GEOGRAPHY BOOK 1

***CHAPTERS***



## Chapter 1

## INTRODUCTION TO GEOGRAPHY

*The word **geography** comes from two Greek words, "**geo** and **graphia". Geo** means the earth while graphia means description.*

*Therefore, **geography** no longer only deals with describing the **earth surface,** but it also concerned with the analysis of the dynamic inter relationship between phenomenon, their distribution, differentiation and how they relate and influence man.*

**The meaning of Geography**

Geography is the scientific study of the earth as a home of man.

Geography can also be defined as the study of man and how he interacts with the environment. Therefore it is study of the distribution and differentiation of phenomenon in space, Interrelationship on natural and human phenomena on the earth's surface and how they are related to man.

**Geography** is the study of man and his surrounding (environment) OR. It is how man interacts with the environment. **Man** refers to an individual in a community.

ENVIRONMENT.

**Activity 1.1.** *In groups, take a walk around your school.*

a) *Write down what you see in environment.*
b) *In your notebook, draw a table showing the natural and human made features in the area.*
c) *Draw a sketch map of the area and show the physical and human made features.*
d) *How do people around your school use the natural and human made features?*
e) *Share your finding with the class for comments, discussions and corrections.*

**Environment** is all that surrounds man for example lakes, rivers, seas, ocean, birds, vegetation, and animals. Etc.

Environment can be divided into two:

**How do people use the environment?**

***Activity 1.2. Exploring how people use their environment?***

a) *Identify the way in which you and your family use features in the environment around your home or your community. Write them down in your notes.*
b) *Explain how each of these uses affects the environment either positively negatively*
c) *How do the activities of the people in these places affect the environment?*
d) *Explain ways in which human being misuse the environment*
e) *Suggest ways in which we can protect or conserve the environment.*

**The Physical Environment**

Natural physical conditions of weather, climate, vegetation, animals, soil, landforms and drainage.

- ***Biosphere,*** under biosphere, we study things like plants and animals. **(Flora and fauna)**
- ***Hydrosphere.*** Here, we normally study things like lakes, rivers, seas, ocean, swamps (drainages features).
- ***Atmosphere.*** This is concerned with the mixture of gases or Air.
- ***Lithosphere.*** Usually, lithosphere consist of study of minerals and rock on the earth surface and underneath.

**Activity 1.3: Finding out how the environment affects us**

In pairs, study Figure 1.1 and do the following:

(a)

(b)

a) In your notebook, write down the natural and human features shown in each photograph.
b) Explain how the human activities carried out in each picture are related to the natural environment.
c) In what ways do you think human activities in each picture affect the natural environment?
d) Present what you have written to the rest of the class and comment on each other's work.

**The Human Environment**

- Human activities such as farming, forestry, mining, tourism, settlement, transportation, trade and industry.

**Positive environmental practices**

Some human activities and practices conserve the environment and resources. They are called positives environmental practices.

***Activity 1.4*** *understanding way of preserving the environment.* *In pairs study figure 1.11. and do the tasks that follow*

a) Identify the positive human activities taking place in each of the photograph.

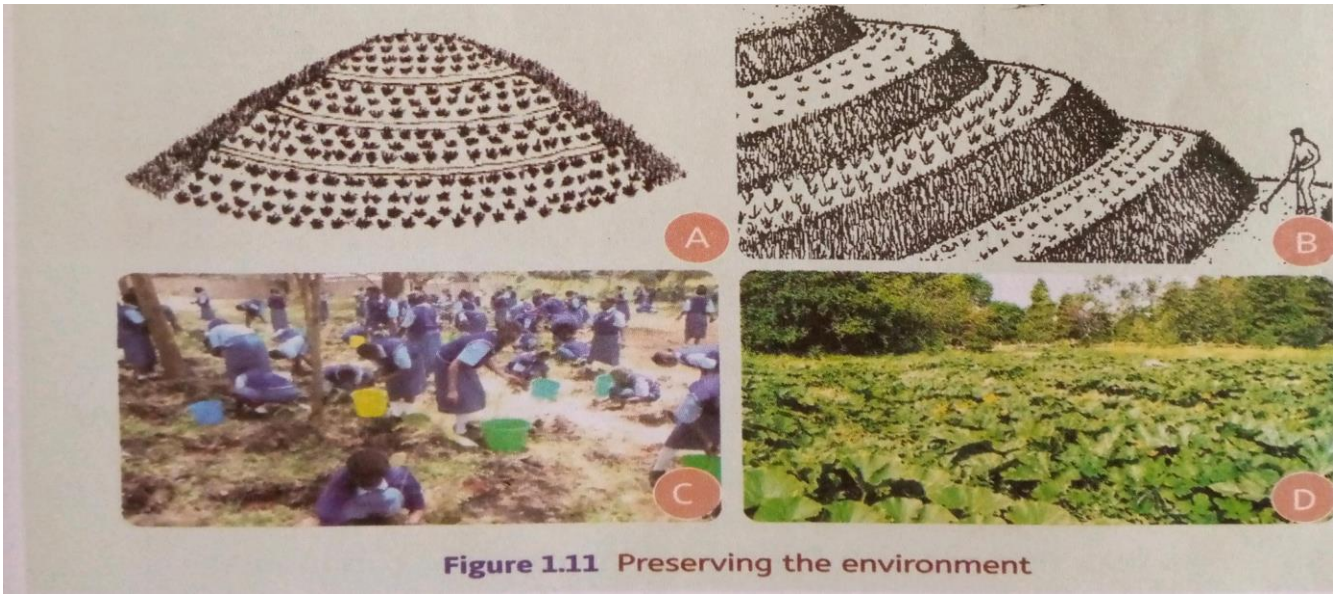



Figure 1.11 Preserving the environment

b) Why do you think people carry out the positive human activities you have identified?
c) What measures have the people in your community or around your school carry out to preserve the environment?
d) How have the people benefited from the practices mentioned in a) above.

**Negative environmental practices**

Some human activities and practices conserve the environment and resources. They are called negatives environmental practices.

***BRANCHES OF GEOGRAPHY.***

There are two main branches of geography and these includes.

- *Physical geography*
- *Human geography*

## *PHYSICAL GEOGRAPHY.*

This is the branch of geography that deals with the study of natural features which are both found on the earth's surface and underneath.

The example of physical features include mountains, rivers, lakes, swamps etc. are found on the earth surface while dykes, laccoliths, batholiths, lapolith, sills are found under ground or underneath.

***Physical geography is further sub divided into major parts and these include***

- ✓ *Geology*
- ✓ *Geomorphology*
- ✓ *Climatology*
- ✓ *Biogeography*
- ✓ *Pedology*
- ✓ *Meteorology*
- ✓ *Oceanography*
- ✓ *Astronomy*

***Geology*:** This is the branch of physical geography which deals with the study of rocks. For example igneous, sedimentary and metamorphic rocks.

***Geomorphology*:** this is the branch of physical geography which deals with the study of formation of landforms.

***Climatology***: this is the branch of physical geography which deals with the study of climate for example temperature and rainfall.

**Biogeography.** This deals with the study of plants and animal. (Fauna and flora). Geographically it deal with vegetation and animal in the environment

**Pedology**. This deals with the study of soils. For examples types, texture, color, profile, PH.

**Meteorology**. This deals with the study of weather condition of the place in terms of elements such as rain,


sunshine, wind, cloud, atmospheric pressure, humidity, temperature and instruments used to measure them like rain gauge, thermometer. Etc.

**Oceanography.** This deals with the study oceans and organism that live in them.

**Astronomy.** This deals with star and outer space.

*Activity 1.6. Finding out about the physical environment*

a) *In groups, use the internet or library to find out what physical geography studies.*
b) *Study the photographs above and identify the different types of the physical environment*
c) *How do people living in the physical environment (A), C), and D) utilize them?*
d) *What problems do you think people living in physical environment D) face?*

*If you were living around physical environment D), how would you control the problems mentioned in task* ***d****?*

***HUMAN GEOGRAPHY.***

This is the second major branch of geography which deals with the study of social− economic activities of man for example farming, mining, lumbering, fishing, manufacturing, transport and communication. This branch of geography is sub divided into branches.

- ✓ *Cultural geography*
- ✓ *Population geography*
- ✓ *Economic geography*
- ✓ *Cartography*
- ✓ *Agricultural geography*
- ✓ *Regional geography.*

***Cultural geography.*** This is the study about the location and spread of beliefs, customs, religion, language, taboos.

***Population geography*** **(Demography) .**This is study about population and the reasons for change of their birth, death, movement and family size.

***Economic geography.*** This deals with the study and distribution of economic activities like mining, fishing, manufacturing and other factors which determines the development and the growth like transport and labor.

***Cartography***. This is the art and science of map making.

**Activity 1.5: Relating geography to your own life in groups:**

*a) Discuss how studying geography may benefit you, your community and country.*

*b) Write down the benefits in your notebooks.*

*c) Discuss what you have written with other groups.*

d) The Value of Studying Geography

- Geography helps us to know various aspects and activities taking place on the earth for example volcanic eruption, mining, farming, and lumbering. Etc.
- To pass examination and go for further studies for example geography teachers, lecturers and researchers.
- Geography helps to get employment opportunities in various sectors for example in industries, school.
- It helps man to become familiar with the world pattern for example drainage, landscape and economic activities.
- It helps man to practice intellectual development for example for example teaching, lecturing and researching.

- To interpret many geographical aspects for example geographical maps and photograph geographical information related to relief, vegetation, climate, population, and landform.
- To understand environment in which man lives for example about vegetation, drainage.
- To understand the fieldwork study i.e. techniques or methods used in carrying out fieldwork for example, observation, interviewing, recording, measuring.
- To plan for the future with respect or in reference to the available resources for example land and vegetation.
- Geography also helps in communication from region to another by use of compass direction.
- It also helps to satisfy curiosity about the earth for example environment.
- Enables us to understand the problem not known to our region and the entire community and also be in position to suggest possible solution.

**Chapter 2.**

# SHOWING THE LOCAL AREA ON THE A MAP.

## 2.1 What is a map?

*Activity 2.1 understanding what a map is?*

*In groups;*

a) *Carry out a library, or internet research to find out*
   *i) The meaning of a map*
   *ii) Characteristics of a good map.*
b) *Identify what a map show*
c) *Types of maps*
d) *Write the finding into your book.*
e) *Present and share your finding with the rest of the class in a discussion.*

A map is representation of an object drawn on flat sheet of paper.

It may also be referred to as the top view of an object. It can also mean an out lay of an object as seen from above.

NB. A map is also a drawing of a geographical area, such as village, city country or continent. A map shows the main features as they would appear if you looked at them from above.

A picture is a representation of an object drawn and seen from a given angle (side). It sometimes referred to as aside view of an object.

***The difference between a map and a photograph.***



***(a)*** ***n*** ***(b***

Photographs are also used to represent some of the information of objects as seen from the side**.** A map of an area can be drawn on paper. It is also possible to have the same area photographed and represented on paper

Activity 2.2.

In groups.

a) *Draw a sketch map of your school showing physical and human made features.*
b) *With the help of the teacher. Take a photograph of your school.*
c) *Study the map drawn and the photograph taken, do they look alike.*
d) *In your notebook, draw a table with two columns, one for similarities and difference you have observed*
e) *List in each of the columns, the similarities and differences you have observed.*

***Type of maps.***

- ***Physical maps.***

These are maps drawn on a flat sheet of paper showing physical features for Example Mountains, lakes, rivers, seas, ocean.

- ***Political maps.***

These are maps drawn showing the international, national, district, county, sub county, boundaries of countries, districts, county. Etc.

- ***Climatic maps.***

These are maps drawn showing the climatic regions of an area. The climatic regions are ever found within vegetation region or zone for examples the equatorial climate, tropical, semi and desert climate.

- ***Economic maps.***

These are maps drawn showing economic activities taking place in an area for example farming, mining, lumbering, and wildlife conservation.

- ***Mental maps.***

They are not drawn but they exist in the people's mind. They exist because people think in terms of spatial relationship and these relationships vary from person to person because they are based on each one's own perception of the real world.

- ***Biogeographical maps.***

Scientist involved in the study of animals and plants and other living organism use maps to locate and display where these features live and migrate i.e. it is mainly used by the zoologist and botanist.

- ***Topographic maps.***

These represent small areas or places. They show 3 dimension worlds into 2 dimension using contour lines representing relief features.

- ***Geological maps.***

These are maps showing geological features like rocks. These maps can help to determine relationship between rock formation and mineral composition, rock structure.

## *QUALITIES /COMPONENTS OF AGOOD MAP.*

A good map should have the following component for examples title, key, frame, scale and compass direction

***Title***

This is what tells map reader to understand the information on the map for example drainage, vegetation, mountain, and climate. Etc. it is also very important to know that title is always indicated above each drawn map, but not below the map.

***A key.***

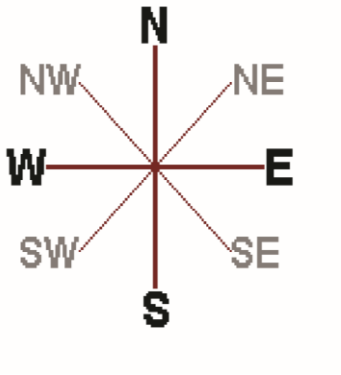
This is a geographical component which explains what is not clear on the map, through the use of symbols on the map representing different items for example mountains, forests, water bodies etc.

***Grid.***

These are line on a map used for locating place. Maps need to have coordinate systems in form of parallel of latitude and longitude so that the area can be placed in a proper location on the globe

***A frame.*** A good map should have a frame to show where the map ends. It encloses the map.

***Compass direction.*** This is an instrument used to show the direction and location of different places on the map for example north, south, east, and west. These can be seen diagrammatically as below.




***Scale.***

This is the relationship between the length on the map and the actual distance/ length distance. All features of the landscape are greatly reduced to suit on the map drawn with the help of the scale.


***Other minor components of a map.***

- *Author /publisher*
- *Date of publication*
- *Source of publication.*
- *Place or origin of publication*

***Activity 2.3: Identifying qualities of a map***

*a) In pairs, draw a map showing the route from your school to home. The map should show the physical and human features found along the way.*

*b) Swap the maps so that each can find out where the other lives.*

*c) Can you follow that map and reach your friend's home?*

*d) What things on the map can assist you in reaching there?*

*e) Ask your friend to describe the things on your map that can help him/her to follow the map up to your home.*

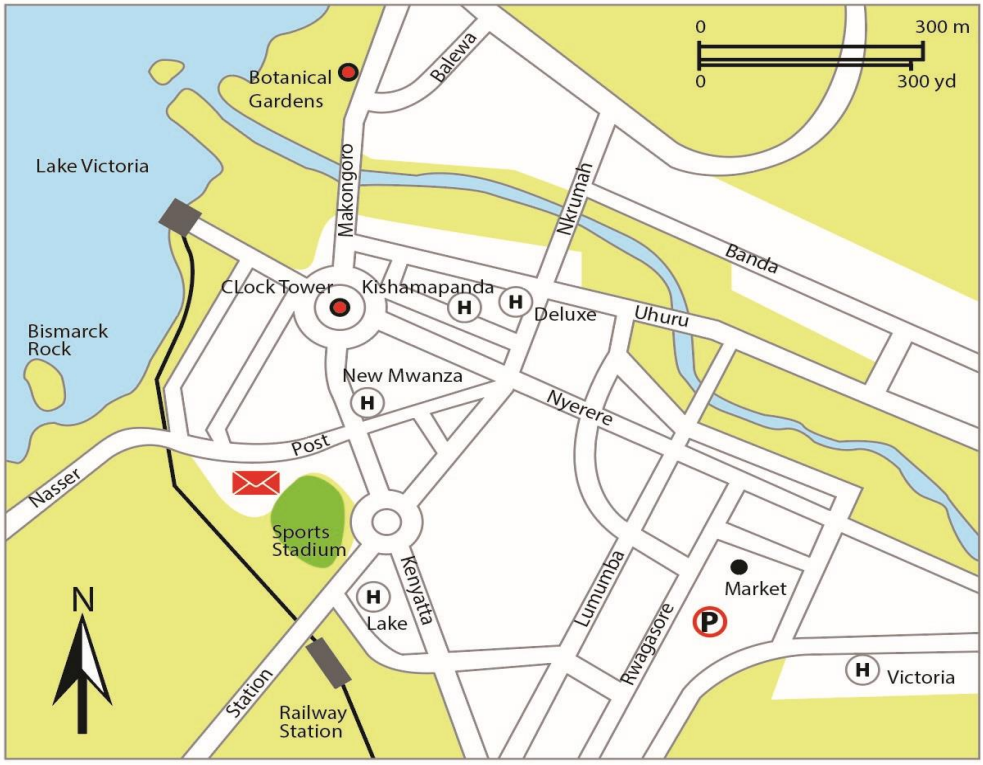
***Some of various uses of maps.***

- ✓ Maps are used to pin point location of important items i.e. physical features.
- ✓ They are used as illustrations to illustrate place or situation.
- ✓ Maps are used to aid navigation from place to place.
- ✓ Maps are also used as wall decoration in houses.
- ✓ Maps are used to show direction and distance.
- ✓ Maps are used for planning purposes i.e. used by town planners and engineers in planning road, building and other human structure constructions.
- ✓ We use maps to visualize what is in our mind i.e. physical feature.
- ✓ They are used in military operations and important research tool for researchers.
- ✓ They store information for a long period of time.
- ✓ They summarize geographical information found in a region.

A map is a special kind of drawing of the earth's surface. It can show the whole world or part of it. Again, you have learnt that we represent features on a map by means of outlines but not as pictures. The features on the ground are drawn in **plan** as if the observer is seeing them directly from above.

On a map, real features and places are represented using **symbols.** These may include signs, colours, shades and Abbreviations. How do features appear on a photograph? The place on the map where all symbols are explained is called a **key**. You are going to learn more about these later in this topic.

***Figure 2.2: Map of Mwanza Town-Port.***




**Activity 2.2: Representing features on a map**

Look at Figure 2.2 above and do the following:

1. Identify the symbols used to represent the hotels, botanical garden, market, stadium, railway line, lake, rocky island and ferry terminal.
2. In your notebook, construct a key for the map

# *MAPS AND THEIR USES.*

- *Scale*

The actual distance of the ground is known through measuring from one point to another and then referring it on the scale. ***Scale is sub divided into three forms, namely***

- ***Types of scale***

- ✓ **Linear scale.** This is a line divided into sections which represents a unit of measurement on the earth's surface.
- ✓ **Fraction/ ratio scale**. For example, 1: 50,000 or 1/50,000. This means that one unit of the measurement on the map is equal to 50,000 of the same unit on the actual ground or earth's surface.
- ✓ ***Statement scale***. For example 1cm represents 100km. this means that 1cm on the map represents 100km on the earth's surface.

## Map Scale

In order to represent features and places on a map, we reduce their actual size by a certain amount. To understand this, let us see how scale is used in pictures or photographs.

**Activity 3.1: Understanding scale**

***Figure 3.1: okello.***

**Look at the picture of okello in Figure 3.1 and do the following:**

a) Measure the length of his arm and leg in centimeters.
b) Measure his height in centimeters.
c) Do you think that is the real size and height of okello?
d) If it is not, explain what has happened to okello's real size.

When a photograph is taken, the size of the object is reduced just as you Joel above. In reality, Joel is much bigger and taller than his picture. He is about 150 cm tall. In the

photograph he is only 5 cm tall. This means that 1cm on the photograph stands for 30 cm on the real person. The photograph is thirty times smaller than his real size. That is to say, every part of Joel's body was reduced 30 times to fit in the photograph. Therefore, the scale of the photograph is 1:30 (1 cm to 30 cm.)

**Measuring distance**

Usually to measure distance of a road, railway or river. a paper edge or thread is used. The paper or a thread is placed along the feature following the patterns. A paper is used to note, the changing patterns along the linear scale below the map to establish the distance in kilometer.

**Activity 3.2: Applying scale**

In groups:

a) Discuss and suggest the tools you need to measure the distance of the walkway or footpath from your classroom to the head teacher's office.
b) Get any one of the tools you have suggested, move outside and measure that distance.
c) Share your results with other groups.
d) Are all your results the same? If not, why do you think they are different?

**Finding shortest distance between two points.**

This is done by drawing a straight line between the two points, and then a paper or thread is placed on the linear scale to establish the distance.

*Using a string or thread*

We can measure distance on a map using a string or cotton thread. To understand this, try the following activity.

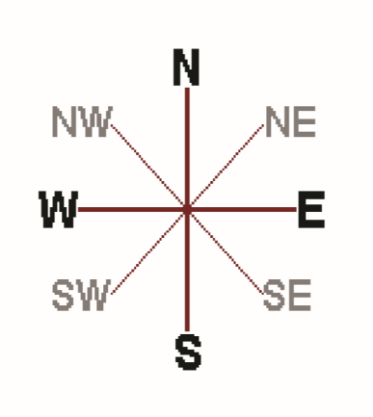
**Activity 3.6: Measuring with a thread**

a) Carry out library research on how we can use a string or thread to measure distance on a map.
b) Make notes pointing out all the steps involved.
c) Share your notes with the rest of the class.
d) Why do you think it is advisable to use cotton thread when measuring distance?
e) Use the string or thread method to measure the distance along any one road on the map in Figure 3.5 above.

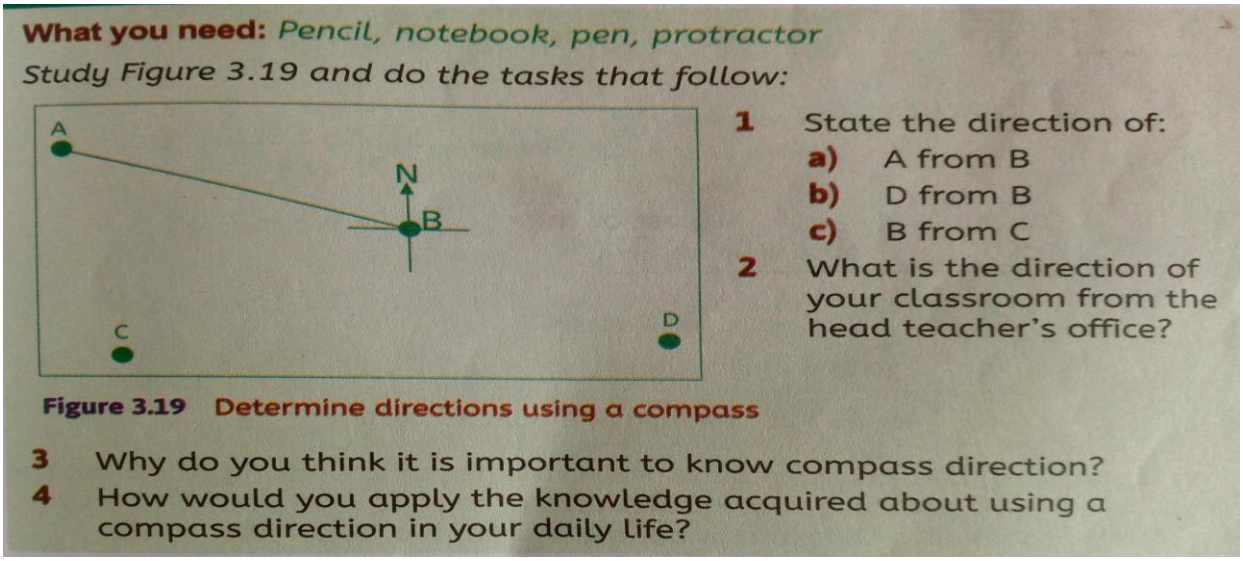
**Direction**.

- Finding a direction is based on cardinal points i.e. North, south, East, west and other minor points.

  *Compass direction*




Copy the compass rose in Figure 3.12 into your notebook.




1. Using a protractor, measure and state:

   i) The angles between nearby cardinal directions.

   ii) The angles between cardinal directions and intermediate directions.

2. Divide the angles between cardinal directions and intermediate directions halfway using straight lines and measure the angle of each.

3. Name the new directions created by subdividing the intermediate directions.

**Calculating area of irregular features on a map.**

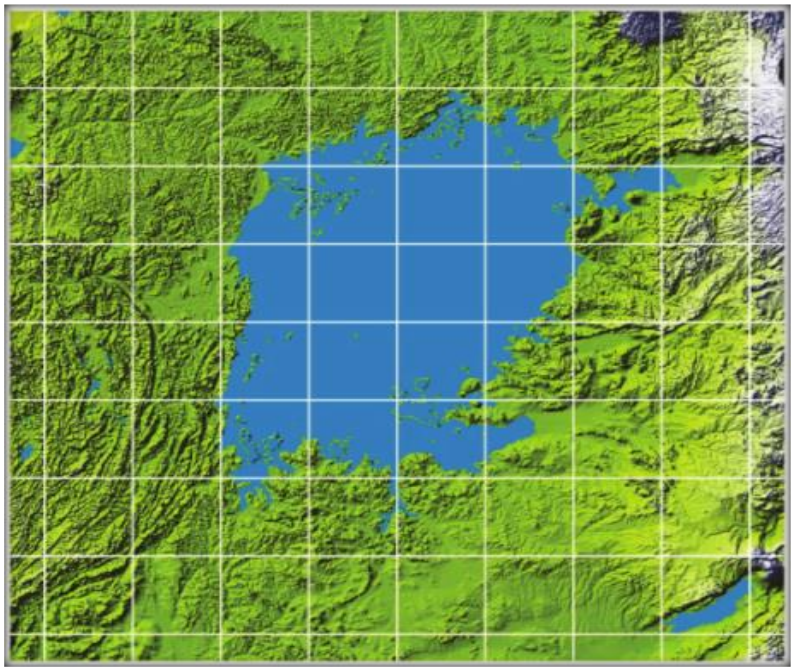
Irregular features on a map may include areas occupied by swamps, forests, lake basins.

Full squares are grid squares fully covered by the feature while half squares are grid squares partly occupied by the feature.

**Area = Full squares+ Half squares**

**2**

***For example*** *Full squares =4*



*Half squares 19*

Area = Full squares+ Half squares

2

Area = 4+ 19

2

*Area =13.5*

*But I square = Ikm²*

*= 35.5 x 1km²*

*Area =13.5 Km²*

**Area of regular Objects** i.e. Airstrips on map.

Rectangle, Length x width

Square, side x side. I.e. we change KM to M by multiply the answer by 1000.

For example, for the Airstrip of length 0.8km, width of 0.4km

0.4km

0.8km

*Working, A=L x W*

*0.8x0.4=0.32km* | *Therefore, we change km to m, 0.32 x 1000 = 320m²*

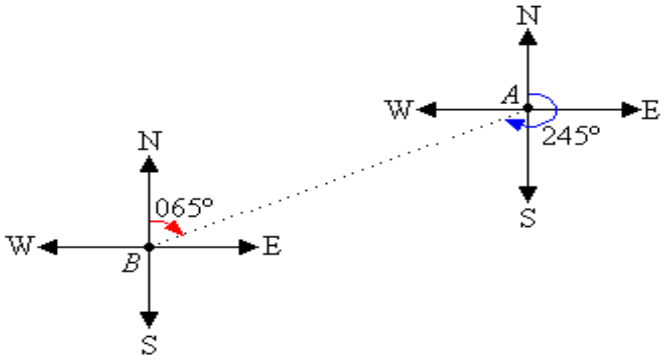
**BEARING.**

To measure or describe direction more accurately a system of degrees is used and it is referred to as bearing. In this system, the north direction becomes 0°, east 90°, south 180° and west 270°

***Procedure of finding the bearing***

- *Identify the two points asked in question.*
- *Draw a straight line joining the two points.*
- *Draw a compass direction on the point where the question states **FROM**.*
- *Use a protractor to determine the north point to the line in a clockwise direction.*
- *State the answer in three figures and do not forget the degrees.*

***Example; find the bearing of point A from B and point B from A***




*The bearing of point A from point B is 065 $^{0}$ Northeast.*

*The bearing of point B from point A is 245 $^{0}$ Southwest*

***NB. Bearings are given using 3 figures. In case you have 2 figures then fix a naught before the figures i.e. 089.***

***Activity 3.16. Finding bearing on a map.***

*8u5tTask*

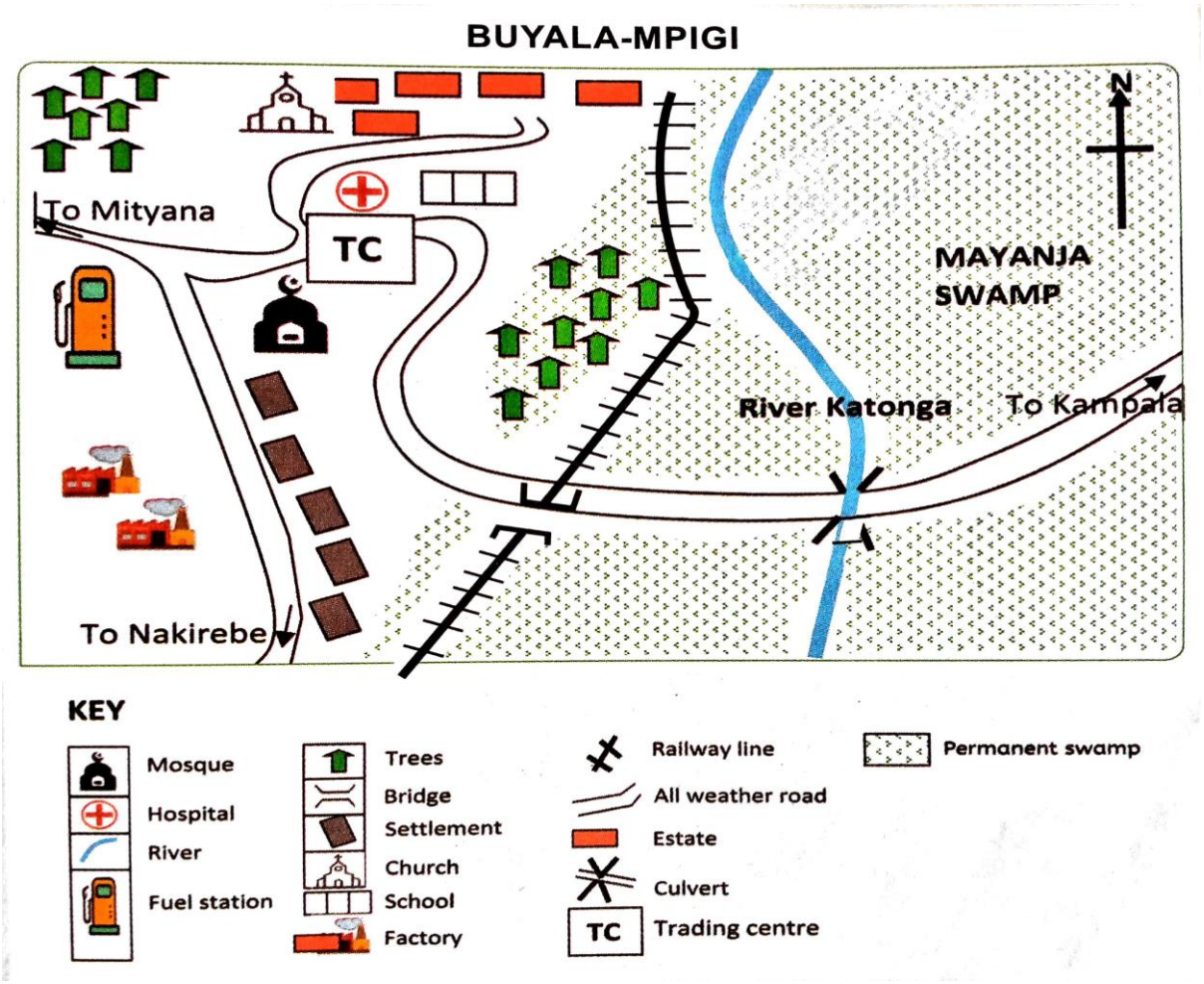
a) *Find the bearing the church from the culvert*
b) *Find the bearing of the bridge from the fuel station*
c) *How do you direct someone to reach the fuel station from the culvert*

***LATITUDES***

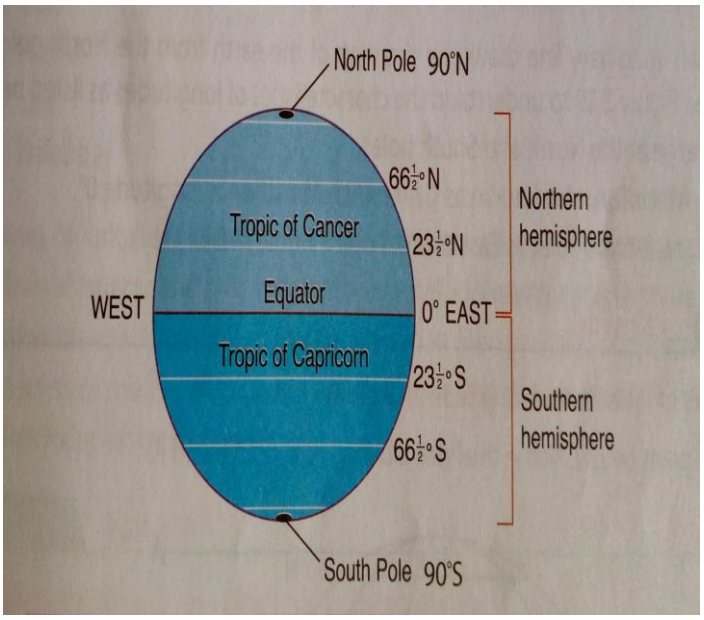
Latitude is the angular distance south or north of the equator. Lines of latitudes are imaginary lines drawn on the map running from west to east and form a circle. There can be as many latitudes as there degrees of a circle, and even fractions of degrees.

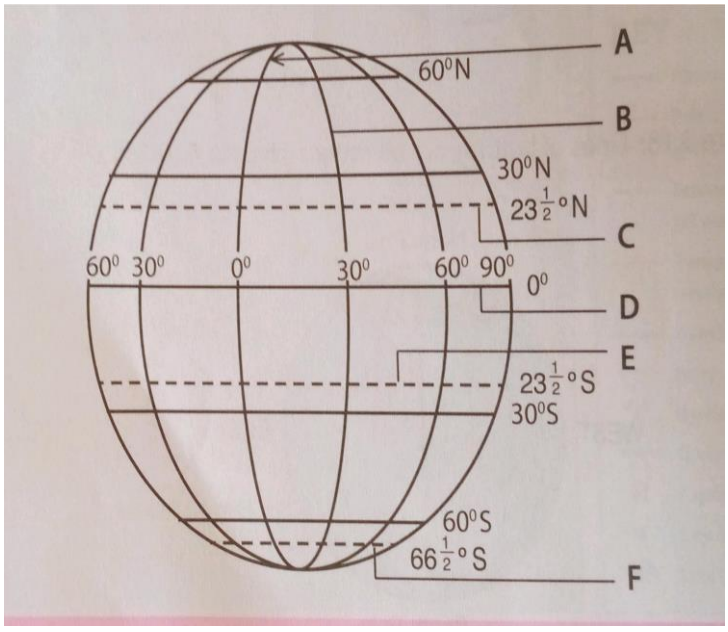
**It's important to note the following about latitudes.**

- They mark positions on the places north or south of the **Equator**.



- The equator is latitude 0º and divides the earth into two halves called **Hemisphere**.




- All other latitudes are measured as degrees North or South of the equator.
- The north and south poles are at 90º from the equator and are points note lines.

***LONGITUDES***.

Lines of longitudes are imaginary lines drawn on the map of the earth from the north pole to the south pole **It's important to note the following about longitudes.**

- *They converge at the North and south poles*
- *The prime meridian, also known as Greenwich meridian is longitudes 0º*
- *They mark position of places east or west of the prime meridian*
- *They help to determine time of different places west or east of the meridian*.

Lines of latitude help to determine how far a place is North or south of the equator. Longitude help to determine how far the place is east or west of Greenwich meridian.

***Activity. Locating places using imaginary lines.***

*a) Name the major lines of latitude*

*b) Identify and write down the characteristics of lines of latitudes.*

*c) Using the characteristics you have identified, define latitude.*

*d) Which is the main line of longitude?*

*e) Write down the characteristics of longitudes.*

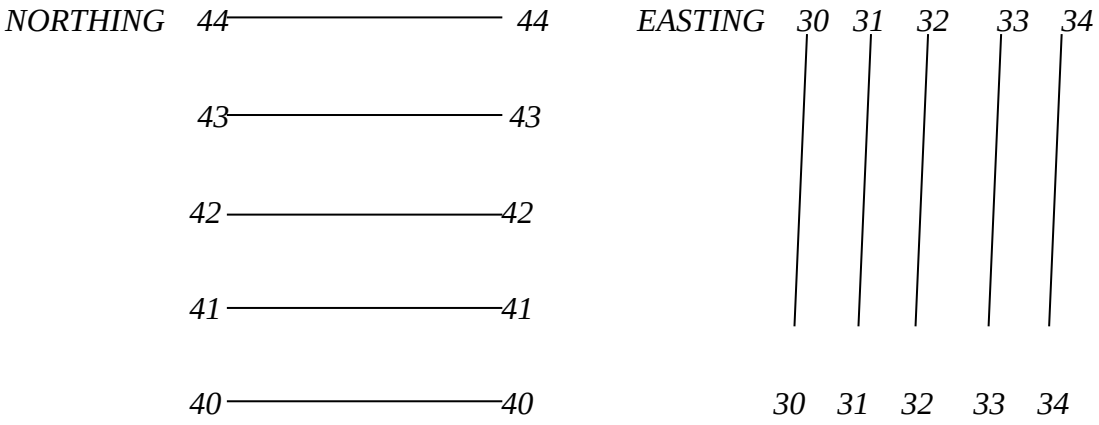
*f) Using the characteristics you have write, define longitude.*

***USING GRID REFERENCE***

***Grid reference*** *involves the horizontal and vertical line forming a network of squares on the map.*

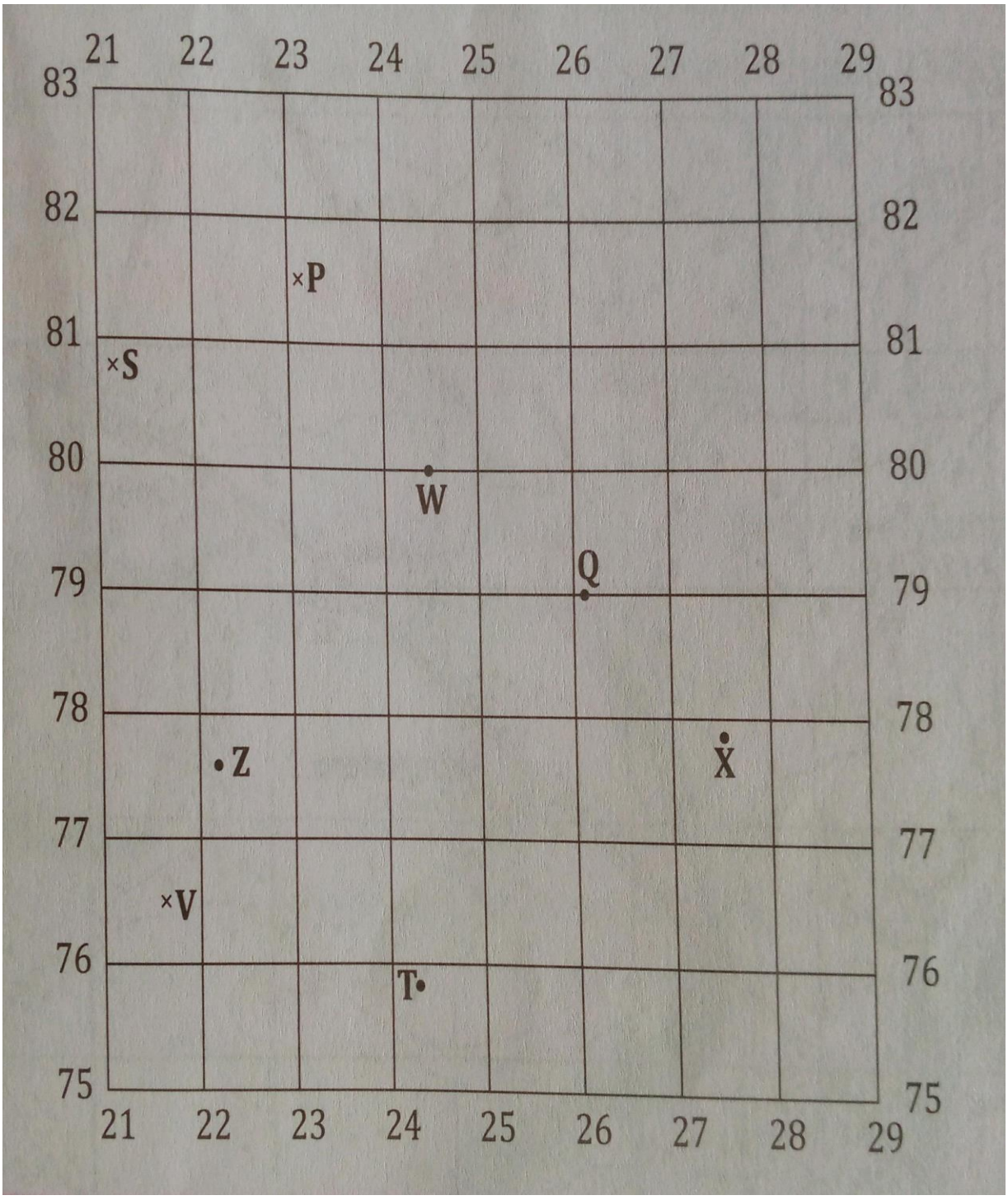
Contour lines. These are tiny brown lines drawn on the topographical maps to show the height of the region. Horizontal lines are called northing and numbered and increase northwards while vertical lines are called easting and numbered and increase eastwards.

***For example.***



***Grid system.*** This is the combination of both easting and northing or vertical and horizontal lines respectively. For the start, we can use four digits, but we normally use ***six digits*** *in examination for seniors four and six in paper one respectively.****Coordinates.***

***p.*** …….



T …….

**W …….**

Z ……

P ……

*Chapter 4*

# WAYS OF STUDYING GEOGRAPHY.

## LEARNING GEOGRAPHY THROUGH FIELDWORK STUDY.

### FIELDWORK

**Activity 4.1: Finding out from the field** In groups, go outside the school and :

a) *Ask people in the local area about the different activities they do.*
b) *Look around and write down the different things you see in the area.*
c) *Write a report about the area studied.*
d) *Through discussion, share your findings with other groups.*

**Definition of fieldwork.**

This is a scientific method of study whereby the students observe, record and interpret for themselves the realities of man and his environment.

