
Temp °c	16	16	17	18	18	20	20	20	21	20	18	16
Rain(mm)	13	13	13	-	-	-	-	13	13	13	13	25

Source: Africa by Minns Pg 34

iii) Timbuktu – Mali – Semi-desert.

Months	J	F	M	A	M	J	J	A	S	O	N	D
Temp °c	12	15	20	25	30	35	37	36	33	26	20	16
Rain(mm)	-	-	3	10	10	35	85	50	13	12	-	-

Source: Africa by Minns Pg 35.

Solution

(a) Draw a suitable graph to represent the climate of Timbuktu.

(b) Calculate:

(i) Total rainfall;

$$= 3+10+10+35+85+50+13+12.$$
$$= 218\text{mm.}$$

(ii) Mean Annual temperature;

$$= \frac{12+15+20+25+30+35+37+36+33+26+20+16}{12}$$
$$= \frac{305}{12}$$
$$= 25.45^{\circ}\text{C}$$

(iii) Annual Temperature range of Timbuktu.

$$= 37 - 12 = 25^{\circ}\text{C}$$

Describe the characteristics of climate of Timbuktu.

- The station experience warm to mild temperatures of 12 °C to 16°C in the months of December to February.
- The station experience hot to very hot temperature of 20°C to 37°C from March to November.
- The station receives heavy rainfall in July and August of 85mm and 50mm respectively.
- The station receives little rainfall and dry in most parts of the year from September to June.
- The mean annual rainfall received in the station is very low of 218mm.
- The hottest month of the station is June, July and August at 35°C, 37°C and 36°C respectively.
- The station has a large temperature range of 25°C.
- The station is hot and dry generally.

(c) Explain the:

(i) Factors which affect the climate of Timbuktu.

- Location near the horse latitudes i.e. Tropic of cancer for Sahara Desert is regions of High Pressure belt where winds blow away causing arid conditions.
- Continentality i.e. absence of large water bodies within the interior of the continent e.g. the Sahara Desert.
- Location on the western sides of continents where the winds are off-shore leading to aridity.
- Presence of scanty vegetation that limits evapo-transpiration process that would lead to rainfall formation.
- On shore winds crossing the cool canary ocean currents bring dry conditions and cool temperatures to the adjacent areas.
- Human activities e.g. bush burning; mining can cause greenhouse effects, deforestation, overgrazing etc. lead dry conditions and hot temperatures.

(ii) Effects of climate in Timbuktu on human activities.

- Nomadic Pastoralism is practiced due to little rainfall and absence of large water bodies.
- Irrigation farming is practiced in areas of dry and unreliable rainfall in the area.
- Caravan trade is practiced, dealing in animal products and general merchandise.
- Industrialization due to provision of raw materials from animal rearing e.g. skins and hides, meat packing, milk cooling plants.
- Tourism due to the interesting landscape and desert landforms to generate foreign exchange.
- Cultivation of drought resistant crops and fast maturing crops for food e.g. date palms.

MEDITERRANEAN CLIMATE.

Also is called Warm Temperate western margins.

It is located around the Cape Town region of South Africa and in the northern parts of Morocco, Algeria and Tunisia.

Characteristics of Mediterranean climate.

- Moderate annual Rainfall ranging between 250mm – 1000mm per annum.
- Experience hot sunny and dry summers from June to October and summers are relatively short lasting 4 months.
- Winters are cool and wet between October and May, the cool wet season is relatively long.
- Heavy rainfall is received in winter between Octobers to March.
- Receives a mono modal (single maxima, rainfall regime).
- Rainfall totals during the wet season are relatively uniform with heaviest rainfall received in December.
- Winters are cool and cloudy with dump air and rain.
- High relative humidity is received in winter and low in summer
- Summers are generally sunny.
- Has large annual temperature range of 14°C

Economic activities in the Mediterranean Climate.

