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**1. Outline the theories (evidences) that prove the shape of the earth as being spherical and not flat:**

If the earth were flat the sun would rise and set at the same time for people in all countries. As we know, the times of sunrise and sunset vary in different parts of the world. This is due to the shape of the earth.

The sun, the moon, the stars and other heavenly bodies always appear to be circular in outline. We can therefore conclude that they are spherical in shape. The earth should not be the only exception.

The shadow of the earth always has a circular edge. This can be noticed by observation of the earth's shadow on the moon during eclipse.

Viewed from the deck of a ship at the sea, the horizon appears to be circular.

An observer on a cliff watching the approach of a ship sees first the smoke, then the funnel and lastly the hull. If the earth were flat the whole of the ship would be seen all at once.

We know that we can travel round the world in various directions, and come back to the starting point. This is known as the circumnavigation of the earth.

Photographs radioed back by artificial earth satellites show the circular outline of the earth.

**2. (a) Explain the two movements of the earth:**

The earth moves in two ways. Firstly it rotates on its axis, making a complete rotation in twenty-four hours.

Secondly it revolves around the sun, making one complete revolution in approximately  $365 \frac{1}{4}$  days. Its path of revolution is known as its orbit.

**(b) (i) State the effects of the rotation of the earth:**

It causes day and night.

It causes the deflection of wind and ocean currents.

It causes the daily rising and falling of the tides.

It causes a difference in time i.e. one hour between two meridians (longitudes)  $15^{\circ}$  apart.

It causes variation in atmospheric pressure on the earth's surface.

**(ii) State the effects of the earth's revolution:**

Is responsible for the change of the seasons (the four seasons).

It causes the varying lengths of day and night at different times of the year.

It changes the altitudes of the midday sun at different times of the year.

It fixes the tropics and the Arctic and Antarctic circles i.e. the varying positions of the earth in relation to the sun.

**3(a) Draw a well-labelled diagram showing the main parts (zones) of the internal structure of the earth:**

- A - SIAL
- B - SIMA
- C - MOHO DISCONTINUITY
- D - UPPER MANTLE
- E - LOWER MANTLE
- F - GUTENBERG DISCONTINUITY
- G - OUTER CORE
- H - INNER CORE

**(b) State the features of the outer shell (the crust/lithosphere):**

It is divided into two distinct layers called Sial and Sima.

Sial is the collective name for those comparatively light rocks, including granite, which form the great landmasses of the continents (granitic or continental rocks).

Sima is the name for the heavier rocks, including basalt, which make up the floor of the ocean lying at a lower level than the Sial (Basalt or oceanic rocks).

The two names Sial and Sima are derived from the initial letters of the two chief elements in the rocks: Silicon and Aluminium in Sial, Silicon and Magnesium in Sima

The crust consists of comparatively low density.

The rock density is about 2.0 to 3.0.

The crust is about 16 to 50 km thick.

**(c) What is the difference between atmosphere and hydrosphere?**

The term Atmosphere refers to the envelope of air which surrounds the earth. It is held to the earth by gravitational attraction.

The term Hydrosphere refers to all the waters of the world - the oceans, seas, lakes, rivers and icesheets which cover nearly three quarters of the earth's surface.

**4. (a) Define the term 'Rock':**

The word rock is a general term used to describe many different solid materials found in the earth's interior and on the earth's surface. Rocks are mixtures of many different minerals.

**(b) Attempt to classify rocks according to the origin (or mode of formation):**

Rocks can be classified into three different families based on the way they originated. These include:

- **Igneous rocks:** These were formed by the cooling of heated liquid minerals. The word Igneous comes from the Latin word *Ignus* which means fire. The rocks that are formed deep within the earth from the molten material (magma) are called intrusive igneous rocks whereas the ones that are formed on the surface are called extrusive igneous rocks. The surface magma is called Lava.
- **Sedimentary rocks:** the name sedimentary refers to the fact that the rocks were formed from layers of sediment. Sediment is created when rocks are broken into smaller and smaller pieces by outside forces involving temperature, wind, water and gravity.

Sedimentary rocks can be further classified into three groups based upon their origin or source:

- (i) *Mechanically formed sedimentary rock:* These are formed from rock fragments which become cemented together with the aid of pressure and other chemical reactions. Examples are: Sandstone, Mudstone etc.
- (ii) *Chemically formed sedimentary rocks:* Are formed from dissolved minerals that are left when the liquids evaporate. Chemical reaction and evaporation causes these minerals to fall out of solution and settle to the bottom. Examples are: Rocksalt, Potash etc.
- (iii) *Organically formed sedimentary rocks:* Are formed either directly or indirectly from substances that were once living. When plants and animals die their soft parts decay. The hard parts such as the shells of marine organisms or the bones of animals remain. Examples are: Limestone, Coal etc.

