DRAINAGE OF AFRICA

Definition of a drainage system

Drainage system is defined as the different sources of water in a given area/region/county. The drainage system includes lakes, rivers and wetlands.

A) RIVERS:

A river is a water body flowing over the surface of the land flowing through a definite natural channel in a linear direction down a slope due to gravity.

Africa has a number of rivers both big and small, all of which rise somewhere in the huge plateau and mountain areas. In these areas plenty of rain falls and supplies the rivers, keeping them full for their journeys to the seas and oceans which surround Africa.

A point where the river starts to flow is known as a **source** like lakes, mountains. Swamps and pours into a **mouth** such as lakes, swamps, ocean, and sea for example;

River	Source	Month
Nile	Lake Victoria	Mediterranean Sea
Congo	Congo forest	Atlantic Ocean

The Nile [white & blue] is the longest of Africa's rivers and the most important. Others major rivers include the Congo, Zambezi, Niger, Limpopo, Orange, Senegal, Ogoove, Volta, Kafue, Awash, Kossou and Omo as illustrated below:

Draw a sketch of Africa and on it mark, and name the major rivers

THE WORKS OF A RIVER

As the river flows, it performs three functions/activities: It erodes, it transports and it deposits [erosion, transformation and Deposition].

River erosion is done though the following processes: Attrition, Abrasion/Corrasion, Solution/Corrosion and Hydraulic Action.

River transportation

After erosion, the eroded materials known as the **load** is transported through the following ways: - Traction, Siltation, Suspension and Solution.

RIVER DEPOSITION

A river transports its load unit it has insufficient energy to transport it any further. When this happens, the load is deposited. Boulders and pebbles are deposited first because they are heavy, and silt and other fine sediments are deposited last.

Rivers can be divided along their course into three fairly distinct parts as the Upper course, Middle course and Lower course.

Some rivers have all three of these stages, while a few have two or only one.

For instance, some small rivers flowing off the plateau edge in South Africa or West Africa, too small, have only upper stage and brief middle stages. Some small rivers flowing in high mountains end their life in a mountain lake and only experience an upper stage.

RIVER'S LONG PROFILE AND ITS CHARACTERISTRICS

River profile is the outline of the shape of a river from the source to the mouth as illustrated below.

Draw the ideal section along the river from its source to mouth

As a river gradually develops its long profile, the cross profile and other general features of the valley also develop, as a result of down and lateral cutting by the river.

THE UPPER VALLEY (YOUTHFUL STAGE)

In its youthful stage,

- The river flows against a very steep gradient
- The river flow very fast with turbulent flow.
- It has a V- shape valley
- There are interlocking spurs
- There is vertical erosion
- The river has a very narrow deep valley
- Potholes are common in this stage
- The river has waterfall and rapids
- Erosion is mainly directed to its bed
- There is no deposition

Draw the diagram showing the characteristics of the first stage refer to Africa by Minns page 15

A river in this torrent stage follows a winding course, flowing round obstacles formed by more resistant rocks and led to the formation of the following:

A gorge is elongated steep sided narrow and deep valley. It forms when water fall retreat up stream.

Formation of a gorge

Process of formation involves the vertical erosion of the river and by fast flowing water over the soft under laying rock between hard rocks.

Waterfall and rapids

Though mainly associated with upper course of rivers, waterfalls and rapids can also be found in the lower courses as well.

Describe the processes responsible for formation of water fall

Plunge pool is a hollow depression formed at the base of a waterfall due to progressive drilling and grinding of the valley floor. Plunge pools are found on rivers with waters in the youth's stages of rivers in rejuvenated section of the profile.

Draw the Illustration of the waterfall and plunge pool refer to Africa by Minns page 16

Conditions for the formation of a plunge pool

- Large volume of water
- Steep gradient
- Great erosive energy due to velocity
- hard rock overlying soft rock

Processes of formation a plunge pool

Erosion of the underlying soft rock produces a waterfall.

Potholes will be produced at the base on soft rocks.

Undercutting scouring action, eddying and cavitation, swirling and erosion collectively enlarge potholes producing a plunge pool.

THE MIDDLE STAGE

In the middle stage of the river,

- There is a reduction in gradient and because of this; the river's velocity is slowed down
- Lateral erosion is dominant in this stage.
- This has a wide valley which is deep
- There is reduced energy because of the reduced gradient
- Meanders develops in this stage
- The river has more water in this stage because of many tributaries.
- The valley floor is flat (broad valley bounded by a low wall of bluffs – flood plains) because the river has worn back the interlocking spurs.

Draw the diagram showing the characteristics of the second stage refer to Africa by Minns page 15

THE SENILE LOWER VALLEY/OLD/FLOOD PLAIN STAGE

The senile stage that is when the river is nearing its destination is characterized by

- A much-reduced gradient.
- In this stage, the river's speed is greatly reduced and the river flows very sluggishly.
- Deposition is far more important than erosion and the load transported mainly include sand, very tiny and light particles and materials carried in suspension & solution.