Fieldwork can also be defined as activities done outside the classroom wall involving activities like observation, recording, analyzing, and interpretation and drawing conclusions from geographical phenomena.

Natural phenomena include climate, soils, natural vegetation, relief, landforms, rocks, drainage and others. The man-made phenomena includes agricultural activities, settlement patterns, fishing activities, trade and commerce, transport systems, tourism, mining, forestry and other.

***Merits of carrying out fieldwork.***

1. Changing patterns
2. Interrelationships
3. Enhances what is learnt in the classroom
4. Acquisition of skills

5. Break of monotony
6. Exposure to new equipments
7. Research methods
8. Writing of books
9. Relationship with other subjects

***PROCEDURE/ STAGES OF CARRYING OUT FIELDWORK***.

**Activity 4.2: Exploring steps in fieldwork**

In a group or as an individual:

*a) Choose a topic to be studied in the area outside the classroom.*
*b) Decide the reasons (objectives) for doing the fieldwork.*
*c) Decide how you are going to collect information while in the field.*
*d) Go out to the field and collect the information, emphasizing how the natural environment and human features are related.*
*e) Draw a map showing how physical and human features are distributed in the area.*
*f) If possible, you may carry out measurements of particular things in the field or you may ask people how much land is used for each activity, how many buildings of a certain kind are in the area, etc.*
*g) After collecting all the information needed, write a report about the area studied. Through discussion, compare group reports.*

**These are divided into 3 major categories**

1) Pre field study or pre – field preparation
2) Real fieldwork excursion (field organization)
3) Follow up study or discussion.

**A. Pre-field study or pre-fieldwork preparation.**

This refers to the study carried out before the real field work excursion. There are various stages involved in the pre-field study

These include the following:

1. Identify the area of study and pilot study
2. Choosing the topic of study
3. Formulation of the objectives of study.
4. Formulation of research method of study.
5. Division of students into groups
6. Seeking of permission
7. Organizing of transport

***Prep$_{B4}$ – PTOM +O3***

8. Preparation of field work instruments and equipment
9. Briefing and departure

1**. PILOT STUDY**

This refers to a tour of the area identified noting important geographical phenomena, which help you in choosing a topic. It will help you in estimating the time required and the equipment needed.

**2. CHOOSING A TOPIC.**

The topic should be clear emphasizing what was structured and where the study will take place.

The topic must also reflect the geographical relationships which include physical to physical relationships, physical to human relationships, and human to human relationships.

**Some of the sample of appropriate topics.**

1. *The growth and development of fishing at Kasenyi Fish landing site on the Northern shore of Lake Victoria near Entebbe in Wakiso district.*
2. *A study of the factors that have favored the growth and development of large scale tea growing at Kasaku tea estate in Buikwe District.*

**3. FORMULATION OF OBJECTIVES**

i. To find out the physical location of Kasenyi Fish landing site.
ii. To find out the historical background of the fishing activities at Kasenyi fish landing site
iii. To identify the factors that have favored the fishing at Kasenyi fish landing site.

iv. To establish the types of fish caught and the methods used to catch each type of fish at Kasenyi fish landing site.
v. To find out how the fish is preserved and marketed at Kasenyi fish landing site.
vi. To investigate the problems facing the fishing activities at Kasenyi fish landing site.
vii. To find out the contribution of fishing to the surrounding areas of Kasenyi fish landing site.
viii. To find out the future prospects of the fishing activities at Kasenyi fish landing site.

**Objectives of sample topic 2**.

i. To find out the physical location of Kasaku Tea factory.
ii. To find out the historical background of tea growing at Kasaku tea factory.
iii. To find out the factors favoring the tea growing at Kasaku tea estate.
iv. To examine the problems facing tea growing at Kasaku tea estate and the solutions to overcome them.
v. To assess the contribution of tea growing at Kasaku tea estate to the surrounding areas.
vi. To find out the future prospects of tea growing at Kasaku tea estate.

NB. We use action words when stating objectives such as ;

i. To find out….
ii. To identify….
iii. To establish…..
iv. To describe…..
v. To assess ……..
vi. To investigate……

## B. REAL FIELD WORK EXCURSSION.

This is the second stage of field work, during the real field work study, the main activity is collection of information or data.

Only information related to the topic and objective should be collected. Various methods or techniques are used in the collecting and recording of information.

**Activity 4.3: Understanding methods**

In pairs, discuss and suggest possible names for the following methods you could have used to get some information while in the field. Through discussion, share the names you have suggested with the rest of the class.

a) *Talking to the local people and asking them questions about the things they do.*
b) *Measuring the size of gardens, market stalls, buildings and other features in the field.*
c) *Drawing sketch maps, field transects and panoramas.*

These include:

1. Observation
2. Interviewing
3. Questionnaire
4. Measurement
5. Pacing
6. Field sketching
7. Sampling
8. Photographing
9. Map orientation
10. Consultation of written data

## OBSERVATION.

This is the process of gathering information from the field by seeing geographical phenomena using the naked eyes. It involves seeing and identification of geographical phenomena.

By means of observation a tropical forest like Mabira and its unique characteristic features such as tall tress canopies, climbing plants, variety of tree species and others can be noted.

Other phenomena that can be observed include landslide, landscape, landforms such as mountains, caves, flood plain, relief features such as rivers, streams, swamps and lakes.

**Illustration**

A student is expected to state what he/she saw in the field. This should be related to the topic and objectives of the study.

**For example**.

For a study carried out at Kasenyi landing site, observation revealed the types of fish caught such as tilapia, and nile perch. Gill netting was the most common method used for catching fish. Smoking was used for fish preservation.

Merits of Observation

1. Accurate information is obtained as one can see with his/her naked eyes the geographical phenomena in the field.
2. Update information is obtained
3. It over comes the problem of language barrier
4. It doesn't require personal contact with other people i.ethe researcher feels free to acquire information relevant to his/her topic.
5. The observer is given a chance to judge the facts on the ground.

**Demerits of using Observation method**.

1. It doesn't gather information about the past historical events.
2. It cannot be used to study people's attitude and opinion
3. It generally uses small sample site which make it inappropriate for making generalization about big environments.
4. Climate or weather changes for example floods, rainfall, landslides etc may affect research using the observation method.

## INTERVIEW METHOD.

This is a part of obtaining information by asking questions in the field. The person asking questions is the interviewer and the person who is being asked the questions is the interviewee.

**Merits of interviewing method**

1. First land information is obtained i.e it eliminates misinterpretation.
2. Mistakes are corrected on spot.
3. It makes it easy to get supplementary answers.
4. It is not expensive compared to other methods.
5. It is faster in getting information.

**Demerits in interviewing methods**

1. There is language barrier among the illiterate.
2. There is a problem of suspicion and lack of cooperation.
3. Interviewing may make people tiresome.
4. Confidential information is left out deliberately.

**Illustration:**

Interviewer: What problems do fishermen face at the fish landing site?

Fishing officer: High taxes upon fishermen which reduce on our profit, price fluctuations and fluctuation of water level of the lake reducing the quantity of fish caught.

## QUESTIONNAIRE

Under this method, questions are composed and typed, sent to the interviewee through various means such as directly handing them to the interviewee.

Written answers to the questions are then sent back.

To illustrate the use of the Questionnaire method, one is expected to give questionnaire sample and answers draft.

**Sample questionnaires:**

1. Location of fishing ground.

……

2. Nature of fishing ground.

……

3. Landing facilities eg shelter.

……

**Merits of Questionnaire method**

1. It gives the correspondent ample time to answer the question.
2. It doesn't require the presence of the interviewer.
3. It is time saving.
4. It can also be used to get information from distant people.
5. Since information can be obtained from a large population, it sets a foundation for general analysis.

**Demerits of Questionnaire method.**

1. It is rigid, the information obtained cannot be easily changed in absence of the the interviewee.
2. Few people may be willing to spare time to answer and return the questionnaire.
3. The method is expensive i.e money need to buy papers, pens, etc.
4. It requires a lot of time to formulate the questionnaire.
5. Mistakes omissions and exaggeration may be experienced.
6. Required information may not be got immediately.

**MEASUREMENTS.**

This is the establishment tor estimation of distance volumes weight, size, and value by instrument such as tape measure, meter ruler, weighing scale, jerricans and others.

**Merits of Measurement**

1. Accurate information is obtained.

2. It is an efficient way of gathering data.
3. Skills in measuring are required

**Demerits of Measurement method.**

1. It is expensive as several instruments may be needed e.g. foot ruler, tape measure.
2. It is time consuming as it demands accuracy.
3. Some physical phenomena feature such as floods, thick vegetation and steep slopes may hamper the experience.
4. The instruments may be inaccurate.

## PACING

This is a method of finding out distance of specific geographical features by means of strides commonly known as pacers.

Pacing is part of measurement which is mainly based on estimation for example the average length and width of a plot is 30 by 30 paces. If each pace is about 1meter then the average size of the plot is 30x20=600m.

**Advantages of Pacing.**

1. It is a quick method of finding the short distance.
2. It is cheap as it does not require instruments

**Demerits of Pacing**.

- It lacks accuracy
- Some physical features such as poorly drained areas may hinder pacing.
- Sudden changes in weather such as sudden rain may hinder pacing.

## SKETCH MAPS

These are mainly drawn to show the physical and man-made features of the area. It shows both physical and man-made features of the area studied plus the local names. For example, a sketch map showing the physical location

of Masese fish landing site include features such as lake Victoria, islands such as Kisimu, falcons, Masese fish factory and others.

A sketch map should have a title compass, key, physical and human features, a frame, etc.

**PANORAMA**

This involves sketching geographical phenomena while standing of view point. It shows both natural and manmade phenomena for example relief landforms, settlement, vegetation and other land uses

The local names of the areas or features must be stated. It is easier to draw panorama of a hilly landscape than a plain or plateau.

Panoramas describes the physical aspects of the area for example showing relief, landforms, drainage and vegetation

It shows relationship between slope, vegetation and other aspects like settlement pattern ie settlement on gentle slopes, steep slopes/upper slopes are left for grazing

**TRANSECT**

This is a cross section of the area studied. This can be from east to west, north to south or any other direction

This is drawn approximately when one walks across a given area observing and recording changes in relief, altitude, soil depth, vegetation types, human activities and other geographical phenomena.

It helps to show various land use pattern along the area of study

**Merits of field sketching**

i. A student acquires skills of drawing sketches such as maps and other
ii. Sketches summarize geographical information obtained in the field
iii. It clearly illustrates relationships between physical and manmade features.

**Demerits of field sketching**

i. It is expensive as it requires various tools to be used
ii. Unpredictable changes in weather may hinder the use oth this method to collect information
iii. It is time consuming
iv. Physical features such as hilly landscape may obstruct researches from getting accurate information in the field.

## SAMPLING

This is a technique used in fieldwork study whereby a selected small part or fraction of geographical phenomenon is used to represent the whole geographical phenomena such as soils, crops, plantation, and forests

**Types of sampling.**

**1. Random sampling**

This refers to sampling method in which every one of the population has exactly the same chances as any other person of being included in the sample. This eliminates any possibility of bias.

**2.Stratified sampling.**

A sample is chosen according to percentage for example a student may want to find out the influence of mukono market on the surrounding area. He/she knows from the census data that 20 % of the people in surrounding area are rich, 30% are moderate/ middle class and 50% are poor

Then she/he will choose sample corresponding with the above percentage

**3. Systematic sampling**

This is where a study sample is selected in same regular way for example suppose 10% is being taken as sample from a list of 100, and the sample is selected beginning with the first, then our sample wound consist of number, 1, 11,21,31,41…..100.

**Merits of sampling**

a) It is time consuming as the researcher doesn't deal with all the numbers of the group ie soil sample from Bwaise
b) A detailed study of the sample can easily be undertaken resulting in accurate information
c) First hand information is got which is often accurate\
d) Lower costs are incurred since only a small population is dealt with
e) Conclusion can be drawn from the sample relating to larger area in relation to the topic of study

**Demerits of sampling.**

a) It tends to be generalize too much and some of the unique characteristics of geographical phenomena are left out

**MAP ORIENTATION.**

This is technique which involves rotating or turning the map to point where the feature on the map tally or match with those on the actual ground

The features are both natural and manmade. For example using a base map/ topographical map of any given place derived from the land and survey department

Features X is in the north, Y in the north east, W in the south and Z in the east. Features and their names as well as their directions must be identified.

**Merit of the map orientation**

a) Skills of dealing with topographical map or base map are learnt.
b) It provides an avenue of locating figures in their relative position on the map.

**Demerits of map orientation.**

a) Very few areas have base map, which an be used in a map orientation
b) Where the map exists, they are not easy to obtain

## PHOTOGRAPHING.

This is a technique of acquiring information by taking photographs using a camera

**Advantages of photographing**

a) It is quick method of data collection
b) Cameras show exactly what is in the field hence accurate information is obtained
c) Students acquire skill of photography

**Disadvantages of photographing.**

a) The camera is not selective but records everything within its range including unnecessary
b) It is an expensive technique as cameras are expensive as well as costs printing the photos
c) Time is required often days to process the photograph and may be a bad print.

## RECORDING.

This is defined as the process of putting down information gathered from the field by use of various tools such as pens, pencil and paper as well as modern tools such as photograph and video recording.

The information is given in form of description charts, graphs and sketch maps diagrams, tables, writing down answer from interviews, photograph and others.

Recording must be done in a systematic and understandable manner. Poor recording may make would be useful material appear useless as even the collector may fail to interpret the material later on

**Advantages of recording**

a) Information can be stored for a long period of time.
b) Sketch map, transect and panorama summarize geographical, information found at a place. Transects summarize the natural and manmade features in a place
c) Recorded materials can be easily interpreted

**Demerit of recording.**

a) Some recording methods are expensive for example taking photograph to show the physical and human feature in the area of study.
b) Unpredictable changes in weather can hinder the exercise for example a heavy rain showers wetted the paper.
c) Some recording methods consume much time for example draw a group bar graph

**FOLLOW UP STAGE**

This is the third and final stage of the fieldwork. The cardinal purpose of the follow up stage is to re− organize the results or data collected and fostering a general comprehensive understanding of the field studies through intellectual reflection aided by empirical data.

Various steps are involved in the follow up stage and these may include the following.

a. Organization of data
b. Comparison of data collected
c. Discussion and interpretation of data
d. Verifying data
e. Polishing sketchnaps and other diagrams
f. Drawing conclusions and recommendations from data collected
g. Final writing of the report
h. Presentation of the fieldwork findings to the general class
i. Evalution of the fieldwork study

Geographical relationship/ findings, significance

Physical – physical relationship

Physical – human relationship

Human – human relationship.

**Physical – physical relationship.**

a) Uppers slopes of hills have steep slopes which accurate surface run off of water resulting in the formation of extensive gullies
b) Gentle slopes at the foot of the mountains have deep fertile soil deposited from the upper slopes.
c) Presence of clay soils in valley resulted from the occurrence of flooding during heavy rains as the clay soils
d) Nabweru valley has deep fertile soils. This is because of depression of soils carried from upper slopes by running water.

**Physical – human relationship**

a) The market at kasenyi fish landing site is located on a very gentle slopes. This is because it is easy to construct building and such relief.
b) Undulating landscape favor construction of road.
c) Swamps/ lakes/rivers led to the development of fishing activities
d) Fertile soils and heavy rainfall have favored the growing of crops in nabuti, mukono.

**Human – human relationship.**

*The fishing activities at kasenyi fish landing site have attracted.*

a) Many other activities such as Eugen fuel station which provides fuel to run the motor boat engines , boat making and repairs, restaurants to provide food to the fishing and other business community
b) Linear settlement along Kampala to wakiso for easy transport and trade purposes
c) Fishing at Gaba landing site on lake Victoria has led to development.

PROBLEMS/LIMITATIONS OF FIELDWORKS

- It tends to be time consuming i.e. a lot of time is taken to gather information.
- Language barrier may hinder communication with the local people in the area being studied

- It is expensive in terms of transport, epipement and other expenses
- It may be hindered by poor or bad weather conditions such as rain, fog hot sunshine.
- There is a tall or obstactles like tall buildings may obstruct observation
- Noise in the field may disrupt interviewing during fieldwork
- Some people or respondent in the field are not cooperative i.e. may refuse to give information.
- Shortage of adequate equipment or tools e.g survey maps, cameras etc.
- The school administration or community leaders may sometimes not allow fieldwork on the ground that is time consuming and tends to interfere with the school programme
- Risk of accidents and danger from wild animals and insects.

**Geographical skills obtained in the fieldwork**

- ❖ Skills in the use of research methods like interviewing to obtain information.
- ❖ Skills in handling and using equipment i.e. psycho motors skill.
- ❖ Map drawing/ cartographic skills
- ❖ Skills in the formulation of geographical fieldwork topic and objectives
- ❖ Skills in interpreting and analyzing raw data or information obtained from the field
- ❖ Public relation skills

**Geographical knowledge obtained in the fieldwork**

*Writing a Report about Fieldwork*

You collected information about the area you studied during fieldwork. How do you think one can know what the geography of the area you studied is like? Possibly you have thought of telling and explaining to the person what you found out. Since it is not possible to tell everybody what we have got from the field, we write it down so that others can read for themselves. The information we write about the area studied is called a **fieldwork report**.

***To be able to write a report about your study, do Activity 4.5 below.***

## Activity 4.4

Using the information you collected during the field study you did in Activity 4.2 above, follow the steps below and prepare a fieldwork report. Present the report to your teacher for any assistance you may need.

a) *Remember the topic and objectives of your study.*
b) *State the topic and summarise your objectives at the beginning.*
c) *Briefly describe the area studied, possibly with a map.*
d) *Write down the information you got about every objective in words.*
e) *Analyse the statistics you got, if any, and present them in tables, charts or graphs.*
f) *Include photographs or other maps, if any.*
g) *Summarize what you found out from the fieldwork, including the relationships between the people of the area and their physical and human environment.*

# Learning Geography through Photographs

**Photographs** can tell us a lot about the geography of even those areas we have never been to. To understand this, do the following activity. ***Activity 4.5***

*Study Figure 4.2 and do the activities that follow*

***Figure 4.2: Photograph as a source of geographical information***

a) *In your notebook, write down the natural and human features you see in the photograph.*

b) *Explain how any two human features are influenced by the natural environment.*
c) *In what ways do you think human activities might affect the natural environment shown in the photograph?*

There are basically two types of photographs namely,

Photographs are of different types. These depend on the angle at which the photographer looks at the features on the ground through the camera.?

Those taken while the photographer is standing on the ground or on another feature connected to the ground are called **ground photographs.**

Photographs can also be taken from the air, i.e. when the photographer is not directly connected to the ground. Such photographs can be taken from an aeroplane, a very tall building or a flight balloon. These are called **Aerial photographs.** To understand this further, do Activity 4.7.

**Aerial photograph**.

These are taken from the air (atmosphere). They are sub divided into vertical aerial and oblique aerial.

Vertical aerial are the ones taken at an angle of 90° from the plane at apposition perpendicular to the ground of the photograph.

Oblique aerial photograph are taken at an oblique angles from the air, they are called low oblique photograph if the part of the sky (horizon) is not shown. it is also called high oblique if the horizon or sky is shown.



**Characteristics of Aerial photograph**

- Aerial photograph doesn't show skyline.
- The size and height of the object is reduced (small & short).
- Aerial photograph cover wider area than ground photograph.
- They only show the top of objects.

**NB**. You could have realized that aerial photographs are not the same. This is because while in the air, the photographer can look at features on the ground at different angles. Photographs taken when looking at features vertically, i.e. at an angle of $90^{o}$, are called **vertical aerial** photographs. These show only the top views of the features on the ground, with all features appearing as flat objects. Those photographs taken looking at features at an angle less than $90^{o}$ are called **aerial oblique** photographs. These show both the top and side views of objects

**Ground photograph.**

These are called horizontal or frontal ground photograph if it is taken at an angle horizontal to the ground (180) for example most pics in photo album.

They are called ground oblique photograph if taken at an angle i.e. 47° off the ground.

## Activity 4.6

Look at Figures, and:

*a) Identify and write in your notebook the buildings and vegetation in each photograph.*

*b) Explain the differences between the photographs shown in each figure.*

*c) Suggest what type of photograph each one is. Give reasons to support your opinion.*

**Determination of time when the photograph was taken.**

*Time of day when the photograph was taken depend on the size, height and position of its shadow.*

a. Photographs taken during mid day has no shadow or relatively shorter.
b. Photographs taken during morning have shadow extending towards the west of the photograph
c. Photographs taken during evenings have long shadow extending towards eastern side of photograp

**Drawing of a landscape sketch of the photograph.**

A good landscape sketch should consist a title, frame, key and well labeled features.

## Activity 4.7

Study Figure 4.7 and do the tasks that follow.

***Figure 4.7: Photograph showing Rukiga Hills, Kabale***

a) *Identify the main feature in the background and in the middle ground.*
b) *Draw a sketch of Figure 4.7 to show the main features on the photograph.*
c) *Divide the sketch you have drawn into appropriate divisions.*
d) *Name the features on the sketch.*
e) *Describe the area shown in the photograph.*

*Describing where things are on a photograph*

When describing features on the ground and aerial oblique photographs, you divide the photograph into regions depending on how far away from the observer the features are. These are foreground, middle ground and background. The part of the photograph which shows the sky is called the horizon. We do not divide this into regions.

**Interpretation of features on photograph basing on their position**

| | | | |
|---|---|---|---|
| Background | LBG | MBG | RBG |
| Middle ground | LMG | MMG | RMG |
| Foreground | RFG | MFG | RFG |

**Types of vegetation on photographs.**

These are trees, shrubs, grass etc. We usually avoid naming vegetation as savanna, montane or equatorial. We therefore use simple but realistic words like grass, trees, thickets...

**Land use types on the photograph.**

- Transport if there is a road, railway line etc.
- Settlement if there are houses, huts
- Crop cultivation if there are crops
- Tourism if there are wild animals, rocks which have significant scenery.
- Buy and selling if there are shops, market, hawkers with goods.
- Forestry if there is forest or several trees.

**Relief landforms, Relief regions, physiographic regions.**

These include hilly or highlands, steep or gentle slopes, lowland areas or valleys

**Relationship between relief features and land use types.**

Identify the relief features and its position on the photograph

Give a reason for that relationship/ explain that relationship

*For example.*

- ✓ *Forestry is practiced along a steep slope in the background because of the need to control soil erosion in the highland area.*
- ✓ *Crop cultivation practiced in the gentle slopes in middle ground of the photograph because of the fertile soil deposited by the surface run off on the gentle slopes.*

**Areas where the photograph could have been taken.**

Areas in East Africa where similar features are found and give reason for your answer showing that the presence of feature X or Y in the photograph which is also found in the area you selected as evidence.

***For example.*** The presence of trees/ forests and a road within can be evidenced that the photograph is of Echuya forest, Mabira forest, Budongo forest since there is a road and forest.

# Studying geography from statistics, chart and graphs.

Other than the use of fieldwork and photographs, we can also study geography through the use of statistics, chart and graphs. *Analyzing data on the visitor to selected national parks.* ***Study the table below showing visitation to Uganda's national park and answer the questions that follows.***

| ***National park*** | ***Percentage (%)*** |
|---|---|
| Murchison fall | 32 |
| Queen Elizabeth | 24 |
| Bwindi impenetrable | 11 |
| Lake mburo | 10 |
| Semliki | 07 |
| Kibale | 06 |
| Others | 09 |

***Activity 4.8 . presenting data on the pie chart.***

a) Which national park received?

I. The lowest
II. The highest number of visitors.

b) List the other national parks that are found in Uganda.

c) Draw a pie chart to show the percentage of visitors who visit each of the national park.

Activity 4.9 ***presenting data on the graph.***

In pairs, study the information in the table showing the number of learners in Hilton high school, day campus in 2022.

| Class | NO of learners |
|---|---|
| S.1 | 18O |
| S.2 | 160 |
| S.3 | 120 |
| S.4 | 110 |
| S.5 | 42 |
| S.6 | 36 |

a) Draw a bar graph to represent the number of learners in Hilton high school, day campus in 2022.

**Steps**

***To draw a bar graph, get a graph paper and follow the following steps.***

1. *State the title*
2. *State both vertical and horizontal scale, for example;*
    - *Vertical scale: 1cm to represent 50 learners*
    - *Horizontal scale. 1cm to represent one class.*
3. *Get a pencil and a ruler, then draw the vertical line, mark off the desired measurements and, then draw the horizontal line mark off length of 1cm for each class.*
4. *Draw separate vertical bars starting from the zero line for each class*

*Chapter. 5*

# THE EARTH AND ITS MOVEMENTS.

**The shape of the earth**

## Activity 5.1

In pairs, look at Figure 5.1 above and do the following tasks:

a) *Identify the positions of the poles, and the equator.*
b) *Describe what the earth looks like at the poles and at the equator.*
c) *Describe the shape of the earth.*

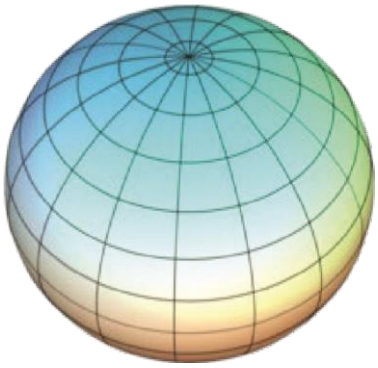


***Figure 5.1: A model showing the shape of the earth***

The shape of the earth is called geoid/ovoid/oblate spheroid due to being an imperfect sphere by being wide at the equator and flat at the poles.

**Proofs/Evidence That the Earth Is Spherical**

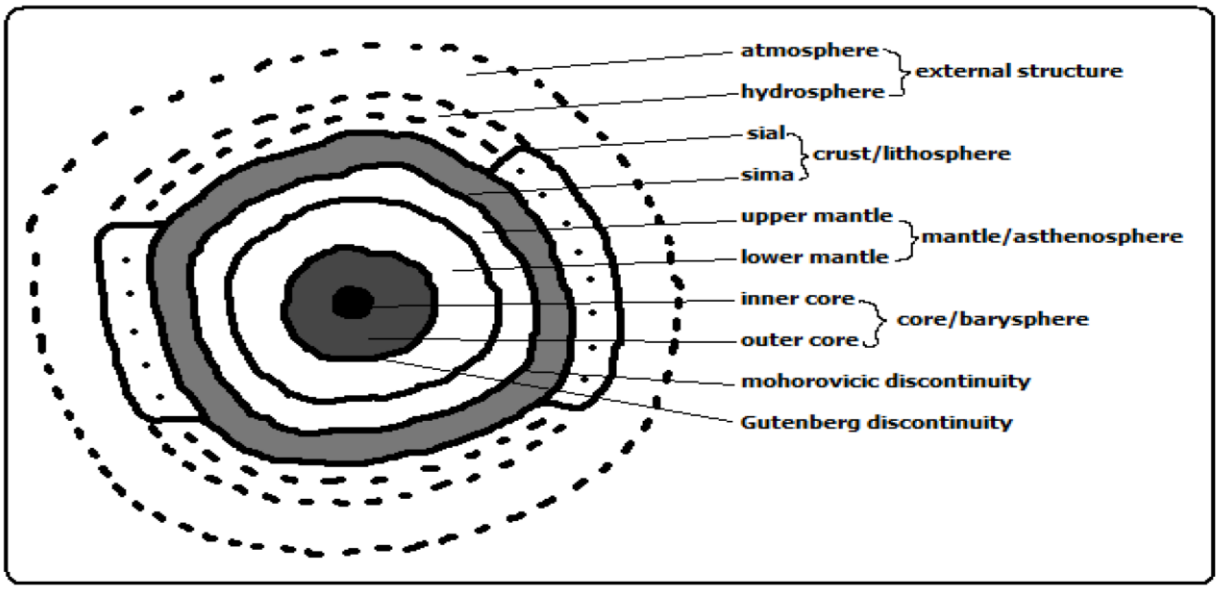
- If one moves towards the east in a straight line he will end up where he started.
- Satellite photographs taken from space show that the earth is like a sphere.
- Places in the east see the sun earlier than those in the west.
- When a ship is approaching the smoke is seen first, then the mast and finally the whole ship.
- All the planets are spherical so the earth being one of them is also spherical.
- During the moon eclipse the earth casts a spherical shadow on the moon.

- The earth's horizon appears curved when observed from a very high point like a tower.

**The size of the earth**

- Equatorial diameter-12756km
- Equatorial circumference-40085km
- Polar diameter-39995km
- Surface area of the earth-$510\times10^6$ km2
- Water surface-73%.

**The Structure of the Earth**




**Internal Structure of the Earth**

The evidence used to study the earth's interior are mining drilling
quarrying/excavation

**A. Crust/Lithosphere**

Outermost layer of the earth Made of soils and other loose deposits of sand. The dominant rocks are granites.

Extends 0-50km and Has 2 layers

1. **Sial** Also called continental crust , Made of light coloured rocks Called sial because it's made up of **si**lica and **al**uminium.

2. **Sima** Also called oceanic crust , Mainly made of basaltic rocks which are brittle. Called sima because it is made of **si**lica **ma**gnesium and iron.

**Mohorovicic discontinuity (Moho)**

A definite zone of discontinuity between the crust and the mantle. Was discovered by Dr. Andrija Mohorovicic in 1909.

**B. The Mantle/Asthenosphere**

Layer lying between the crust and the core , Made of iron and magnesium and Has two layers

- **Upper mantle** Rocks are more elastic than those of sima. Temperature is about 1000◦c.
- **lower mantle** Rocks are like very viscous liquid. Temperature ranges between 1000◦c to 3000◦c.

**Why the Interior of Earth Is Very Hot**

- ✓ Due radio-active decay causing most of the heating.
- ✓ Due to great pressure as a result of overlying crustal materials.
- ✓ The original heat resulting from slow cooling of the materials which were pulled off the sun

**Gutenberg Discontinuity** A definite zone of discontinuity between mantle and core.

**C. Core/barysphere/Centrosphere** The innermost/central layer of the earth. And has 2 layers

**Outer Core** Composed of very dense rocks, Made up of nickel and iron and Temperatures are up to 3700◦c.

**Inner Core** A solid mass of mainly iron and Temperatures are estimated to be 4500◦c to 5000◦c.

**External Structure of the Earth**

**The Atmosphere**

- ✓ Layer of gases surrounding the earth.
- ✓ The earth revolves with it because its held onto it by gravity
- ✓ It's about 330km thick.

**Composition of the Atmosphere**

- ✓ Gases-exist as a mixture
- ✓ Smoke particles
- ✓ Dust particles
- ✓ Water vapour

**The structure of the Atmosphere**

It's divided into 4 layers/zones namely:

**Troposphere**

- ✓ -Lowest layer of the atmosphere
- ✓ -Contains 90% of water vapour
- ✓ -Rainfall is got from it
- ✓ -Temperature decreases with increase in altitude (lapse rate)
- ✓ -Air is turbulent due to mixing of air
- ✓ -Contains dust particles

-There is a zone of transition between troposphere and stratosphere called **tropopause**.

**Stratosphere/ozonosphere**

- ✓ Layer lying next to troposphere
- ✓ Has layers
- ✓ Lower isothermal layer in which temperature is constant
- ✓ Upper layer of temperature inversion in which temperature increases with increasing altitude

- ✓ Has ozone layer which absorbs harmful ultraviolet radiation.
- ✓ Air is calm so it's used by passenger jets
- ✓ Limited amounts of water vapour
- ✓ There is a zone of transition between stratosphere and mesosphere called **stratopause**.

**Mesosphere**

- ✓ Middle layer of the atmosphere.
- ✓ Temperature decreases with increasing altitude.

*-There is a zone of transition between mesosphere and thermosphere called mesopause which is an inversion layer.*

**Thermosphere/ionosphere**

- ✓ High radiation is present.
- ✓ The pressure is very low.
- ✓ Gases and molecules in this layer exist as ions due to high radiation.
- ✓ Has no definite top but merges gradually into the outermost part of the atmosphere called exosphere.
- ✓ Exosphere consists of rare gases like hydrogen and helium.
- ✓ Beyond the atmosphere there is the outer space.
- ✓ Outer space is the universe beyond the atmosphere in which other planets and stars exist.

**Significance of Atmosphere**

- ✓ Animals and plants breathe in from it oxygen for respiration.
- ✓ Plants use carbon dioxide from it for photosynthesis.
- ✓ Water vapour in the atmosphere condenses to form clouds which give us rain.
- ✓ Ozone layer in the stratosphere shields us from ultraviolet radiation which may cause cancers.
- ✓ Carbon dioxide and methane in the atmosphere cause global warming through the green house effect.

### b) The Hydrosphere

Part of the earth's surface covered by water masses e.g. oceans, seas, lakes, rivers and even underground water.

It comprises 73% of the earth's surface area.

The atmosphere and hydrosphere are related in that atmospheric gases penetrate to the ocean depth in solution form.

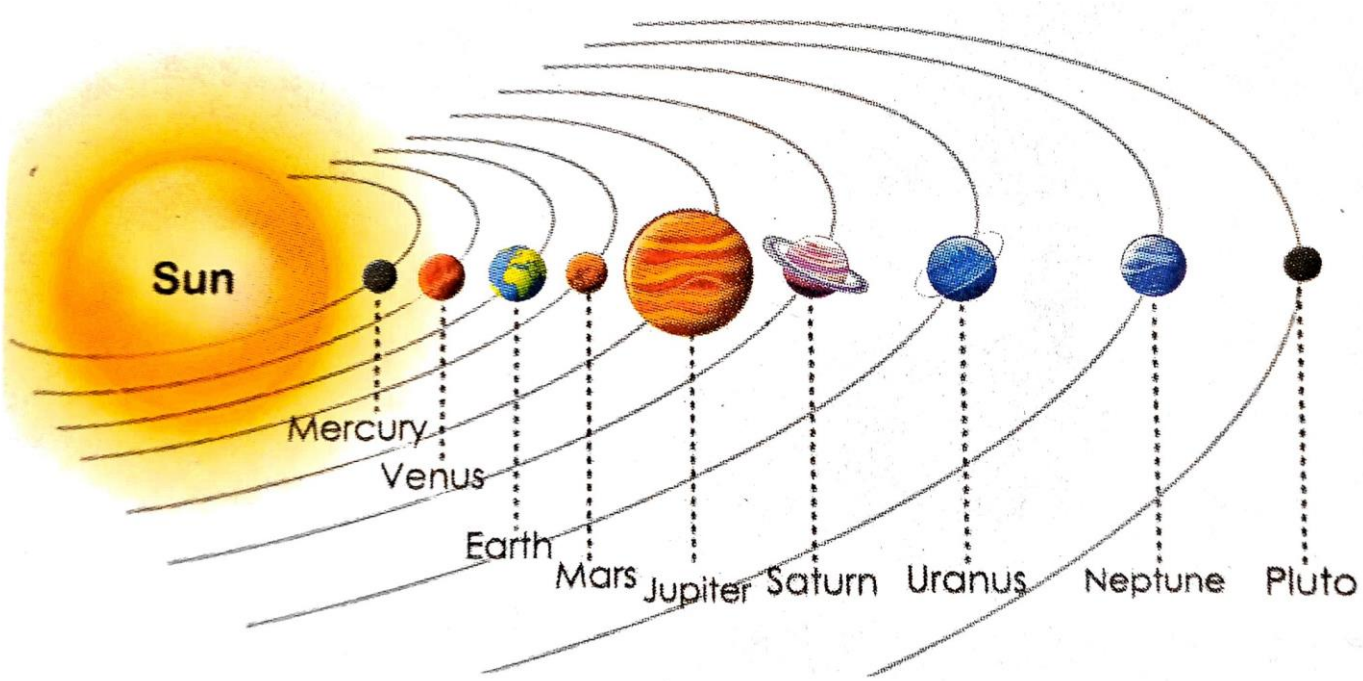



***Figure 5.1(a)*** *The Planets of the Solar System*

The lower atmosphere, hydrosphere and the upper part of the earth's crust are called biosphere meaning the sphere of the earth in which organic life exists.

**Position of the earth in the solar system.**

Solar system is the group of heavenly bodies comprising the sun and the nine planets.

**The origin of the Solar System**

**Theories**

A theory is a set of reasoned ideas intended to explain facts or events

**Passing Star Theory**

A star with a greater gravitational pull passed near the sun. It attracted large quantities of gaseous materials from the sun .The materials split, cooled and condensed to form planets. The planets were set in orbit by the passing star

**Weaknesses**

- ✓ Doesn't explain the origin of the sun and star.
- ✓ Minimal chance of a star approaching another
- ✓ Materials would disperse than condense

**Collision Theory**

- ✓ Star with greater gravitational pull passed near the sun
- ✓ It attracted large quantities of gaseous materials
- ✓ The materials split into portions
- ✓ Large portions collided with smaller ones and swept them to form planets.
- ✓ The weaknesses are the same as the passing star's Theory.

**Nebula Clod Theory**

- There was a slowly rotating cloud of dust and gas called Nebula
- It cooled and began to contract
- Rotation speed increased and successive rings of gaseous materials were formed.
- The rings condensed to form planets
- The central gaseous material remained as the sun

**Evidence**

- ✓ Rotation and revolution of planets in anticlockwise direction

**Weakness**

- ✓ The origin of nebular is not explained.

**Supernova/explosion Theory**

- ✓ There was a violent explosion of a star.
- ✓ A cloud of dust (nebular) remained from the star.
- ✓ There was fast movement of the cloud due to the force of explosion.
- ✓ Rotation speed increased due to gravitational attraction
- ✓ The cloud flattened into a disc.
- ✓ The matter began to accumulate towards the centre to form a proto-sun which later began to shine.
- ✓ The rest of the cloud collapsed to form planets.

**Weaknesses**

- ✓ Doesn't explain the origin of the star
- ✓ Doesn't explain the cause of explosion

**Composition of the Solar System**

**1. The Sun**

- ✓ It's the centre of the universe.

**Characteristics**

- It's a star.
- A **star** is a heavenly possessing its own light which it transmits.

**Nebula/galaxy** is a cluster of stars.

- ✓ The earth is in a galaxy called **The Milky Way.**
- ✓ It's made of very hot gases mainly hydrogen (70%) and helium (30%).
- ✓ Has a diameter of 1392000km.
- ✓ Surrounded by a layer of gas which has boiled from its surface which is called **corona**.
- ✓ Rotates on its own axis in anticlockwise direction.
- ✓ Has gravitational pull which holds all the planets in orbit around it.
- ✓ An **orbit** is a path which a planet or a satellite follows around a star or a planet.
- ✓ Temperature at its centre is 15m◦c and at the surface is 5500◦c.
- ✓ Radiates solar energy which is very important for all forms of life on the earth.

**2. The Planets**

- ✓ Planets are large spherical celestial/heavenly bodies in space.
- ✓ There are 9 planets in our solar system.

**Characteristics**

- ✓ Spherical in shape
- ✓ Don't have their own light but reflect it from the sun.
- ✓ Revolve around the sun in anticlockwise direction.
- ✓ Have their own force of gravity
- ✓ Only one is known to support life.

The following are the planets arranged in order from the one nearest to the sun

**Activity 5.2**

a) Draw a diagram showing the shape of the earth and on it include the main lines of latitude and longitude.
b) Conduct internet or library research about the solar system and make notes with diagrams.
c) Find out why it is called so and how many planets make up the solar system

**Mercury**

- ✓ Nearest from the sun
- ✓ Its 58m km from the sun
- ✓ Has no satellites
- ✓ Takes approximately 88 earth days to revolve around the sun

**Venus**

- ✓ 2nd planet from the sun
- ✓ It's 108m km from the sun
- ✓ One of the brightest planets
- ✓ Can be seen clearly with naked eyes
- ✓ Takes approximately 225 earth days to revolve around the sun
- ✓ Slightly smaller than the earth
- ✓ Has no satellites
- ✓ Together with the earth they are called twin planets due to having many similarities

**Earth**

- ✓ The 3rd planet from the sun
- ✓ The earth and the heavenly bodies make the universe
- ✓ The only planet that supports life
- ✓ The home of man
- ✓ Approximately 149m km from the sun
- ✓ Takes 365 ¼ days to revolve around the sun
- ✓ Has one satellite, the moon

**Mars**

- ✓ Also called The Red Planet because when it's observed through a telescope it appears reddish.
- ✓ The 4th from the sun

- ✓ Slightly smaller than the earth
- ✓ Approximately 228m km from the sun
- ✓ Takes 687 earth days to revolve around the sun
- ✓ Between Mass and Jupiter there are small celestial bodies called planetoids.
- ✓ Has no satellite.

**Jupiter**

- 5th planet from the sun Approximately 778m km from the sun Largest in the universe Rotates on its own axis at very fast speed
- Has flattened poles due to its fast speed of rotation Has very thick layers of ice on its surface takes 12 earth years to revolve around the sun
- Has 16 satellites

**Saturn**

- 6th planet from the sun
- Second largest planet
- Approximately 1427m km from the sun
- Takes 29 ½ earth years to revolve around the sun
- Has a ring around it
- Has 18 satellites

**Uranus**

- 7th planet from the sun
- About 4 times bigger than the earth
- Approximately 2870m km from the sun

- Also rotates very fast
- Also has flattened poles due to fast speed of rotation It appears greenish foe being surrounded by methane gas
- Has 8 satellites
- Takes 84 earth years to revolve around the sun

**Neptune**

- One of the farthest from the sun
- $8^{th}$ planet from the sun
- Approximately 4497m km from the sun
- Has 8 satellites
- Takes 165 earth years to revolve around the sun
- Very similar in size, colour and character with Uranus

**Pluto**

- $9^{th}$ planet from the earth
- Farthest from the sun
- The smallest
- 1/6 the size of the earth
- Approximately 5900m km from the sun
- Takes 248 earth years to revolve around the sun
- Has one satellite
- Very little is known about it

**Other Celestial Bodies**

**Natural Satellites**

Any natural heavenly body that orbits around a planet e.g. moon for earth, tritan for Saturn and Triton for Neptune.

**Asteroids/Planetoids**

Also called minor planets.

Are small fragments of rocks left going around the sun when the solar system was formed

Found between Mass and Jupiter

Are 1500 in number

They sometimes collide with each other and planets due to Jupiter's gravitational pull causing them to move in erratic orbits.

**Comets**

- Heavenly bodies which appear to have a head and a long tail
- Made of ice, dust and frozen gas
- The head is made of many particles of dust, rock and frozen gases.
- Their tail is made of gases and points away from the sun.
- Move around the sun in extremely long and oval orbits
- Their orbits cross the earth's orbits e.g. Halley's Comet which appears after every 76 years.