- Lumbering industry due to presence of Mediterranean vegetation.
- Arable farming mainly growing of annual crops like cereals like wheat, fruits, potatoes, vegetables, etc.
- Animal rearing like cattle, sheep, goats due to presence of pasture.
- Game hunting in the range lands.
- Food gathering like roots, fruits, etc.
- Mining industry.
- Wildlife conservation to promote tourism.
- Trade due to crop growing and animal rearing.
- Transport industry.

Problems faced by the people in the Mediterranean lands.

- Unreliable rainfall mainly in summers up to relatively long to 4 months.
- Costly irrigation farming.
- High evaporation rates due to hot temperatures in hot sunny summers.
- Shortage of water and pasture during the long dry hot sunny summers.
- Shortage of food during the droughts.
- Soil erosion soil exhaustion.
- Transport difficulties during the wet months in mountainous areas.
- Pests and diseases during the dump humid and rainy winters.

ALGIERS — North-west Africa												
Temp. °C	12	13	15	16	19	22	25	26	24	20	17	15
Rain mm	150	87	87	60	30	12	—	—	25	75	110	140
CAPETOWN — South-west tip of Africa												
Temp. °C	21	20	20	17	15	13	12	13	15	16	18	20
Rain mm	12	12	15	50	90	110	87	87	50	35	20	15

Activity

Study the table below showing the climate of station A and answer the questions below;

Table I: Climate statistics of station A.

Months	J	F	M	A	M	J	J	A	S	O	N	D
Temp °c	12	13	14	16	19	22	25	26	24	21	17	13
R/F(mm)	110	90	90	60	35	15	3	10	30	80	115	135

a) Draw a suitable graph to show the information in the table above.

- b) Calculate the;
- Mean Annual Temperature.
 - Annual range of temperature,
 - Mean Annual Rainfall,
- for station A.
- c) (i) Describe the characteristics of the climate for station A.
(ii) State the hemisphere in which the station A is located.
- d) Outline the:
- the economic activities that can be carried out.
 - the problems faced by People living in areas where station A is the found.

Solutions.

- b) (i) Mean Annual Temperature.

= Add all the temperature for 12 months in a year

12

= $\frac{12+13+14+16+19+22+25+26+24+21+17+13}{12}$

12

= $\frac{222}{12} = 18.5^{\circ}\text{C} = \mathbf{19^{\circ}\text{C}}$

12

- (ii) Annual Range of Temperature;

= Highest temp - Lowest temp.

= $(26 - 12)^{\circ}\text{C} = \mathbf{14^{\circ}\text{C}}$

- (iii) Mean Annual Rainfall;

= Add rainfall for 12 months

1 year

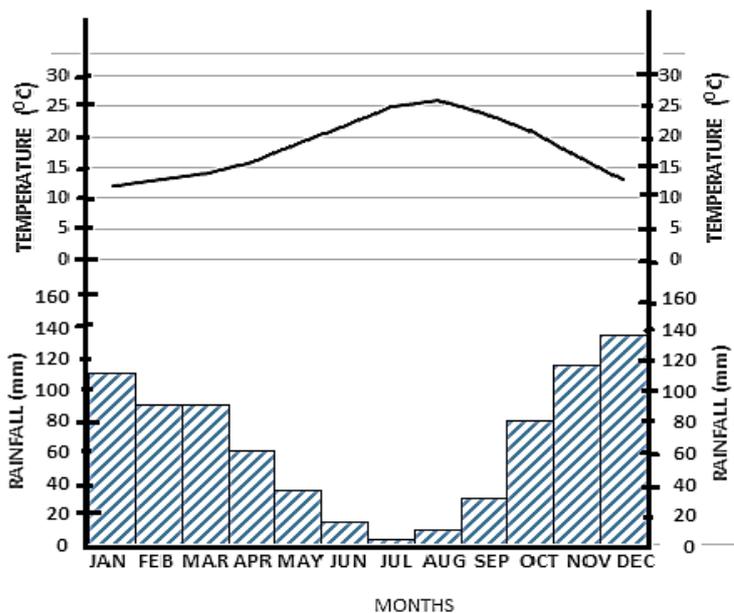
$\frac{110+90+90+60+35+15+3+10+30+80+115+135}{1 \text{ year}}$

1 year

= $\mathbf{773 \text{ mm p.a.}}$

The station is in the Northern hemisphere in Mediterranean climate.