Draw the diagram showing the characteristics of the third stage refer to Africa by Minns page 15

- The main landforms in this stage include

Meanders are curved bends in the river channel. Meanders usually start from the youthful stage as swings in the river but are more developed in the senile stage.

Oxbow lakes and meander scars

An Oxbow lake is a horse shoe shaped lake formed when pronounced meander is cut off from the main river.

When the water that was trapped in the oxbow lake dries up, a meander scar is formed.

Flood plain is wide flat plain of alluvium found in the old stage of a river as Illustrated below:

Draw the diagram of the flood plain

Processes for the formation of a flood plain

Downstream migration of meanders causes the widening of the river valley where the spurs are eroded off and low bluffs formed on either side of the plain.

In this stage the valley filled with alluvium, the river swings freely without touching the valley sides the wide valley filled with sediments at this stage (old) is said to be in its flood plain.

Other features found in the old stage are Levees and Braided channel

Deltas is a large flat low-lying plain of silt, boulders, pebbles and gravel deposits at the river mouth where it flows into the sea or lake.

The deposited material forces the river to divide into channels called distributaries. These are flanked by swamps, lagoons, spits and bars.

The delta is built on the sea and in the senile stage where the river loses competence to carry load.

As the river loses energy, it deposits, heaviest first. This goes on through the long profile of the river. However, whenever there is an increase in energy, the river will pick up the deposited material again sweeping it into the sea which is the goal of any river.

As sediments formulate at the mouth, a delta is formed.

Types of Deltas

Arcuate is a type of delta which is triangular in shape, with a convex out margin which is rounded and composed of coarse sediments like gravel, sand and slit

The Arcuate delta has many distributaries and is the most common on River Nile in Egypt and River Niger in Nigeria.

It is formed where offshore currents are strong to round the river mouth, sea ward edge with fine and course materials

Draw the diagram of the arcuate delta

Lacustrine Delta is an inland delta formed in the lake for example River Omo in Lake Turkana.

Illustration: Draw the diagram of lacustrine delta

Bird's food delta/Digitate resembles the bird's foot formed as a result of the river carrying a lot of load composed mainly of the fine material or silt and having low wave energy.

The river channel divides into a few distributaries bounded by levees. **Illustration**

Estuarine Delta is a type of delta found in submerged river mouth (Rias).
Here a river deposits its load in the submerged river mouth leading to formation of sand banks and Islands. Around these sand banks and islands, numerous distributaries and currents remove the sediment load as it deposited. Rufigi has an estuarine delta as it has submerged river mouth and River Zambezi
Associates with delta formation are coastal features like spits and lagoons. Illustration

Conditions necessary for the formation of a Delta

- The river should have a mountainous upper course where erosion is rapid. The delta building power of a river is greatly increased if it has a number of tributaries which also gather a considerable load of sediments
- There should be no strong tidal currents to remove the accumulation of silt from the mouth of the river. If tidal currents exist, they should be minimal.
- Low of flat gradient for accumulation of material
- Presence of sheltered bay
- Absence of artificial barriers like walls or dykes at the mouth
- The river should have a long plain or lower course so that its current will have slackened before it reaches the sea. Where the gradient of the lower course of the river is shift the strength of the current may be sufficient to carry the sediments well out to the sea beyond the mouth of the river.
- There should be no big lakes along the course of the river because the lakes remove sediments from the river channel before reaching the sea.

Formation (processes for the formation of a delta)

When the fresh rivers meet the saline water of the ocean, the meeting produces an electric charge the causes the clay particles to coagulate/precipitate and settle on the sea bed (a process known as flocculation).
The fines particles are carried fastest and deposited as bottom set. These are covered by slightly course materials which are deposited to form a slope making up the fore set bed. The upper part is nearest the; and composed of more coarse sediments form the top set. Increased deposition causes splitting of the river into distributaries.
Levees extend to the sea via distributaries. Spit, bar and lagoons are formed. Lagoons are later filled with sediments becoming swampy places. Plants colonize older parts of the delta. As the delta takes a sound appearance, swamps disappear forming or leaving dry land.
The range which the delta grows varies according to the rate at which silt is deposited.

Importance or benefits of deltas in Africa

- Deltas contain fertile soils so provide man with agricultural land.
- Deltas attract settlement due to the presence of well drained fertile soils. The delta of the Nile has for a long time been a home to a large population.
- Mining (pottery and petroleum deposits) takes place in delta areas like in Niger delta.
- Delta are tourist attractions hence tourism.
- Fishing takes place in the delta, lagoons. The silt that is brought by the river is good food for these planktons.
- In deltas where the mangrove forests are found the trees are harvested for poles which are good building materials.
- They have promoted art and craft industry due to the presence papyrus vegetation.

Problems associated with deltas in Africa

- Due to many distributaries a delta has, this impedes communication.
- Delta's harbour diseases carry vectors like mosquitoes and snails.
- Flooding occur especially after exceptionally heavy rains
- Salinity of the water.

Alluvial fans

Alluvial fans are similar to deltas (usually referred to as dry deltas) except that they are built on land and not at sea as the delta.
An alluvial fan is fan shaped mass of materials (sand and gravel) deposited by a stream with large load as it emerges from a steep narrow valley onto a wide gentle plain.