**Meteoroid**

- Small heavenly body which strays from its orbit in the solar system and enters the earth's atmosphere at very high speed.

**Meteor**

A meteoroid which is burning out due to friction after entering the earth's atmosphere.

**Meteorite**

- Remains of a meteoroid which have reached the earth's surface or incompletely burnt up meteoroid.
- When they fall they sink into the ground forming craters
- They are rich in iron

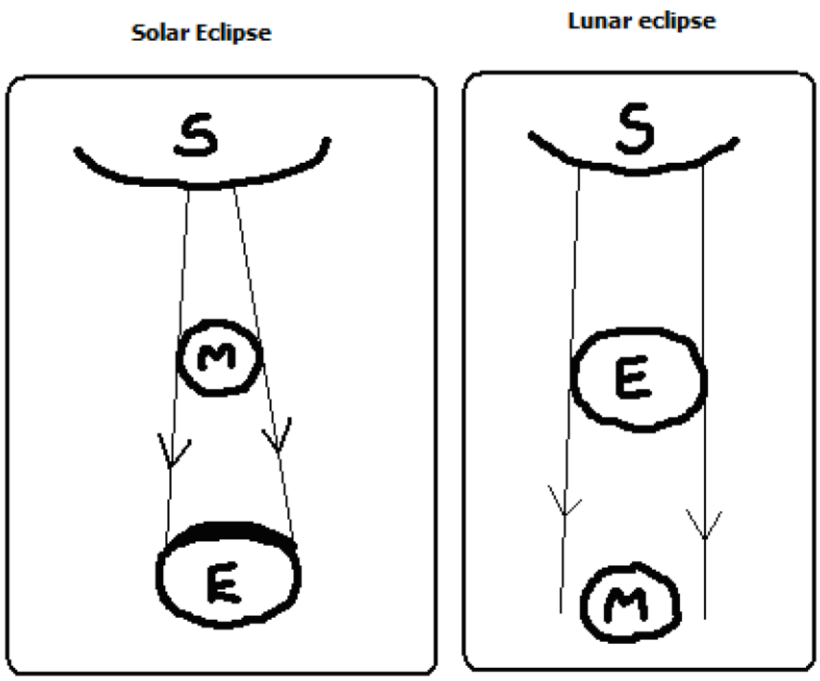
**The Moon**

- A natural satellite
- Receives its light from the sun and reflects it onto the earth.
- It revolves around the earth
- Takes 29.5 days to complete one revolution around the earth
- Its orbit is almost circular
- As it revolves around the sun it appears in various shapes ranging from crescent/new moon, half moon, gibbons moon and full moon.
- Has gravitational pull which causes the rising and falling of the ocean level
- As the moon orbits around the earth it creates an event called eclipse.

**Eclipse**

-Phenomenon occurring when the rays of the sun are blocked from reaching the earth or the moon.

**Solar/Sun Eclipse**




The moon comes between the earth and the sun

The moon's shadow is cast on the earth

The sun appears to be covered by darkness

**Lunar/moon Eclipse**

- The earth comes between the moon and the sun
- The earth's shadow is cast on the moon
- The moon appears to be covered by darkness

**The Origin of the earth**

- A star with a greater gravitational pull passed near the sun
- It attracted large quantities of gaseous materials from the sun
- The materials split, cooled and condensed
- Heavier materials collected at the centre to form the core
- Less dense materials collected around the core to form the mantle

- The lightest materials formed the crust

**The Movement of the Earth**

There are 2 movements of the earth namely:

a) Rotation of the earth on its axis
b) Revolution of the earth around the sun

**Rotation of the Earth**

- Movement of the earth on its own axis (imaginary line through the centre from N pole to S pole.
- Rotates through 360◦.
- Takes 24 hours (day) to complete 1 rotation.
- Rotates in an anticlockwise direction (west to east).

**Characteristics of rotation**

- ✓ Direction ie it complete on rotation from west to east using 23 hour, 56 minutes and 4.09 seconds
- ✓ Inclination of the earth axis at the polar star at an angle of 23½
- ✓ Speed of the earth rotation is 1670km/hr at the equator

NB.Axis is an imaginary line which passes through the centre of the earth.

**Activity 5.3**

*a) In pairs, get a globe or football, torch and marker.*
*b) Using a marker or bold ink, put an X-mark on the ball, in case you do not have a globe.*
*c) Hold the globe or ball in your hands such that your friend standing at the opposite side flashes a torch upon it.*
*d) Spin the globe or ball and observe what happens.*
*e) Write a paragraph to explain what you have observed.*
*f) Explain how we get daytime and night-time on earth.*

**Effects of Rotation of the Earth**

- Creates day and night because at any one time one side of the earth faces the sun (day) and the other remains in darkness (night).
  - ✓ At the arctic circle . the day hours are longer, no nights
  - ✓ Tropic of cancer. The days are longer than the nights
  - ✓ At the equator. There is equal days and nights
  - ✓ Tropic of Capricorn. The night are longer than the days
  - ✓ Antarctic circle. There is only night hour, no day hour.
- Causes deflection of winds and ocean currents in the N hemisphere to the left and in the S hemisphere to the right.
- It causes rising and falling of ocean tides.
- Causes time difference between longitudes..i.e. Takes one hour to go through 15◦ and 4 min to go through 1◦.
- Sunrise and sunset
- The sun, the moon and the stars seem to move from east to west
- Centrifugal force. The earth spins at every great speed and buldges at the centre

**Calculation of Local Time**

-The time recorded in places within the same longitude.

A longitude is an imaginary line running from N to S which shows how far E or W a place is from the prime meridian.

Greenwich Meridian (0◦) longitude is the point of reference when calculating time.

Time is gained towards the E and lost towards the W.

*Why places on earth have different time*

Apart from causing day and night, the rotation of the earth also results in time differences. For every $15^0$ of longitude we move from the Prime Meridian eastwards, we gain one hour. And as we move westwards, for every $15^0$ of longitude, we lose one hour.

The sun reaches the highest position in the sky at 12 noon. At that time, the Greenwich Meridian lies under the sun. This is called 12 noon local time along the Prime Meridian. Local time at the Greenwich is called **Greenwich Mean Time** or simply GMT. All meridians to the east of the Q

Greenwich Meridian have sunrise before the Prime Meridian. Local time

along these meridians is ahead of GMT. Meridi ans to the west have sunrise after the Greenwich, and the local time is behind GMT. See Figure 5.4.

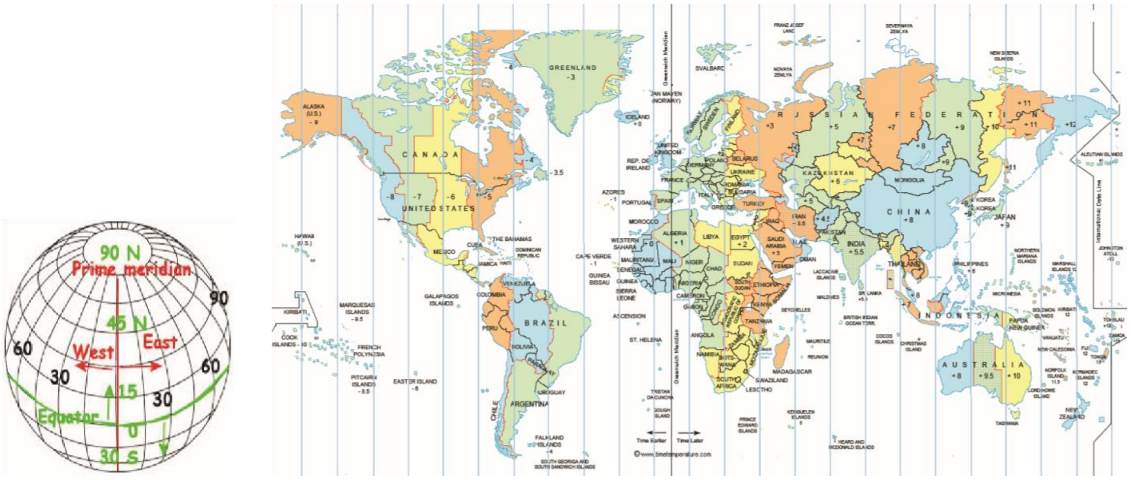



***Fig 5.4: Longitude and time***

**Activity 5.4**

1. If the time at place X is 1600 hours and GMT is 1400 hours, find o ut:

   i) How many hours X is from GMT.

   ii) The longitude at which place X lies.

2. If the time at Greenwich is 7.00 GMT, calculate the time at:

   (i) $75^0$ E (ii) $75^0$W

**Examples**

Suppose the time at GWM is 12 noon what is the local time at Watamu 40◦E?

Time gained=40×4=160min=2 hours 40min

Local time at Watamu is 12.00+2.40=14.40-1200=2.40pm.

At Dar-es-Salaam 40◦E time is 12pm what is the time at Ecuador 20◦E?

40◦+20◦=60◦

60×4=240min=4hours
Ecuador is behind in time =12.00-4=8 am.

If the places are on the same side subtract the degrees to get the difference and add or subtract from the reference time depending on which side the place is.

**Activity 3. Calculating time using longitude.**

*In groups, carry out a library research or internet search to find out.*

a) *What determines the difference in time in the different parts of the earth?*
b) *How many degrees the earth rotates within 24 hours.*
c) *What duration of time the earth takes to 15º?*
d) *What happens to time as you cross the meridians from?*
    i. *East to west.*
    ii. *West to east.*

*3. (a) Mombasa is located approximately 40º East of Greenwich Meridian. Calculate the time in Mombasa when the time in Greenwich is 7:00pm.*

*b) Tokyo in japan is at longitude 140º East of Greenwich. Calculate the time in Tokyo when the time in Greenwich is 2:00am.*

- ***Present and discuss your work with the rest of the class.***

**Calculation of Longitude**

What is the longitude of place x whose local time is 8 am when local time at GWM is noon?

Time difference =12.00-8=4 hours

Degrees=4×15=60◦

Since x is behind in time its then 60◦W.

**Standard Time and Zones**

Standard time is time recorded by countries within the same time zone.

Standard time was come up with due to confusion resulting from time changing at every longitude.

The world has 24 time zones.

**The International Date Line**

It's the 180◦ longitude.

**Effects of Crossing It**

One gains time when he crosses it from W to E and has to adjust the clock ahead by 24 hours. One loses time when he crosses it from E to W and has to adjust the clock backwards by 24 hours. **Tasks** 2. Study Figure 1 showing the location of Bangkok and Dar es Salaam using latitude andLongitude and answer the question that follows.

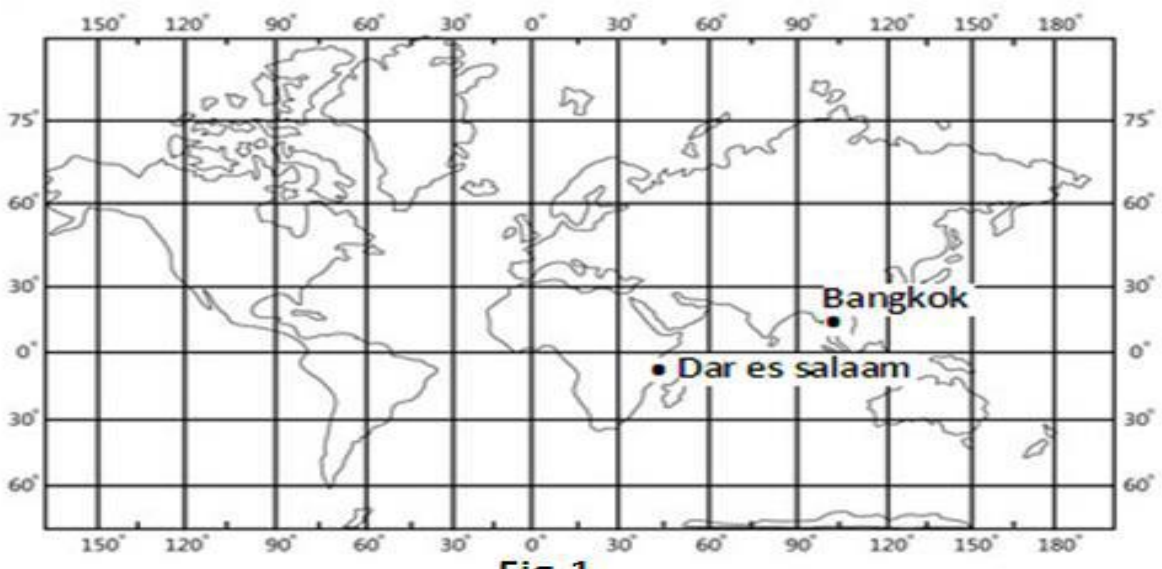



**Fig.1**

**(Source: Shutterstock.com. 127117656)**

Gowa lives in Dar es Salaam City which lies 40° east of the Prime Meridian. Her elder sister

Lives in Bangkok City which lies 100° east of the Meridian. Gowa usually communicates with

Her sister very early in the morning before going to school.

(a) If Gowa makes a phone call at 7:00 am (GMT), determine the time at which her sister in Bangkok will receive the call.

(b) Explain **two** ways in which the rotation of the earth influences the ways of life of the People in your community.

# Revolution of the Earth

Movement of the earth in its orbit around the sun. It's in anticlockwise direction.

The orbit of the earth's revolution is elliptical.  Takes 365 ¼ days in a year or 366 days in a leap year (every 4 years).

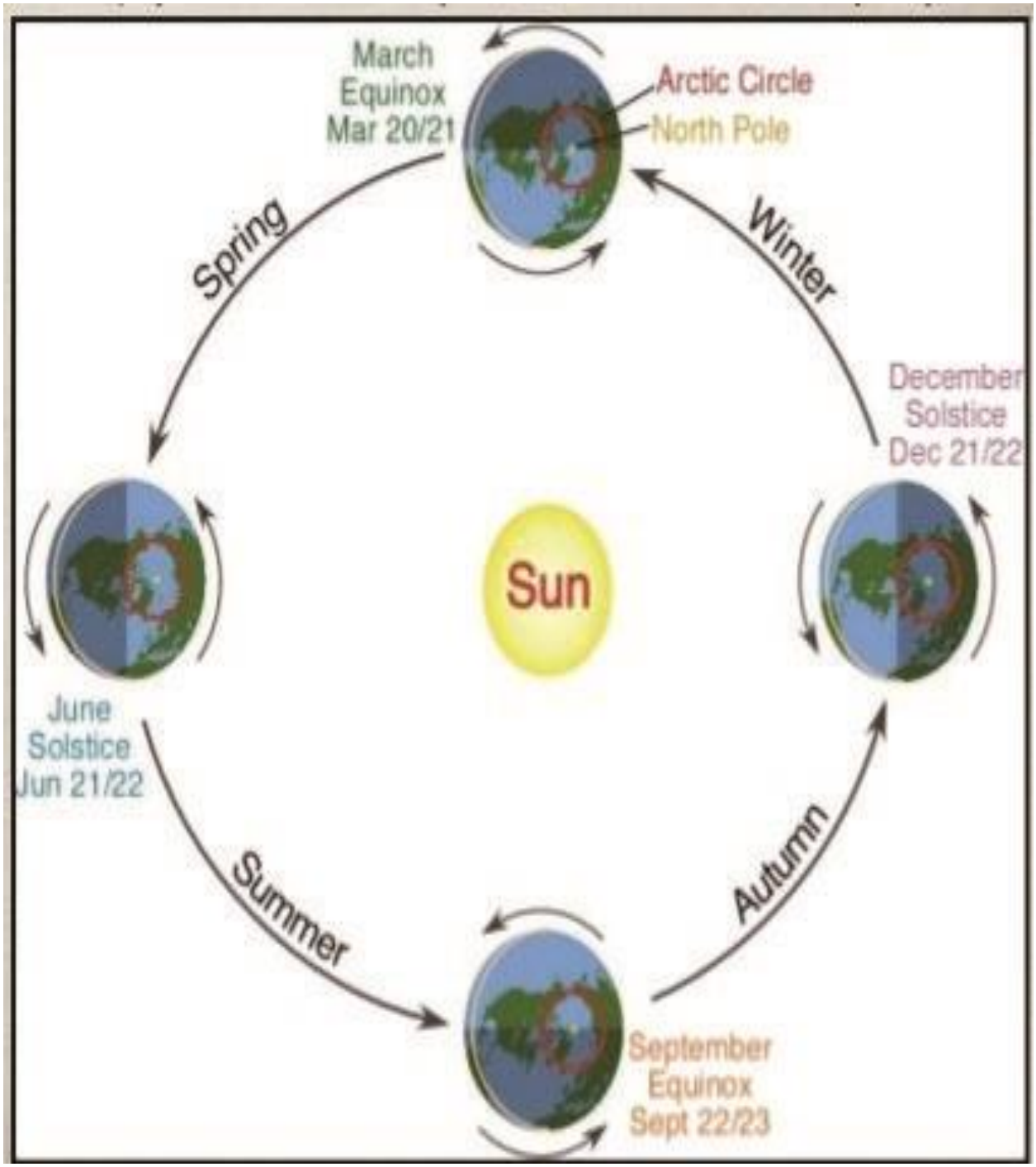
The sun moves from the tropic of cancer to the equator and then towards tropic of Capricorn and back to the tropic of cancer.

21st march and 23rd September are called **equinoxes** because the length of day and night is equal. The sun is vertically overhead at noon at the equator.

21st June is called **summer solstice** because its summer in the N hemisphere. The sun is vertically overhead at noon at the tropic of cancer.

22nd December is called **winter solstice** because its winter in the S. hemisphere. The sun is vertically overhead at noon at noon at the tropic of Capricorn.

Solstice is the period of maximum tilting of the earth towards the sun.


March
Equinox
Mar 20/21
Arctic Circle
North Pole
Spring
Winter
December
Solstice
Dec 21/22
Sun
June
Solstice
Jun 21/22
Summer
Autumn
September
Equinox
Sept 22/23

## Activity 5.5

Study Figure 5.4 above and do the following:

a) Find out the hottest months in places along the equator and are they hot (05 scores)……
……
……
……

b) When is it summer in the Northern Hemisphere?
c) When is it spring in the Southern Hemisphere?
d) When is it summer in the Southern Hemisphere?
e) Conduct internet or library research about how the four seasons influence people's activities and way of life.

**Effects of the Revolution of the earth**

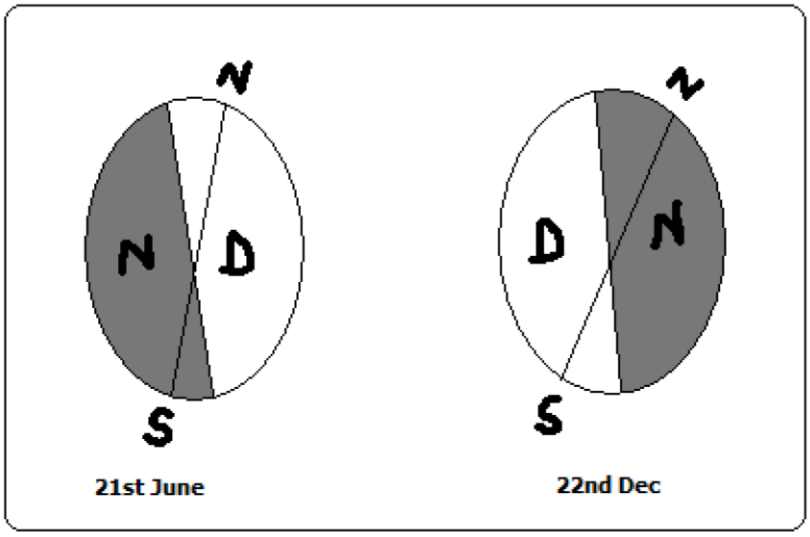
Causes the four seasons summer, autumn, winter and spring due to the movement of overhead sun causing changes in the heat belt.

Causes variation of day and night's lengths due to the earth's axis being inclined to the path of revolution at an angle of 60◦.

Equinoxes have equal lengths of day and night.

Summers have longer days and shorter nights.

Winters have longer nights and shorter days.
Perihelion and aphelion positions
Perihelion takes short distance ie 147.3 million km on 3rd January and aphelion takes 152 million kilometers on the 4th July.
Creation of heat zones eg. Torrid( tropical) located at 23½ north and south of the equator , temperate zone ranges between 23½ to 66½ north or south of the equator, and frizid/ polar zone ranging between 66½ to 90.




Causes changes in the altitude of the midday sun due to the earth's orbit being elliptical.

Highest altitude during equinox

Lowest altitude during solstices

Causes lunar eclipse due to revolution bringing the earth in line with the sun and the moon.

**Effects of the sun on the people's way of life.**

## Why is the Earth Divided into Zones with Different Temperatures?

### Activity: 5.6

Conduct internet or library research about world climate zones and in your notebook:

i) *Draw the earth, mark and name the equator, the tropic lines, and the Arctic and Antarctic Circles.*
ii) *Mark out the tropical, temperate and the polar zones.*
iii) *Describe the characteristics of each of these zones.*
iv) *Explain the other factors that cause temperature differences in an area.*
*v) Share your report with the class through discussion.*

*Chapter 6*

# WEATHER AND CLIMATE

## Activity 6.1: Understanding weather

a) *Look outside. How would you describe the weather around your school?*
b) *What was the weather like around your school yesterday?*
c) *Is today's weather different from that of yesterday or the last three days? If yes, describe the differences.*
d) *In your own words, explain what you understand by weather.*

***WEATHER***

This refers to the atmospheric condition of a given place at a particular time. It is studied and recorded over a short period of time. It may be a day to day or even hour to hour phenomenon varying from time to time, place to place.

The elements of weather include ***temperature, humidity, cloudiness, precipitation, wind direction and speed, amount of sunshine and atmospheric pressure***. Weather affects small or localized area.

Weather conditions are described using words such as ***rainy, windy, cloudy, sunny, misty*****, and *foggy*.** The study of weather forecasting is thus termed as **meteorology.**

### Activity 6.2: Identifying weather conditions

In pairs, study the photographs in Figure 6.1 below and do the following:

a) Identify the different weather conditions in each.
b) Write a paragraph of at least four lines describing the weather conditions in each photograph.
c) Present what you have written to the class.

***Figure 6.1: Conditions in the atmosphere***

***CLIMATE***

This refers to average weather conditions of a place studied and recorded for a ***long period of time*** for example after ***35 years.*** The elements of climate are the same as the element but studied over a long period of time unlike weather conditions, which vary from time to time.

Climatic conditions are relatively stable for a long period of time and also affect large areas as compared to weather with affect small area. The scientific study of climatic condition is referred to as **climatology.**

## What are Elements of Weather?

**Activity 6.3: Understanding elements of weather**

1. In pairs, discuss and list the things you talked about when describing weather in the two activities above.
2. Write them down and share your list with the rest of the class.

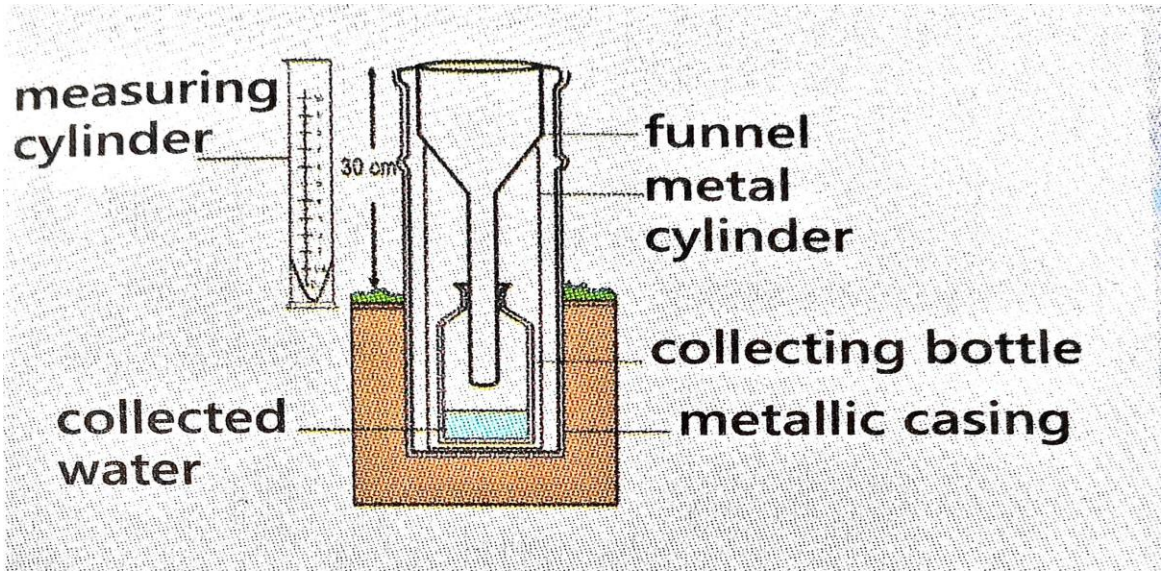
## *RAINFALL*

This is a form of precipitation which involves ting water droplets falling on to earth's surface under gravitational force.

The water droplets form due to cooling and condensing of the water vapor on to the nuclei of pollen grains, dust and smoke particles. The rising air must reach a great height in the atmosphere (the condensation level)

When the water droplets becomes too heavy for the rain bathing low clouds to hold. They fall as rain by the gravitational force. Rainfall is measured using the instrument called ***Rain gauge.***

***The structure of rain gauge.***




The rain gauge must be placed in an open space so that the run of rain droplets from buildings and water droplet from tree do not enter the funnel.

It must also be sunk into the ground for about 30cm or 12 inches in order to obtain collect information.

Rainfall is named according to how moist air is forced to cool and condense into water droplet which finally falls as rain.

**Recording of rainfall on weather maps.**

*Lines are drawn on the map through all places having the same rainfall. They are drawn at a uniform interval. Such lines are called* ***isohytes.***

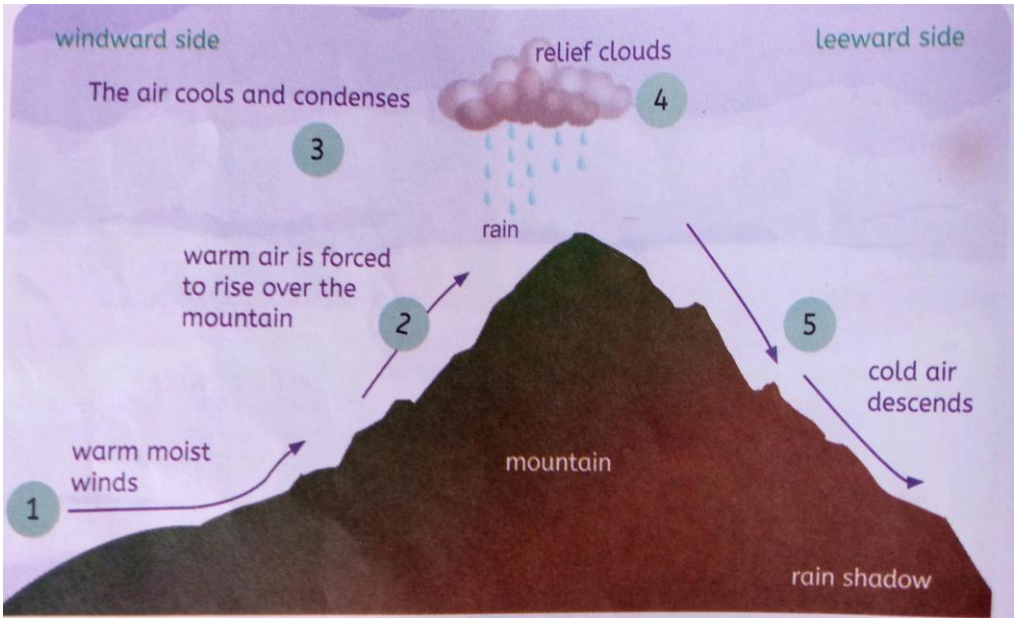
***These are three types of rainfall, these include.***

- ***Orographic/ relief rainfall***

This is the type of rainfall formed when moist warm moving wind or air meets a mountain. The warm moist air is forced to rise upon meeting a highland, the cooling release heat which makes the atmosphere more un stable and this forces the air to continue rising up to condensation level leading to the formation of cumulonimbus clouds hence leading to rainfall on windward side. Such rainfall is received on the western side of Mt Rwenzori, Mt Elgon, and Mt Kenya.

*NB. The leeward side of mountain receives little rainfall and high temperature during dry season as compared to the windward side because it is rain shadow and experiences dry cold wind with little moisture.*

***Illustration of relief (Orographic) rainfall***

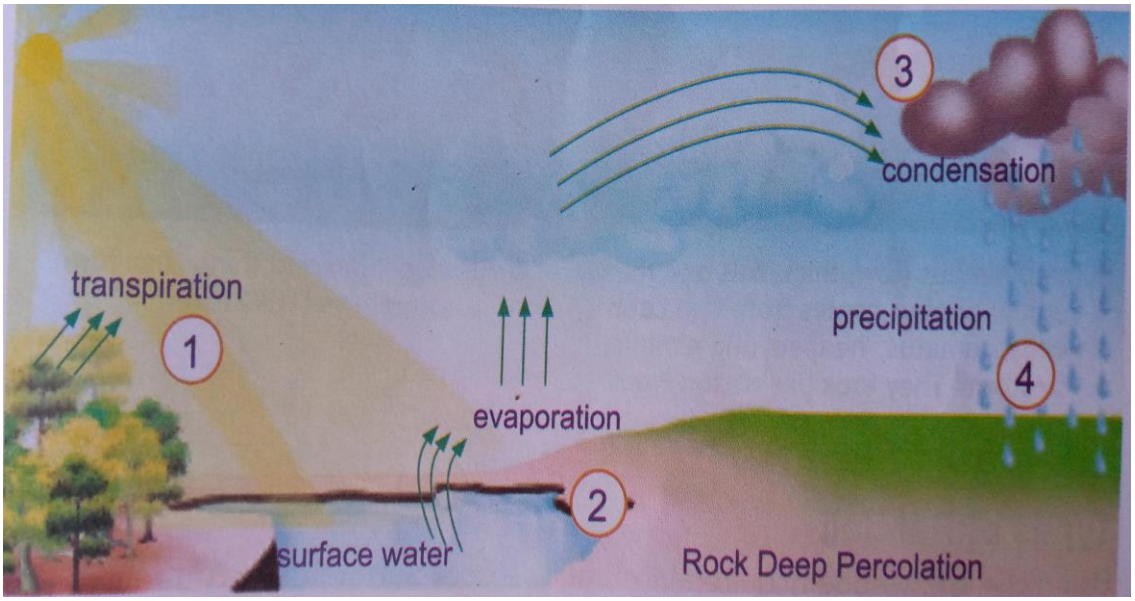


***Convectional rainfall***

This type of rainfall which occurs when the ground surface is heated by the sun's insolation leading upward movement of warm moist air. The air rises and cools to form strato cumulus clouds. The rising air continues to rise and cool to form cumulo nimbus clouds. These result into rainfall accompanied by thunder and lightning. It's usually sudden and falls in the afternoon.

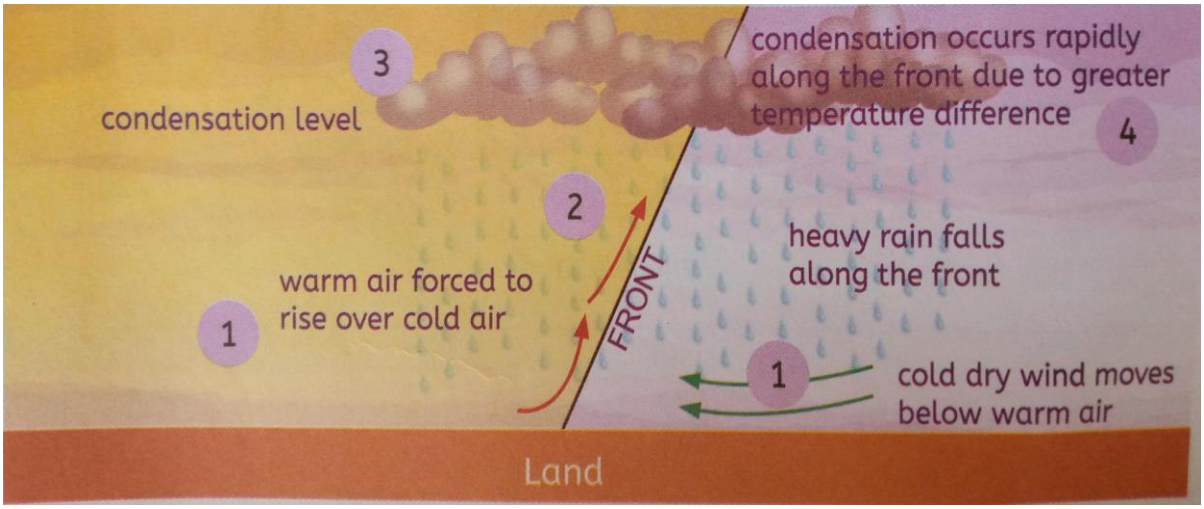
Such rainfall is common around big water bodies, forested areas and swamps for example Entebbe, Kampala, and Mukono. Etc.

***Formation of convectional rainfall.***




- ***Frontal/ cyclonic rainfall.***

This is the type of rainfall that occurs when air masses of different characteristics in terms of humidity and temperature meet. The warm moist air is light and therefore it rises on top of the cold dry air masses. As the warm moist air masses rises it undergoes adiabatic cooling until it forms cumulo nimbus clouds and later precipitates into rainfall.




**01.** *Explain the advantages and disadvantages of rainfall to farmers in your community*

***TEMPERATURE***

Temperature refers to the degree of sensible hotness or coldness of atmosphere of a particle place. Temperature of a place is in hence by number of factors, this includes sun, cloud cover and altitude.

The temperature of a place is measured on the weather station using minimum and maximum thermometer.

**Temperature of the year for station X.**

| **Mouth** | **J** | **F** | **M** | **A** | **M** | **J** | **J** | **A** | **S** | **O** | **N** | **D** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temp | 26 | 23 | 22 | 22 | 22 | 20 | 19 | 19 | 22 | 24 | 26 | 24 |
| R/Fall | 170 | 170 | 236 | 279 | 216 | 127 | 104 | 157 | 185 | 127 | 125 | 1923 |

Adapted: Hickman, G (1995) lands and people of east Africa. P33.

(a) Draw a suitable graph to show the climate of the station.

(b) Calculate

i. Rainfall total

ii. Range of temperature.

(c) Describe the characteristic of the climate experienced at station X

(d) Giving reasons for your answer.

i. State the hemisphere in which the station is located

**ii.** Outline two economic activities that can be carried out around the station.

**The following terms are important in temperature measuring and recording.**

***Daily range of temperature (DRT)***

This is calculated by subtracting the minimum temperature recorded in a day from the maximum temperature recorded in a day.

- ***Mean daily temperature (MDT)***

This is calculated by adding the total of maximum and minimum and then divides the result of number of item.

- ***Mean monthly temperature (MMT)***

This refers to the sum of mean daily temperature divide by the number of days in a month.

- ***Mean annual temperature (MAT)***

This is obtained by getting the sum of mean monthly temperature divided by the number of month in the year. It is divided by 12 mouths. For example.

$$\text{M.A.T} = \frac{26+23+22+22+22+20+19+19+22+24+26+24}{12} = \frac{269^{\circ}c}{12} = 22.4^{\circ}\ C$$

***Mean annual range of temperature. (MART)***

This is calculated by subtracting the lowest mean monthly temperature from highest mean monthly temperatures.

M.A.R.T = Highest mean monthly temperatures – lowest mean monthly temperature.

26°c– 19° c= 7°c

***Recording of temperature on weather maps.***

*A map is used to show temperature for a region.* ***Isotherms*** *are lines used to join areas having the same temperature.*

**Illustration of minimum and maximum thermometer.**

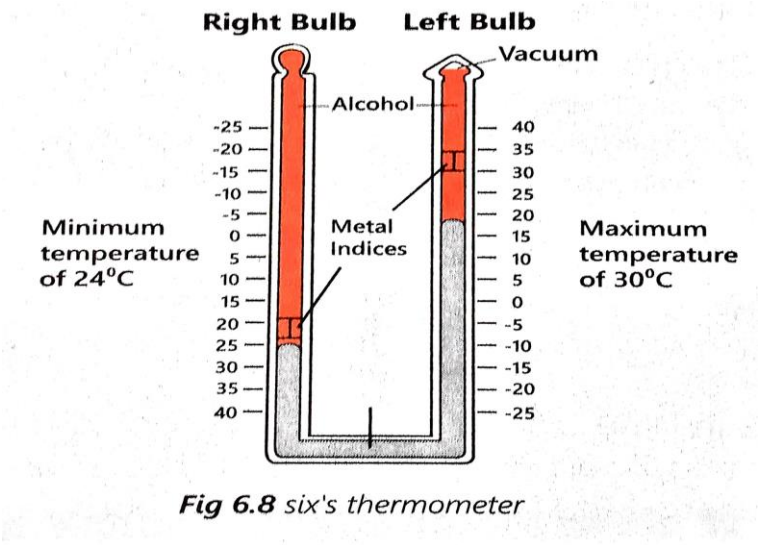



***Fig 6.8*** *six's thermometer*

***HUMIDITY***

This is the amount of water vapor in the atmosphere. It is highly unconstant throughout the atmosphere.

***Relative humidity (RH***) is the actual amount of the water vapor in the atmosphere or air at a given temperature expressed as a percentage of the maximum amount of vapor the air can hold at that given temperature.

When airs contain or holds no more water vapor. It is said to save to saturate and its humidity is 100%

***Absolute humidity (A.H)*** is the amount of water vapor the given volume of air contain.

Absolute humidity is expressed in $g/m^2$. Absolute humidity is usually high on low latitude and it decreases towards the poles.

Humidity is measured by an instrument called the ***hygrometer***. This hydrometer is a combination of wet and dry bulb

***The structure of a simple hydrometer.***

When air is not saturated, the water evaporates from the muslin and it cools the wet bulb and causes mercury to contract. The dry bulb is not affected in the same way and so the two thermometers show different reading.

When air saturated, there is no evaporation and hence no cooling. The two thermometers show the same reading.

The difference between readings is an indication of humidity of the air.

## *ATMOSPHERIC PRESSURE*

Pressure is the weight of air exerts on the surface of the earth. Air show how weight and the pressure exert on the surface of earth.

Atmospheric pressure varies from place to place depending on altitude and temperature of the place and rotation of the earth.

These means that air at ground level is highly greater than that at the top of a mountain. The air at ground level has to support the weight of air above it and the bottom air and molecules must push outwards with a force equal to that exerted by air above it.

To obtain atmospheric pressure at a place, two principle types of barometer.

- Mercury Barometer
- Aneroid Barometer.

***Recording of pressure on weather maps.***

*Lines on the map joining places having equal pressure are called* ***Isobars.***

## *SUNSHINE*

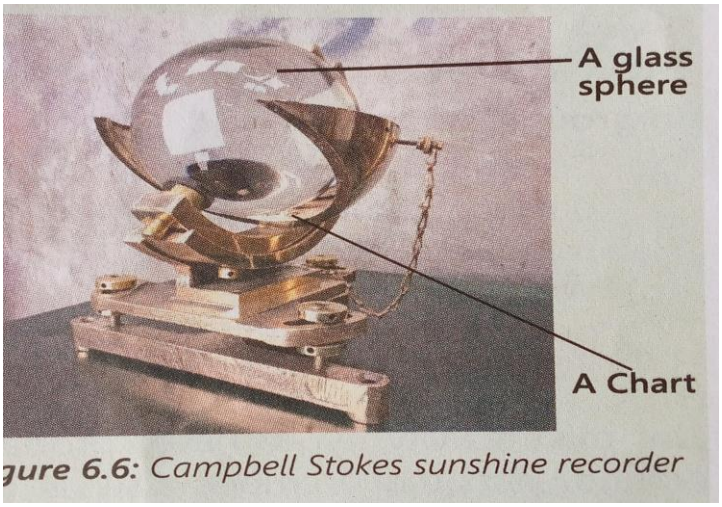
Sunshine refers to the sun's heat received on earth's surface or absorbed into the atmosphere.

**The factors are likely to influence the amount sunshine of place or received by an area include.**

- *Altitude*
- *Latitude*
- *Ocean currents*
- *Distance from the sea.*
- *The amount of the impurities in the atmosphere.*

Sunshine is measured by an instrument called Campbell stock recorder. The Campbell recorder consists of glass, sphere, metal frames and sensitized recording carder sheet.

***Illustration of Campbell stock sunshine recorder***




*gure 6.6: Campbell Stokes sunshine recorder*

*On weather station, **isohels** lines are drawn on climatic map joining places having the same amount of sunshine.*

***WIND DIRECTION AND SPEND.***

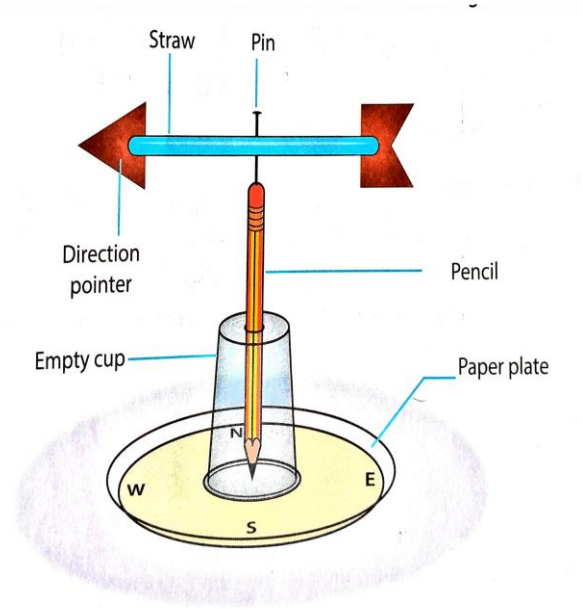
Wind is the horizontal or vertical currents of air which moves from one area of high pressure to area of low pressure.

Wind blow in specific direction of wind is shown by freely allow of wind vane.

A wind vane therefore is used to measure the direction of wind. This instrument consists of the rotating arm pivoted on vertical shaft.

The arrow of the wind vane always point in the direction from which wind is blowing.

***The structure of wind sock and wind vane***




The speed of wind is measured by an instrument called anemometer. It has four arms provided on vertical sheet metal cape

***CLOUD COVER.***

Clouds are masses of small water droplets or tiny ice crystals that float in the air.

A cloud is formed due to cooling and condensing of water vapor, nuclei of pollen grain, dust and smoke in the atmosphere. This results in the formation of water droplets.