- **Metamorphic rocks:** These rocks are formed from both Igneous and Sedimentary rocks. When these rocks are buried deep beneath the earth, they are exposed to tremendous pressure and high temperature. This causes the igneous or sedimentary rocks to undergo gradual change in its composition. This process of change is called Metamorphism, thus the name metamorphic rock. Some of the changed rocks are shown below:-

Limestone changes to Marble.

Clay changes to slate.

Granite changes to Gneiss.

Sandstone changes to Quartz.

**(c) State the economic importance of rocks to man:**

- Some rocks attract tourists hence foreign Exchange earnings.
- Some rocks are used as building material e.g. sand.
- Some rocks act as underground water stores.
- Limestone rock are processed to produce cement used in buildings.
- Rocks contain valuable minerals.
- Some rocks e.g. coal is a source of fuel.

**(a) Explain the meaning of the following terms:**

**(a) Plate tectonics:**

The term Plate Tectonics refers to the theory that explains the major geological structures of the earth in terms of the relative movements of rigid crystal blocks or plates of lithospheres across the partially fluid Asthenosphere.

(b) **Continental drift:**

The term continental Drift refers to the supposed horizontal displacement of portions of the original continent (the Pangaea) which comprised the entire land mass of the world to form the present day continents.

(b) **Isostasy:**

The term Isostasy refers to the state of equilibrium that is said to exist between the highlands and the lowlands of the earth, due to the fact that the former are made of lighter rock materials than the latter.

According to the theory of Isostasy known as the Isostatic theory, the continental platforms are made up of lighter material and are, as it were floating at a higher level than the material of the ocean floor.

**(b) (i) Name the plates of the lithosphere based on plate tectonic theory:**

- N. America plate
- African plate
- Australian plate
- Pacific plate
- Adriatic plate
- Arabian plate
- South America plate
- Eurasian plate
- Antartic plate
- Carribbean plate
- Fiji plate
- Nazca plate

**(ii) State and explain the evidences for the continental drift theory:**

- Topographic evidence; for example the Jigsaw of the continents. South Africa fits into Africa so well.
- Geological evidence; there is a close structural resemblance and many geological similarities especially between the the eastern coast of South America and the western coast of Africa.
- Tectonic evidence; the distribution of Fold Mountains and volcanic zones which are comparable from one side of the ocean to the other.
- Climatological evidence; only continental drift can account for the apparent reversals of climate that have glacial deposits in the Congo Basin and other parts within the tropics.
- Biological evidence; this evidence is based on the study of fossils showing the distribution of plants and animals in the past compared with the present day distribution of certain plants and animal species whose occurrence seems quite inexplicable unless continental drifting is invoked.
- Palaeo-magnetism evidence; This is the most influential evidence of continental drift. When rocks solidify, they are magnetised in the direction of magnetic North at that time. By studying the magnetism of ancient rocks, it is possible therefore determine the where on the surface they were originally formed.

6. (a) **What is faulting?**

Faulting refers to the fracturing of the rocks of the earth's crust.

(b) **With the aid of diagrams, state and explain the types of faults:**

- These results from tensional forces.
- The movement is basically vertical in nature

- These results from compressional forces.

- Reversed fault refers to a fault in which the upper rock strata have been pushed forward over the lower strata, the upthrow being on the dip side of the fault plane.

Tear fault is a fault in which the movement of the rock is mainly horizontal rather than vertical. Terms regarded as synonymous with tear fault are wrench fault, lateral fault, strike slip or transform fault.

**(c) State the significance of faulting:**

Faulting results into beautiful scenes that attract tourists.

The fresh Rift Valley lakes contain fish hence fishing.

Minerals are found in faulted regions hence mining industry.

Block mountains formed due to faulting are sources of rivers which are used for various activities.

Cracks created due to faulting may disrupt lines of communication.

**7. (a) A part from Rift Valley, name other features that result from faulting:**

- Fault scarp; Also known as an escarpment, the scarp refers to a steep slope where the land falls from a higher ground to a lower level.
- Block mountain (Horst); This refers to an upland bordered by faults on one or more sides. Formed when earth movements lift the rocks between fault.
- Rift valley lakes; Faulting produces depression or inland basins which are later filled with water to become lakes.
- Tilt block; This refers to a landscape of angular ridges and depressions formed by a series of tilted fault blocks.