Benefits of Rivers to the people of Africa

- Generation of hydro-electrical power in the African countries for domestic, industrial and agricultural purposes such as: Kossou hydro power station on Bandama in Cote D' Ivore. And Kainji dam on River Niger in Nigeria.
- It has led to the development of the tourism sector. This is because rivers are tourists' attractions and have facilitated tourism activities like White water rafting at Victoria water falls, spot fishing on River Orange in South Africa.
- They have promoted water transport hence promoting internal trade among different parts of Africa.
- Rivers provision of water for irrigation farming for example River Senegal provides water to Sir Richard Toll Rice irrigation Scheme in Senegal and River Nile provides water to Gezira irrigation Scheme in Sudan.
- Rivers provision of water for domestic and industrial uses in different part of Africa.
- Rivers acts as internal political administrative boundaries.
- Rivers are sources of food in form of fish like Tilapia to the people of Africa.
- Rivers contribute to the modification of the microclimate through rainfall formation.
- Source of raw materials for art and craft and construction industry, due to the presence of clay soils, sand, and swamp vegetation.
- Rivers are wild life habitats and centers of biological diversity like crocodiles.
- Promotion of agricultural activities due to the presence of fertile soils (alluvial soils) along the river banks
- Study and research purposes

THE PROBLEMS ASSOCIATED WITH RIVER IN AFRICA

- Seasonal rivers in Botswana and Namibia hinder water transport during the dry season, and the generation of hydro electric-power.
- The seasonal flooding of rivers leads to destruction of farmland and transport and communication networks and loss of life.
- Rivers are habitat for harmful vectors like snails, which spread Bilharzia; Simullium flies which transmit river blindness, breading areas for mosquitoes.
- Presence of water falls and rapids, narrowness of the African rivers hinders navigation in many African countries.

Drainage patterns in Africa

Drainage pattern refers to the arrangement/lay out/plan of the river and its tributaries.
The way tributaries are laid out is usually influenced by geological history of the drainage basin and precipitation.
The main types of drainage patterns include:

Dendritic drainage pattern

This is a type of drainage pattern which resembles the branches of a tree.
The river tributaries join the main river at acute angles.
Process of dendritic drainage pattern development:
There must be a consequent river [Main River] where insequent (minor) streams develop from the main river by head ward erosion.
The minor streams may also develop from insequent streams as obsequent streams.
Finally, the pattern of drainage develops resembling the branches of a tree.

Give examples of the dendritic drainage pattern and draw the Illustration

Radial drainage pattern
Here rivers originate from one central area and flow outwards from the highland to lowland. It is controlled by slope of the land and rivers start from mountain areas and flow down slope.
The minor stream flows in accordance with the slope direction, obsequent streams; flow in opposite direction to the slope joining other streams at right angles.
Give Examples of radial pattern in Africa and draw the Illustration
Centripetal drainage pattern
Here rivers flow from different directions and converge into one place which is a basin. Centripetal drainage is guided by the slope of the land. Areas with centripetal pattern are areas of inland drainage. ***Give Examples of centripetal pattern in Africa and draw the Illustration***
Parallel drainage pattern
Here the river flows for a long distance parallel to each other.
It is a common pattern in ridges or escarpments and also where alternating hard and soft rocks downstream.
Research work: Other drainage patterns include Annular Drainage, Rectangular pattern

LAKES

A Lake is a body of water occupying a hollow/depression on the earth's surface.
Most of the lakes found in Africa are fresh water bodies with few salty lakes.
There several Lakes found in Africa and classified according to their mode of formation. These include-
CRUSTAL DOWN WARPED LAKES
These lakes occupy basin- like depressions/Saucer like depressions and were formed by down warping and drainage reversal like Lake Victoria
FAULT LAKES (TECTONIC LAKES)
Rift Valley Lakes/Graben Lakes are found in the rift valley floor.
They were formed due to earth movements that culminated into faulting by tensional or compressional forces leading to the formation of the rift valley.
The minor Grabens/depressions were formed on the rift valley floor after secondary faulting.
The Grabens were later filled with water and accumulated to form rift valley lakes/Graben lakes like Malawi
They are elongated, deep, narrow and regular shape.
LAKES DUE TO VULCANIVITY:
These are formed as a result of volcanic activities.
These are divided into mountain crater Lakes, Lava dammed Lakes/Lava blocked lake, Explosive/Explosion cater lakes and Caldera Lakes
LAKES FORMED DUE TO EROSION: Glacial Erosional lakes formed due to alternating freeze- thaw (frost action). They are known as the cirque Lakes/Tarns.
DEPOSITION LAKES:
These are lakes formed by deposition of weathered material by either water, ice/glaciers, wind or waves.
They include River depositional lakes, Wave depositional lakes and glacial deposition lakes.
MAN-MADE LAKES: These are formed due to man's activities like through the extraction of minerals using open cast method, construction of dams across the rivers; channel development of the agricultural irrigation scheme.
Research work

- ***Explain the importance or benefits of lakes to the people of Africa***
- ***Outline the Problems associated with lakes in Africa***