Clouds are classified to their appearance form and height. This means that cloud can be divided into 3 major categories.

***Stratus clouds.*** These are sheets or layers of high fog. They appear as flat, white blankets, usually less than 2100m above sea level. These clouds occur in layers and are generally formed by the mixing of two nearly saturated air masses, which have different temperatures.

Stratus clouds are sub divided into stratocumulus and nimbostratus clouds. It appears grey in color and cover wide area. It is associated with heavy rainfall and high relative humidity. \

***Cumulus clouds.*** These are round topped and flat based clouds which form whitish grey globular mass or cotton like features in the sky. It is sub divided into Fracto cumulus and cumulo nimbus clouds.

Cumulo nimbus is formed from air with a high relative humidity and high instability. It is dark looking clouds rising like mountains high into the atmosphere. They occur between height 500 to 9000 m. it is associated with high atmospheric instabilities, torrential or very heavy rainfall accompanied with snow, lightning and thunder.

***Cirrus clouds.***

These are fibrous looking cloud, which often indicate fair weather. They are formed where air is relatively stable and that condensation is taking place by the forced ascent of air cover the warm front of the depression or over a mountain range.

They consist of ting spicules of ice, white or milky in appearance and found at a high altitude 6,000 t0 12,000m.

*On the weather map, lines drawn joining places having an equal amount of cloud cover is called* ***Isonephs.***

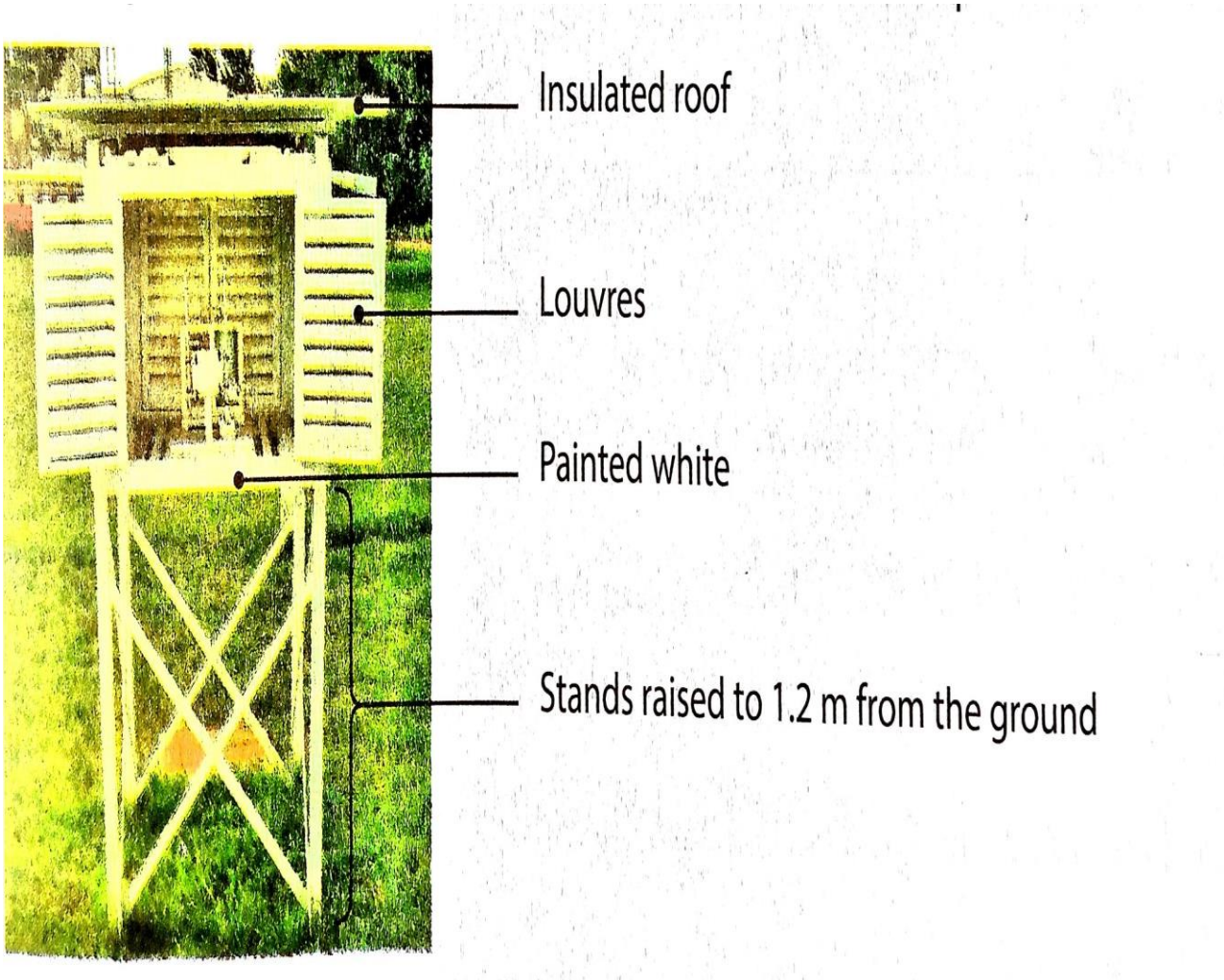
## *THE STEVENSON SCREEN*

This is a wooden box whose major function is to keep instruments of weather and more so the thermometer and hygrometer.

The box is wooden in order for it to only measure the temperature of the surrounding air without any other influence. if it was metallic, it would warm up on being heated by the sun to rise the temperature and eventually give a wrong temperature.

**The screen has the following characteristics.**

- It is painted white to reduce the effect of heat from the sun by reflecting to reduce sunshine intensity.
- It has louvers to protect the thermometer from being moist and allow free circulation of air.
- It is made up of wood because wood is a bad conduct of heat hence preventing sun's heat
- The roof is double boarded to prevent the sun's heat from reaching inside of the screen
- It is placed on a stand of about 120cm above the ground to prevent heat.
- It is placed away from building and tree shade i.e. Placed in open spac
- **Illustration of Stevenson screen**

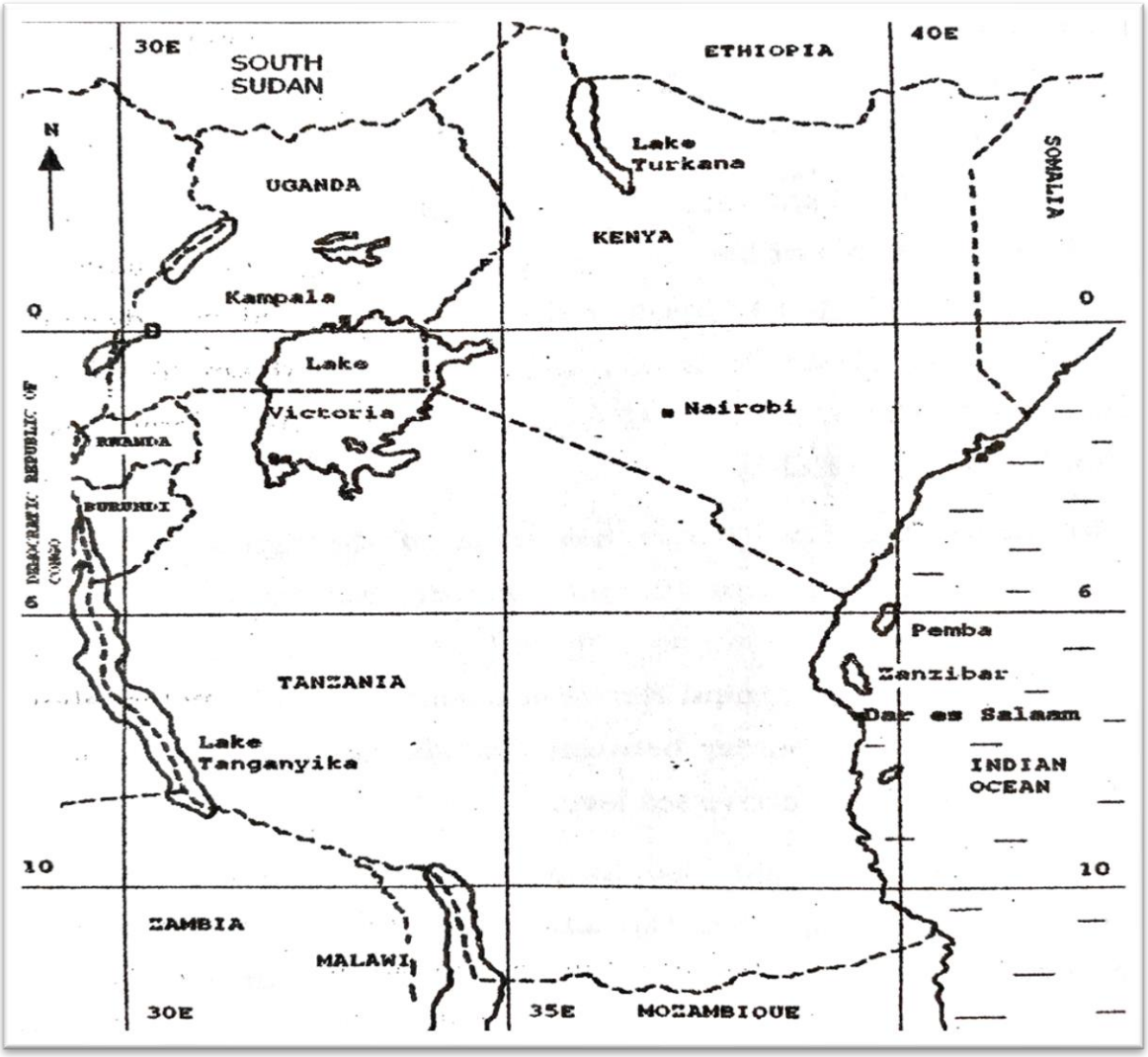


## *Chapter 7* LOCATION, SIZE AND RELIEF OF EAST AFRICA.

### *LOCATION*

East Africa is bordered by Sudan and Ethiopia in the North, Somalia in the North East, Indian Ocean in the East, Mozambique in the South, Malawi in the South west and Democratic Republic of Congo in the West.

East Africa lies astride the equator meaning that it's crossed by the equator which implies that much of East Africa receives rainfall throughout the year.



## POPULATION

East Africa is made up of three major races i.e. the blacks are the majority and Asians plus some few Europeans.

Tanzania has got the highest population closely followed by Kenya and Uganda.

Uganda has got the highest population density.

## RELIEF DIVISIONS OF EAST AFRICA

East Africa is made up of five relief divisions which are;

- Coastal plains (0- 250m above sea level)
- Eastern plateau (250-1100m above sea level)
- East African Rift valley (300-1800m above sea level)
- Central and lake plateau (1000-1500m above sea level)
- East African highlands (1500-6000m above sea level)

### Coastal plains (0-250m asl)

- ❖ This region forms low lying areas along the East African coast bordered by the Indian Ocean.
- ❖ The region is made up of sedimentary rocks due to wave deposition from the Indian Ocean and river deposition.
- ❖ Many rivers flow towards the Indian Ocean along this region e.g. R. Pangani, Ruvuma, Galana, Tana & Athi hence depositing their loads along the coast of the Indian Ocean.
- ❖ Major activities on the coastal plains include Agriculture (sisal growing, cloves, coconuts, cashew nuts); Fishing; Trading; Quarrying; and Tourism.

### Eastern plateau (250-1100m asl)

- From the coastal plains, the land generally raises towards the west.
- Here, Inselbergs (isolated hills and mountain ranges) occur.

- In south East Kenya, the Eastern plateau is called **Nyika plateau**, a Swahili word which means ‘open grassland’.
- The major activities are animal grazing and tourism because Game parks & Reserves can be set up.

## East African rift valley (300-1800m asl)

- ❖ Its sub- divided into two branches i.e. the western arm the Eastern arm.
- ❖ The Western arm stretches from Lake Albert to Lake Malawi (Lake Nyasa). It was formed by compression forces. It is also known as the Wayland rift valley.
- ❖ Eastern arm stretches from Lake Turkana (Lake Rudolf) up to Lake Malawi in Tanzania. It was formed by tension forces. It is also known as the Gregory rift valley.
- ❖ This region contains most of the lakes in East Africa e.g. L. Tanganyika, Albert, Turkana, George, Edward, Tanganyika.
- ❖ Most of these lakes are very narrow and very deep.
- ❖ Economic activities here include; tourism, farming, fishing, wildlife conservation, animal rearing, mining etc.

## Central & lake plateau (1000- 1500m asl)

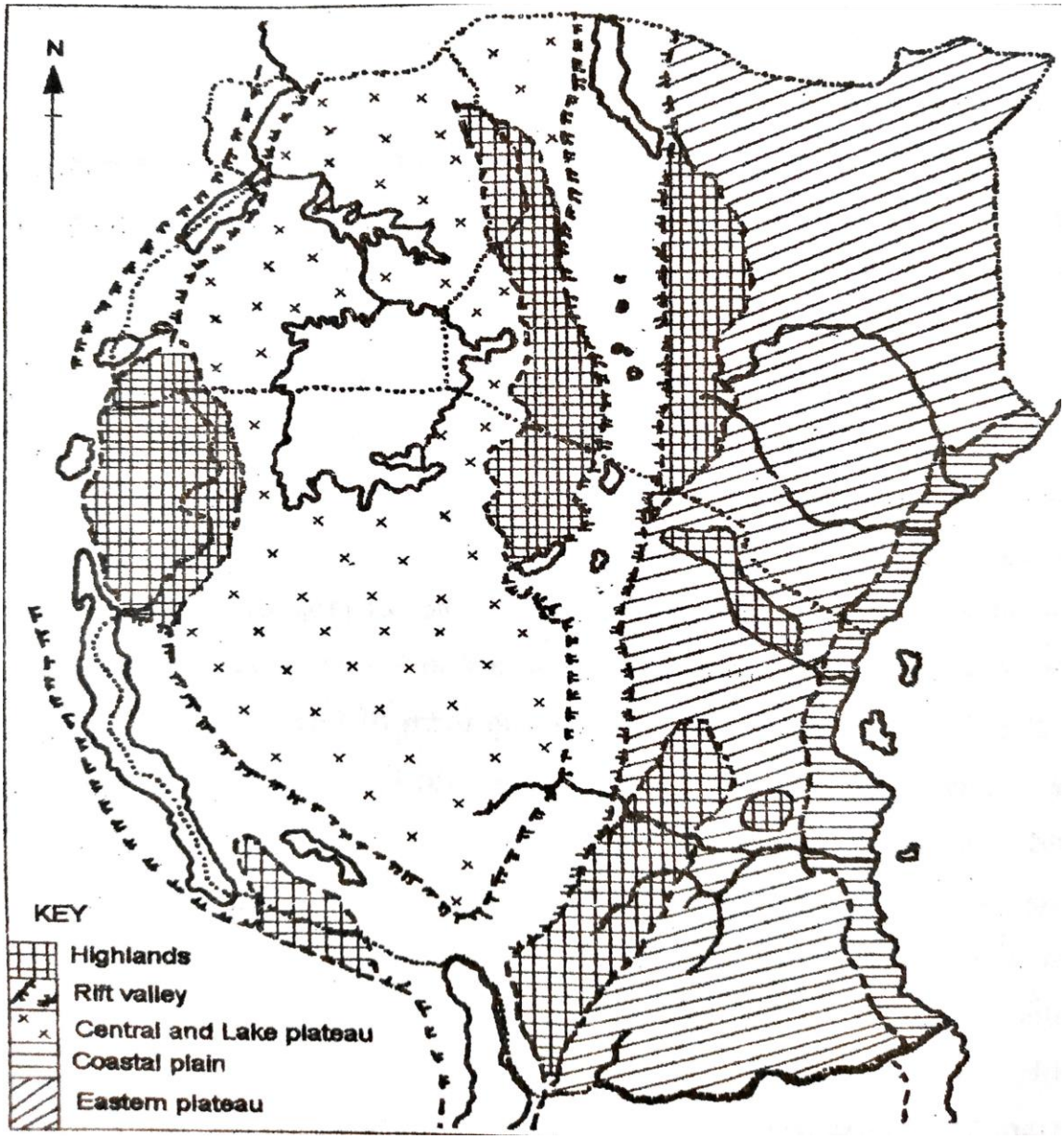
- It’s found between the arms of the rift valley.
- Most rivers pour their water into this region because its saucer shaped.
- It’s an important region because of fertile soils for farming and it has the highest population densities.
- It has down warped lakes i.e. Victoria & Kyoga and it has got major cities and towns like Kisumu, Mwanza, Kampala, Jinja etc.

## East african higlands (1500-6000m asl)

- ❖ Most of the highlands here were formed as a result of folding, faulting, Volcanicity and warping.

- Mountains here include Rwenzori, Kilimanjaro, Elgon, Usambara, Muhavura, Kenya, Uluguru ranges e.t.c. The other highlands include; Kenya highlands, Kigezi highlands, Southern Tanzania highlands, AnkoleBukoba region highlands.
- The high lands have got fertile soils which favour crop growing especially coffee.
- The East African highlands have got the highest population densities in East Africa.

A SKETCH MAP OF EAST AFRICA SHOWING MAJOR RELIEF REGIONS



Chapter 8 .

# FORMATION OF MAJOR LANDFORMS AND DRAINAGE IN EAST AFRICA.

## Landforms in east Africa.

**Landforms** are features that protrudes and projects or makes depressions on the earth 'surface. The features that projects onto the surface of the earth include hills, inselbergs, mountains etc. while the features that make depressions includes basins, valley, craters, caldera etc.,

**Rocks and mineral.** A rock is an aggregate of mineral particles forming part of the earth's crust.

- Rocks may include substances like sand, stones, clay, coral reefs and shingle.

Rocks are mainly classified into three major categories according to their mode of formation.

**(a) Igneous rocks:** These are fire formed rocks or volcanic rocks.

**Formation of igneous rocks**

- Molten rocks/magma under intense heat and pressure beneath the earth crust is ejected through cracks or faults/fissures/ line of weakness/vent onto the earth's surface or within the earth crust.
- When magma reaches the surface of the earth it is referred to as Lava which cools down and solidifies to form extrusive volcanic rocks e.g. obsidian, Basalt, gabbro and granite.
- When magma doesn't reach the earth's surface due to reduced pressure, it cools down and solidifies within the earth crust to form intrusive volcanic rocks e.g. pumice.

**Types of igneous rocks.**

a) **Extrusive igneous rocks.** These are rocks that form on the surface of the earth. They are thrown onto the surface after a volcanic eruption. They are also referred to as **volcanic igneous rocks. e.g Basalt, Obsidian, Andesite, Rhyolite and Pumice.**

**b) Intrusive igneous rocks.** These are due to vulcanism. They form within the earth's interior due to insufficient pressure. They are of two categories namely;-

i. Hypabyssal igneous rocks. These form at an intermediate height. They form near the surface of the earth.
ii. Plutonic igneous rocks. These form at a great depth underground.

## Characteristics of igneous rocks.

- ❖ They are fire formed.
- ❖ They have large crystals when formed underground within the earth's crust (intrusive volcanic rocks).
- ❖ They are fine grained when formed on the surface of the earth (extrusive volcanic rocks). so, they are crystalline in nature.
- ❖ Some igneous rocks are spongy due to presence of gases at the time of formation e.g. pumice.
- ❖ They are very hard and resistant to erosion.
- ❖ Some are glassy in appearance e.g. obsidian.
- ❖ Some are basic and others are acidic depending on the lava type that was ejected. Examples of intrusive igneous rocks include; Quartz, Granite, Diorite, Mica, Dolerite, Gabbro, Granophyre etc.

**Activity 1. Group work: Finding out about igneous rocks**

*a). Carry out a library or internet search about the formation of metamorphic rocks, their types and examples.*

*b). Draw diagrams to illustrate how each type is formed.*

*c). Construct a table to summarize examples of each type of igneous rock.*

*d). Suggest ways in which igneous rocks may benefit people living in areas where they are found and your country.*

## Sedimentary rocks:

These are laid down rocks in different layers called strata. They are formed from the remains of previously existing weathered rock fragments (Particles), dead plants and animals that have been eroded, transported and deposited in various layers called Strata.

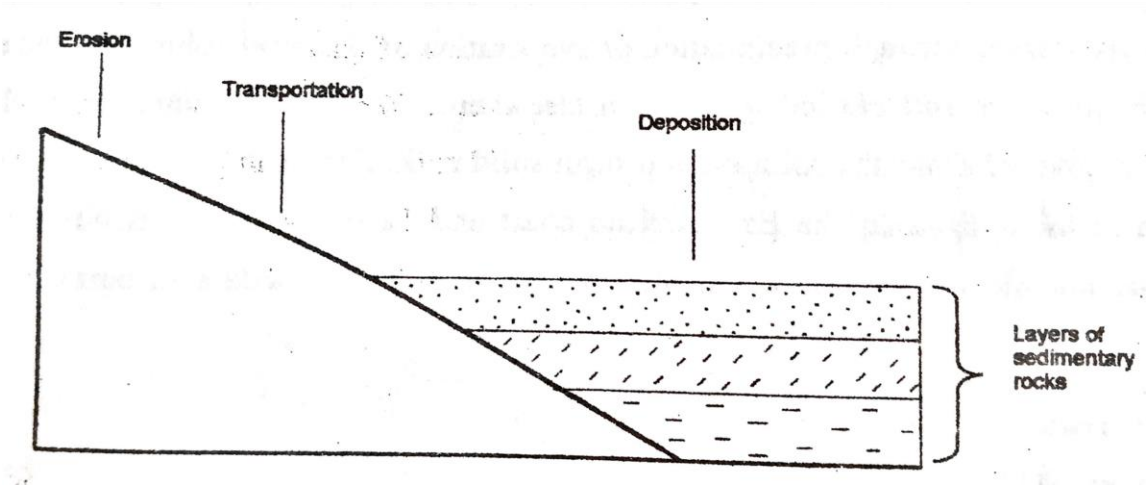
**Formation of sedimentary rocks**

a) These are formed by the process of deposition of sediments like sand, gravel and clay.
b) Deposition is in water or on land as a result of processes like erosion, transportation and deposition.
c) Several rock particles (sediments) are stratified and laid down in layers after deposition. This process is called stratification.

**Types of sedimentary rocks.** Sedimentary rocks are subdivided into three types which are;
**Mechanically formed sedimentary rocks**; These are pre-existing rocks or sediments that are weathered, eroded, transported and deposited in layers by moving wind, ice or water.

The layers are then cemented, compacted, compressed and hardened to form a rock e.g. Ice deposits (moraine), wind deposits (Loess),water can deposit sand stone, clay and mud stones. Other examples include; Shale, Gravel, Conglomerate etc

**Organically/biologically formed sedimentary rocks;** these formed from remains of dead animals and plants which are laid down in layers.
They accumulate in lakes or on land and are then compacted, sealed and compressed to harden and form solid rocks e.g. limestone, coal, petroleum, lignite, peat, Chalk and coral reefs.



**Chemically formed sedimentary rocks**; they are formed after precipitation and evaporation of chemicals from solutions. When mineral particles are dissolved from land by moving water, they are carried in solution form into water bodies such as lakes.

They accumulate at the bottom of the lake in different layers and are compressed and compacted to form a rock e.g. soda ash, Trona, Gypsum, Rock salt and Dolomite.

**Characteristic of sedimentary rocks**

- ❖ They are made of sediments that are found in layers or strata.
- ❖ The strata or layers are separated by bedding planes.
- ❖ They contain fossils or remains of dead plants and animals.
- ❖ They range from fine to coarse texture in their different layers.
- ❖ They are made of rock wastes e.g. precipitates.
- ❖ Some are porous or permeable (rocks allow water to seep through).
- ❖ Some are soft while others are hard.

*Activity 2*

*Conduct an information search on the internet or in the library or in the library and do the following:*

a) *Find out how sedimentary rock are formed.*
b) *Write a description of how they are formed.*
c) *Write down examples of sedimentary rocks.*
d) *Name places in east Africa where the sedimentary rocks are found.*
e) *Make a presentation in class for further discussion*

**(c) Metamorphic rocks:**

These are rocks which have been changed from their original nature i.e. when sedimentary or igneous rocks are subjected to chemical or physical changes of great pressure and heat, there is a change in the physical and chemical nature of the original rock.

If the sedimentary rock is heated, it melts and cools again to form crystals and in this case, it bears characteristics of both sedimentary and igneous rocks.

**Types of metamorphic rocks.**

- Thermal metamorphic rocks. These are formed due to intensive heat and less pressure.
- Dynamic metamorphic rocks. These are formed due to much pressure and reduced heat.
- Thermo-dynamic metamorphic rocks. These are formed due to a combination of both pressure and heat.

**Formation of metamorphic rocks**

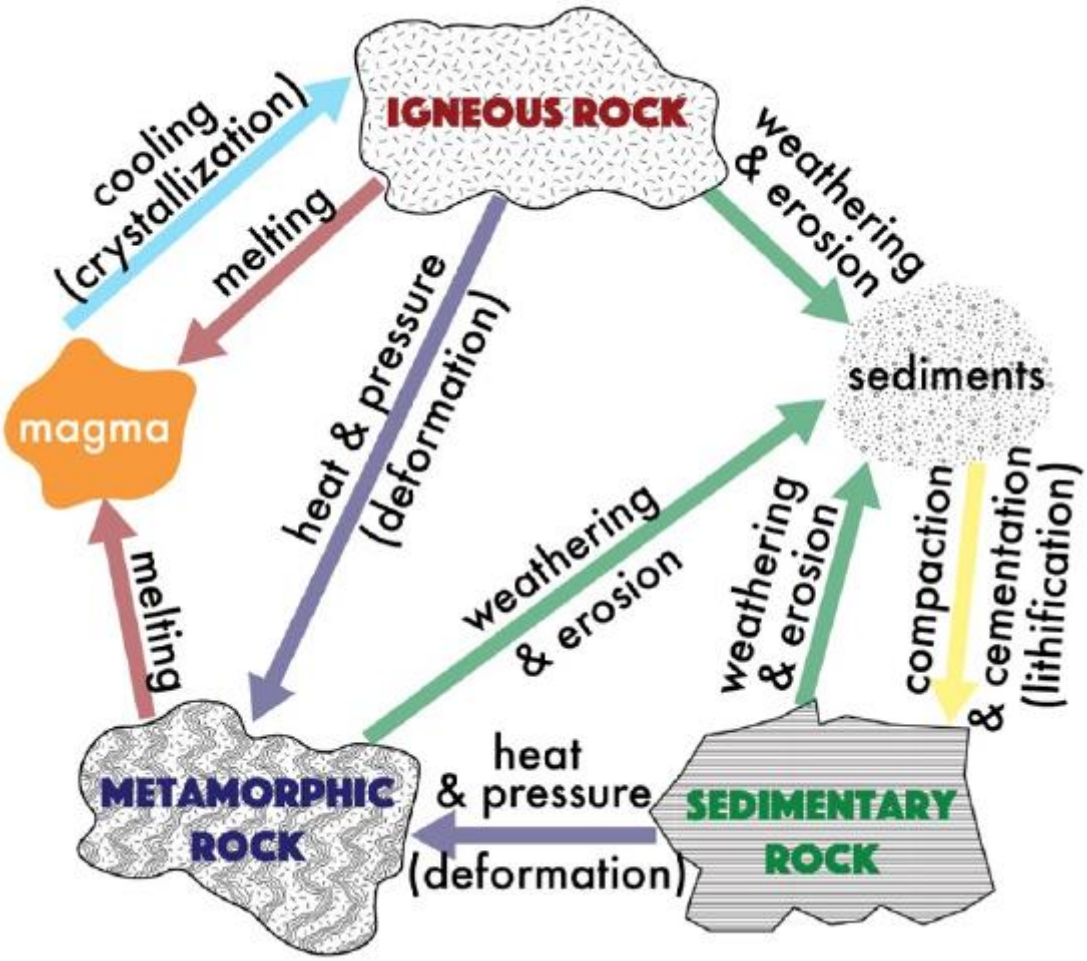
- Pre-existing rocks are subjected to intensive heat or pressure.
- This changes the original rocks into a new form of rocks.
- Metamorphic rocks can be changed/ formed from igneous or sedimentary rocks into other rock types e.g.

| **Original rock** | **Changed form** |
|---|---|
| Limestone | Marble |
| Granite | Gneiss |
| Clay | Schist |
| Sandstone | Quartzite |
| Coal | Graphite |
| Mudstone | Slate |

**Characteristics of metamorphic rocks.**

- They are hardened rocks and resistant to erosion.
- They may contain precious minerals e.g. diamond, marble, slate and schist.
- They are changed rocks from their original nature.
- They form the basement of the continental crust or bed rocks.
- They are foliated rocks (found in thin layers) e.g. schist.

**N.B: Metamorphic rocks are tertiary rocks since they emerge from secondary rocks (Sedimentary rocks).**




**Economic importance of rocks**

**Positive:-**

- ✓ Rocks contain valuable minerals and natural gas that are sold for money e.g. copper at Kilembe, Limestone at Tororo and Kasese (Hima), oil near Lake Albert. This improves people's S.O.L
- ✓ Rocks provide materials for building houses, dams and road construction e.g. Lake sand and murram hence improving people's living standards and efficiency in

mobility/movement.  Rocks give rise to soil formation which supports agriculture e.g. the fertile red volcanic soils along Mt. Elgon in Mbale.

- ✓ Rocky areas provide beautiful scenery for tourism which brings in foreign exchange e.g. the volcanic mountains hence leading to development of infrastructure.
- ✓ Some rocks are used for medicinal purposes e.g. clay for pregnant women.
- ✓ Rocks provide raw materials for industrial development e.g. rock salt used for making salt.
- ✓ Provision of employment opportunities which improves peoples' standards of living e.g. through mining and tourism where workers are paid or earn income.
- ✓ Some rocks are used domestically for grinding e.g. millet.
- ✓ Some rocks are sources of fuel used for boiling and cooking e.g. coal.
- ✓ Rocks such as mountains help to modify climate through the formation of relief rainfall on the wind ward side.
- ✓ Mountains are sources of water for rivers e.g. river Sebwe flows from the top of Mt. Rwenzori and provides water in Kasese and Mt. Elgon is a source of rivers Koitobos, Turkwel, Sippi, Manafa and Malaba. The water is used for domestic and industrial purposes.
- ✓ Rocks are used for study purposes by geologists and students on fieldwork which widens their knowledge scope.

**Negative importance**

- ✓ Rocks act as barriers to transport and communication lines making road construction difficult rendering such places remote.
- ✓ Rocks help in promoting remoteness by limiting trade &commerce due to absence of roads.
- ✓ Mountain tops are too cold limiting agriculture and settlement.
- ✓ Mass wasting (Landslides) occurs along slopes leading to loss of lives.
- ✓ Volcanic eruptions are dangerous hence leading to loss of lives and property.
- ✓ Mountain slopes promote soil erosion and landslides hence hindering agriculture.
- ✓ Some rocks lead to water logging e.g. clay hence encouraging the spread of diseases such as cholera, malaria fever.

- ✓ The leeward side of mountains receives little or no rainfall at all hence limiting agriculture.
- ✓ Some rocks are infertile and don't support crop growing e.g. sand.
- ✓ Some rocks limit navigation and fishing in water bodies e.g. coral reefs at Mombasa.
- ✓ Porous rocks lead to loss of water hence accelerating drought e.g. in Kisoro.
- ✓ Caves are hideout areas for criminals e.g. child sacrifices.

**Relationships between rocks and formation of landforms.**

**Activity 4. Group work***Finding out the relationship between rocks and formation of landforms.*

## LANDFORM EVOLUTION IN EAST AFRICA

Several processes are responsible for the formation of physical features in East Africa. These processes are mainly physical in nature although to some extent man has also been responsible for landform formation. The physical processes are sub divided into two, i.e.

**Endogenic (internal) processes**; These are generated from within the earth crust and are popularly known as earth movements. Such processes include faulting, vulcanicity, folding, warping & earthquakes.

**Exogenic (external) processes;** These are generated on the surface of the earth. Such processes include erosion, weathering, mass wasting, transport and deposition. These processes are generally known as **Denudation processes.**

*NB. Endogenic processes are responsible for building up landforms while Exogenic processes are responsible for wearing down or removal of land forms.*

### FAULTING

It refers to the fracturing or cracking of rocks with in the earth's crust followed by displacement of rocks along lines of weakness. Faults are cracks that develop after rocks have been subjected to both tensional and compressional forces.

Faulting originates from Radio-activity and Geo-chemical reactions within the interior of the earth (mantle and core); generating intense heat that keeps the weak rock in the upper mantle (Asthenosphere) in molten state/ form.

Temperatures within the mantle are very hot exceeding 3700 degrees. This creates pressure and temperature differences between the mantle and the crust resulting into convectional currents.

**Types of faults.**

**Normal faults**. These are due to tension forces.

**Reverse faults**. These are due to compression forces. They are also referred to as abnormal faults.

**Strike** (**Tear**/**wreck**) faults. Here, there are two blocks sliding past each other usually due to tension forces.

**Faulting has been responsible for the formation of several features like;**

**Fault guided valleys.**

This is a valley that comes out of a fault line due to either compression or tension.
e.g. Aswa valley occupied by River Aswa (i.e. a fault guided river valley).

**Fault scarps / escarpments.**

This is a steep side of a rift valley. It is either due to tension or compression.e.g.Nandi escarpment, Mau escarpment, Elgeyo escarpment in Kenya; Butiaba escarpment, Kichwamba escarpment near Lake Albert in Uganda ;and Chunya escarpment and Manyara escarpment near Lake Manyara in Tanzania.

**The Great East African Rift valley with the western arm and the Eastern arm**.

**Grabens**

These are formed as a result of secondary faulting within the Rift valley. Most lakes in East Africa are Rift valley lakes. They are also known as Graben lakes or Tectonic

lakes or fault lakes. Examples of such lakes include Lake Albert, Baringo, Malawi, Naivasha, Turkana, Edward, George and Elmenteita.

**The East African rift valley.** The rift valley is an elongated trough bordered by steep side called escarpments/ fault scarps. It is bordered by two in-facing fault scarps. Two theories have been forwarded to explain the formation of the Great East African Rift valley.

**Tension force theory**:

This was developed by Gregory. Tension forces pull the landmass apart leading to the formation of normal faults. The landmass is then sub-divided into three parts and with continued pulling, the central block subsides / sinks under its own weight to form a rift valley. The side blocks remain standing to form the escarpments.

**Compression force theory:** This was evolved by Wayland. Compression forces push the landmass from either side leading to the formation of reverse faults (abnormal faults).

The landmass is then divided into three parts and with continued pushing; the side blocks rise up leaving the central block in position. The central block then forms the rift valley while the side blocks form the escarpments.

**Economic activities carried out in the Great East African rift valley.**

- Tourism due to the national parks in the rift valley e.g. Queen Elizabeth and Lake Nakuru for flamingos which brings in foreign exchange used to build infrastructure.
- Fishing especially in the rift valley lakes e.g. Albert, George and Tanganyika which provides food to the people.
- Mining e.g. oil from Lake Albert, soda ash from Lake Magadi and salt from Lake Katwe hence providing employment opportunities to improve people's standards of living.
- The Rift valley is also used for animal rearing e.g. Masai pastoralists and the Turkana of Northern Kenya.
- Transport especially water transport on Rift valley lakes e.g. Kazinga channel connects Lake George to Lake Edward and then Lake Edward is used to link Uganda to DRC.
- Hunting especially in the National parks found within the Rift valley.
- Crop growing (Arable farming) e.g. Maize and cotton in the Mobuku irrigation scheme in Kasese.
- Rift valleys are also used for wildlife conservation.

**Problems faced by people living in the rift valley areas.**

- Steep escarpments (Rift valley shoulders) hinder development of transport and communication lines e.g. near Lake Albert hence rendering the places remote.
- Low rainfall is received in the rain shadow areas of the rift valley e.g. in Kasese.
- Rift valley lakes are very deep hence they are poor fishing grounds e.g. Lake Tanganyika.
- Rift valley regions contain soils which are sandy hence not favouring farming.
- Rift valley areas are prone to earthquakes and Volcanicity which are destructive to human survival e.g. in Bundibugyo and Kabarole.
- Steep slopes in rift valley areas hinder mechanization on farms.
- The escarpments are associated with soil erosion which leads to loss of soil fertility e.g. in Bundibugyo.

**SOLUTIONS TO THE ABOVE PROBLEMS**

- ✓ Resettling people away from the rift valley to reduce effects of landslides and earthquakes.
- ✓ Irrigation can be used in the rain shadow areas to provide water for crops.
- ✓ Soil erosion can be controlled through terracing and contour ploughing.
- ✓ Re-afforestation and afforestation can be used to control landslides.
- ✓ Spraying with pesticides to control pests and diseases within the rift valley.
- ✓ Fencing National parks to ensure security of people from wild animals in the surrounding areas.

## BLOCK MOUNTAINS / HORSTS

A horst or block mountain is formed due to faulting.

It is a raised block bordered by fault scarps.

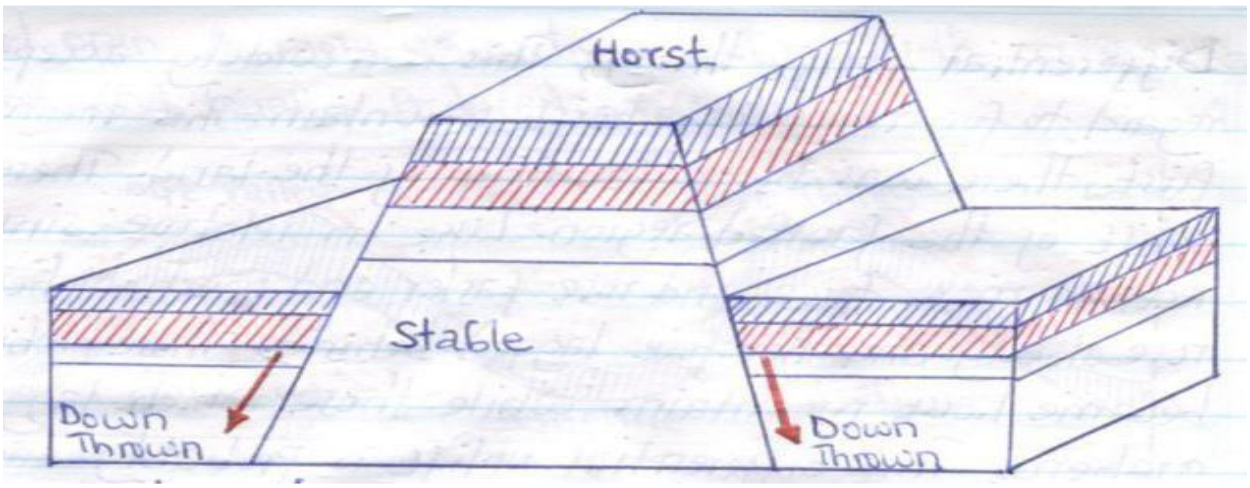
There are many block mountains in East Africa e.g. Mt. Rwenzori in Uganda.

- In Kenya, they include; Aberdare ranges, Mt. Nyiru, Mt. Mathews (Mathews' ranges) and Mt. Ndoto (Ndotos ranges).
- In Tanzania, they include; Usambara, Uluguru, Mt. Pare, Poroto, Mbeya ranges, Iramba plateaus and Ufipa plateau.

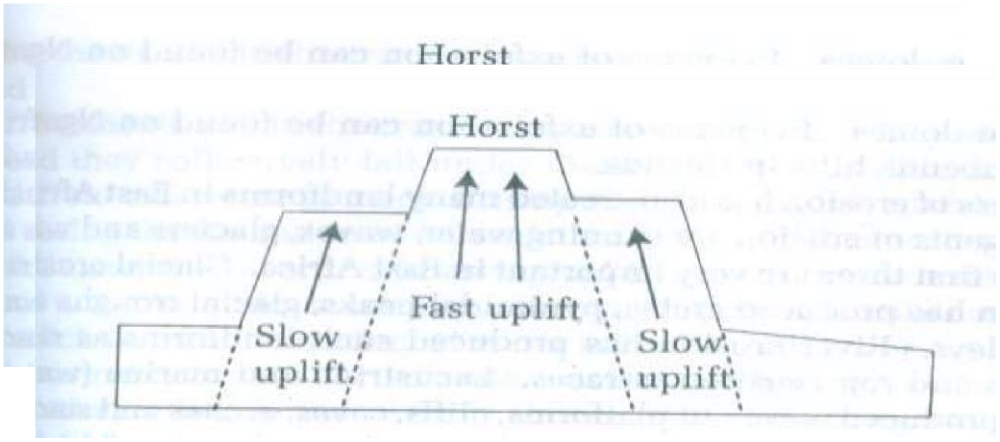
**FORMATION OF THE BLOCK MOUNTAIN**

It's formed as a result of **compression forces** acting on the landmass.

As the forces continue to push in either side, fault lines are formed and the landmass is divided into several blocks.




Due to **differential uplift forces**, the side blocks rise slowly while the middle block rises faster to stand as a horst or block mountain.




**ECONOMIC IMPORTANCE OF BLOCK MTNS**

- ✓ They are tourist attractions hence promoting tourism which brings in foreign exchange hence leading to infrastructural development.
- ✓ Block Mtns are sources of rivers which provide water for irrigation e.g. river Mobuku which originates from Mt. Rwenzori to supply water to the Mobuku irrigation scheme.

- ✓ Rivers along the mountainous areas are used for generation of H.E.P e.g. Mobuku Power Project in Kasese along river Mobuku.
- ✓ Block Mtns help in the formation of relief rainfall on the windward side hence boosting agriculture.
- ✓ Mining is carried out on the lower slopes of block Mtns e.g. copper and cobalt from Kasese.
- ✓ Block Mtns have got forests along the slopes hence promoting lumbering.
- ✓ Block Mtns contain rocks which provide building and construction materials e.g. gravel. They therefore aid quarrying activities.
- ✓ Some act as sources of rivers which provide water for domestic and industrial use. e.g. Mt. Rwenzori is a source of rivers like Nyamwamba, Lubiriha, Rukooki, Mobuku, Sebwe, Rwimi etc.