**(b) With the aid well-labelled diagrams, explain how the African Rift valley was formed:**

TENSION THEORY	COMPRESSION THEORY
(1) Layers of rocks are subjected to tension	(1) Layers of rocks are subjected to tension.
(2) Two normal faults develop	(2) Two reversed faults develop.

(3) Middle block sinks hence rift valley	(3) Middle rock remains at lower level as the two side blocks rise hence rift valley.
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8 (a) **Define the term folding:**

- Folding refers to the bending of rocks of the earth's crust. The bending is caused by the tremendous compressional forces that develop as the tectonic plates of the crust moves towards each other.

(b) **List the types of folds:**

- Symmetrical (simple) folds
- Asymmetrical fold
- Overthrust fold (Nappe)
- Synclinalorium.
- Overfold
- Recumbent
- Anticlinorium

(c) **Write short notes on the following:**

- (i) *Syncline* : This refers to the structure formed when the rock layers are downfold.
- (ii) *Anticline*: Refers to an arch-like structure formed when the rock layers are upfolded.

9. (a) **Outline how a fold mountain is formed:**

- Extensive shallow depressions called geosynclines develops.
- Sediments from higher grounds are deposited in the geosyncline.
- Internal forces cause the crust on either side of the geosyncline to move towards the geosyncline.
- As a result, the sediments are compressed and form folds which rise above sea level.
- The process continues and eventually the rocks or sediments become so intensively folded to form high mountains.

(b) **Explain the ways in which fold mountains influence human activities:**

- Some fold mountains have valuable mineral deposits which promote mining industry.
- Fold mountains influence the climate i.e. it brings relief rainfall which influence agricultural activities.
- Fold mountains creates good sceneries that attract tourists, hence earning the much needed foreign exchange.
- Fold mountain slopes are normally forested and hence source of timber used in construction industry.
- Fold mountains act as communication barriers especially during the construction of roads and installation of telephone lines.
- Fold mountains slopes are water catchment areas hence source of many rivers that provide water for domestic and industrial uses.

10. (a) **Define the term vulcanicity:**

- The term vulcanicity embraces all the activities and processes by which gaseous, liquid and solid substances of internal origin are injected into the crust of the earth or ejected onto its surface.

(b) **Other than the sill, list other intrusive volcanic features:**

- Dyke
- Batholith
- Laccolith
- Lopolith
- Phacolith

(c) **With the aid of a diagram, state the meaning and formation of a sill:**

Sill is a horizontal sheet of rock solidified from magma which has been injected concordantly between (or along) bedding planes.

(d) (i) **Apart from caldera and composite volcano, name other extrusive volcanic features:**

- Balast dome (shield volcano)
- Plug dome
- Explosive crater
- Ash cones and cinder cones
- Crater lake
- Lava plateau

(ii) **With the aid of diagrams, explain the meaning and formation of a caldera and a composite volcano:**

A composite volcano refers to cones which are build up by several eruptions of lava, ashes and pyroclast from the main vent. Each new eruption adds a new layer to each side of a volcano which grows steadily in height.

A caldera is a large rounded depression bounded by steep sides resulting from the destruction of the upper part of a volcano either due to violent eruption or subsidence

12. (a) **Explain the difference between hot spring and geyser:**

- Hot spring refers to a stream of hot (super-heated) water coming from the ground often being heated by magma. The flow of water is quiet.
- Geyser refers to a situation where very hot water is ejected with considerable force accompanied by steam. Some erupt periodically at regular intervals while other occur more spasmodically.

(b) **List and explain the three life cycles of a volcano:**

*Active volcano*; This is a volcano which has erupted or is thought to have erupted within recent time (500 years ago).

*Dormant volcano*; This refers to a volcano that has not been known to erupt and yet is not thought to be extinct and still shows some limited activity in the form of fumaroles.

*Extinct volcano*; This refers to a volcano that shows no sign of further eruption and much of the original structure or appearance may have been destroyed by denudation.