A COMBINED BAR AND LINE GRAPH SHOWING THE CLIMATE OF STATION A



TRADE WINDS COAST CLIMATE.

(Tropical and Sub- Tropical East coast climate)

This type of climate can be found along the East coast of Africa roughly between Dar-es-salaam and Durban.

Onshore winds, mostly Trade winds, blow all the year round and so rains fall all year round.

However, these areas lie largely within the tropics and are affected by the same controls as tropical continental climate.

Rainfall is heavier in the hot season (summer) when rain bearing winds are attracted to the inland by low pressure areas.

Temperatures in these areas are very warm through all the year.

Summers are hot and wet while winters are warm and drier.

Temperature ranges are far greater than in equatorial areas but not as great as in savanna lands owing to modifying effect of the sea.

LINDI — South coast, Tanzania												
Temp. °C	26	27	25	24	24	23	23	23	24	25	25	26
Rain mm	160	112	175	180	35	12	10	5	10	10	55	160
MOZAMBIQUE												
Temp. °C	28	27	27	26	24	23	23	23	25	26	26	27
Rain mm	300	325	275	150	50	25	25	35	100	150	225	250
DURBAN — Natal coast												
Temp. °C	25	26	24	22	20	17	17	18	19	21	23	24
Rain mm	112	125	135	85	50	25	25	37	75	125	125	125

MONTANE CLIMATE.

There are many high mountains and plateaus regions in Africa. This include; the Ethiopian highlands, the Drakensburg, etc.

Their altitude changes with effects on temperatures.

The size and altitude of mountains affects the distribution of rainfall over large areas.

Temperatures decrease with increasing altitude and thus we find permanent snow and ice on Africa's highest peaks.

Temperatures increase with decreasing altitude; thus we find some of the hottest temperatures on (lowlands) in Africa in the Danakil desert in Ethiopia where large areas are below sea level.

Temperatures changes by about 2°C for every 300 Metres rise or decrease in altitude.

Mountain ranges and high plateaus cause much of relief rainfall.

The slopes that face rain bearing moist winds are very well watered indeed, but on the far side (leeward side), away from these winds, there is often much less rainfall.

By the time rain bearing winds reach the peaks of a high mountain, there is little moisture left in the air. Thus the very tops of these mountains do not receive as much rain / snow as the lower slopes.

As the air falls down other side of the mountain becomes warmer and warm air does not loss its moisture.

Thus the windward slopes are often wet and leeward slopes are often dry. These areas are known as **Rain shadows**.

Characteristics of Montane climate.

- The temperature decreases with an increase in height or altitude.
- They receive relief or orographic rainfall mainly on the windward side of highlands.
- The upper slopes of the mountains do not receive as heavy rainfall compared to the lower slopes.
- Where altitude exceeds 4500m above sea level, the areas are covered by permanent snow (glaciers) e.g. Atlas Mountains, Ethiopian highlands, etc.
- The leeward slopes are often dry due to the rain shadow effect.
- Lower slopes are warmer than higher slopes.

Economic activities carried out in Montane climate.

- Tourism encouraged by existence of permanent snow and glacial features that attract tourists that brings in foreign exchange.
- Lumbering encouraged by Montane forest on slopes of that receive heavy rainfall.
- Agriculture for food production on the windward slopes that have fertile soil and receive heavy rainfall.
- Nomadic pastoralism on the leeward sides of the highlands with dry weather conditions.
- Mineral exploitation encouraged by occurrence of some mineral deposits in mountain rocks e.g. copper at Kasese.
- Stone quarrying which provides materials for road construction and building.