**Problems faced by people living near the Block Mountains**

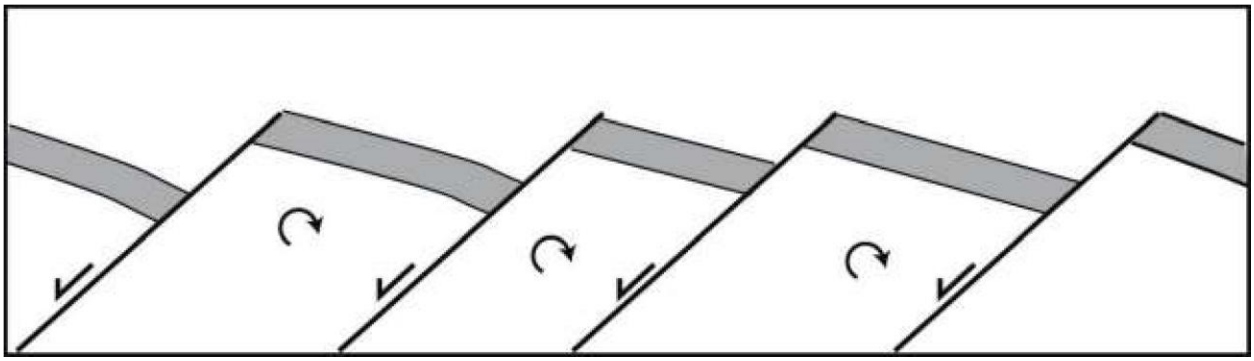
- The leeward side is in the rain shadow hence having dry conditions e.g. Kasese and Ankole-Masaka Corridor and therefore leading to climate demodification.
- Block Mountains are barriers to construction of transport and communication lines hence rendering the places remote.
- Block Mountains accelerate soil erosion which leads to loss of soil fertility hence affecting agricultural output.
- Landslides are common along Mountain slopes which are destructive to human life and property.
- Mountain tops are not suitable for human settlement due to extremely low temperatures.
- Block Mountains are associated with earth quakes which are destructive to human life and property.
- Block Mountains limit the use of machines (Mechanization) in agriculture due to steep slopes.
- Mountains are good hiding places for rebels who cause insecurity in surrounding areas as well as straining the defence budgets.

- Forests along the mountains harbour dangerous wild animals which scares away human settlements.
- The dense population near mountains leads to land fragmentation on the lower slopes leading to low output.

**Tilt blocks.**

These are formed when one side of the middle block is uplifted higher than the other side. It results from differential faulting. The middle block therefore becomes the tilted block. E.g. Kichwamba and Aberdare ranges.

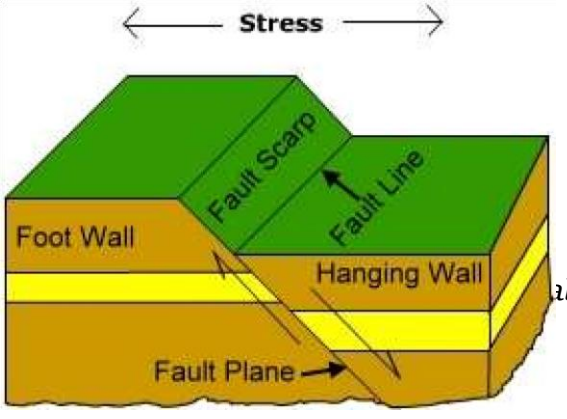
Diagram



**Escarpments/ Fault scarps:**

It is a steep sided feature bordering a rift valley formed when faulting is accompanied by upland or downward movement of parts of the earth's crust.

A fault scarp is where the land falls from a higher level to a lower level and it's also formed as a result of faulting especially the formation of the rift valley.

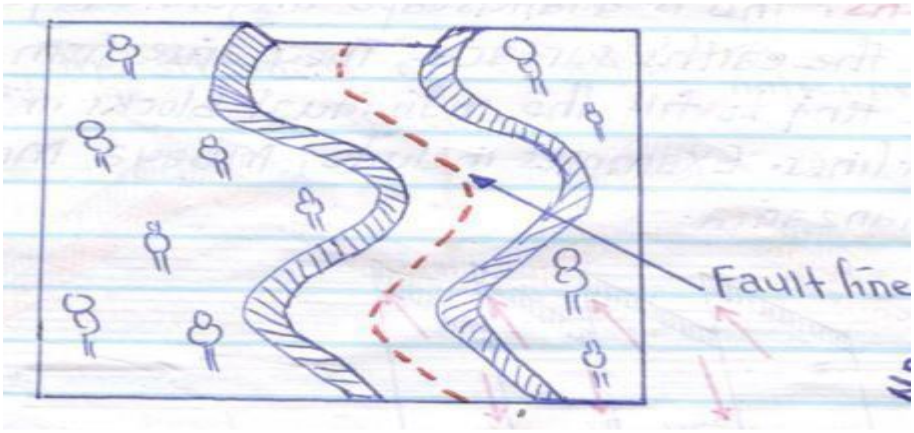


It can easily be modified by of erosion.

Examples can be found near Lake Albert where there is Butiaba escarpment, Kyambura escarpment along Lake Albert and Kichwamba in Fort Portal; Chunya and Manyara in Tanzania; and Nandi, Mau and Elgeyo in Kenya.

**Fault guided valley**

These are valleys formed after creation of lines of weakness (Fault lines) that were formed due to faulting. Rivers flow through the faultlines to broaden/widen them to form fault guided valleys e.g. R. Nkusi and R. Hoima in Western Uganda and R. Achwa in Northern Uganda.




**WARPING**

Crustal warping occurs as a result of the influence of lateral compressional forces which are normally applied on the earth's crust.

These forces make the rocks to react by gently warping to form a new landscape and in East Africa, areas of warping display land that is uplifted and at the same time land that is gently depressed in the Centre.

The uplifting and gentle warping of the basement complex has formed broad plateaus and basins.

Therefore warping involves the disfigurement of the earth's original surface as a result of un- even up warping and down ward movements. These movements are normally gentle and extend over a large area for instance the Buganda area, Kisumu and Mwanza.

Down warping, Uganda's plateau is responsible for the formation of shallow and irregular shaped lakes like Victoria and Kyoga.

These lakes are generally rounded depressions many of which were formed in between uplands. There was reversal of drainage of rivers like Kafu into L. Kyoga and Mara, Nyando, Ngaila, Nzoia, Kagera and Katonga into L. Victoria.

These rivers filled up the down warped depressions with water with the aid of climate (Rainfall).

Illustration

## VULCANICITY

This is a process through which molten rocks (magma) are either intruded within the earth's crust or extruded onto the earth's surface.

Vulcanicity is aided by the process of faulting which forms cracks in the earth's crust through which magma escapes.

When magma is intruded within the earth's crust, it cools down and solidifies to form intrusive volcanic features e.g. batholiths, sills, dykes, lapolith and laccolith.

When magma is extruded onto the earth's surface, it changes to lava leading to the formation of lava plateaus, calderas, craters, hot springs, steam fumaroles and geysers.

**Types of Lava:**

They are three types namely;

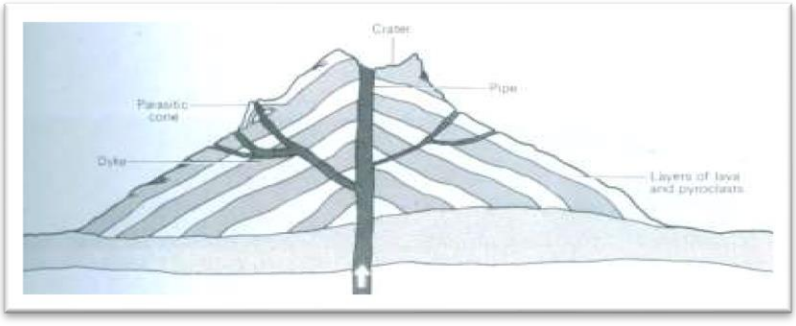
**Acidic lava.** This flows for a short distance from the point of eruption. The lava is highly viscous (thick and sticky) and solidifies even at hot temperatures. It is immobile.

**Intermediate lava.** This flows at an intermediate distance from the point of eruption (vent).

**Basic lava.** This flows for a long distance from the point of eruption. It has low silica content and highly mobile.

**Extrusive features:** These are formed as a result of lava solidifying on the earth's surface. The features formed include;

**Volcanoes**: They are formed as a result of subsequent eruptions through which magma is ejected onto the earth's surface. These volcanoes are mainly made up of alternating layers of ash and lava/cinder hence they are also called **composite cones or ash and cinder cones** e.g. mountain Kilimanjaro, Muhavura and Mt. Kenya.



**Formation of composite volcanoes** These are formed as a result of volcanic eruptions leading to the extrusion of ash and cinder/lava at different intervals. With time, ash and Cinder cones develop parasitic cones e.g. Kibo and Mawenzi peaks on Mt. Kilimanjaro.

**N.B.** Volcanoes are grouped according to their present states.

There are three types of volcanoes i.e.

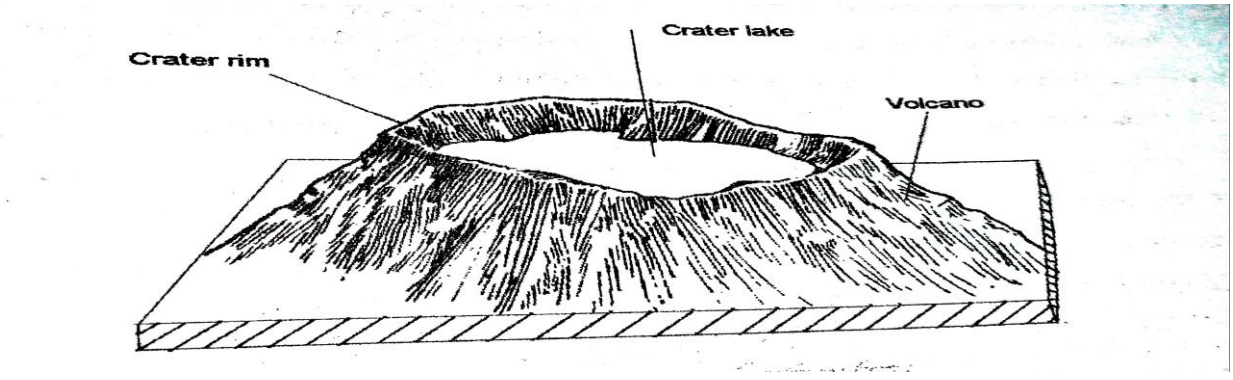
**Active volcanoes**. These are volcanoes which have erupted in recent years and still show signs of eruption e.g. Muhabura/Muhavura (Mufumbiro ranges), Oldoinyo Lengai, and Mt. Longonot.
**Dormant volcanoes.** These have never erupted but still show some signs of eruption e.g. Mt Kilimanjaro, Mt Kenya and Mt. Elgon.

**Extinct volcanoes.** They are volcanoes that have ever erupted and show no signs of further eruptions and **the** original shape of the mountain has been destroyed/modified by denudation processes e.g. Mt. Moroto.

**Crater:**

This is a shallow and funnel shaped depression found on top of a volcanic mountain after a violent eruption. It's formed as a result of magma cooling in the vent without subsiding /sinking back to the magma chamber. When a crater is filled up with water, it becomes a crater lake (Explosion crater lake) e.g. Lake Katwe, Lake Kyamwiiga, L. Nkugute (Rutooto), L. Munyanyange, L. Nyamunuka, L. Nyungu and L. Nyamusingiri.

Many explosion craters are found in Mt. Rwenzori National park acting as tourist attractions.



**Caldera:** This is a large and rounded shallow depression on top of a volcanic mountain. It's formed when violent explosions blow off a mountain top with a crater leaving behind a large and rounded shallow depression. Examples in East Africa include; Ngorongoro, oldoinyo Lengai, Napak and Longonot.

**Volcanic plug:** It's also known as a volcanic neck. It's formed when magma solidifies and cools in the vent. It's then exposed as a result as of erosion leaving behind a hard and resistant rock e.g. Tororo rock and Mwadui plug.

**Lava plateau:** It's an extensive upland formed as a result of ejection of lava through many vents e.g. Kericho plateau, Yatta plateau, Nyika plateau, Aberdare ranges, Kaputiel plains and Kisoro plains.

**Geysers and hot springs:**

These are formed through ejection of hot water and steam from the underground water aquifers. Examples in East Africa include; Sempaya in Bundibugyo and Kitagata in Sheema, Maji-Moto in Tanzania.

**Lava dammed Lakes (**Lava dammed Lake basins)**:**

These are formed when a mass of flowing lava blocks a river channel to form a Lake e.g. Lake Bunyonyi, Lake Mutanda, L. Chahafi, Lake Murehe, L. Kayumba & L. Saka (Kabarole).

**Intrusive volcanic features**

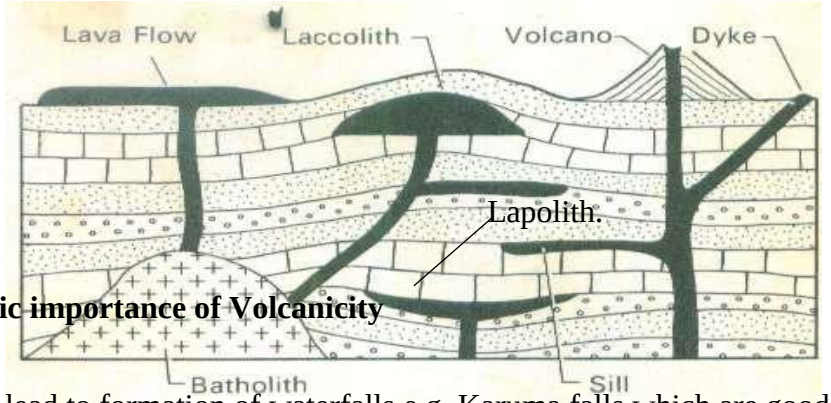
**Batholiths:** This is a very large mass of magma which often forms the root of a volcanic mountain. It is made up of granite and it is formed very deep in the earth's crust but can be exposed on the surface by the denudation forces like weathering, mass wasting and erosion to form an Inselberg. Examples include; Singo in Mubende and the central parts of Tanzania.

**Sill:** It is formed when a sheet of magma is intruded along the bedding planes (horizontally) in the earth's crust. It forms a ridge-like escarpment when exposed by erosion. Sills also lead to formation of water falls and rapids when they are crossed by a river e.g. waterfalls can be seen along Pakwach-Arua road.

**Dyke:** It's formed when a mass of magma cuts across the bedding planes and it forms a wall-like feature. The magma may either be steeply inclined or vertically inclined. Examples of such can be witnessed in East Africa e.g. in the Rungwa complex in Kisumu and Thika falls in Kenya.

**Laccolith:** This is a dome shaped feature formed when magma bulges near the surface. The magma forces the upper layer of the earth's crust to bulge e.g. at Voi in Kenya.

**Lapolith:** This is a saucer shaped feature that is formed when the overlying rocks lead to the formation of depressions on the intruded magma.




**Economic importance of Volcanicity**

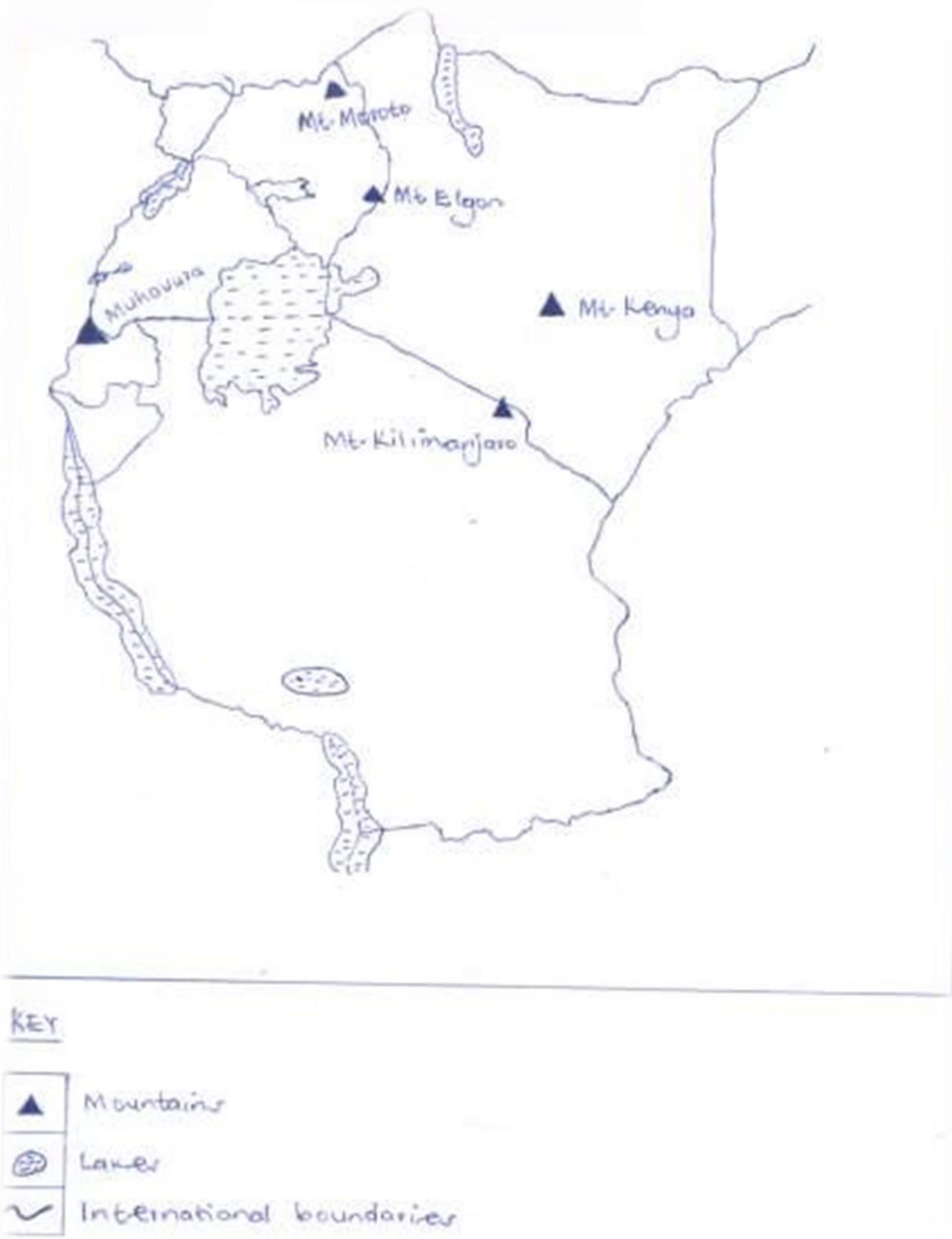
- Sills can lead to formation of waterfalls e.g. Karuma falls which are good sites for generation of hydro-electric power.
- Volcanic Mountains help in the formation of relief rainfall on the wind ward side which supports agriculture.
- Hot springs provide medicinal water e.g. Kitagata hot spring water contains sulphur which is used to treat skin diseases.
- Volcanicity leads to the formation of lakes which provide water for domestic and industrial use e.g. Lake Bunyonyi.
- Crater lakes are a source of minerals which can be sold for money e.g. salt obtained from Lake Katwe hence improving people's S.O.L.

- Volcanicity favors mining because it exposes valuable minerals near the surface of the earth e.g. Diamond mining in Mwadui plug in Tanzania.
- Volcanic features attract tourists who bring in foreign exchange used for national development/infrastructural development.
- Volcanic lava leads to production of fertile soil hence favouring agriculture e.g. coffee growing along the slopes of Mt. Elgon.
- It's a basis for geographical studies hence improving on research and study purposes.

**Negative importance**

- Violent volcanic eruptions lead to destruction of property and human life.
- Volcanic mountains have caused rain shadows on the lee ward side of the mountain hence causing dry conditions that discourage agricultural practices.
- Salty volcanic lakes e.g. Lake Katwe can't support fishing and provision of water for human and domestic purposes.
- Mountains are covered with thick forests which hide dangerous animals e.g. Gorillas, lions and Monkeys which make human settlement very difficult.
- Mountains are used as hide outs for criminals and rebels who destabilize peace and sanity in the surrounding communities hence straining the defence budgets.
- Volcanic rocks that are not fully weathered to provide infertile soils that hinder agriculture.
- Landslides are common along Mountain slopes which are destructive to human life.
- Mountain tops are not suitable for human settlement due to extremely low temperatures.  Mountains accelerate soil erosion which leads to loss of soil fertility.
- Dense population near mountains leads to land fragmentation on the lower slopes leading to land conflicts.

**A sketch map of East Africa showing its major volcanic mountains.**




**DRAINAGE FEATURES IN EAST AFRICA**

## LAKES IN EAST AFRICA

A lake is a mass or a body of water contained within a basin or depression. Most lakes in East Africa are found in the Rift valley and were therefore formed as a result of secondary faulting.

**In East Africa, lakes are grouped as;**

**Volcanic lakes:** These are associated with volcanic activity and they occupy basins formed as a result of Volcanicity.

**Crater lakes** e.g. Lake Katwe, Nyamulagira, Nyungu, Nyamusigira, Kigere, Wabikere in western Uganda.

**Caldera lakes** e.g. Lakes Ngonzi, Menengai, Lake Ngorongoro, Lake Longonot.

**Lava dammed lakes** e.g. Lake Bunyonyi, Mulehe, Mutanda, Ndalaga and Lake Muhondo and Saka(Kabarole).

**Rift valley lakes**: They are also known as fault Lakes / tectonic Lakes/ Graben Lakes. Most lakes in East Africa were formed due to tectonism or faulting.

They were formed as a result of secondary faulting on the rift valley floor. Tension forces acted within the rift valley and secondary faults developed. This forced the land to sink forming a valley within the rift valley.

When it's filled up with water, it forms a rift valley lake e.g. Lake Albert, Lake Edward, Lake Eyasi, Nakuru, Amboseli, Bogoria, Naivasha, Manyara e.t.c.

Rift valley lakes are very deep with steep sides which have greatly hindering fishing.

**Crustal warped lakes**:

These were formed as a result of down and up warping.

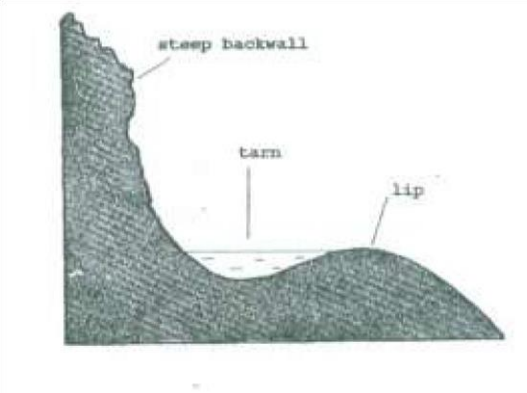
Down warping leads to the formation of the Lake basin while up warping on the sides causes river reversal.

The reversed rivers fill the depression in the middle to form a lake e.g. river Nzoia, river Kagera and river Katonga reversed their flow, to fill up the depression occupied

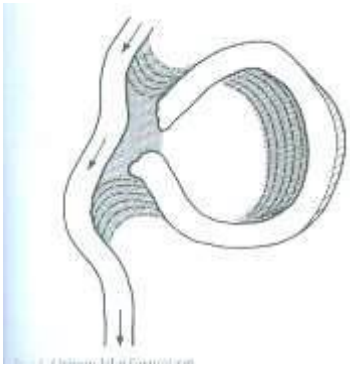
by Lake Victoria.  Other crustal warped lakes include: Lake Kyoga, Lake Wamala, Kijjanebarola, L.Nakivali, L. Kwania,Lake Bisina and Lake Opeta.


**Manmade lakes**: formed as a result of man creating a dam along a river channel. When a dam is set up along a river, it blocks the flow of a river's water. The held up water is forced to pond back and form a lake e.g. Lake Kindaruma on river Tana, Lake Kibimba on river Kibimba. Other manmade lakes include Kabaka's Lake near Mengo, Martyrs lake in Namugongo, L. Kajjansi.

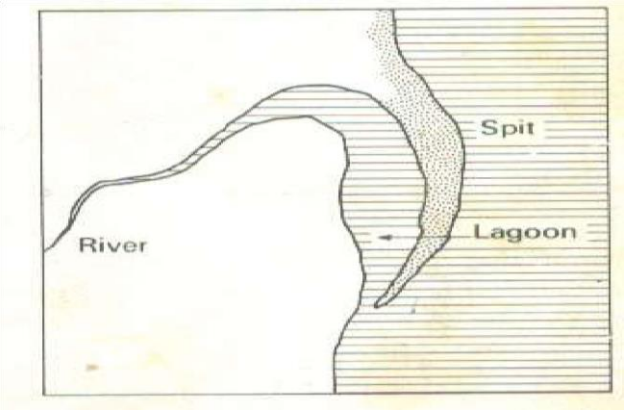
**Glacial lakes**: These are formed as a result of glacial erosion through processes like back wall recession, sapping, plucking and abrasion which form a depression along glaciated mountain slopes that appears in the shape of an arm-chair. They are also known as Tarn lakes or cirque lakes e.g. lac- du-Speke, lac- du-Stanley, lac-du-Catherine which are found on Mt. Rwenzori. Other glacial lakes include: Tyndal tarn and Teleki tarn on Mt. Kenya; and Mawenzi tarn on Mt. Kilimanjaro.




**Ox-bow lakes**: They are found along river courses in the old stage or senile stage or lower course of the river. They are formed as a result of river deposition leading to the creation of meanders. These meanders are later cut off from the main river leaving behind a horse-shoe shaped Lake e.g. along river Rwizi in Mbarara, along river Nzoia, river Nyando,R. Tana and river Kilombero and R. Rufigi in Tanzania.



**Lagoon lakes**: They are formed as a result of wave deposition along the coast line or shore line of the lake. Long shore drift along the shores leads to the formation of spits and sand bars which cut off the lagoon lake e.g. Lake Nabugabo in Masaka was cut off from Lake Victoria. Other lagoons are also found at Mombasa.




**Solution lakes**: These are lakes found in limestone areas. They are formed as a result of water dissolving the calcium within rocks to form small basins. When these basins are later filled up with water, they form solution Lakes e.g. Lake Nanyuki. These lakes tend to be seasonal and only appear during the wet season.

**Rock basin lakes:**

These are formed by the scouring action of ice resulting into creation of a shallow hollow/depression which is then filled with water. With an increase in ice, it over deepens the rock basin to form a lake. Examples include Lac Verti on Mt. Rwenzori and Michaelson on Mt. Kenya.

**Economic importance of lakes**

- ✓ Lakes are tourist attractions and hence earn the government a lot of foreign exchange e.g. Lake Victoria used to develop infrastructure.
- ✓ They also act as natural habitats for wildlife e.g. Lake Nakuru in Kenya and L. Munyanyange in Kasese are well known for flamingos which also attract tourists.
- ✓ Some lakes are sources of minerals e.g. Lake Magadi for soda ash, Lake Albert for oil and natural gas, Lake Katwe for salt hence boosting industrialization and employment.
- ✓ Mining on lakes has led to the development of industries which provide employment e.g. Soda ash from Lake Magadi has led to development of glass manufacturing industry hence improving people's S.O.L.

- ✓ Lakes are favourable fishing grounds e.g. Lake Victoria for tilapia and Nile perch, Lake Tanganyika for Dagaa, Lake Kyoga for moon or silver fish and haplochromis also known as Nkejje fish.
- ✓ Lakes help in the modification of climate through formation of convectional rainfall which boosts agriculture.
- ✓ Lakes provide water for domestic and industrial use e.g. cooking and washing.
- ✓ The shores of some lakes are fertile grounds hence favoring farming e.g. Robusta coffee grows well on the shores of Lake Victoria.
- ✓ Lakes also provide water for industrial use e.g. cooling machines and also used as a raw material e.g. manufacture of soda and breweries, fruit canning.
- ✓ Lake shores provide building materials e.g. Lake Sand from the shores of Lake Victoria at Entebbe.
- ✓ Lakes provide water used for irrigation e.g. Lake Kindaruma provides water used at MweaTebere irrigation scheme.
- ✓ Some lakes act as natural boundaries between countries e.g. Lake Albert, Lake Victoria, Lake Tanganyika and Lake Malawi hence minimizing border conflicts.
- ✓ Lakes are also used for transport e.g. Lake Victoria which connects Uganda with Kenya and Tanzania.
- ✓ Swampy lake shores have provided clay and papyrus which have led to development of art and crafts industry.

**Negative importance**

- Lakes are used for smuggling purposes which leads to loss of government revenue e.g. Lake Victoria.
- Lakes with swampy shorelines act as good breeding grounds for disease spreading vectors like mosquitoes and snails e.g. Lake Kyoga and Lake Victoria.
- Lakes act as habitats for wild animals which scare away human settlements e.g. crocodiles, hippos e.g. Lake Mburo.
- Lakes are subjected to floods during heavy rains which endangers peoples' life.

- Waves on lakes cause accidents which claim many peoples' lives.
- Lakes have made the construction of roads and railway lines very difficult.
- Lakes with swampy shorelines are also used as hiding places for criminals and rebels hence destabilizing peace in the surroundings.
- Some lakes have got floating vegetation e.g. papyrus and water hyacinth which hinder navigation or water transport e.g. Lake Kyoga.

## RIVERS IN EAST AFRICA

A river is defined as a mass/stream of flowing water from its source to the mouth in a defined channel or valley on the surface of the earth. A river has got a life cycle along its profile.
A river profile refers to a measured slope along which a river flows from its source to its mouth.
A river profile is sub divided into three stages:

- Youthful / torrent / upper course/ juvenile/young
- Mature /middle course
- Old /senile/lower course.

N.B: River sources are found in high altitude areas especially highlands or mountains and the river's mouth is always found at low altitude e.g. a lake, ocean or sea.

**Characteristic features along a river profile**

**Youthful stage**

- Water flows very fast due to steep gradient.
- It mainly erodes vertically due to fast flowing water. (Deep under cutting)
- The river flows in a V-shaped valley due to head ward erosion & vertical erosion.
- Waterfalls, rapids, cataracts, potholes and plunge pools, interlocking spurs are common features at this stage along the profile.
- The load consists of big rock particles.

**Middle stage**

- The gradient becomes more gentle.
- Major activity is transportation of material eroded (load) in the first stage.

- Lateral erosion is very common i.e. erosion on the sides/banks of the river valley.
- U-shaped valleys are formed because of erosion on the sides.
- The load consists of fairly rounded rock particles.

**Old stage:**

- The gradient is very gentle.
- The river flows very slowly.
- Deposition is the major activity.
- The load consists of very fine rock particles.
- The river develops meanders due to deposition of materials.
- Features formed in this stage include deltas, floodplains, levees, alluvial fans, estuaries, braided channels and ox-bow lakes

**N.B:** (i) The general term given to material transported by a river is **Load**.

(ii) The general term given to the material deposited by the river is **silt or alluvium**.

**Major terms used under river action**

- ✓ **River confluence:** This a meeting point of two or more rivers.
- ✓ **River regime:** Refers to the seasonal variation/fluctuations in the amount of water carried by the river.
- ✓ **River rejuvenation:** This refers to the renewed erosive potential of a river after the old stage.
- ✓ **Catchment area/water shed:** It's an area that is drained by a river and its tributaries and it is usually a source.
- ✓ **River divide:** It refers to a ridge/highland that separates two or more rivers. It is a piece of land that separates two or more rivers.
- ✓ **River capture:** It's the diversion of the headwater from a weaker stream into a much stronger stream.

- ✓ **Interfluve:** It is a piece of land that separates two subsequent streams (tributaries). **Long profile:** This is the distance between a river source and its mouth.
- ✓ **Cross profile:** This is the distance between the banks of a river.
- ✓ **Tributary:** This is the small river (Subsequent stream) connecting to a main river ( Consequent stream).
- ✓ **Distributary:** This is a small river connecting to a tributary.
- ✓ **River Source:** A point where a river starts flowing from.
- ✓ **River Mouth:** A point where a river ends.
- ✓ **Competency:** This is the ability of a river to carry its load.

# River Erosion:

1. **Vertical Erosion**:

This is when a river digs into its bed through abrasion leading to deepening (Increased deepening) of the bed. It is common in the upper stage of the river.

11. **Lateral Erosion**: This is the wearing away of the river sides (banks) leading to the widening of the river valley.

111. Head-ward(Backward) Erosion:

This is when a river cuts back at its source hence increasing its length and material eroded.

**A river carries out erosion in four major ways;**

**Hydraulic action:** It occurs when the water enters the cracks or jointed rocks and it breaks some rock particles.

**Abrasion/Corrasion:** It occurs when the load of a river rubs against the sides and valley bottom of the river channel hence breaking the rocks into smaller particles due to friction in water.

**Solution/Corrosion**: Here a river dissolves certain materials from the valley sides and bottom and transports them in a solution form e.g. limestone and Calcium can be dissolved and transported in water.

**Attrition**: It occurs when the load of a river rubs against each other during transportation hence becoming smaller and smaller rocks.

**River transportation**:

**Solution:** Materials are dissolved in water are then transported in a solution form by a river. This takes place in areas with soluble rocks like limestone and rock salt.

**Traction:** this involves transportation of large and heavy materials where the load is rolled down along the river bed.

**Suspension/ siltation:** This involves transportation of lighter materials within or they float on top of the water.

**Saltation:** This is a process where small particles (small stones are carried downstream along a river bed.)

**RIVER DEPOSITION**

The deposition of materials carried by a river occurs mainly in the lower course. Deposition occurs when;-

- ✓ there is reduced water volume in a river
- ✓ there is reduce speed
- ✓ the river competence reduces.
- ✓ the gradient/slope decreases
- ✓ the river meets stagnant water.

During deposition, heavy materials are deposited first followed by small and fine particles.

**FEATURES PRODUCED BY RIVER EROSION.**

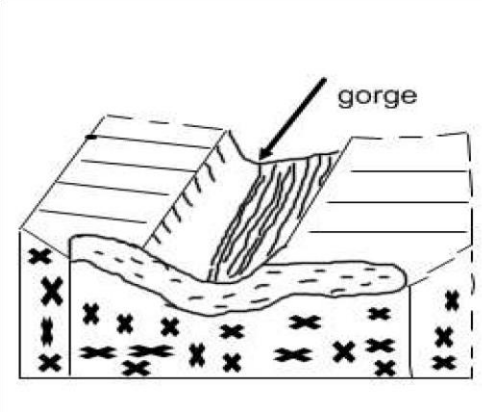
**V-shaped valley:**

This is a narrow valley with steep sides. It is formed due to vertical erosion (under cutting) of a river bed. It is formed when vertical erosion is more dominant than lateral erosion. **Diagram**

**Gorge:**

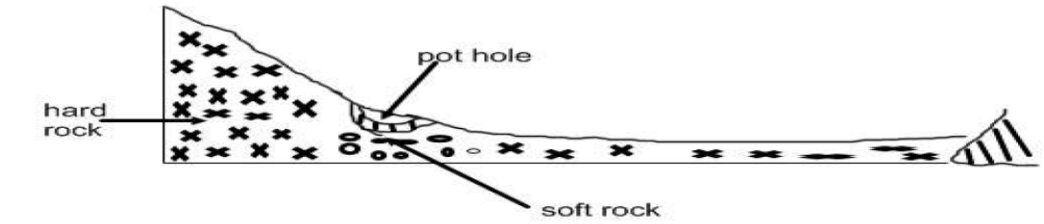
This is a narrow deep steep sided river valley. It is formed due to over deepening of the valley floor by vertical erosion. Examples include Mitano gorge on R.Birira in western Uganda and on river Ruaha in Tanzania.

Diagram




**Potholes:**

These are circular/round depressions formed on the bed of a river. They form where water moves in a circular motion especially where the river bed is uneven. When this happens, the stones and pebbles in the water erode the river bed to form deep circular depressions called potholes. Examples can be found on river Athi in Machakos Kenya. Diagram




**Waterfall:**

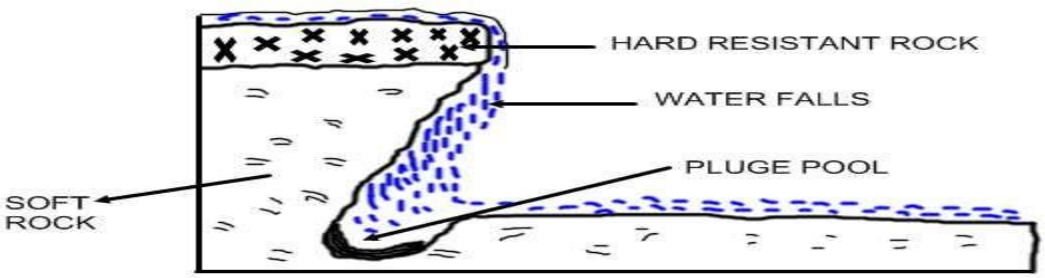
This is a sharp break in the river's bed that causes water to suddenly fall from a high level to a lower level. Waterfalls are mainly found in the upper course of river. Sometimes, it may occur in the middle stage/course.

Waterfalls occur due to the following conditions;-

- ✓ When a layer of resistant rocks lies across the river bed either laterally or vertically.
- ✓ When there are alternate hard and soft rocks on the river's bed. (Heterogeneous rocks)
- ✓ When a river flows over a cliff.
- ✓ When a river flows over a fault scarp.
- ✓ When a river descend over a hanging valley into a glacial trough

Examples of waterfalls in East Africa include; Murchison falls, Sippi falls, Webuye falls, Bujuku falls, Sezibwa falls, Karuma falls etc

Diagram



**Plunge pool:**

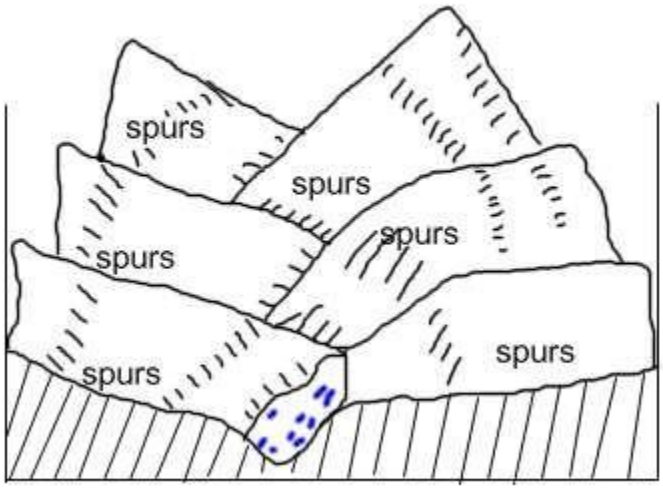
It is a depression that is created at the base of a water. As waterfalls from a higher level to a lower level, the rocks carried by the water erode those at the base of the waterfall hence creating a depression into which water settles.

**Interlocking spurs:**

These are series of protrusions of land lying between winding course of a valley formed where a river flows along the channel which has alternating hard and soft rocks at the river banks.

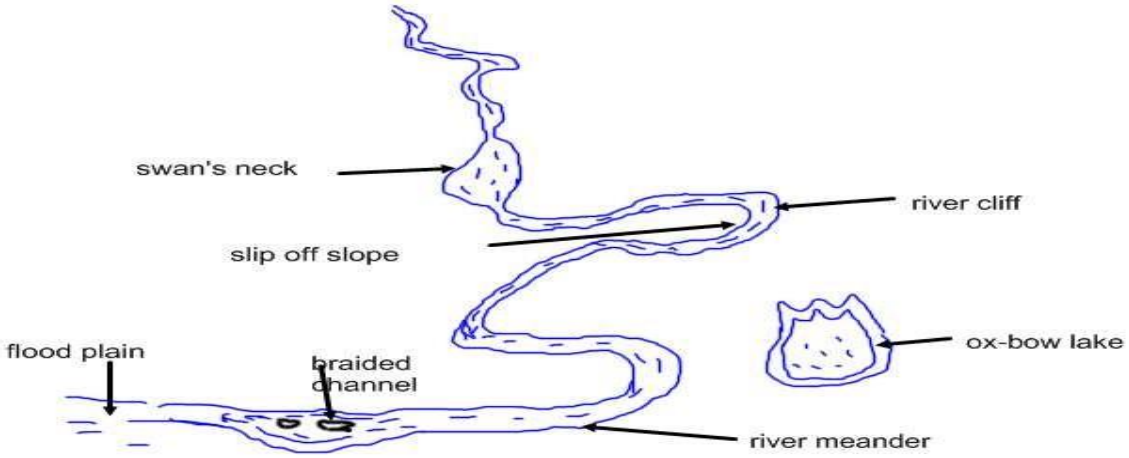
Vertical erosion rapidly deepens the valley which forces the river to twist its flow and turns around the obstacles of the hard rocks.

Erosion becomes pronounced on the bends/curves and this leads to the formation of spurs as the resistant out crop rocks are curved by rapid river flow. The spur alternate on each side of the river forcing them to interlock/join together.

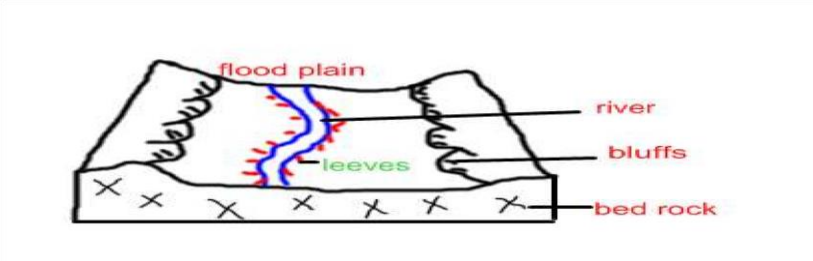


FEATURES ASSOCIATED WITH RIVER DEPOSITION.

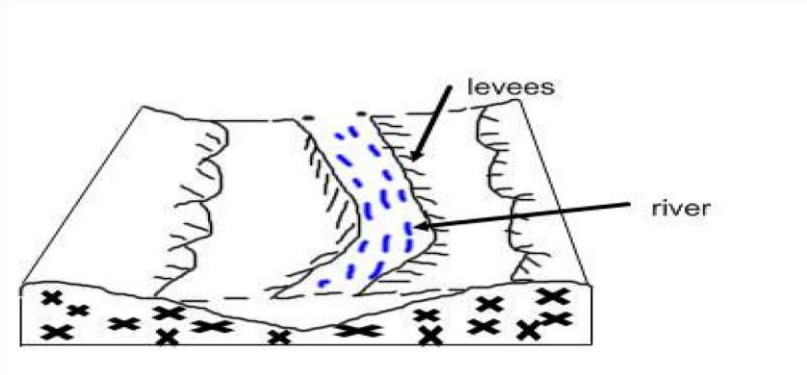
**Meanders**: These are wide curves/bends/loops of a river channel as it moves sluggishly through the lower course. It gradually widens its valley by lateral and vertical erosion. The meanders begin to develop mainly due to; existence of obstacles like hard rocks; occurrence of massive deposition on the river bed forcing the river to avoid the raised part of the river channel; and decrease in the river gradient, thus the reduction in the channel slope reduces the river energy to erode and it deposits all carried load.