(c) **State the significance of vulcanicity to human activities:**

- Volcanic rocks are exploited and used for building houses.
- Volcanic landforms are beautiful and attract tourists.
- Volcanic mountains influence rainfall (relief rainfall) hence supporting agriculture.
- Weathered volcanic rocks produce fertile soils for agriculture.
- Geysers associated with vulcanicity produce geothermal energy that is used to generate electricity.
- Volcanic activity sometimes results in the formation of precious stones and minerals.
- Volcanic eruptions results into loss of life and property.
- The leeward side of a volcanic mountain is a rainfall barrier hence hinders human activities like farming.

14. (a) **State the meaning of the term 'Earthquake':**

An earthquake is a shaking of the ground due to a sudden and rapid displacement of rocks beneath the earth's surface. When the earthquake takes place, shock waves, or vibrations spread through the rocks in all directions.

(b) **State the causes of earthquakes:**

Some earthquakes are due to volcanic explosions.

Majority of earthquakes and severe ones are due to faulting.

Earthquake are also caused by the collision of tectonic plates.

Other earthquakes are due to folding which cause stress on rocks.

Man's action such as the use of explosives e.g. in mining may also earthquakes.

Other earthquakes are caused by isostatic adjustment and gravitative pressure.

**(c) Define the following terms:**

(i) Seismic focus - This is the spot in the earth's crust where the earthquake originates.

(ii) Epicentre - This is the point on the earth's surface vertically above the focus.

(iii) Seismograph - Also known as seismometer, seismograph refers to a delicate scientific instrument used to detect and record an earthquake thousands of kilometers away.

**15.(a) Explain the difference between:**

(i) Primary(P) waves and Secondary (S) waves:

- Primary waves behave like sound waves i.e. each particle vibrates to and fro in the direction of propagation. They penetrate both in solid and liquid substances.
- Secondary waves are like ocean or light waves where the motion of each particle is at right angle to the direction of propagation. They only penetrate through solid substances.

(ii) Richter scale and mercalli scale:

Richter scale is used to measure the size of an earthquake (i.e. its magnitude). It is based on instrument recordings.

Mercalli scale is used to measure the intensity and is based on observed effect of damage and changes in the earth's surface.

**(b) State the effects of earthquakes on physical and human environment:**

- Earthquakes results into great loss of life.
- It leads to destruction of property especially buildings.
- It alters the appearance of the landscape.
- It may trigger off a landslide or an avalanche causing some danger.
- Earthquakes may destroy communication lines and transport lines.

**16. (a) What is the difference between denudation and weathering:**

- Denudation refers to the wearing away of the land by various natural agencies: the wind, the rain, frost, running water, moving ice and the sea.
- The term weathering refers to the loosening, decaying and breaking up of the rocks. Weathering produces rock wastes in "situ" i.e no movement is involved.

**(b) Apart from chemical weathering, name two other types of weathering:**

- Mechanical (physical) weathering
- Biological weathering.

**(c) Name and explain the processes of chemical weathering:**

Five main types of chemical weathering may be distinguished. They include carbonation, hydrolysis, oxidation, hydration and solution.

- Carbonation: This process occurs when percolating rain water contains carbon dioxide derived from its passage through the atmosphere. It in turn forms a dilute acid (weak solution of carbonic acid and rain water) which reacts with calcareous rocks such as limestone and chalk and thus dissolving them.
- Hydrolysis: This process involves the reaction between water and mineral elements, that is between the hydrogen ions of water and the ions of the minerals. Felsper decomposes into clay in this process.
- Oxidation: This process occurs when oxygen combines with a mineral. Oxidation takes place actively in rocks which contain iron, when the oxygen combines with iron to form iron oxide.
- Hydration: This refers to the process where some minerals take up water and thus expand which in turn stimulate them to disintegrate.



- Solution: This process involves the presence of water and rocks which are directly soluble in water. However its process is more or less like that of carbonation.

**17. (a) Apart from frost action, name other types of mechanical (physical) weathering:**

- Temperature changes
- Repeated wetting and drying
- Pressure release
- crystal growth

**(b) Explain how frost action occurs:**

Frost action is common in mountaneous regions which are subjected to alternate freezing and thawing (melting), that is where the temperature fluctuates

either side of 0° C. water seeps into cracks in the rock and on freezing its volume thus increases, which exerts great pressure and the rocks tend to shatter and the cracks widen.

**(c) Explain the factors that influence the rate and the nature (type) of weathering:**

The nature of the rock: Mineral composition of rocks, their structures and texture to a larger extent determine the rate and nature of weathering.

The nature of climate: different types of climate affect the nature of weathering differently.