**Flood plain:** This is a lowland/flat plain of alluvium on the floor of a river valley. It's formed when the river widens its valley by eroding on the concave banks and deposition on the convex bank. With time, the spur ends are cut widening the valley and depositing sediments with in it. It's formed when the river floods over its banks. Examples include; river Manafwa, river Ngaila, river Rwizi.

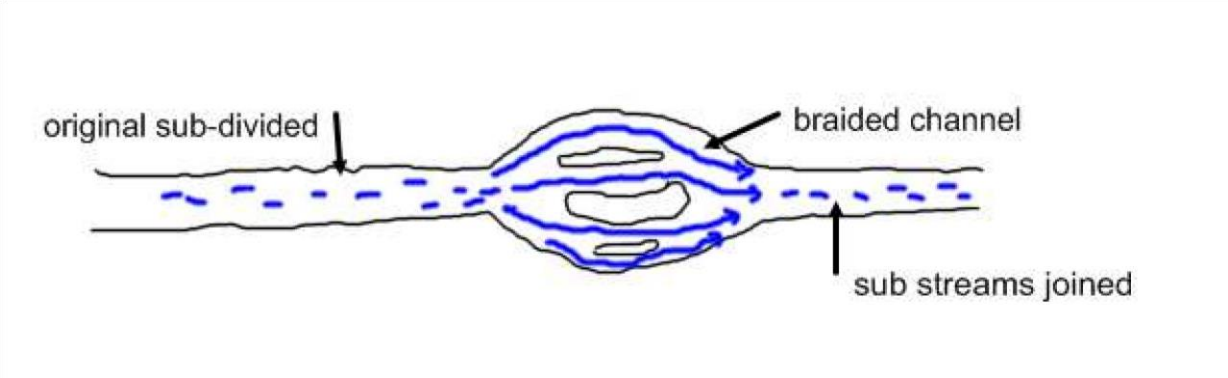


**Levees:** These are embankments built along the sides of a river channel by alluvial deposits. Deposition occurs mainly during floods out of the main channel. Its speed is checked by friction at the river bank. The materials at the river bank build up embarkments at the sides of the river known as levees.




**Braided channel:** This is a wide cone shaped mass of alluvium which subdivides/splits into a series of inter connecting small channels separated by deposits to form a single channel.

They are formed when a river carrying large quantities of load reduces its competence. Examples are common along River Tana, River kilombero,




**Alluvial fan:** This is a cone shaped mass of alluvial deposits made of sand and gravel. They are formed when fast flowing rivers emerging from a very narrow valley in high lands flows into a wide a low lying plain. The river loses its velocity due to reduced gradient and deposition occurs at the mountain front. The deposits spread out to form a fan as the river splits into distributaries. Examples are along river semliki, kilombero valley.

**Deltas:** this is a large low lying plain of accumulated silt deposited/laid by a river at its mouth i.e. an ocean, sea, lake as its speed is reduced. This forces the river to deposit its load. The larger and heavier material like gravel are deposited first while the fine silt and lighter ones are carried into the sea bed where they are deposited.

Deposition interferes with the smooth flow of the river causing it to split into several channels known as distributaries.

Diagram

**Estuaries:**

An estuary is a funnel shaped opening at the mouth of the river. This occurs where a river enters a sea (Large water body)

**Ox-bow lakes:**

These are meander cut-offs formed as a result of lateral erosion and deposition along meanders. They are formed along parts of flood plains. Examples are sited on rivers Tana, Ngaila, Rwizi, Mpanga, Semliki, Kagera and Kilombero.

**RIVER CAPTURE**

This refers to the diversion of a weak river stream into the course of a strong river/pirate stream. A powerful river erodes its valley through head ward and vertical erosion than the weak river/captured river.

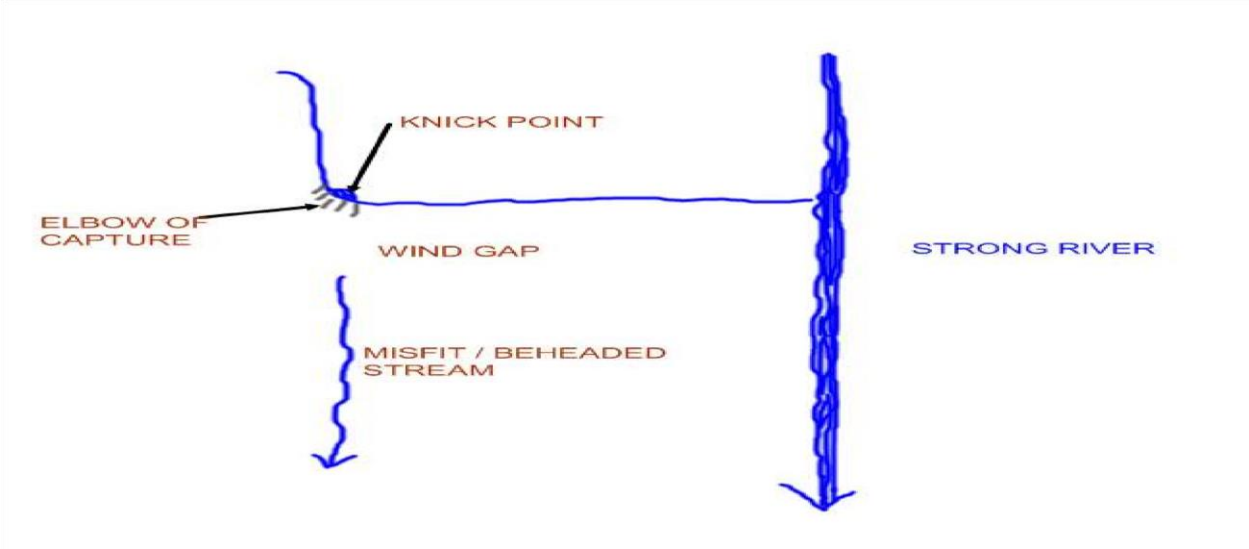
CONDITIONS THAT FAVOUR RIVER CAPTURE

- The nature of gradient of the long profile of the two rivers .the powerful river should flow on steeper slopes than its victim increases its erosive powers.
- The captured river should flow on gentle slopes with less resistant rocks.
- There should be two rivers flowing parallel to each other separated by rocks.ie a powerful river basin with rivers having differential erosive abilities where a

powerful river and a less powerful are flowing adjacent to each other on homogeneous rocks.

- A more powerful river erodes its bed faster through head ward erosion and captures water of another river. Examples River Nile captured Tochi, Arocha and Okole Rivers.
- The pirate river must flow at a higher level than its victim.
- The pirate river must erode head wards and vertically faster than its victim when it has high volumes of water.
- Earth movements where uplift or down warp occurs along the course of a river may cause river capture. A river flowing over a down warped channel may extend its valley by head ward erosion and captures the waters of the adjacent weaker river flowing over an uplifted channel.eg reverse rivers Katonga and Rwizi captured the weak adjacent streams in western Uganda.
- Differences in rock hardness,a river flowing over soft rocks deeply cuts its valley by head ward erosion into the valley of a the river flowing on soft rocks deeply cuts its valley by head ward erosion into the valley of the river flowing over hard rocks and captures it.eg river Wasa flowing on soft rocks captured river Nyaboroga in Kabarole.
- Rock jointing i.e. the capturing river flowing over well jointed rocks is able to deepen its valley when the captured is on massive rocks.
- River rejuvenation due to changes in the base level of the base level of the pirate stream. The rejuvenated river eroding a long a steeper gradient may extend its valley into a weaker adjacent river.
- The climate ie the rainy season increases the river water volume and enhances both vertical and head ward erosion.

ILLUSTRATIONS




FEATURES OF RIVER CAPTURE

**Elbow of capture;** it refers to the curved bend formed when the capturing river takes over the waters of a weaker river stream.
**Misfit stream;** is a beheaded stream whose waters have been captured and reduced in volume.

**Wind gap**; is the dry valley of a beheaded stream below the point of capture. It's either dry or swampy due to loss of its waters to the strong river.

**Knick point**; is a break in the river course where the new valley profile changes to the old valley due to river rejuvenation. At this point, the volume of water is high and it erodes deeply forming a knick point.

Knick point water fall; this is formed where the captured stream flows down steeply on the knick point.

**Over Fit River**; is a river which appears too big for its present valley due to increased volume of water from the captured river.

**Gorge/incised valley** is formed due to under cutting of the pirate river near the point of capture due to increased water volume which results into renewed erosion producing a steep and deep valley.

Examples of river capture include;

- Lower Tiva captured upper Tiva in eastern ,Kenya formally a tributary of river Galana,
- River Aswa captured Agago, Moroto and Pager rivers in northern Uganda, river Ruaha captured Palwanga drainage systems in Tanzania, River Nile captured the waters of river Torchi, Okole and Arocha.
- Upper Cunene was captured by the lower Cunene

## RIVER REJUVENATION

This refers to the revival or renewal of the erosive powers of a river. It can also be defined as the process when a river appears young after the rebirth of the erosive activity.

### Rejuvenation of a river is caused by;

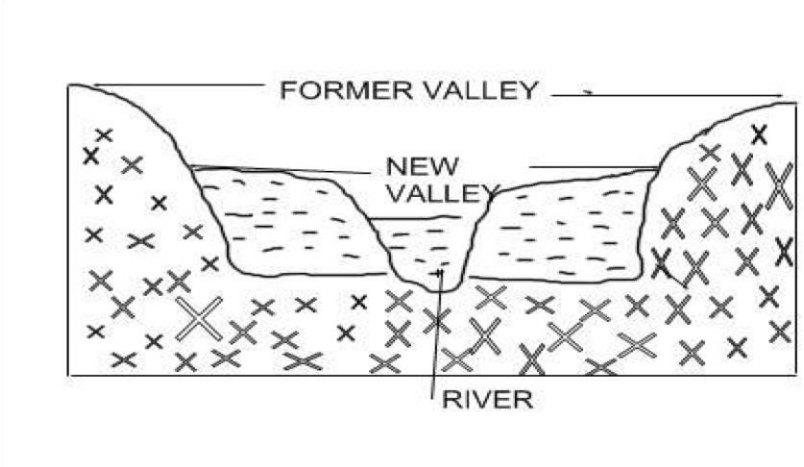
- A fall in sea level changes resulting from earth movements increase the velocity of the river flow and hence gain more powers to erode its valley.
- River capture when part of the rivers course is diverted into the system of a nearby powerful stream.
- Tectionism involves land uplift and this happens when the land has been raised. A river in such an area will be elevated upwards and increases the speed/velocity towards its mouth thus rejuvenation.
- Increase in rain fall from the water catchment area.
- Melt water from glaciers increases the volume of water into a river flowing at a low rate.

# Features due to river rejuvenation

Valley in valley; this is a valley which redevelops from the old existing valley .The river begins to erode a new valley with in the former. The widening of the new valley is relatively swift because the rejuvenated river is working in the old river's sediments and rotten rocks.

As the river increases its erosive powers vertically, the new valley widens and the old valley surface is reduced into terraces.egs of rivers with valley in valley include;

River Nyando as it crosses the Kano plains, Ngaila in western Kenya, river Rwizi in south western Uganda.




Knick point is a break in the long profile of a river valley which results from rejuvenation involving renewed under cutting of a river valley due to a fall in the base level. The knick point is formed in the rivers bed where the new valley changes to the old valley. Its position is marked by water falls and rapids.eg along river mwachi in Kenya, mkomanzi at usambara ranges.

**Estuaries**; an estuary is a form of submerged coast formed when the lower parts of a river valley have been deeply indented. The marshes, swamps, and mud flats can be seen in the estuaries at the low tides.

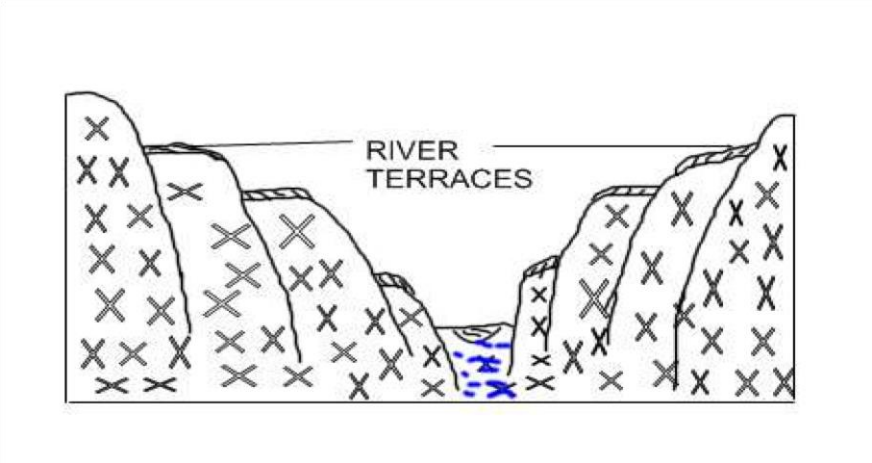
**Rias**; a ria is a funnel shaped drowned river valley. Rias are wider and deeper at their entrance than the inland.

**Ingrown meanders**; these develop on resistant rocks and where the base level falls gradually e.g. river mkomanzi btn mgwash and kifungiro in usambara mountains, north of lushoto in Tanzania, river mwachi west of Mombasa.

**Incised meander**; these are curved bends of a river which has been cut into the land surface so that the river winds between the valley walls. Most of the incised meanders are formed as a result of rejuvenation of an already meandering stream. This is associated with a fall in the base level along the river profile.

**Entrenched meanders**; these are formed where the meander is being uplifted at a relatively fast rate and where the rocks are quite soft and of uniform resistance. As a result vertical erosion occurs rapidly resulting into meanders which have steep even slopes. The cross section of an entrenched meander is symmetrical e.g. along river mpanga in Uganda, umgeni in Kenya.

**River terraces**; these are steps cut in the sides of a river valley covered by a layer of gravel and alluvial deposits. River terraces are formed when the base level falls and the rivers erosive capacity is renewed due to reduced load. Some parts of the flood plain and underlying rock floor may not be eroded by lateral erosion of which remains on the sides as terraces.




**Economic importance of rivers**

- Rivers are tourist attractions hence earning government a lot of foreign exchange used to develop infrastructure e.g. River Nile.

- Rivers help in the generation of Hydro Electric Power near sites of waterfalls used for industrial development e.g. Hale project on river Pangani, Owen falls and Nalubale power projects on river Nile and Seven folks dam on river Tana.
- Rivers in the old stage have fertile banks with deep and well drained alluvial soils which favour farming e.g. rice growing at Kibimba.
- Rivers provide water for a variety of uses e.g. domestic work and industrialization e.g. Nile breweries at Jinja.
- Rivers also provide water for irrigation which supports agriculture e.g. river Manafwa provides water for irrigation on Doho irrigation scheme.
- Rivers are used for transport / navigation hence connecting different places e.g. river Kafu and Katonga.
- They help in the modification of climate through the formation of the convectional rainfall which supports farming.
- Rivers are fishing grounds especially for tilapia, lung and mud fish which supplement on food e.g. river Katonga.
- Rivers in the old stage have got swamps which provide raw materials for the art and crafts industry e.g. clay and papyrus from river Katonga.
- They are used for study and research purposes hence widening our geographical scope of knowledge e.g. formation of waterfalls.
- Rivers also provide building materials e.g. river Sand along the banks.

**Negative importances**

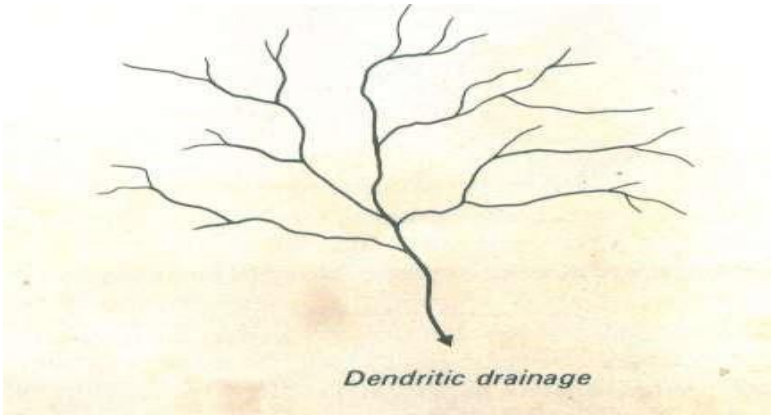
- ✓ Rivers are used for smuggling purposes hence reducing on government revenue e.g. river Malaba at the border of Uganda and Kenya.
- ✓ Rivers harbour dangerous animals which scare away human settlement e.g. crocodiles at Murchison falls National park.
- ✓ Rivers lead to floods during heavy rains which destroy peoples' crops, houses and roads.
- ✓ Rivers that have got waterfalls and rapids hinder transport on water e.g. river Nile with Kalagala falls, Sezibwa falls and Karuma falls.

- ✓ Rivers with swamps make the construction of transport and communication lines very expensive e.g. river Katonga at Lwera near Masaka.
- ✓ River banks act as breeding grounds for disease spreading vectors e.g. mosquitoes and snails.
- ✓ Some rivers have got floating vegetation especially water hyacinth and papyrus which affect the respiration of the fish leading to destruction of aquatic life.
- ✓ Most rivers in East Africa are narrow and shallow hence can't be used for navigation. Some rivers are seasonal and they disappear in the dry season hence making their use very limited to specific times of the year.
- ✓ Floating vegetation e.g. Papyrus on river Katonga also hinders water transport/ navigation on rivers.

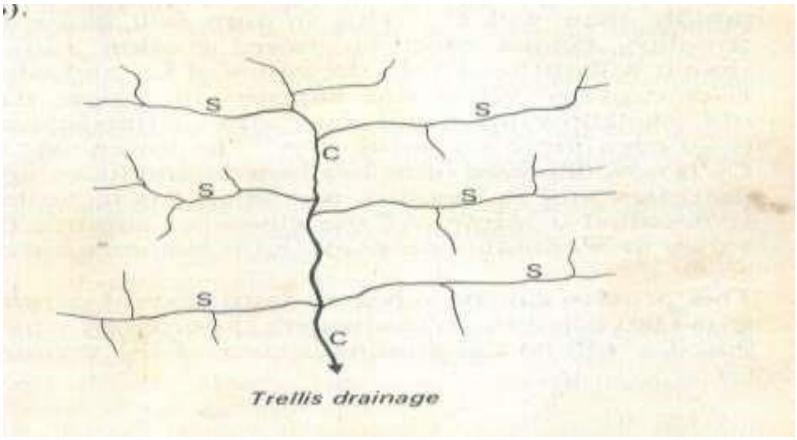
**DRAINAGE PATTERNS:**

It refers to the layout / plan made by rivers and their tributaries on the landscape. The major types of drainage patterns in East Africa:

**Dendritic pattern**: Here, the tributaries join the main river from different directions and at acute angles. E.g. on rivers Athi, Nyando, Galana, Nzoia in Kenya; Ruvuma, Rufigi and Pangani in Tanzania.

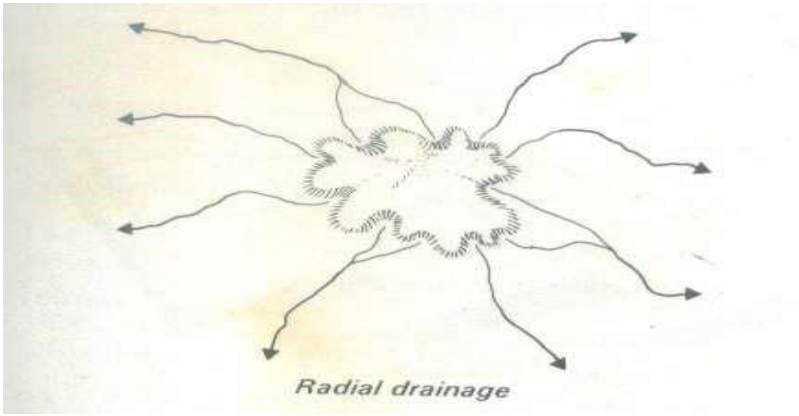


**Trellis drainage pattern**: Here, tributaries join the main river at approximately $90^0$. (Right angle) e.g. R. Achwa, R.Pager, R. Tochi in Northern Uganda.

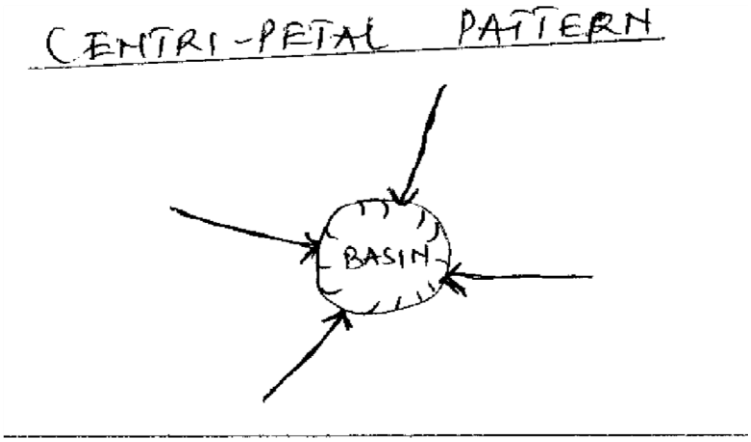


Trellis drainage

**Radial pattern**: It's an arrangement of streams flowing down a slope from one central point and then radiating in different directions e.g. on Mt. Elgon, rivers such as Malaba, Koitobos, Manafwa and Sironko originate from its summit.


Radial drainage

**Centripetal drainage pattern**: It's an arrangement of streams where they pour their water into one common basin e.g. river Kagera, river Nzoia and river Katonga all pour their water into the basin occupied by Lake Victoria while Lake Baringo has got river Mukutan, river Molo, and river Arabel pouring their waters into its basin.




**Parallel pattern:** in this case, rivers flow parallel to each other. They flow through valleys that are common on ridge slopes or escarpments e.g. Aberdare and Mau escarpments. Examples of such rivers include; river Athi, river Tana and river Nkusi, river Hoima in western Uganda.

## GLACIAL LANDFORMS IN EAST AFRICA.

Glaciation refers to the formation of ice on a highland. When there is more snow falling than that which can melt, it leads to accumulation of ice on the top of a highland. When the temperatures remain constantly below $0^0$ (zero degrees), ice sheets known as glaciers are formed.

A glacier is a mass of moving ice. As glaciers move, they erode the surface leaving behind glacial erosional features e.g. pyramidal peaks, hanging valleys, corries/cirques and arêtes.

After transportation, glaciers deposit all the eroded materials leading to formation of glacial depositional features e.g. drumlins, outwash plains, eskers, kettle holes, boulders and moraine.

N.B: The general term given to all the material deposited by glaciers is moraine**.**

In East Africa, glaciers are only limited to the 3 highlands of Mt. Kilimanjaro (5895m), Mt. Kenya (5199m) and Mt. Rwenzori (5109m).

### Limitations of glaciation in East Africa.

**Altitude:** Much of East Africa lies below 3000m above sea level which is below the snowline.

This means that many areas in East Africa have high temperature which doesn't support accumulation of ice e.g. along the coastal plains.

**Latitude**: East Africa lies astride the equator (crossed by the equator) where temperatures are constantly high and this does not favour the accumulation of ice e.g. along the shores of Lake Victoria.

**Aspect**: This refers to the direction of earth's surface in relation to the angle of the sun. Much of East Africa receives direct heating from the sun throughout the year hence less glaciation.

**Global warming**: The ever increasing world temperatures have led to the destruction of the ozone layer which has exposed East Africa to direct sun's rays hence leading to high temperatures which don't support glaciation.

**Low Precipitation**: Most areas in East Africa receive very little rainfall which implies that the temperatures are constantly high thus reducing the level of glaciation e.g. Ankole-Masaka corridor.

**Expansion of deserts:** Due to increased deforestation, urbanization and industrialization, the Sahara desert is widely spreading southwards into East Africa and since it's associated with extremely high temperatures and low rainfall, glaciation is reduced in East Africa.

**Industrialization; (greenhouse gas effect):** Industries release dangerous fumes into the atmosphere hence destroying the ozone layer which has led to increase in temperatures thus reducing glaciation.

**Rain shadow effect**: some areas in East Africa are in the rain shadows which are made up of high temperatures and low rainfall hence limiting glaciation e.g. Kasese, Ankole-Masaka corridor and Turkana land.

**Urbanization**: The construction of roads and buildings has put the concentration of many people in one area which has led to high temperatures hence limiting glaciation. E.g. Kampala, Mombasa and Dodoma.

**N.B:** ***All processes by which glaciers erode, transport and deposit materials mould the landscape.***

**Glacial Erosion:**

Glaciers carry out erosion just like rivers under processes like abrasion, plucking, sapping and back wall recession.

**Abrasion**. This is the wearing away of the valley bottom and valley sides by the rocks frozen within a glacier. As the glaciers move, they scratch and scrap the underlying rocks to widen and deepen the valley (River valley). The glacier acts as a grinding tool to the rock particles i.e. pebbles, boulders etc.

**Plucking**. This involves the tearing away of blocks of rocks as the glaciers move across a jointed rock.

**Basal sapping (freezing and thawing**)

This involves the disintegration of rocks along the back wall of the cirque due to melt water enabling alternate freezing and thawing. This is mainly seen in the formation of arêtes, pyramidal peaks, cirques etc.

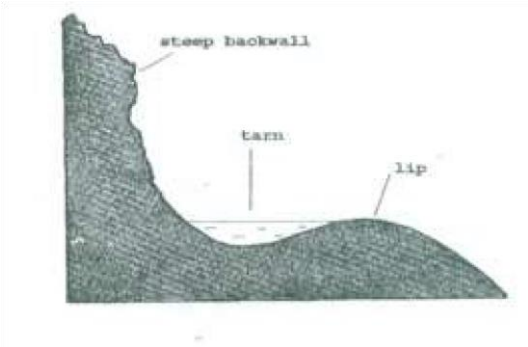
**Back wall recession (head ward erosion)** this involves gradual cutting back by the glacier into the mountain top.

**Glacial Erosional Features:**

**CIRQUE/CORRIE ;** A cirque is a semi-circular hollow depression on the side of a mountain. It's formed when a glacier or a block of ice erodes the side of the mountain through processes like back wall recession, abrasion, plucking or sapping leaving behind a depression that is like an arm-chair. When a cirque is filled up with water, it forms a lake known as a ***Tarn Lake.***

Examples of tarn lakes in East Africa include Lake Teleki and Tyndal tarn both on Mt. Kenya, Lac-Catherine and Lac-du-Speke which are all found on Mt. Rwenzori.

Illustration of the tarn lake




**Arêtes:**

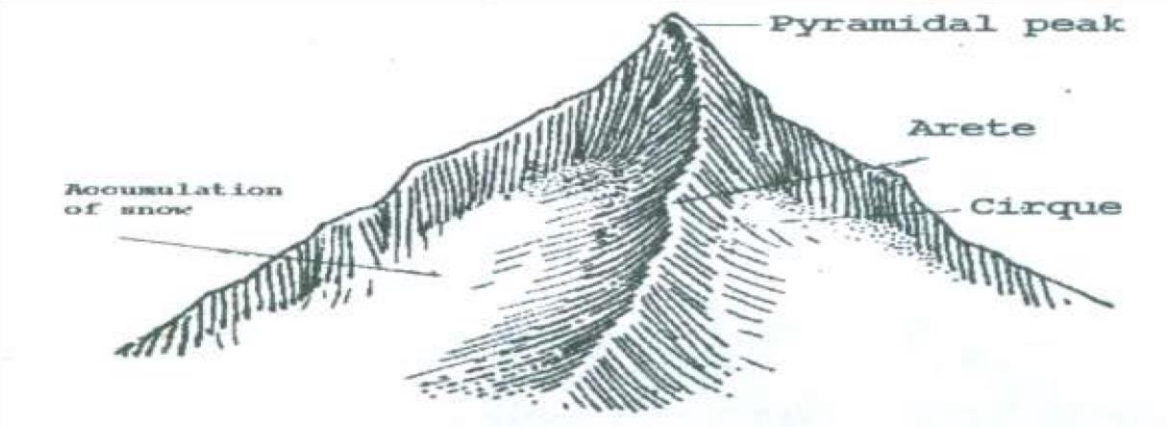
These are steep sided knife-edged ridges separating two corries. They are formed as a result of glacial erosion where two corries form adjacent to each other. These corries cut back to back to keep on widening through a process known as back wall recession and only leave behind a sharp ridge separating them.

**Pyramidal peak or horn;** It is a sharp mountain peak in a glaciated landscape which is pointed like a pyramid.

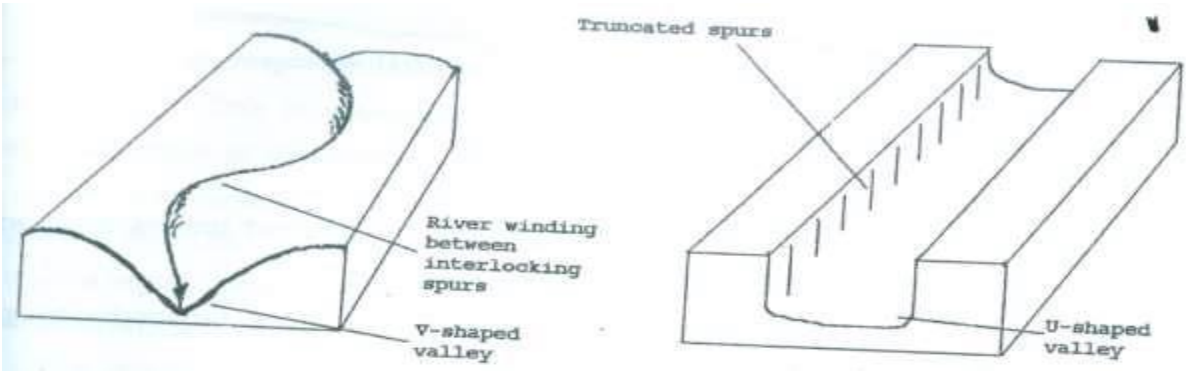
It's formed when a resistant rock (hard rock) remains on top of the mountain after the weak rocks on the sides have been eroded by glaciers.

It is formed where three or more corries are eroded backwards in a process of back wall recession by plucking leaving behind a central pillar in the middle called a Pyramidal peak/horn. It is later sharpened by frost action.

Examples include Margherita peak on Mt. Rwenzori, Kibo and Mawenzi peaks on Mt. Kilimanjaro.

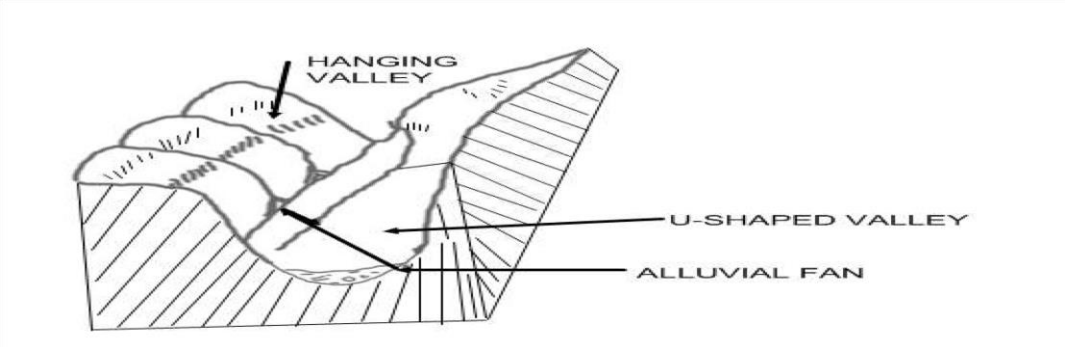



**U-shaped valleys/glacial troughs:** This is a broad, flat bottomed, steep sided U-shaped valley with a u-shaped cross profile. It's formed when glaciers erode the sides and bottom of small river depressions through processes like plucking and abrasion along the slope profile e.g. Mobuku valley along Mt. Rwenzori and Hobley and gorges valley on Mt. Kenya.




**Hanging valleys:**

These are tributary valleys left high above the main valley/U-shaped valley. Ahanging valley is formed due to presence of more ice in the main valley than in the tributary valley. Because of this, there is more erosion in the main valley than in the tributary valley through processes like abrasion, plucking and basal sapping(frost action) such that tributary valleys are left standing high above the main valley e.g. river Little Nithi joins river Nithi on Mt. Kenya through a hanging valley.




**Roche mountonee:**

It is an outcrop of resistant rock in the path of a glacier. The upstream end is eroded by abrasion into a smoothened gentle slope by the on-coming ice. The down-stream end is plucked by moving ice to give a steep jagged slope.

**Crag and tail**

It is a knob of resistant rock which obstructs the movement of the ice. The resistant rock is known as the crag and protects the weaker rocks downstream. The eroded material is deposited on downstream to form an elongated tail. **Illustration of crag and tail.**

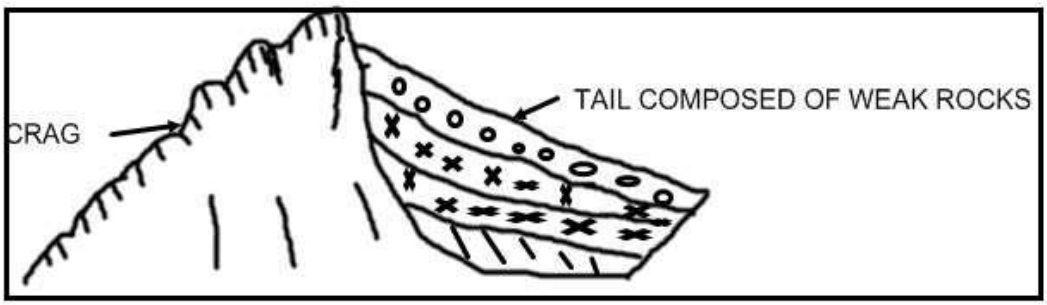
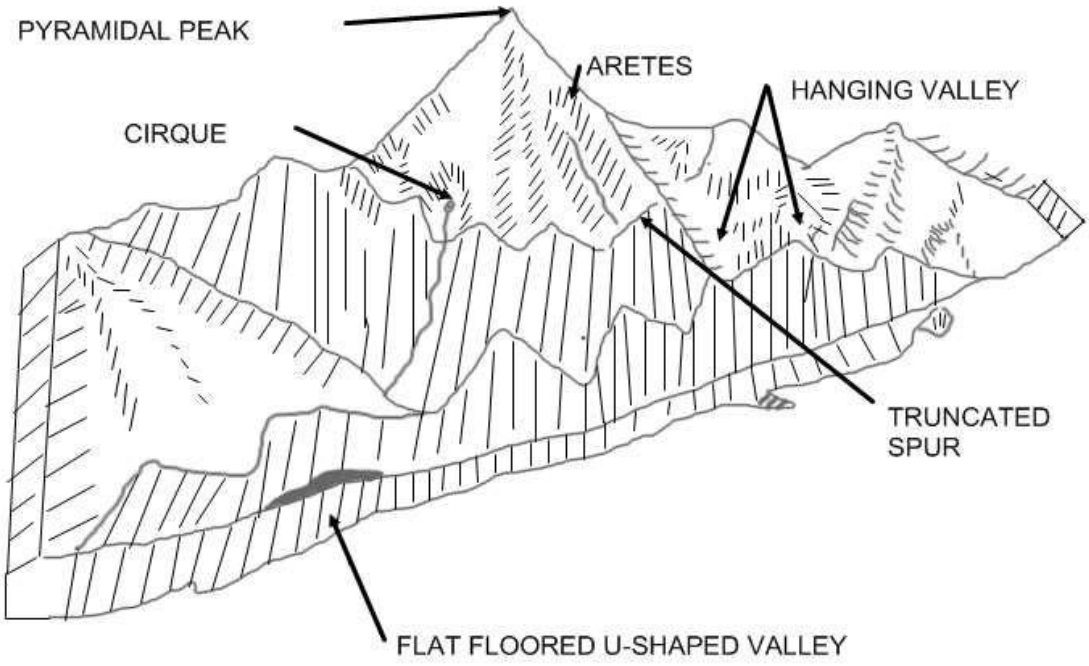



**Illustration of Glacial erosional features**




**MORAINE:** This refers to a large mass of material transported and deposited by a glacier.

**Formation of moraine**

Formed when glacier ice erodes pre- existing depressions or valleys along the glacial slope through processes like sapping, abrasion and plucking.

In this process, glacial debris are transported and deposited down slope. Due to decrease in gradient and melting of the glacier, the **material is then deposited in four major ways;**

***Lateral***: moraine deposited along the sides of a glacial valley.

***Medial:*** moraine deposited in the middle when two glaciers meet at center of a glacial valley.

***Terminal:*** moraine deposited at the front/end/ snout of a glacier/ glacial valley.

***Ground***: moraine deposited at the bottom of the glacier and covers the entire floor of the valley

**Erratics:** These are rock fragments of one kind that have been transported by glaciers and deposited on materials of another kind.

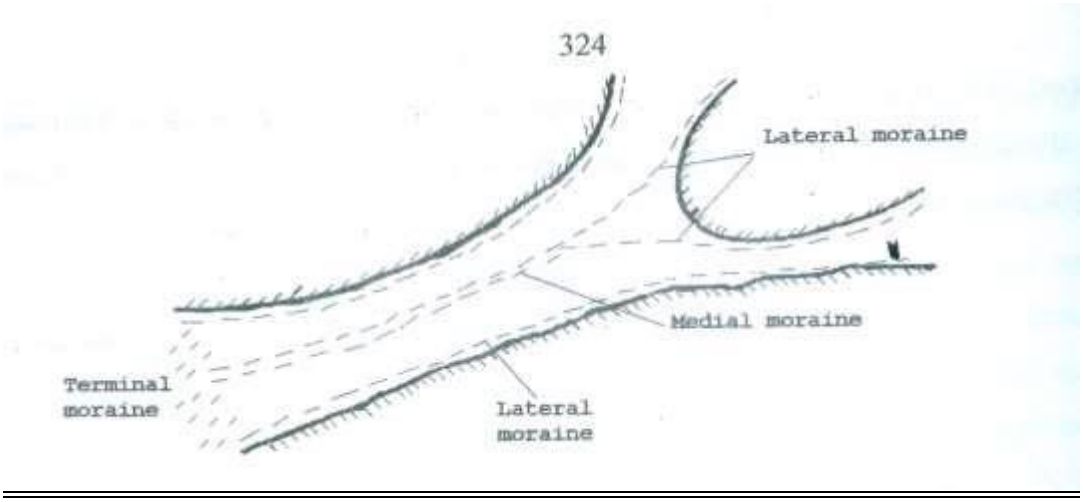
**Out-wash plains:** Terminal moraine transported by a glacier is deposited as a layer over a wide and large area called an outwash plain.

**Drumlins:** Glacial deposits are sometimes several hundred meters thick and their surface is marked by long rounded hills / mounds called drumlins.

**Illustration of the moraine.**

**N.B:** Glacial deposition also leads to the formation of kettle lakes and ribbon lakes.

**Economic importance of glacial features**




- ✓ Glacial features are tourist attractions hence earning government a lot of foreign exchange used to develop infrastructure.
- ✓ Glacial features are used for filming and photography and therefore advertising East Africa and the sites for film industry help to diversify the economy.
- ✓ Hanging valleys form waterfalls which help in the generation of Hydro Electric Power used for industrial development e.g. Mobuku valley in Kasese.
- ✓ Glaciers are sources of water for rivers used for irrigation and domestic use e.g. river Mobuku(R. Sebwe) provides water used on Mobuku irrigation scheme.

- ✓ Out wash plains provide fertile land for crop farming e.g. Mobuku valley in Kasese for cotton and maize.
- ✓ U-shaped valleys act as route ways/ passes in highland regions mainly used by tourists engaged in mountain climbing.
- ✓ Boulder clay deposited in valleys can be used in the art and craft industry for making pots and bowls.
- ✓ Glacial features are used for research and study purposes which boosts our geographical knowledge.
- ✓ Eroded rocks and boulders brought down by glacial melt water provide building and construction materials.
- ✓ Glacial features are used for research and study purposes by students on field work which widens knowledge scope.
- ✓ U-shaped valleys are used as communication passes for roads and railways.
- ✓ The tarns modify the local climate through influencing convectional rainfall formation.
- ✓ They encourage mountaineering, a spot and leisure e.g. mountain climbing on the peaks of Mt. Rwenzori.

**Negative importance**

- ✓ Glaciation leads to landslides (avalanches) which destroy people's life and property  Glaciation also leads to soil erosion which results into loss of soil fertility.
- ✓ Glaciation leads to very cold temperatures which hinder human settlement.
- ✓ Sand and boulder rocks are normally deposited in the outwash plains forming infertile soils that hinder crop cultivation.
- ✓ Glaciation leads to the formation of rugged landscape that hinders the development of transport and communication lines.
- ✓ Melt water from glaciers may cause flash floods in the lower regions that destroy life and property.
- ✓ Stagnant water on lower parts forms breeding grounds for disease spreading vectors and pests e.g. mosquitoes which lead to malaria fever.

# The process of weathering and how weathered rock particles form the basis of soil,

## WEATHERING

It refers to the disintegration of rocks into increasingly smaller particles.
Weathering can also defined as the breakdown of bigger rocks into smaller rock particles. It's the first process during the formation of soil. Weathering is a denudation process which acts on existing rock particles.

### TYPES OF WEATHERING

There are three types of weathering i.e.

a) Physical / mechanical
b) Chemical weathering
c) Biological weathering.

**Physical/mechanical weathering:** It's mainly common in the hot/dry regions of East Africa e.g. North East Uganda (Karamoja), northern Kenya (Turkana land), and Central Tanzania (Miombo woodlands).

It takes place as a result of temperature change which increases and then drops rapidly and this causes rocks to expand and contract. This continues over a period of time leading to the formation of cracks within the rocks.
This process is known as **exfoliation or Onion weathering**. It leads to the formation of rock Screes and the feature formed after exfoliation has taken place is known as an exfoliation dome.
Mechanical weathering also takes place under **frost shattering**: This is the action of ice on top of mountain summits e.g. Mt Rwenzori, Kenya and Kilimanjaro. It occurs when water enters into joints and cracks through hydraulic action and then freezes and expands in volume. This process continues over a long period of time leading to rock disintegration. It's also known as **freeze and thaw action**.