Plants and animals: The presence or absence of plants and animal will increase or decrease the rate of weathering.

The nature of the landscape (topography). The type of relief or topography of a place will influence the speed and type of weathering e.g. the steeper the slope the higher the rate of weathering.

Time: if other factors are held constant, the amount of weathering will always depend on the time taken.

**18. (a) Explain the meaning of mass wasting:**

Mass wasting refers to the movement down the slope of weathered or loose material derived from rocks under the influence of gravity.

**(b) State the factors that determine the nature and speed of mass wasting:**

- The degree of slope.
- The absence or presence of plants or vegetation.
- The nature of the material.
- The amount and nature of rainfall.
- Man's activities such as mining, grazing of animals e.t.c.
- Earth movements e.g. during volcanic eruption, earthquake e.t.c.

**19. (a) Other than soil creep, list other types of mass movement:**

- Talus creep
- Rock fall (rock avalanche)
- Rock slump (slumping)
- Rock slide
- Solifluction
- Landslide

**(b) (i) With an aid of a well labelled diagram, explain the meaning of soil creep:**

- Soil creep refers to the slow, almost imperceptible (unnoticed), but continual movement of the surface soil and rock fragments down a gentle slope under the influence of gravity. Soil creep causes tree trunks to bend in the direction of the creep.

(ii) **Explain the ways in which solid creep occurs:**

- Heating and cooling (temperature changes) of soil causes its expansion and contraction thus moving down the slope.
- Alternate drying and wetting of the soil. Rainwater causes soil to become wet and compact and on drying, the particles loosen and shift position downslope.
- The shaking of the ground due to mining or earthquake make the soil to move downhill and downslope.
- The trampling of grazing animals and the burrowing of animal also cause the soil to move downwards.
- Ploughing on slopes and the turning of soil in one direction causes soil to shift downslope.
- Boulders and stones in the soil or resting on it, are carried down the slope by moving soil.

(iii) **Explain the effects of soil creep on physical and human environment:**

- Deep fertile soils accumulate at the base of a slope which support agriculture.
- Soil creep leads to blocking of roads and railway lines and maintaining them becomes expensive.
- Soil creep over a long period of time leads to slope retreat or gradation of landscape or change of landscape.

20 (a) **What do you understand by the term underground water:**

The term underground water refers to the name given to water that sinks into the ground and enters into the rock.

(b) **State the factors that determine the amount of water that enters into the ground:**

- The porosity and permeability of the surface layers.
- The amount of water already in the soil.
- The slope of the land surface.
- The amount and nature of the rainfall.
- The rate of evaporation.
- The amount and nature of the vegetation cover.

(c) **Explain the meaning of the following terms:**

- |                   |                   |
|-------------------|-------------------|
| (i) Artesian well | (ii) Water table. |
| (iii) Aquifer     | (iv) Spring       |

- (i) Artesian well refers to a type of well which normally gives a continuous flow, the water being forced upwards by hydrostatic pressure; this pressure is due to the outlet of the well being some depth below the level of the source of water. It is often found where a basin-shaped, permeable layer of rock (Artesian basin), such as chalk is sandwiched between two impermeable layers, such as clay, so that rain falling on the outcrop of the permeable layer will filter through and collect underground. As the water cannot escape below, the permeable layer becomes saturated to the rim of the basin, and if a well is sunk through the upper impermeable layer into it, the water flows into the well.
- (ii) Water table refers to the surface of the ground water, or the surface below which the pores of a rock are saturated with water. This surface is uneven, and it is also variable, from time to time depending on the amount of rainfall received.
- (iii) An aquifer refers to a layer of rock (especially in an artesian basin) which holds water (saturated with water) and allows water to percolate through it.

(iv) A spring refers to a continuous or intermittent flow of water from the ground to a certain point, where it accumulates and finally gushes or oozes out. Its site thus depends on the position of the water table, the shape of the land surface and the type of rock.

**21. (a) Define the term 'Hydrological (water) cycle':**

- Hydrological cycle refers to the endless interchange of water between the sea, air and the land in an orderly progressive manner or sequence.

**(b) With an aid of well-labelled diagram, explain the process of water cycle:**

- Evaporation takes place from the oceans, seas, lakes and other water bodies.
- Transpiration takes place from various plant communities (vegetation).
- Condensation of water vapour in the atmosphere leads to the formation of clouds and hence precipitation in form of rain or snow.
- Most of the water which has fallen on the land then returns to the oceans, seas, lakes and other water bodies - so completing the cycle.

**22. (a) Other than doline, name other surface features of a karst landscape:**

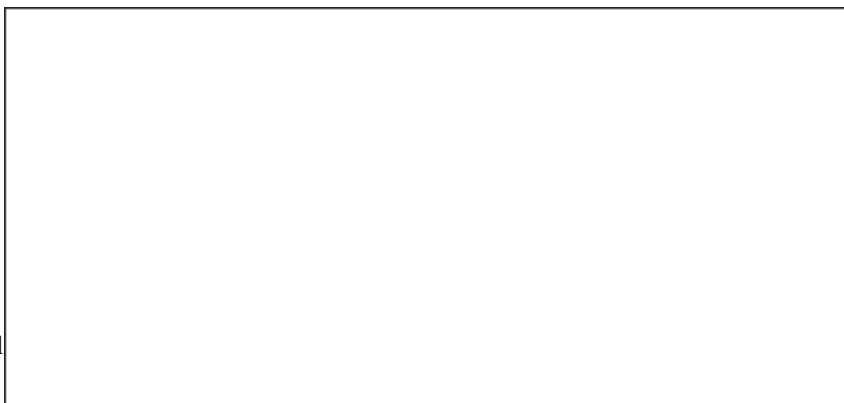
- Uvala            - Grikes                            - Poljes
- Clints           - Sink (swallow) holes            - Limestone pavement

**Define the term doline (dolina):**

- Doline is a shallow depression or hollow, round in shape with gently sloping sides. When several dolines join together they form an Uvala.

**(c) Illustrating your answers with the aid of a well labelled diagram, explain the meaning and formation of the following underground features of a karst landscape:**

- (i) STALACTITE                            - STALAGMITE
- (ii) CAVERN                                - PILLAR



1. Stalactite
2. Stalagmite
3. Cavern
4. Pillar

- Stalactite refers to a column of mineral matter (e.g. calcium carbonate) often found hanging from the roof of a limestone cave (cavern). Calcium carbonate is deposited on a cave ceilings from the line of water seeping through crevices and joints. Either because the water evaporates, or more probably because some of the carbon dioxide in the water escapes and so part of its dissolved bicarbonate become once more insoluble. As a drop of this water hangs, it partially evaporates, and leaves behind a small quantity of calcium carbonate; the next drop leaves a further small quantity and deposit (long stalactite) grow downwards from the roofs.
- Stalagmite is a stumpy, roughly cone-shaped mass of calcium carbonate formed on the floor of a limestone cave. It is often produced by the water dripping from a stalactite above it, and usually shorter and thicker than the stalactite.
- Cavern (limestone) cave refers to a large subterranean hollow space in the earth's crust which may be entered from the surface.
- Pillar refers to the feature formed when stalactite and stalagmite meet. The pillar extends from floor to roof of the cave.

(d) **State the importance of karst scenery:**

- Features of karst landscape are attractive to look at the hence fanciful descriptive names, thus attracting tourists.
- Blocks of limestone are used for building houses.
- Limestone regions are always dry with short grass which favours sheep rearing.

23. (a) **Define the term 'River':**

- A river is a mass of water flowing over the land surface, from its source in a spring, a marsh, at the end of a glacier or as a collected surface run off of rainwater, until it reaches its mouth, which usually opens into the sea.

(b) **State and explain the processes of river erosion:**

- *Hydraulic action*: This refers to the process by which running water removes or sweeps out loose material such as gravel, sand and silt. It also erodes by surging into cracks thus helping in breaking up of solid rock.
- *Corrosion*: This is the wearing away of the bed and banks, using the load as the grinding tool. Eddies in a river's flow whirl pebbles around in hollows on the bed of the channel, thereby causing them to get deeper.
- *Attrition*: This process refers to the wearing down of the load itself. It occurs because the rock fragments (loads) are in constant collision with each other.
- *Corrosion (solution)*: This process refers to the solvent work of water as it flows over soluble rocks such as limestone and chalk.

(c) **Explain various processes by which a river transports its load:**

*Traction*: This refers to the process whereby large particles and boulders are rolled or dragged along the river bed.

*Saltation*: This refers to the process whereby particles which are not so heavy bounce at interval as they move downwards. The particles are moved along the river bed in series of jumps.

*Suspension*: This refers to the processes where light particles of load are carried and maintained with the turbulence of flowing water i.e. the particles float in water.

*Solution*: This refers to the process where some of the load is dissolved in water and carried in solution.