Other processes/types of physical weathering include; a***ridity shrinkage, block disintegration, granular disintegration, salt crystallization, etc.***

Features due to physical weathering include; Inselbergs (isolated hills found in plateau regions) e.g. in Mubende, Nakasongola, Gulu, Lira, Kapchorwa and Songea; Arenas; Rock pedestals; Granite tors; disintegrated blocks

**ii) Chemical weathering:** It's dominant in wet and humid conditions e.g. shores of Lake Victoria. Rocks are decomposed due to chemical reactions between rock minerals, water and gases such as oxygen and carbon dioxide.

**Processes of chemical weathering**

**Carbonation:** It takes place when carbon dioxide reacts with water (rain water) to form a weak carbonic acid which reacts with rock compounds. It occurs mainly in limestone and dolomite rock. It is common along the East African coast, Kasese and Nyakasura.

**Oxidation:** It involves the addition of oxygen in minerals leading to chemical reactions. It occurs when additional oxygen is taken in by a mineral compound and each time a reaction takes place, the rock acquires different characteristics hence losing its hardness and breaks down e.g. Oxidation leads to the formation of lateritic/murram soil. It's also common in sedimentary rocks like clay.

- **Hydrolysis:** It occurs when hydrogen ions from water react with minerals to form a different rock.
- **Hydration: I**t occurs when rocks absorb water and expand causing stress to the rocks finally leading to rock fractures/cracks which lead to rock disintegration.
- **Reduction:** It is the removal of oxygen from the rocks.
- **Solution:** This process occurs when rocks composed of soluble compounds dissolve in water forming a solution that can easily be carried away. For-example; rock salt is dissolved by rain water to form salty water.

**iii) Biological weathering:** This involves disintegration of rocks by living organisms e.g. man, trees, grass, worms, and burrowing animals or rodents e.g. rabbits, squirrels, moles, rats and termites. Some of these animals also die and in the process lead to the accumulation of soil / humus.

Man's activities through digging, road construction, grading of hills/quarrying and construction of industries, lead to disintegration of rocks hence breaking them up.

When plant roots force themselves into rocks, they enlarge the rock joints which later break into smaller rocks. Plants also drop their leaves on the ground which also leads to accumulation of humus.

### *FACTORS WHICH AFFECT WEATHERING*

**Climate**. Wet climate facilitates rapid chemical weathering while hot climate facilitates rapid physical weathering.

**Parent rock**. Hard rocks like granite take long to be weathered while softer rocks like limestone are easily worn down.

**Vegetation cover**. Areas with thick vegetation may receive heavy rainfall to influence chemical weathering while those with scanty vegetation experience physical weathering.

**Relief**. There is a faster rate of weathering on the steep slopes due to erosion which exposes rocks to weathering agents. On the other-hand, weathering is slow in the valleys due to high levels of deposition which covers the existing rocks.

**Altitude**. There is rapid physical weathering by frost action in high mountains due to cold conditions. On the other-hand, there is rapid physical weathering by exfoliation in the low altitude areas due to hot temperatures.

**Human activities**. Man's activities like road construction, mining, construction etc. expose rock surfaces to weathering agents thus speeding up both physical and chemical weathering.

**Time**. When rocks are exposed to agents of weathering for a longer time, and then take less time.

Features due to chemical weathering include; ***grikes and clints, stalagmites, stalactites, pillars, limestone gorge, limestone cave (Cavern), Sinkhole/swallow hole, doline, Uvala; polje, dry valley, etc.***

# How weathered rock particles form the basis of soil.

## Soil.

It refers to the loose substance that is formed on the upper layers of the earth crust. Soil is made up of both organic and inorganic materials.

**Components of soil** include;

- ✓ Minerals e.g. potassium and calcium.
- ✓ Water
- ✓ Humus
- ✓ Gases e.g. nitrogen, oxygen, carbon dioxide
- ✓ Living organisms e.g. bacteria.

**N.B**: The amount of the above components depends on the type of the soil.

**SOIL FORMATION:**

The process of soil formation begins with weathering.

Physical/mechanical weathering is responsible for breaking down rock particles into smaller pieces while chemical weathering is responsible for the decomposition of rocks.

Soil formation depends on a number of factors, and these include;

**The nature of the parent rock**; the characteristics of the parent rock are responsible for soil formation. Either thin or deep layers of soil form due to the major characteristics of the parent rock e.g. if the parent rock is very hard, then it becomes difficult to form deeper soil layers and rocks

with a high degree of permeability (water retention) will be easily broken down than rocks that don't allow water to penetrate easily.

**Climate**; high temperatures and heavy rainfall increase the rate of decomposition of dead materials leading to deeper soil layers. They also favour the growth of bacteria which decompose the dead materials to form humus.

**Relief/topography;** the nature of the slope influences soil formation from thin to deep layers. On the steep slopes, due to too much erosion, there are thin layers of soil while in the valleys, there are deeper layers of soil due to too much deposition.

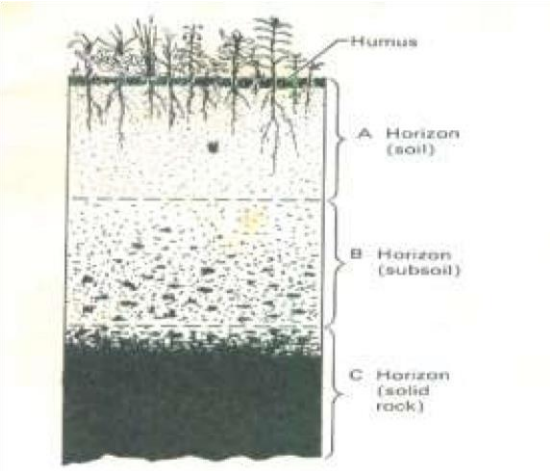
**Living Organisms**: Animals, plant roots and leaves decay to form part of the soil. Also, man's activities through quarrying and mining lead to soil formation. Worms, ants and burrowing animals like squirrels, rats and rabbits lead to soil formation.

**Vegetation**: Leaves provide humus through decay. Plant roots also help to break down soil through biological weathering. Vegetation also helps to protect soil from erosion hence leading to deeper soil layers.

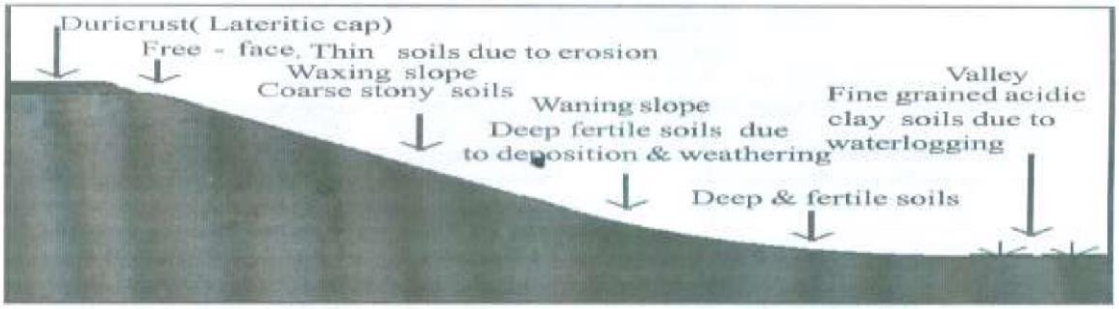
**Time**; the process of soil formation is slow, very long and a lot of time is needed for the full interaction of all the factors that influence soil formation. The longer the time, the well-developed soil layers will be and the shorter the time, it leads to formation of thin soil layers.

**SOIL PROFILE:**

It refers to the vertical arrangement of soil layers from top to the bottom. These layers are sometimes called horizons. Along the profile, soil layers differ in colour, chemical composition and size of soil particles.



**Soil catena:** This is the horizontal sequence/arrangement of soil down the slope. It's the arrangement of soil from the top of the hill to the valley bottom. It also shows differences in colour, soil depth, and water content in the soil. Normally, lateritic soil occupies hill tops while steep slopes are covered with loam soil and the valley with clay soils.




**Soil texture:** refers to the size of soil particles i.e. thickness or thinness of the soil particles. It's also concerned with roughness and smoothness of the soil particles.

**Soil PH:** This refers to the degree of alkalinity or acidity of the soil i.e. different soil particles have got different mineral composition.

**Classification of soil types in East Africa**

The main types of soil in East Africa are loam soil, clay soil, Sandy soil and lateritic soils.

**Lateritic soils:** they are mainly common on Buganda hills. They are also known as murram soil.
**Loam soils:** These are the most fertile soils and support the growth of various crops.

**Clay Soil:** These are fine drained and contain less or no humus.

**Sandy soil:** These are so common in the dry areas of East Africa i.e. Turkana Land, Masai Land, Miombo woodlands and Karamoja e.t.c.

# Erosion on the land surface;

## Soil erosion

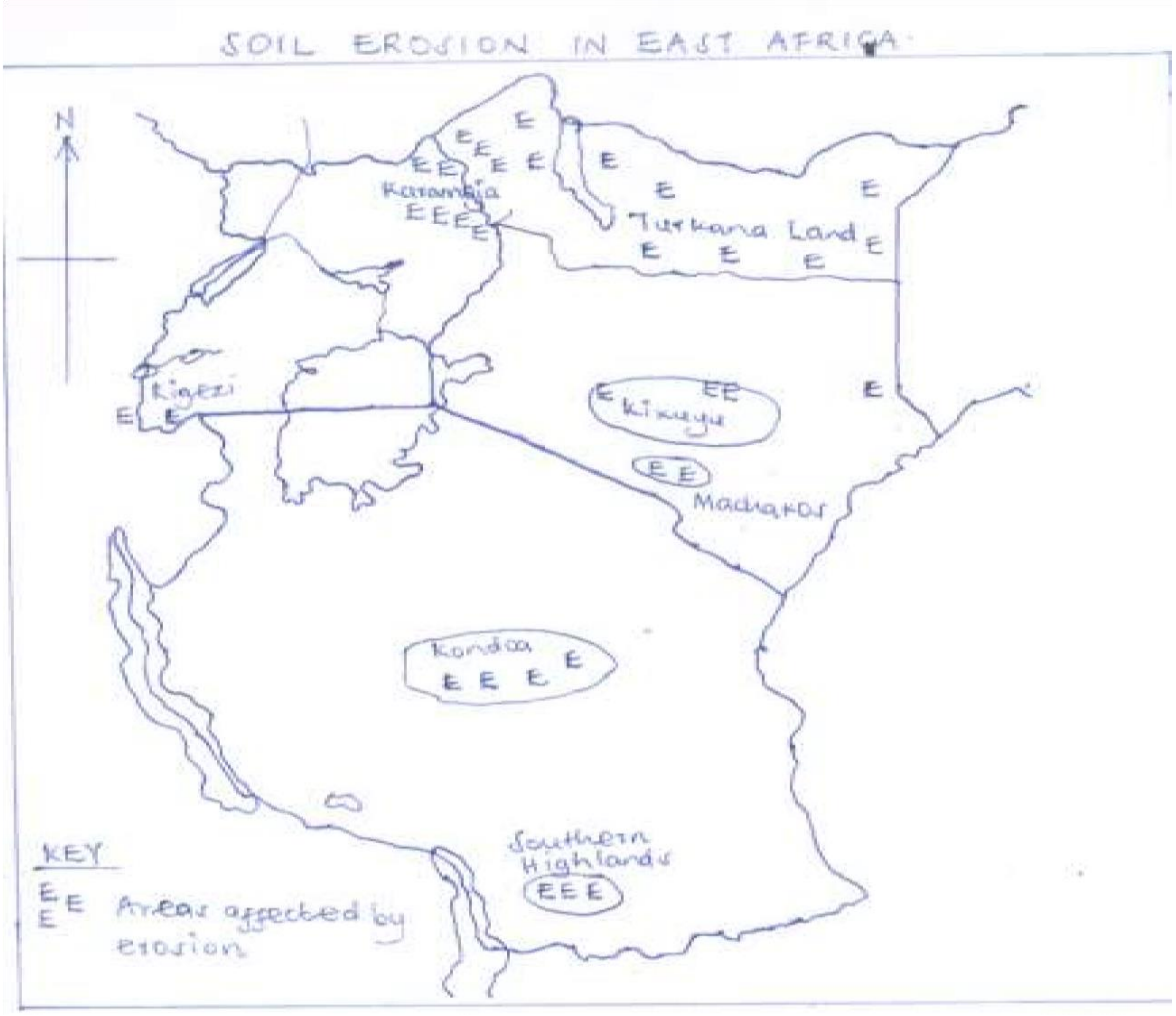
It's the washing away of the top soil from one place to another by erosional agents like wind, water, animals, and glaciers. It takes place in both dry and wet areas.

The wet areas include; the shoes of Lake Victoria, Kigezi highlands, Nyanza province, Imatong hills in southern Tanzania.

The dry areas include; Karamoja in North Eastern Uganda, Ankole-Masaka Corridor, Masai land, Turkana Land and Machakos district in Kenya, Kondoa region (Miombo woodlands) in Tanzania. Running water is the most common agent of soil erosion in East Africa.

Glacial erosion is common in snowcapped mountains e.g. Mt. Kenya, Rwenzori and

Kilimanjaro. Wind erosion is most common in the dry areas like Karamoja and Turkana land.




**Types of soil erosion**

- ✓ **Splash erosion:** This occurs from the impact of raindrops hitting the earth surface and the soil particles are splashed to different directions leaving behind small depressions.
- ✓ **Rill erosion**: This is the removal of top soil by water leading to the formation of small channels called rills.
- ✓ **Gulley erosion:** This occurs when the rills are deepened by water to form depressions called gulleys.
- ✓ **Wind erosion:** This is the removal of top soil by wind and in most cases it's the lighter particles which are eroded. This type of erosion is common in dry areas and in areas with little or no vegetation.

- ✓ **Sheet erosion**: This is the uniform removal of top soil over a large area especially from the sloping land as a result of over flow of water. This type of erosion is difficult to notice or detect because of uniformity.

**CAUSES OF SOIL EROSION**

- ✓ **Over grazing**: This is common in savannah and semi-arid areas of East Africa where pastoralists keep large numbers of animals e.g. Masai land, Turkana land and Karamoja. The animals especially goats eat up all the grass and leave the ground bare and exposed to agents of erosion like torrential rainfall.
- ✓ **Industrialization and mining**: these activities lead to the breakdown of soil during extraction of minerals and construction of buildings and when it rains heavily, the soils are easily washed away.
- ✓ **Deforestation**: here, the trees are cut down and the soil is exposed to agents like rain water and wind which easily carry away the soil particles.
- ✓ **Monoculture**: when one crop is grown season after season, this leads to soil exhaustion which loosens up the soil hence making the soil particles to be easily eroded.
- ✓ **Heavy rainfall of over 1500 mm** per annum leads to serious surface water runoff which easily erodes the soil from one place to another.  **Bush burning**: This is commonly practiced by pastoralists when they are expecting rain which brings new pasture with it. It leaves the ground bare hence exposing it to erosional agents like surface runoff and strong winds.
- ✓ **Over population**: This leads to increased pressure on land through deforestation, monoculture and land fragmentation which are responsible for exposing the soil to agents of erosion like running water.
- ✓ **Cultivating up and down slope**: This loosens the soil particles making them to be easily eroded by runoff.
- ✓ **Steep relief**: this also leads to soil erosion due to downward movement of soil as a result of gravitational pull.

**Effects of soil erosion**

- ✓ Top soil which contains humus is removed hence barren soils are left behind.

- ✓ Barren soils have led to low agricultural output because land less productive land is left.
- ✓ Famine is a result due to low agricultural productivity e.g. in Masailand and Machakos.
- ✓ It leads to mudslides in highland areas which cause loss of lives and property e.g. in Bududa and Mbale along Mt. Elgon.
- ✓ It leads to destruction of vegetation therefore opening the soil to even more severe effects.
- ✓ Deep and wide gulleys are created which leads to destruction of scenic beauty of the landscape.
- ✓ Gulleys created can lead to destruction of transport and communication lines e.g. roads in highland areas.

**Soil Conservation methods**

- ✓ **Terracing:** This is the digging of step-like trenches across a hill, which helps to trap the moving soil hence preventing soil erosion especially in Sukama lands.
- ✓ **Crop rotation**: This is the planting of different crops on the same piece of land. This helps to control monoculture and its effects.
- ✓ **Afforestation and re-afforestation**: here, trees are planted in areas where they have been cleared or areas where trees have never been planted. The planted trees help in controlling the effects of heavy rain drops and speed of wind, which are major agents of erosion.
- ✓ **Mulching**: this is the covering of soil with different materials e.g. grass so that it can be able to store moisture in the soil. The stored moisture then helps to keep the soil intact hence reducing soil erosion. This is the most common method of soil erosion control used by small holder farmers.
- ✓ **Controlled grazing** e.g. paddocking, zero grazing and tethering. This can help to reduce on the effects of overgrazing like eating up of all the vegetation from the ground.
- ✓ **Educating people** about the importance of environmental conservation and the dangers of bush burning hence reducing on the effects of soil erosion.
- ✓ **Application of fertilizers/Manure**: this will help to hold soil partials together hence reducing soil erosion.
- ✓ **Strip cropping**: This is the planting of grass between strips of crops and the grass helps to trap the moving soil.

- ✓ **Contour ploughing** where cultivation takes place along contours on a hill. Farmers cultivate around a hill and not up and down the hill to prevent soil run-offs. It's common in Kigezi among the Bakiga and the Kenyan highlands.
- ✓ **Controlling bush burning** which is a necessary measure especially among the nomads.
- ✓ **Using the Umatengo system**: here, pits are dug on steep slopes to trap eroded soil and plants are cultivated between the pits. This system is mainly used among the Matengo people of South-Eastern Tanzania.
- ✓ **Population control measures** should be enforced so that pressure on land is reduced e.g. resettling people away from highland areas to lowland areas.

# EROSION BY LAKE OR SEA.

## Coastal landforms

A coast refers to the land bordering the sea. A coastline is a boundary between the land and the sea. Various coastal processes such as wave action and sea–level changes have been responsible for various coastal landforms in East Africa.

### Wave action:

Waves are ripples/oscillations which appear on water bodies when disturbed. Waves either move towards the coast or away from the coast.

**Swash:** this is the forward movement of waves towards the coast and it leads to deposition of sand and shingle (mixture of smallish flat stones and sand).

**Back wash:** this is the back movement of waves away from the coast into the lake or ocean and it leads to erosion of the coastline.

There are two causes of waves;

- ✓ Wind blowing over a water body.
- ✓ Catastrophic events like Vulcanicity and earthquakes.

**N.B:** Waves on water are responsible for the formation of several features at the coast which are grouped into wave erosional and wave depositional features.

## WAVE EROSION

Waves are able to erode rocks through various processes and these include;

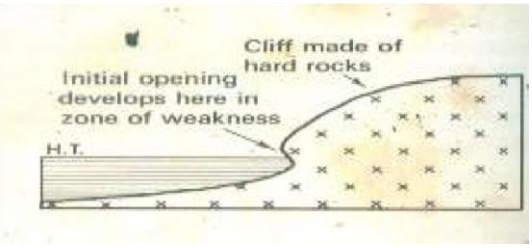
- ✓ **Hydraulic action**: water enters a rock and the air in the cracks of the rocks may be compressed by the breaking waves causing the rocks to fracture hence leading to wave erosion.
- ✓ **Abrasion.** The load in form of boulders pebbles and sand are hurled against the shore line by the waves.
- ✓ **Attrition**: this is where sea waves hurl/throw pebbles and rock boulders against the rock face of a cliff thereby eroding it.
- ✓ **Solution**: some rocks near the coast are soluble e.g. limestone, and where the coastal line is made up of such a rock, it would be eroded by chemical reaction of water.

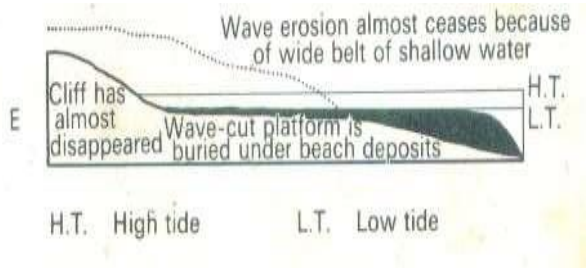
### Features formed by wave erosion

**Cliff:** it's a steep slope or a rock face along the sea coast. It's formed as a result of waves eroding a highland along the coast through processes like hydraulic action. A cliff tends to be undercut and in time the upper part collapses into the sea under its own weight. Examples include; Fort Jesus in Mombasa, at Lutembe beach in Entebbe and at Kasenyi landing site on Lake Victoria.

**Wave-cut platform:** as attrition and cliff behind as a platform of rock. Material deposited from the cliff may be deposited on top of this terrace-like feature. Wave-cut platforms are often visible only at low tide (low water level).

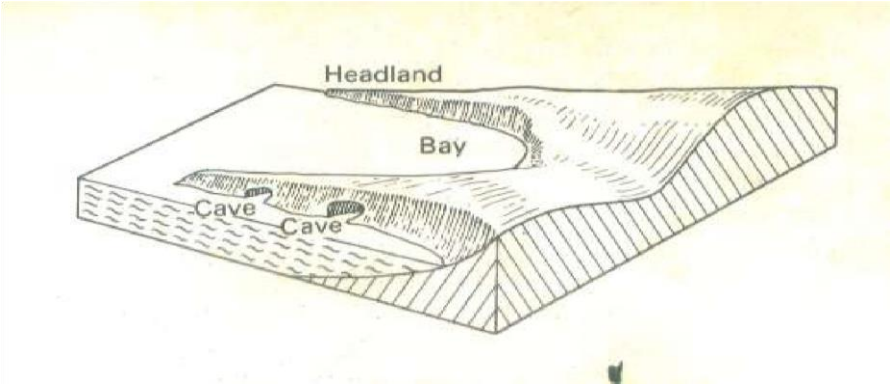
recession take place, the base of the cliff is left



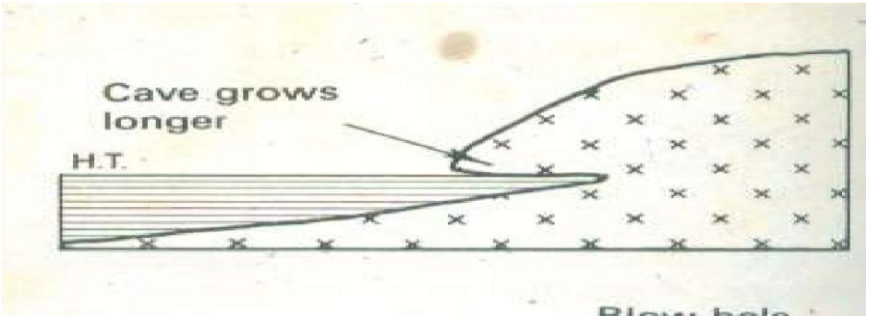




**Bays and headlands:** these are formed in areas along the coast where a soft rock lies between two areas of hard rock. The sea doesn't erode soft rocks evenly with hard rocks. The softer rock is eroded through solution process while the hard rocks on either side are left jutting into the sea.

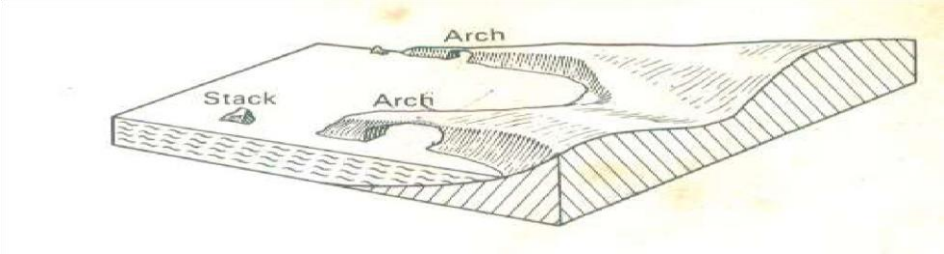
The eroded area forms a bay while the projected areas form the headlands. Examples are found at Kasenyi landing site on Lake Victoria.




**Caves, arches, stacks and stumps: Caves** are hollows found at the base of the cliff. They are formed when waves erode the cliff along its line of weakness through processes like hydraulic action and solution, hence removing rock material. Caves can be seen at palm resort beach and Kasenyi landing site in Entebbe.




However, when a cave forms on a headland, erosion through hydraulic action may continue until a passage is made through the headland and this leads to the formation of an **arch**. With time, the rock above the arch may also be worn away by continued wave erosion through solution and attrition processes and eventually collapse. One wall of the arch is left projecting from the sea, forming a **stack e.g. at** Kasenyi.




Continued wave erosion through solution and attrition, will lead to the stack disappearing below the surface of the water to form a **stump** e.g. at Kasenyi.

**Wave deposition:** the sea transports and deposits eroded material from the cliff and this process is known as **long shore drift.** It leads to the formation of several wave depositional features which include;

**Beach:** a beach is an accumulation of sand, shingle and pebbles along the coast. It's formed when eroded rock material is transported by long shore drift to bays and deposited there. Examples of beaches include Lido, Lutembe and resort beach along the shores of Lake Victoria and several beaches at Mombasa, Pemba and Dar-es-salaam.

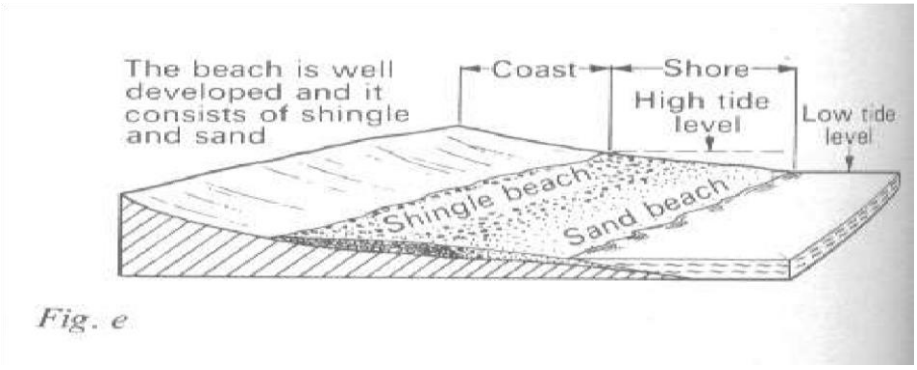
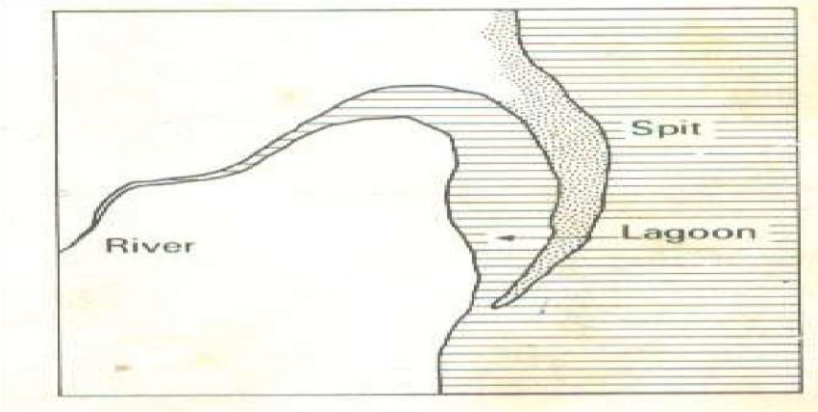
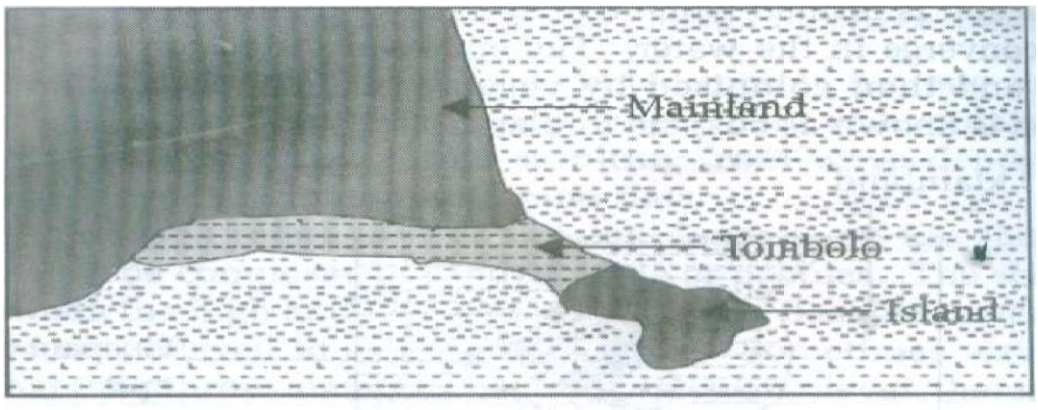


*Fig. e*

**Spit:** it's a long and narrow ridge made up of sand, pebbles and other deposits attached to the coast and which extended towards the sea. It's formed where there is a river discharging its waters into the sea. As a river pours its waters into the sea, sand is deposited and this material is added onto by long shore drift. A long narrow ridge of sand builds up to form a spit e.g. Kaiso and Tonya spits near Lake Albert.




**Tombolo:** it's a special kind of bar that forms and connects an island to the mainland. A tombolo provides access to the island from the mainland often at low tide and at high tide, the island remains cut off e.g. Lambu landing site on Lake Victoria is connected to the mainland by a tombolo.




**Sand bar:** it's a bank of sand or mud which extends from one headland across a bay to the headland on the other side. A bar is formed when two spits are joined together from either side of the headlands. Bars may be either partly submerged by sea or may be viewed at low tide.

**Mud flats:** these are formed as a result of tides depositing fine silt along the gentle sloping coastal features such as bays and estuaries. Along the coast, salt-tolerant plants have colonized the flats leading to the development of mangrove swamps.

**Lagoons:** this is a depression formed behind a sand bar that is connecting one end of a headland to another. When it's filled up with water, it forms a lagoon lake e.g. Lake Nabugabo on Lake Victoria.

### Types of coasts

Changes in sea level may lead to formation of either sub-merged coasts or emerged coasts.

**a) Sub-merged Coasts:** These are caused by either a rise in sea-level or subsidence of the land adjacent to the sea. A sub-merged coast may lead to formation of the following land forms;

i) Ria; a ria coast is a long narrow coastal inlet resulting from sub-mission of a river valley under the sea water. Examples include; Kilindini and Pemba. ii) Fjord; this is a sub-merged glaciated valley.

**b) Emerged coasts:** these are formed when there is relative fall in the sea level or when the land near the sea or lake rises up. Emerged coasts are characterized by raised cliffs and wave-cut platforms.

## CORAL REEFS

A coral reef is a limestone rock which is made up of skeletons of small living organisms called **polyps**.

The formation of coral reefs is highly attributed to the presence of calcium carbonate in the skeletons of polyps.

When the polyps die, their skeletons which contain calcium carbonate are compacted together to form a coral rock.

In East Africa, they are only found along the East African coast.

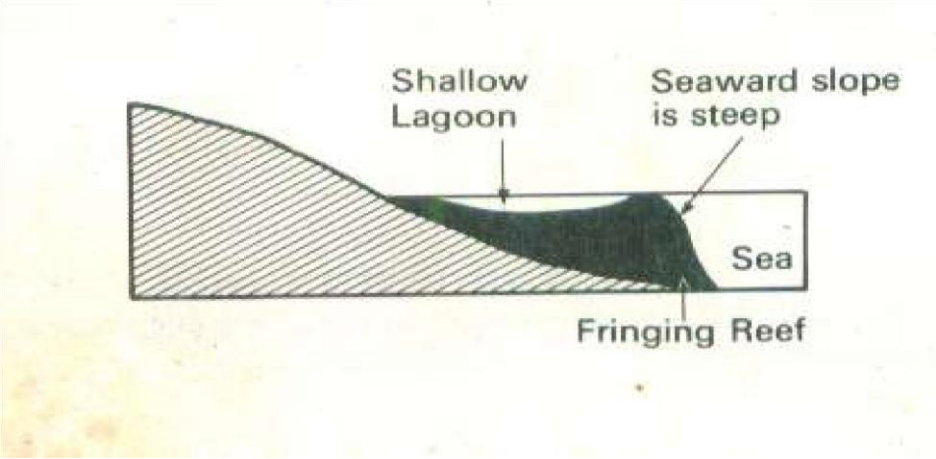
**Conditions for the formation of coral reefs**

- ✓ Warm water temperatures of between $21^0$C to $30^0$C.
- ✓ Shallow water of less than 30m deep.
- ✓ Extensive continental shelf which has a base for growth of the coral platform.
- ✓ Well oxygenated water for the survival of polyps.
- ✓ Abundant supply of plankton used as food for the polyps.
- ✓ Clear water free from silt with no sediments and mud.
- ✓ Salty water of at least 27% to 40% of salt content.

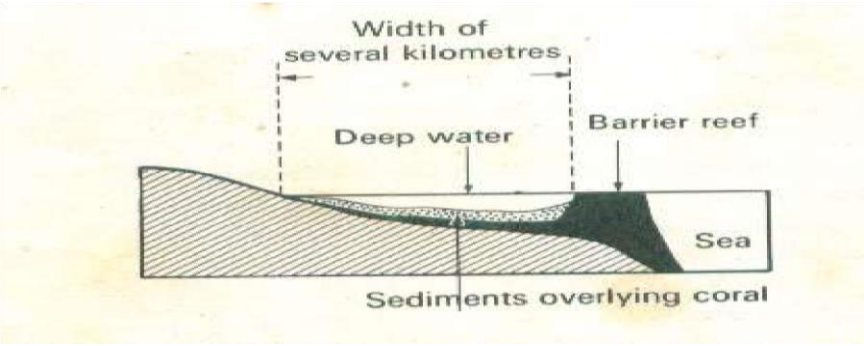
- ✓ Calm waters which allow for the accumulation of dead polyps.
- ✓ Variations of water level to allow death of polyps and accumulation of coral shells.

**TYPES OF CORAL REEFS**

**Fringing reefs:** this is a narrow coral landform separated from the coast by a lagoon which may disappear at a high tide. Examples include; Andro-mache and Leven reef at Mombasa.



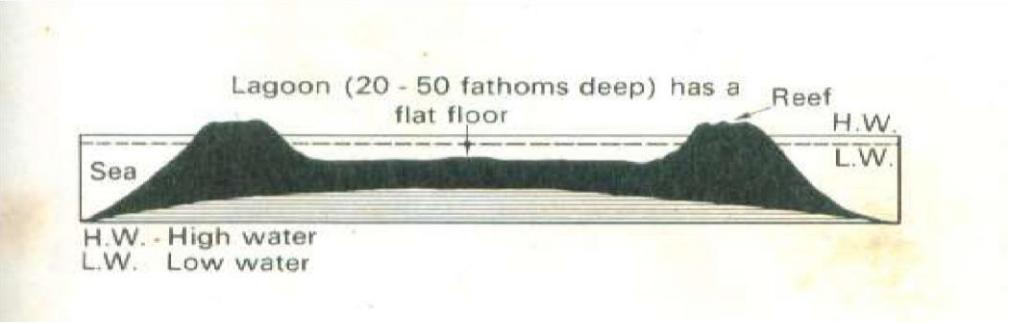

**Barrier reef:** this is almost similar to a fringing reef but with a deeper and wider lagoon separating it from the mainland. It is formed far away from the coast. A barrier reef can be seen at Diani Beach and Tiwi in Mombasa.




**Differences between fringing reef and barrier reef**

- ✓ Fringing reef is joined to the mainland while the barrier reef is separated from the mainland.
- ✓ A fringing reef is separated from the mainland by a narrow lagoon while a barrier reef is separated from the mainland by a wide lagoon.
- ✓ A fringing reef is near the coast while the barrier reef is far away from the coast.
- ✓ A fringing reef is exposed at low tide while a barrier reef is never exposed at a low tide.
- ✓ Accumulated material of a fringing reef lies at shallow depth while accumulated material of a barrier reef lies at great depth.
- ✓ A fringing reef has a narrow platform while a barrier reef has a wider platform.
- ✓ The lagoon of a fringing reef may disappear but the lagoon of a barrier reef is permanent.

**(iii) Atoll reef:** An atoll is a circular or broken ring of small islands made up of coral reefs. It forms a shape of a horseshoe magnet. Such islands surround a fairly deep lagoon e.g. The Aldabara Atoll in Zanzibar.




**Economic importance of Coral reefs**

- ✓ Coral reefs contain limestone and are processed to obtain cement e.g. Tanga cement of Tanzania and Bamburi cement at Mombasa.
- ✓ Coral reefs provide beautiful scenery which attracts tourists who bring in foreign exchange.
- ✓ Fringing reefs shelter ports from sea waves and tidal currents e.g. Andra-mache reefs and Leven reefs at Mombasa hence favouring shipping activities.
- ✓ There are possibilities of obtaining chromium from under the coral polyps.

- ✓ Fringing reefs shelter lagoons from dangerous marine animals hence forming safe swimming places for tourists.
- ✓ Some coral reefs weather into good fertile soils which support growth of crops like coconuts, oil palms and cloves at Zanzibar.
- ✓ Coral reefs are used for research and recreation purposes.

**Negative importance**

- ✓ Coral reefs break down into coral Wanda which are infertile soils hence can't support agriculture.
- ✓ Coral reefs can be an obstacle to navigation because sharp rocks at the sea bottom can cause boats and ships to capsize.
- ✓ Lagoons resulting from coral reef formation are breeding grounds for disease spreading vectors like mosquitoes.
- ✓ Coral reefs damage fish nets by tearing them hence making losses for the fishermen.
- ✓ Quarrying of limestone leads to land degradation.
- ✓ Processing and mining of coal rocks produces dust which pollutes air

# Eustatism /eustatic movements/ sea level changes

Eustatism refers to changes in the seal level which may be positive involving a rise in sea level or negative involving a fall in sea level relative to the coastal land.

Sea level change refers to the rise and fall of the sea level worldwide relative to the adjacent land.

Sea level change can also be defined as the vertical movement of the land relative to the sea that results into a fall or rise in the water levels worldwide.

Sea level changes are also referred to as **Eustatic changes**. Sea level changes are grouped into two;

a) A **positive** sea level change which implies to a rise in sea level. It is also termed as **Marine transgression**. It results into the **submergence** of coastal area.

b) A **negative** sea level change which implies to a **fall** in sea-level and it is also known as **marine regression**. It results into **emergence** of coastal areas/features.

**The changes in the sea level may be caused by the following:-**

- ✓ Increased plaviation (rainfall) and desiccation (drought).
- ✓ Glaciations (freezing) and deglaciation (melting).
- ✓ Increase in temperature will lead to a rise in sea level because H2O expands when heated from beneath.
- ✓ Tectonic movements e.g. uplift of the coastal land down warping of the coastal lands. Expansion and contraction of ocean basins.
- ✓ Sedimentation of materials into ocean basins.

***Chapter 9***

# Climate and Natural Vegetation of East Africa

## Introduction

*In this chapter, you are going to learn about the different types of climate and natural vegetation in East Africa. You are going to learn how these two are natural resources that need to be appreciated and sustainably used for the benefit of the people of Uganda in all generations.*

ACT 9:1

a) *Explain what you understand by climate.*
b) *List any five climates you know.*
c) *Describe two of the climates listed above.*

***Definition of climate.***

Climate is the average weather conditions for a place recorded for a long period of time usually 35yrs.

**Factors influencing the climate of East Africa**

**Altitude:** Climate changes with height above sea level. Areas near mountains receive heavy rainfall and low temperature especially on the windward side e.g. Mt. Kenya, Elgon, Kilimanjaro.

Altitude also influences temperature differences e.g. areas on a higher altitude are cooler e.g. Nairobi, Kabale and Kampala while lowland areas receive high temperate e.g. Mombasa and Kasese.

**Distance from the sea:** Areas close to water bodies receive heavy and reliable rainfall e.g. shores of Lake Victoria (Kisumu, Entebbe, Bukoba, Mwanza and Nyanza province).

This is due to the abundant moisture released into the atmosphere through evaporation whereas areas which are far away from water bodies receive low and unreliable rainfall and hot temperature due to less moisture release e.g. Dodoma, Karamoja and Masailand.

**Latitude:** Climate changes as one moves away from the equator, North or south. The equator influences the occurrence of the InterTropical Convergence Zone (ITCZ).

This is in relation to apparent movement of the overhead sun. Areas around the equator receive double maxima of rainfall and hot temperature between February and May and between September and November e.g. Entebbe, Kisumu while areas that are far away from the equator receive single maxima of rainfall e.g. Gulu and Dodoma.

**Relief:** Highland areas act as barriers to prevailing winds. In such areas, there are differences between the conditions on the lee ward side and the wind ward side.

The leeward side receives little or no rainfall because it's in the rain shadow e.g. Kasese and Arusha while areas on the wind ward side receive heavy rainfall and lower temperatures e.g. Mbale and Kigezi region.

**Vegetation:** Areas with tropical rainforests receive heavy rainfall due to abundant moisture release through evapo-transpiration e.g. near Mabira forest in Mukono district while areas without vegetation cover receive hot temperatures and low rainfall e.g. Kondoa region(Miombo woodlands), Machakos, Turkana land and Karamoja.

**Influence of man:** Due to man's activities such as bush burning, swamp reclamation and deforestation, this leads to disappearance of vegetation hence low rainfall and high temperature.

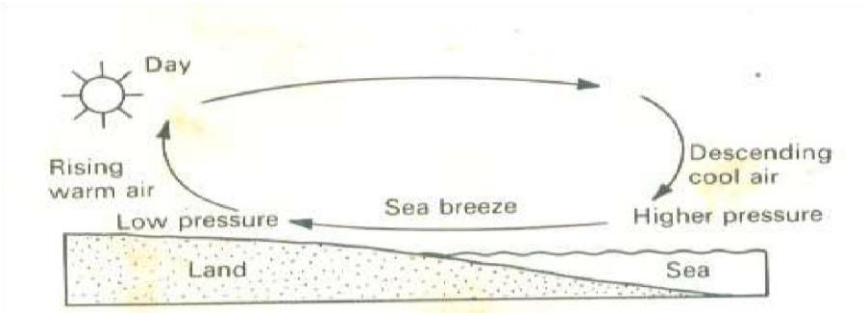
Urbanization through industrialisation and road construction has also led to global warming hence hot temperatures in cities e.g. Kampala and Dodoma. Activities such as afforestation and re-afforestation have led to growth of vegetation hence leading to heavy rainfall.

**Influence of local trade winds:** Trade winds have got an impact especially along the coastal areas and shoes of Lake Victoria. They lead to formation of land and sea breezes.