24.(a) (i) **Apart from waterfall, state other features or characteristics of a river at its youthful (upper) stage:**

- The river valley is narrow and from V-shaped.
- The gradient of the river valley is steep, hence rapids and cataracts.
- Erosion is more active than deposition.
- The river bed has depressions called pot-holes.
- Interlocking spurs are common.

- Deep valleys called gorges are common.
- The river has small volume of water and little load.
- Vertical erosion is more active than lateral erosion.

(ii) **Define the conditions necessary for the formation of waterfall:**

- The presence of a bar of rock (rock outcrop) lying transversely across the valley of a river, thus interrupting its progress towards a graded profile.
- Where a river falls over a sharp, well-defined edge of a plateau.
- Some waterfalls are due to faulting, especially where a fault-line scarp brings a less resistant rock downstream side against a more resistant rock, leading to erosion of the weak rocks and the formation of a fall at the faultline.
- Waterfalls are common in glaciated regions where over-deepening of the main valley leaves hanging valleys high above the main floor.
- Falls sometimes occur where rivers flow over the edge of a steep cliff into the sea.
- A lava barrier across a river may create a lake and a waterfall may form at the overspill from the lake where the river drops over the edge of the barrier.
- Rejuvenation of a river channel may lead to formation of a waterfall especially at the knickpoint.

(b) **State the features of a river at its middle (mature) stage:**

- Lateral erosion is dominant.
- A broad, U-shaped valley bounded by the low walls of the bluff forms.
- River cliffs develops on the under-cut bank.
- A slip-off-slope projecting from the opposite or cliff side develops.
- The river is joined by various tributaries.

(c) (i) **Apart from a flood plain, state other features of a river at its old(lower) stage:**

- The speed of the river decreases and deposition of sediments takes place on a much larger scale.
- The volume of the river gets swollen or large.
- Braided channels (split of the stream into different channels) develop.
- The river develops very pronounced meanders.
- Deferred tributaries or junctions are common due to deposition along the bank of the major river.
- The river has a large amount of load.
- Deltas are formed due to increased deposition at the river mouth.
- Bluffs and levees are formed at the flood plain.
- Ox-bow lakes are formed in areas that were once pronounced meanders.

(ii) **With an aid of a well labelled diagram, define the term a flood plain:**

- A flood plain refers to a plain bordering a river, which has been formed from deposits of sediment carried down by the river. When a river rises and overflows its bank, the water spreads over the flood-plain and a layer of sediment is deposited at each flood, so that the flood-plain gradually rises.

A CROSS-SECTION OF A FLOOD PLAIN:



(iii) **State the characteristics of flood plain:**

- It has braided channels.

- It contains ox-bow lakes (meander scar).
- The surface gentle or flat.
- It contains deferred tributaries.
- Alluvial fans are common.
- Has thick silt deposit.

25. (a) **What is 'A Delta'?**

A delta is a fan-shaped alluvial tract formed at the mouth of a river when it deposits more solid material there than can be removed by tidal or other current. As material is deposited, it becomes easier for the rivers to divide and flow to each other, each new branch forms new banks, then divides and sub-divides, and the deposit grows outwards in the shape of a fan or triangle, which finally becomes covered with a network of channels called distributaries.

(b) **Giving example of each, name the types of delta:**

- An Arcuate delta      example; the Nile river, Niger, Ganges.
- A Bird's foot delta    example; the Mississippi, Omo.
- An Estuarine delta    example; R. Seine, Vistula, Ob.

(c) **State the conditions that are necessary for the formation of a delta:**

- The river should have a large amount of load (sediment).
- The speed of the river should be low to allow deposition of sediment.
- Absence of obstacles such as a lake or a dam to filter off the load.
- Presence of a shallow sea shore because deep shore will swallow the whole load.
- A very clam seashore with no remarkable coastal waves. This allows deposition to exceed removal of the load.