- ✓ **Land breeze:**

it takes place during the night. After sunset, both the land and the sea cool down but land cools down faster than water meaning that air over land becomes cooler than air over water. Moist air

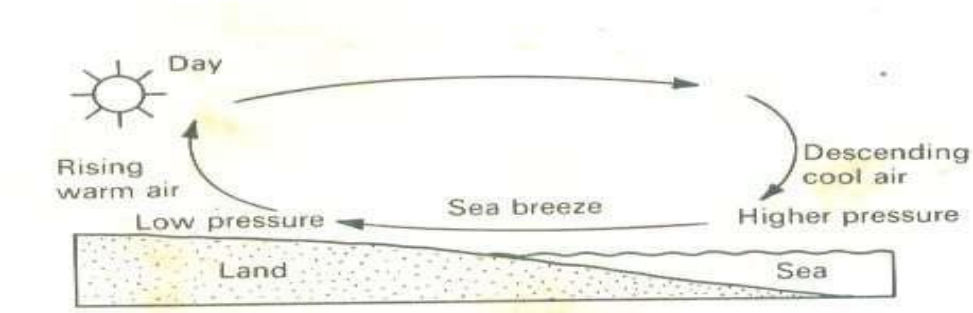
therefore flows from land to the sea or lake. Warm air over the sea is forced to rise up to the condensation level forming clouds and forming rain which falls especially during the morning hours.




- ✓ **Sea breeze:**

It takes place during the day when land heats up faster than the water. Air above land becomes warmer and it's forced to rise up forming a low pressure zone on land. Moist air from the sea begins to push its way beneath the warm air over the land.

The warm air is pushed upwards to the condensation level where it forms clouds which fall back as rainfall especially during the afternoon hours.




**N.B: temperature inversion:** This is a situation where temperatures at high altitude are warmer than those in the valleys or it's a situation where temperatures increase with increase in altitude e.g. near Kenya highlands and Kigezi

Describing climate means pointing out its main **characteristics**. It is these characteristics that differentiate one climate from another. You are going to learn about the characteristics of the main climates in East Africa.

***Climatic types of East Africa.***

In East Africa, there are four major types of climatic zones which are;

- ✓ *Equatorial climate*
- ✓ *Tropical climate,*
- ✓ *Desert/semi-arid climate*
- ✓ *Montane climate.*

Climate influences human activities e.g. agriculture, settlement, feeding, dressing and other physical aspects like vegetation

What are the Characteristics of the Main Types of Climate?

***In pairs or individually, study Figure 9.1 and do the following tasks***:

1. Write down the months in which the highest amount of rainfall is received at Entebbe
2. How many seasons of highest rainfall does Entebbe experience? Why do you think the area experiences that number of seasons?
3. Is the relative humidity at Entebbe high or low? Give reasons to support your answer.
4. Calculate the annual range of temperature for Entebbe. Is the range high or low?
5. Calculate the total annual rainfall for Entebbe. Is the rainfall low, moderate, or heavy?

**Equatorial Climate**

This climate is found in areas that lie between 5°N and 5°S of the Equator. In East Africa, the Equatorial climate is experienced around the Lake Victoria basin, including the islands within the lake.

**Characteristics of Equatorial climate:**

- ✓ Heavy and reliable rainfall of about 1500mm per annum is experienced throughout the year. There are two rainfall seasons/peaks (double maxima) in a year.
- ✓ The length of the days and the nights is almost equal throughout the year (equinox).
- ✓ Humidity is always high due to high rate of evaporation.
- ✓ The climate is both hot and wet.

- ✓ It has a small annual temperature range of about $3^0 – 4^0$C.
- ✓ The rainfall is received throughout the year and is well distributed.
- ✓ Rainfall is mainly convectional resulting from high evaporation from lakes, rivers and forests. Rainfall mainly falls in the afternoon accompanied by lightning and thunder.
- ✓ Temperatures are high in this region and even throughout the year.
- ✓ The region is also characterized by dense cloud cover making both days and nights warm.
- ✓ Low pressure all year round due to high evaporation rates

***Economic activities carried out in equatorial climate regions***

- ✓ Due to the existence of dense forests, wild life conservation has been made possible and this attracts tourists.
- ✓ Equatorial climate has also favoured the existence of numerous water bodies giving rise to fishing activities.
- ✓ The dense vegetation in equatorial regions harbours wild animals making hunting possible.
- ✓ The dense forests due to heavy rainfall and hot temperatures experienced in that region have favored lumbering activities e.g. in Mabira forest.
- ✓ Agriculture and forest products existing in equatorial region have made industrial growth possible.
- ✓ Growing of perennial crops like coffee, palm oil, cocoa and tea due to heavy rainfall received throughout the year.
- ✓ Charcoal burning due to existence of dense forest cover.
- ✓ Food gathering e.g. passion fruits due to thick forests with fertile and dump grounds.

***Problems faced in equatorial regions***

- ✓ Rampant occurrence of pests and diseases which attack man, livestock, crops and this has scared away settlements leading to low development rates.
- ✓ Heavy rainfall received throughout the year and existence of the dense forested regions has made the establishment of transport network very difficult.
- ✓ The region with its dense forests has made it difficult to exploit such areas leading to remoteness.

- ✓ The equatorial forests are commonly inhabited by robbers and this has constrained any attempts to the development of the region.
- ✓ The heavy rainfall received throughout the year has caused a danger of erosion especially in areas where agriculture is practiced.
- ✓ Heavy rainfall may also lead to flooding which destroys peoples' lives and property.
- ✓ Leaching of the soils due to heavy rains and erosion has also led to serious loss of soil fertility.
- ✓ High rate of weed growth hence increasing costs of farming and clearance of land.

***Steps taken to improve conditions in equatorial regions***

- ✓ Establishment of transport and communication networks such as roads to reduce remoteness.
- ✓ Ensure political stability by talking peace with the respective rebel groups so as to allow development to take place in the affected areas.
- ✓ Practice modern methods of agriculture such as application of both organic and in-organic fertilizers to check on the rate of soil fertility loss.
- ✓ Setting up processing and manufacturing industries to take up products from agriculture and forestry to minimize wastage
- ✓ Use of herbicides to control growth of weeds.
- ✓ Market research so as to enable the farmers in the region to sell their agricultural produce.
- ✓ Provision of capital in form of soft loans to enable different activities like agriculture and lumbering.
- ✓ Planting of trees to control soil erosion.

**Conditions leading to equatorial climate**

**Influence of trade winds** especially the south east trade winds which blow over the Indian Ocean causing the inter - tropical convergence zone leading to heavy rainfall, high humidity along the equator.

**Distance from the sea**: areas near water bodies e.g. Lake Victoria and Kyoga receive heavy rains due to on-shore and off-shore breezes hence equatorial climate.

**Latitudinal location**: Areas along the equator experience hot and wet conditions due to inter-tropical convergence zone (ITCZ) formed when winds converge at the equator blowing from different areas especially over the Indian Ocean.

**Ocean currents** especially the warm Mozambique currents that bring heavy rainfall along the equatorial belt of East Africa.

**Man's activities** through afforestation & re afforestation programs which lead to creation of green belts of vegetation leading to heavy rainfall along the equator.
**Influence of vegetation**: Thick forests e.g. Mabira lead to rainfall formation through evapotranspiration.

Study the table in Figure 9.13 and do the activity that follows.

| | **J** | **F** | **M** | **A** | **M** | **J** | **J** | **A** | **S** | **O** | **N** | **D** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temp ($^{0}$**C**) | 21 | 21 | 21 | 22 | 22 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| Rainfall(mm) | 155 | 176 | 243 | 357 | 288 | 80 | 49 | 69 | 99 | 165 | 211 | 209 |

***Figure 9.13: Climatic statistics for Bukoba, Tanzania***

a) Copy the table into your exercise book.

b) Draw a graph to represent the climate of Bukoba.

c) Which is the hottest month in the year? 4. Which is the wettest month at Bukoba?

d) Calculate the total annual rainfall for Bukoba.

e) Describe the rainfall distribution at Bukoba.

f) Explain the relationship between temperature and rainfall distribution at Bukoba.

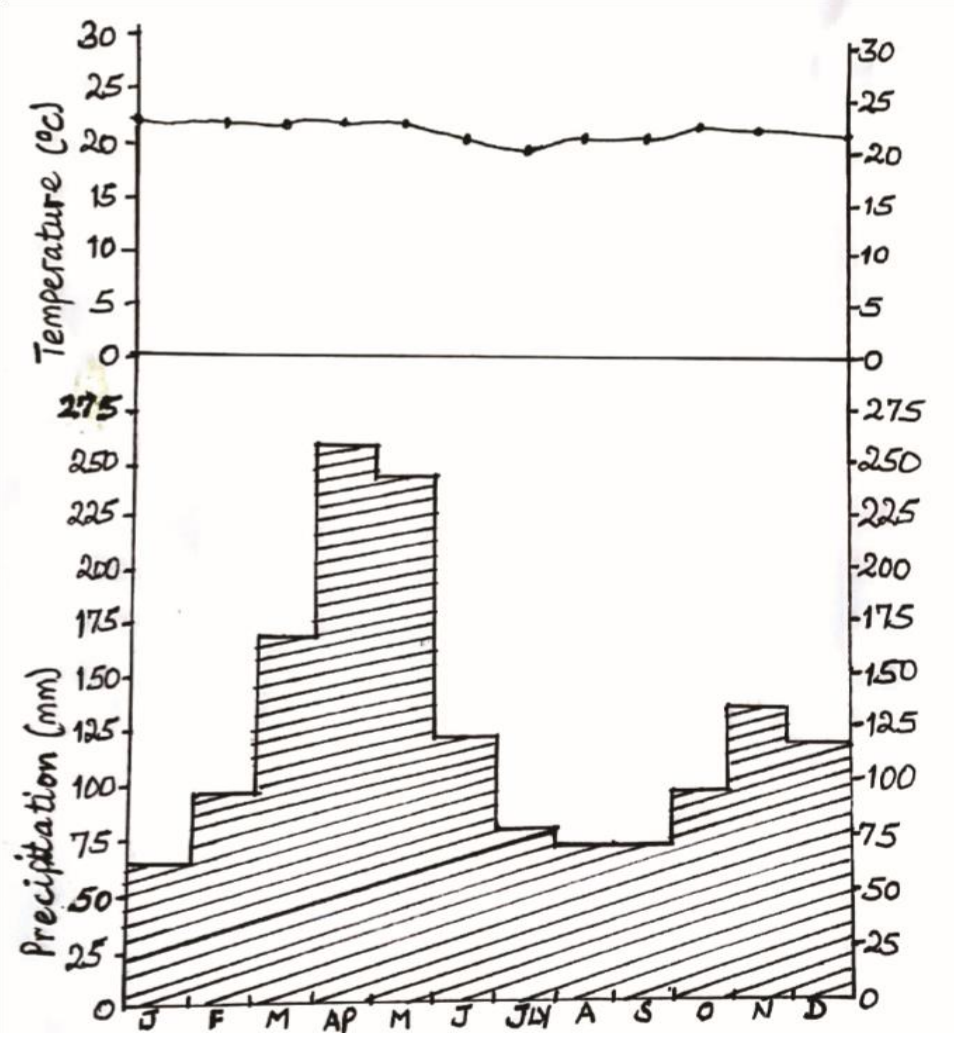



***Figure 9.1: An equatorial climate, Entebbe***

## Tropical Climate

It occurs between 5° to 15° north and south of the Equator. It's found in the broad zone between the equatorial climate and the hot desert.

This type of climate covers the greatest part of East Africa. It is found next to the equatorial region, both north and south of the equator.

It may not differ much from the equatorial climate. Generally, Savannah lands receive less rainfall than places in the Equatorial climate region. Also, they have well marked rainy and dry

seasons. You can understand the other characteristics of the Savannah climate by studying Figure 9.4.

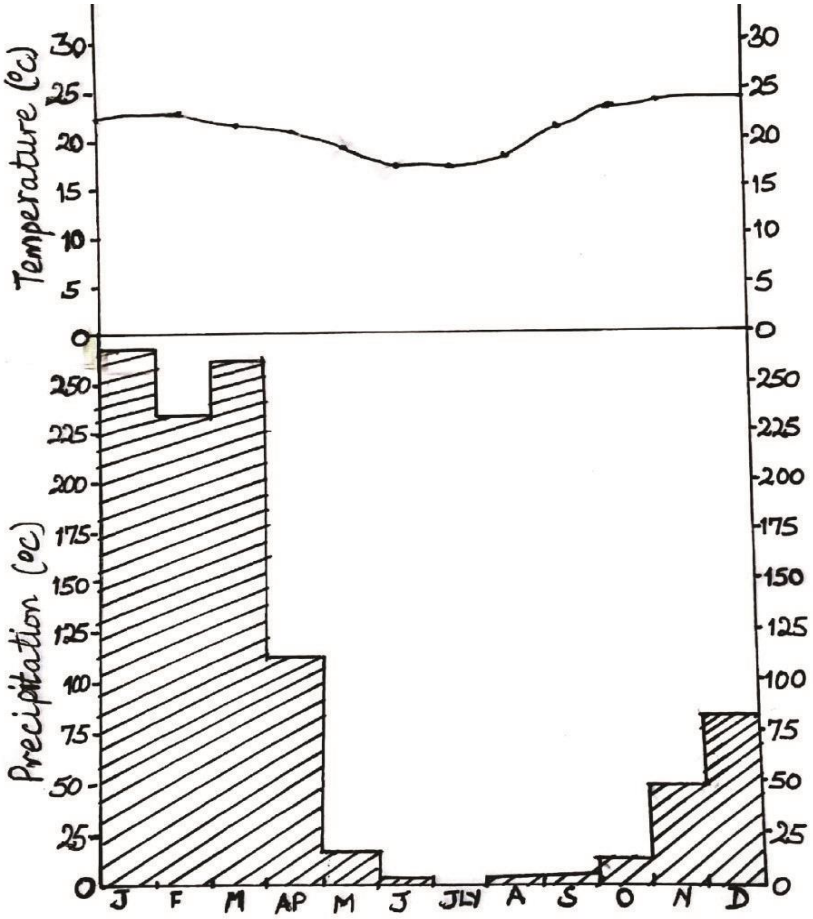



**Figure 9.4: Tropical climate, Songea, Tanzania**

***Characteristics of topical climate***

- ✓ Rainfall varies in amount from 1000 mm near the equator and decreases towards the desert about 250 mm.
- ✓ Rainfall is mainly received in summer when temperatures and evaporation rates are high.
- ✓ The rainfall received in the region is convectional in nature coinciding with the overhead sun.
- ✓ Receives single maxima of rainfall i.e. one peak.
- ✓ Annual temperature range is moderate ranging between $7^oC$ – $9^oC$.

- ✓ Humidity is relatively high throughout the year due to high evaporation rates.
- ✓ The region experiences a low cloud cover generally though the cloud cover is a bit dense during the summer seasons.
- ✓ Alternate wet and dry seasons are experienced.

***Economic activities that can be carried out in savannah regions***

- Crop growing i.e. Annual/seasonal crops are grown e.g. maize, millet, groundnuts beans, and cotton due to seasonal rainfall.
- The natural vegetation in the savannah consists of mainly grasslands that favour livestock rearing.
- Lumbering has also been carried out in savannah from the woodlands.
- The Savannah grasslands provide a natural habitat for many species of wild life which forms the basis for the tourism industry.
- Due to agriculture that takes place in the savannah, development of processing and manufacturing industries has been made possible. E.g. grain mills, ginneries for cotton, milk processing plants e.t.c.
- Charcoal burning and extraction of wood fuel also has been favoured in the savannah due to the existence of woodlands.
- Hunting of animals has also been favoured in the savannah due to the existence of the wild animals.
- Bee keeping can also survive in the savannah woodlands.

***Problems faced in savannah regions***

- Low and unreliable rainfall which leads to crop failure after planting.
- Shortage of adequate pasture for the livestock especially during the dry season forcing people to live a pastoral life.
- Large herds of livestock are kept which leads to over stocking, over grazing and eventually soil erosion.
- Wide spread fire out break especially during the dry seasons which leaves the surface bare leading to erosion when the rain season begins.

- Occurrence of pests and diseases which affect the crops and livestock e.g. tsetse flies which spread sleeping sickness in human beings and Nagana in livestock.
- Poaching of wild animals and this has affected the tourism industry.
- The severe occurrence of drought conditions forces wild animals to migrate which affects tourism.
- Some savannahs have inadequate transport and communication network which has led to remoteness and low levels of economic development.
- Inadequate capital to develop savannah regions.
- Growth of weeds during the wet season which makes crop growing very expensive.

***Solutions to the above problems***

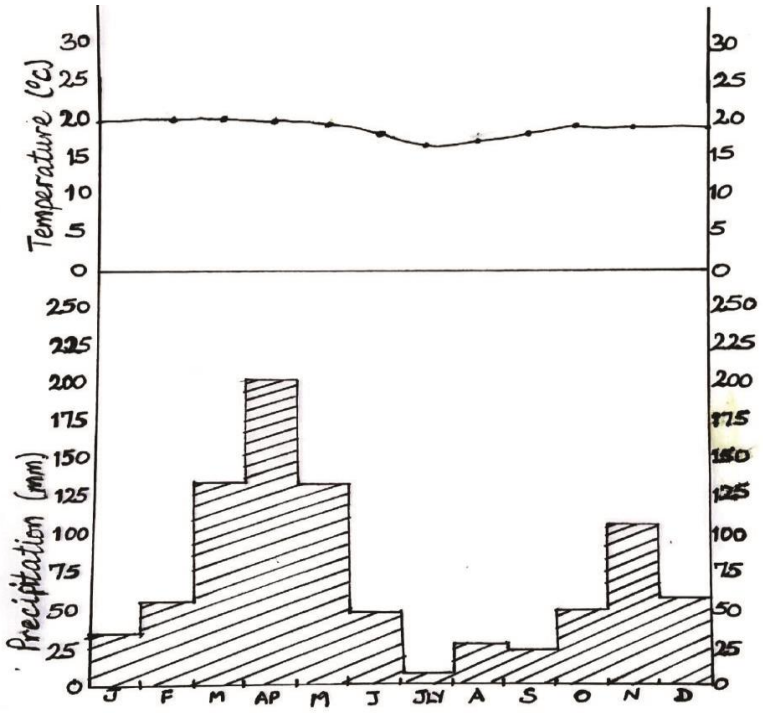
- Use of chemical spraying to control weeds and pests.
- Provisions of soft loans to reduce shortage of capital for developing the regions.
- Encourage crop rotation to ensure soil fertility and high productivity.
- Construction of valley dams to store water for the dry season.
- Establishing ranches to act as demonstration farms for the pastoralists.
- Extending veterinary services to reduce animal diseases.
- Construction of roads to reduce remoteness of such areas

# Mountain or Montane Climate

This type of climate is mainly found in the highlands, especially in the mountains. Examples of these areas include; Kikuyu land (Mt. Kenya), Chagga land (Mt. Kilimanjaro), Bugisu land (Mt. Elgon) and Kigezi land.

In these areas, temperatures are generally low and air pressure decreases with altitude. Areas with the montane climate receive mainly relief rainfall, which is heavier on the windward side. The leeward side receives very little rainfall. Why do you think this is so? The condition you have explained is called the **rain shadow** effect.

To understand the characteristics of Mountain climate, study Figure 9.




## Activity 9.3

*Study Figure 9.2 and do the following tasks:*

a) *Which months have the highest rainfall?*

b) *Which months have the lowest rainfall?*

c) *Describe rainfall distribution in Nairobi.*

d) *Which are the hottest months?*

e) *Which months have the lowest temperatures?*

f) *Calculate the total rainfall for Nairobi.*

***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 tops of the mountains do not receive as much rain as the lower slopes.

- Where altitude exceeds 4500m above sea level, the areas are covered by permanent snow/glaciers e.g. Mt. Kenya, Kilimanjaro and Rwenzori.
- The leeward slopes are often dry due to the rain shadow effect e.g. Kasese and Ankole Masaka corridor.
- Lower slopes are warmer than higher slopes.

***Economic activities carried out in montane climate***

- Tourism due to existence of permanent snow and glacial features that attract tourists that brings in foreign exchange.
- Lumbering especially from the mountain forest favoured by the heavy rains.
- Slopes that have fertile soil and receive heavy rains favour agriculture for food production especially on the windward side.
- Nomadic pastoralism especially on the lee ward sides of the highlands.
- Mineral exploitation due to occurrence of some mineral deposits in mountain rocks e.g. copper at Kasese.
- Stone quarrying which provides materials for road construction and building.

## Semi-arid and Arid Climate.

This type of climate is found in northern and north-eastern Kenya, e.g. the Chalbi Desert, Karamoja in north-eastern Uganda, Nyiri desert in southern Kenya, in central Tanzania and in north-eastern parts of Tanzania, e.g. the Masai **steppe.**

It is also experienced in the Ankole-Masaka corridor in Uganda. Areas in the Western Rift Valley region around Lake George and Lake Edward also experience a semi-desert climate

***Characteristics of desert and semi-desert climate***

- They receive low and reliable Rainfall.
- Annual Rainfall total is below 250 mm per year.
- The region experiences hot temperatures above 30$^{o}$C throughout the year.

- The days are very hot while the nights are very cold due to absence of cloud cover.
- These regions experience low relative humidity because of the extreme dry conditions.
- They experience hot and dry conditions throughout the year.
- Rainfall is rare but torrential which leads to seasonal floods.

***Factors that have led to desert type of climate.***

- Latitudinal location far away from the equator where rainfall is low and unreliable.
- Location on Eastern side of the continent where off-shore winds especially the North East trade winds lead to aridity.
- Absence of large water bodies in the interior hence reduced evaporation e.g. Chalbi desert.
- Rain shadow effect due to presence of Ethiopian highlands hence dry descending winds reaching Karamoja and Turkana land.
- Presence of scanty vegetation which limits evapo-transpiration leading to low rainfall totals.
- Presence of off-shore winds which blow parallel to the coast diverting moisture bearing winds from the land mass.
- Bush burning by pastoralists which leads to rise in temperatures.

***Economic activities in desert and semi-desert climate***

Tourism due to the existence of numerous desert landforms that attract tourists e.g. sand dunes.

- Nomadic pastoralism due to existence of scanty pastures e.g. the Karamojong.
- Mining and sand quarrying e.g. gold in Karamoja although it exists in small quantities.
- Cultivation of drought resistant crops under irrigation e.g. cotton in Kasese.
- Bee keeping due to the existence of scattered trees.

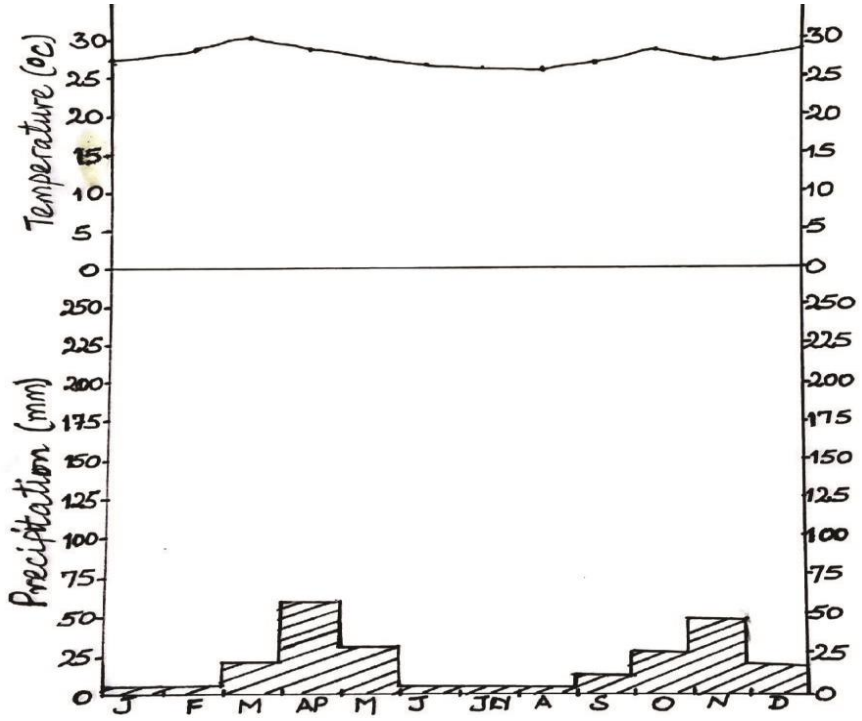
***Problems faced by people living in desert regions***

- Inadequate/limited supply of surface water for livestock and human consumption.
- Shortage of pasture for livestock rearing leading to nomadism.
- Infertile soils which don’t support crop growing.
- Low and unreliable rainfall which limits growth of crops and vegetation.
- Excessively high temperatures during the day making settlements difficult.

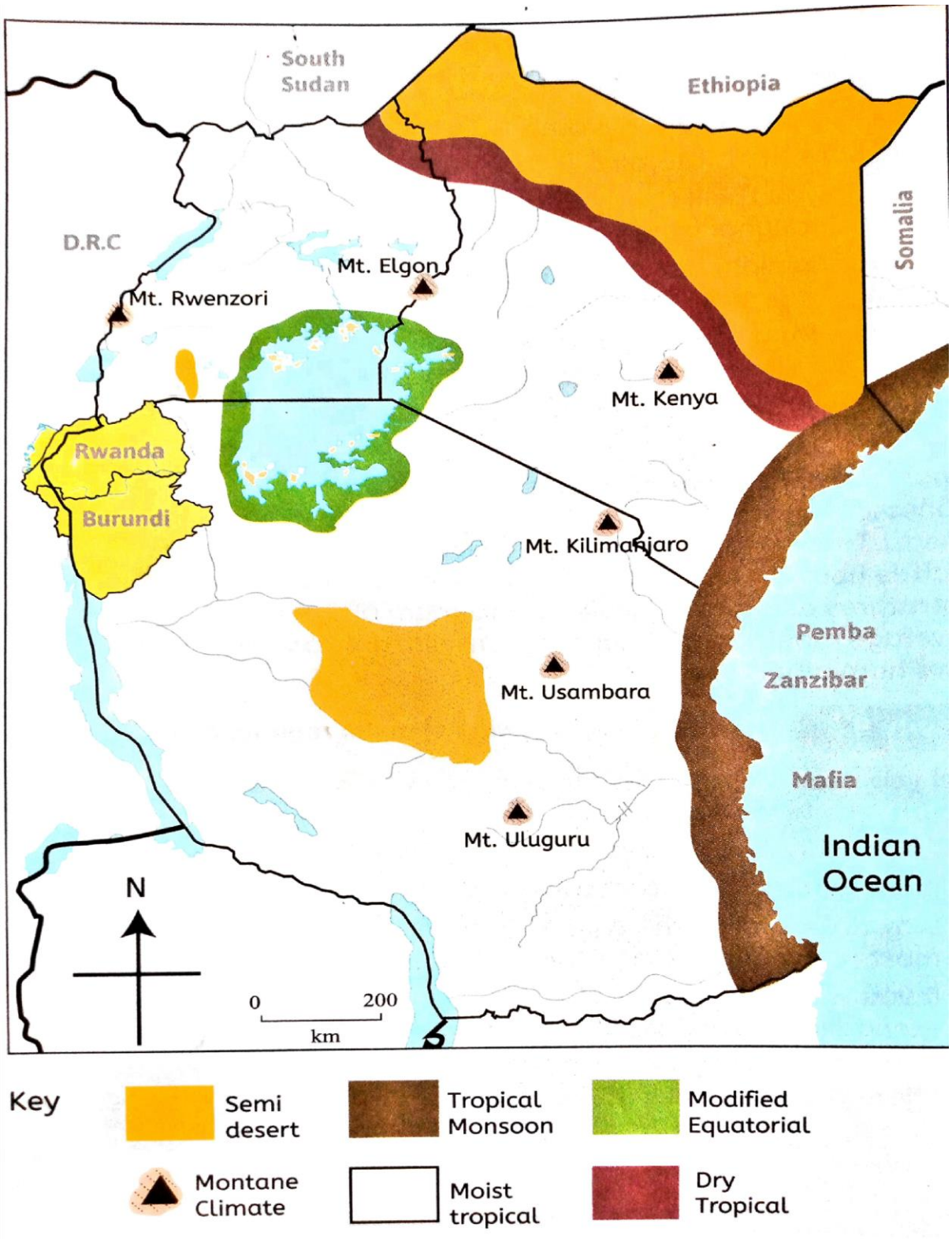
- Very cold nights due to absence of cloud cover.
- Desert areas are remote due to absence of road network.
- Limited supply of food leading to frequent famine.
- Sandstorms due to strong winds are common leading to loss of lives and poor visibility.
- Small population makes it difficult to provide social services.
- Temporary flooding due to torrential downpours.

*In groups, study Figure 9.3 and do the following:*

1. *Copy the figure into your notebooks.*
2. *Find out the months with the heaviest rainfall.*
3. *Which months have the lowest rainfall?*
4. *Describe the characteristics of the climate of the area represented by Figure 9.3.*
5. *Suggest the likely economic activities carried out by the people living in the area represented by the graph. Give reasons for each activity you suggest*



CLIMATIC ZONES OF EAST AFRICA



# Natural Vegetation of East Africa

Vegetation is the general term given to all living plants of various categories i.e. the trees & grass that cover the earth's surface and those that grow in water. Biologically, vegetation is known as Flora. There are four major types of vegetation in East Africa which include;

Equatorial /tropical rainforest, Savannah vegetation (woodlands and grasslands), Swamp or mangrove vegetation and Semi-arid/desert vegetation.

**Factors influencing vegetation distribution in East Africa**

**Climate:** tropical forests grow in areas that experience heavy and reliable rainfall of about 1500mm and above. They also thrive well where temperatures are high throughout the year e.g. Mabira and Budongo forests.

The amount of rainfall reduces as one moves away from the tropical region and this has led to Savannah vegetation consisting of Savannah Woodland and Savannah Grass Land e.g. Miombo woodlands. Desert regions receive rainfall which is very low, hence shrub and dry bush are dominant e.g. in Karamoja and Turkana land.

**Altitude:** Tropical rain forests, mangrove forests and savannah vegetation thrive well on the low altitude areas e.g. Masai Mara while Montane forests, heath and moorland thrive well on high altitude areas e.g. in Kabale.

**Drainage:** Areas with permanent and stagnant water have favoured swamp vegetation as well as mangrove forest e.g. at the East African Coast. Areas with no permanent drainage features such as lakes and rivers tend to be very dry and these have a dominance of semi-arid vegetation e.g. Karamoja. Areas that are well drained have a dominance of savannah and tropical rain forests e.g. along mountain slopes.

**Soils:** Areas with deep and well drained fertile soils tend to favour tropical forest vegetation. Areas with moderately fertile soils favour the growth of Savannah grasslands whereas very infertile areas will favour semiarid vegetation and at times do not favour vegetation at all e.g. Karamoja region.

The water retention capacity of the soil (soil porosity) will also influence vegetation. High water retaining soils e.g. clay soils lead to occurrence of swamp or mangrove vegetation e.g. along the coastal belts.

**Biotic factors: s**ome areas that are infested with pests tend to scare away settlement creating favorable conditions for the growth of dense vegetation or savannah wood lands e.g. Miombo Woodlands of central Tanzania. Areas without pests attract settlements and lead to savannah grass land. Areas that are infested with locusts tend to have scanty vegetation because these insects destroy the existing vegetation.

**Human activities:** Large areas of forested land have been cleared for timber to create room for settlement and cultivation which has resulted into forested areas turning into savannah grasslands. Large areas of savannah vegetation have been turned into shrubs and wood lands because of activities like over grazing, bush burning, charcoal burning etc.

Some areas have been left without vegetation because of human practices like monoculture and shifting cultivation e.t.c leading to semi desert and desert vegetation. In areas where man has engaged in afforestation and re-afforestation activities, he has led to luxuriant tropical rain forests.

**Characteristics of vegetation zones**

**i) Equatorial / Tropical Rain forests**.

- ✓ Trees have big trunks
- ✓ They are ever green through-out the year because of high rainfall.
- ✓ They have little or no undergrowth.
- ✓ Trees are very tall above 30-40 metres.
- ✓ Trees form canopies of about 3 different layers due to varying tree heights.

- ✓ Trees have many climbing plants (lianas) because of search for sunlight e.g. passion fruits.
- ✓ The trees mainly provide hard wood e.g. Mvule, Mahogany and Ebony.
- ✓ Trees have broad leaves.
- ✓ The trees have buttress roots to hold the huge tree trunks.
- ✓ Trees appear in impure stands.
- ✓ Forests are always thick i.e. impenetrable e.g. Bwindi impenetrable forest.
- ✓ Trees have a long gestation period of over 60 years.

**ii) Savannah vegetation:**

it's divided into two i.e. grasslands which include; Queen Elizabeth National Park, Serengeti National Park, Kidepo valley National Park and Murchison Falls National Park and Woodlands which include; Miombo woodlands in Tanzania.

- Trees are ever green because of relatively high rainfall especially during the wet season.
- During the dry season, trees have brown leaves which they shade off to prevent loss of water (deciduous trees).
- Trees have got long tap roots in order to reach underground water.
- Trees are always scattered e.g. acacia.
- Grass grows up to 2m e.g. elephant grass.

**iii) Semi-desert / Desert vegetation:**

Mainly found in areas that receive low rainfall below 750mm per year. Areas with this type of vegetation include; Turkana land, Karamoja region and Ankole-Masaka corridor.

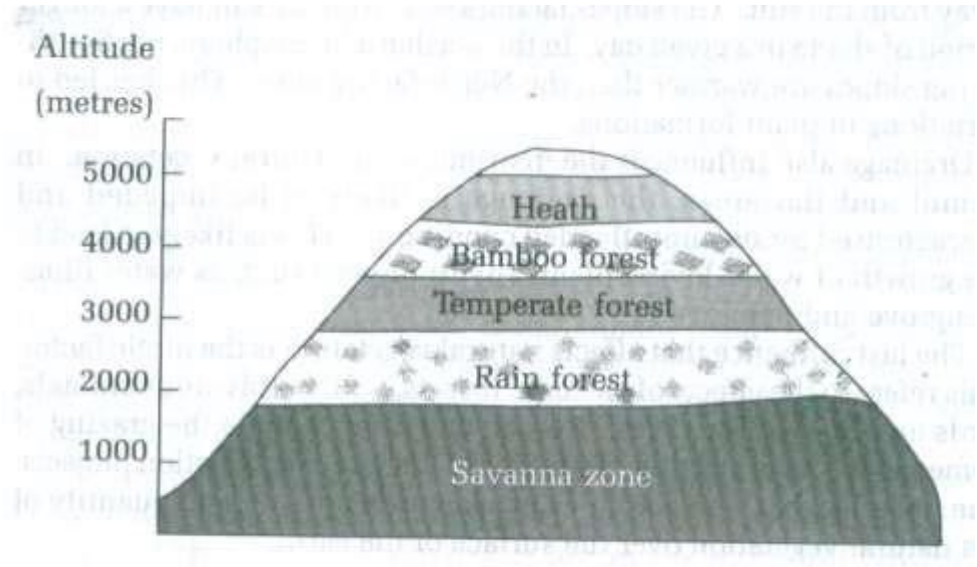
- Trees are very short and usually stunted.
- Trees have very long tap roots to reach to the water level which is very deep.
- They have scattered bushes and thickets.
- Trees have thorny leaves e.g. lantana camara and baobab trees to prevent the animals from eating their leaves.
- Some plants have swollen trunks in which they store water to use during the long dry season e.g. Baobab.

- The plants have seeds that can lay dormant on the ground for a long time until the rain falls to allow germination.
- Many plants complete their life cycle within a few weeks before the soils dry up e.g. shrubs.

**iv) Swamp/mangrove vegetation:** In East Africa, swamps are found around water bodies e.g. around Lake Victoria and Kyoga, along the coast (mangrove swamps) and around the various rivers (Riverine swamps) e.g. River Kafu, River Katonga and River Nzoia. Some swamps are also found in Dombos (broad valleys) e.g. Awoja swamp in Soroti, Olwenyi swamp in Lira.  Swamp vegetation is found in water logged areas.

- Vegetation is a mixture of mangrove trees, palm trees, coconuts and papyrus.
- The ground has a lot of mud and it's marshy.
- Trees are evergreen throughout the year.  Trees are medium height usually less than 10m due to high temperatures.
- Trees grow close to each other making forests thick.
- Trees have fibrous roots and straight stems.
- Trees have broad leaves and are characterized by hard wood.
- Some trees have twisted stems/trunks

**v) Montane vegetation:** This occurs in mountain ranges and highland regions e.g. along Mt. Kenya, Elgon and Kilimanjaro. Due to varying altitude, the vegetation changes as one moves up the mountain as shown below.




***Savannah:*** this is found at the lowest level of the mountain below 1000 meters and consists of dry grasses and shrubs. It's due to man's interference through clearance of tropical forests.

***Tropical rain forests:*** these are above savannah at an altitude between 1500 to 2500 meters. It consists of thick luxuriant and evergreen vegetation.

***Temperate and bamboo forests: a***s altitude increases, the rainfall amount reduces and this gives rise to the temperate and bamboo forest which thrive well under cold conditions.

***Heath and moorland: a***t the level between 3500 to 4500 m above sea level. The

Temperatures are very low as well as rainfall. Vegetation here consist of flowering plants, grasses and shrubs e.g. cedar and camphor.

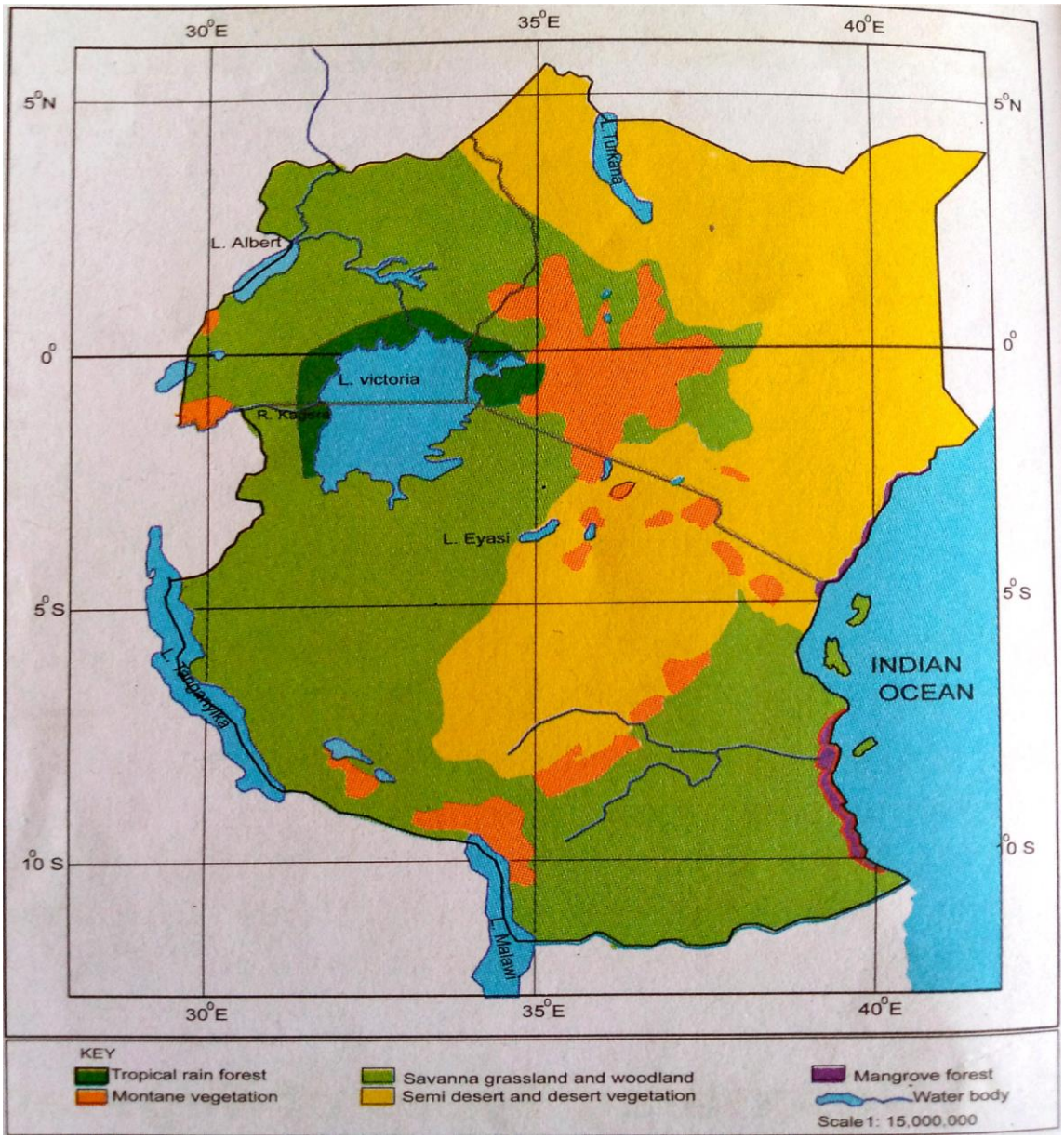
***Snow and bare rock: a***bove 4500 above sea level, temperatures are extremely cold thus the existence of snow and bare rocks. No vegetation grows at this level.

**Characteristics of montane vegetation** include;

- Altitudinal zonation of forest vegetation i.e. tropical forests at lower slopes, temperate slopes at mid-slopes, coniferous and bamboo slopes at higher slopes.

- Tropical forests (low altitude) are of mixed stand and have two layers of canopy.  Tropical forests are of hard wood.
- Temperate, coniferous and bamboo forests are in pure stands and have single canopy.
- Temperate and coniferous forests are soft wood, have thick barks, cone shaped trees, needle shaped leaves, straight trunks and some species have hollow stems.

Vegetation types of East Africa.



Activity.

Climatic statistics for station Y

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rainfall (mm) | 8 | 25 | 76 | 132 | 175 | 150 | 178 | 180 | 140 | 112 | 145 | 36 |
| Temperature ($^{o}$ C) | 26 | 27 | 26 | 26 | 24 | 24 | 23 | 23 | 24 | 24 | 25 | 24 |

Study the table above and do the following tasks:

1. Calculate:
   i) The total annual rainfall for station Y.
   ii) the mean annual temperature for station Y.
2. Draw a suitable graph to represent the climate of station Y.
3. Using the graph you have drawn, describe the climate of station Y.
4. Suggest the type of vegetation found in the region where station Y is located. Give reasons to support your suggestion.
5. Draw a map of East Africa and on it shade the likely regions where station Y is located. If you were given a chance to settle in the area where station Y is found, what kind of economic activities would you carry out? Give reasons to support the choice of each activity you suggest.

END,