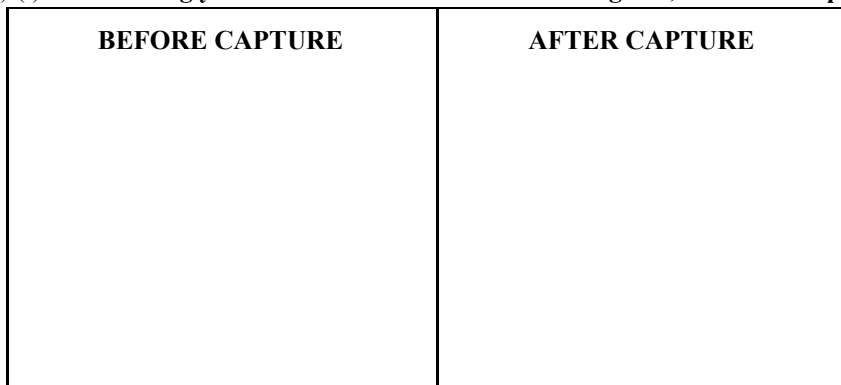
26. (a) **What is 'river capture'?**

Also known as river piracy or beheading, a river capture refers to the action of a river in acquiring the headstreams of a second river by enlarging its drainage area at the expense of the other. This process is carried out by the more powerful river, which erodes its valley more deeply and cut back into the valley of its weaker neighbour. The headstreams of the latter are thus diverted into the former and the latter is said to have been beheaded.

(b) **State the conditions that are necessary for the formation of a river capture:**

The more powerful river (i.e private river) must flow at a lower level than the weaker (i.e its victim).  
 The more powerful river must be having greater energy for vertical and headward erosion than its victim.  
 The pirate or more powerful river should be flowing over easily eroded rocks than its weaker neighbour.  
 The more powerful river should be flowing down on a much steeper slope or gradient than its weaker neighbour.  
 There must exist two adjacent or neighbouring rivers with different qualities.

(c) (i) **Illustrating your answer with a well labelled diagram, name and explain the features of a river capture:**



1. Pirate stream
2. Victim stream
3. Elbow of capture
4. Wind gap
5. Misfit river/stream

- *Elbow of capture*: This refers to the sharp bend in the direction of a river course at which the capture took place.

- *Misfit river*: This refers to a river that appears to be too small for its valley through which it flows. This is due to the fact that it has lost its headwaters to its stronger neighbour.
- *Wind gap*: This refers to the valley of the beheaded stream below the point of capture which is now dry.

(ii) Name rivers which have experienced a river piracy or capture in Africa:

- Tiva river in Kenya                                 - Nsaki river in Ghana
- Cunene river in Angola                                 - Volta river in Ghana
- Great Berg river in South Africa                     - Niger river in Nigeria

27. (a) **Define the term 'River rejuvenation':**

- River rejuvenation refers to the process by which the erosive activity of a river is renewed.

(b) **State the causes of river rejuvenation:**

- It can be caused by the uplift of the land over which it flows.
- It can also be caused by a fall in sea level, so that it begins to cut into its bed once more.
- It can be caused by an increase in its discharge or volume thus causing increased energy.
- It can be as a result of river capture.

28. (a) **What is a drainage pattern of a river?**

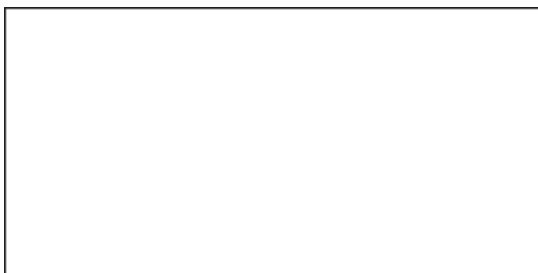
A drainage pattern refers to the layout or plan made by rivers and their tributaries on the landscape, depending on the rock structure, the gradient of the land and difference in rock structure.

(b) (i) **Apart from radial and dendritic patterns, name other types of drainage patterns:**

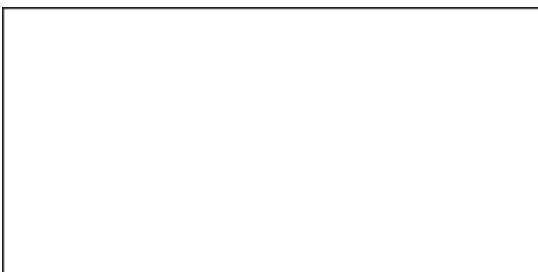
- Trellised pattern                                 - Centripetal pattern
- Rectangular pattern     - Fault-guided pattern
- Parallel pattern                                 - Annular pattern

(ii) **With an aid of diagram explain the meaning of dendritic drainage pattern and radial drainage pattern:**

- The word dendritic comes from a Greek word dendron which means, a tree. This pattern resembles a tree trunk with its branches. The tributaries join the main river at acute angle. This drainage pattern is formed on rocks of uniform structure and hardness.



- Radial drainage pattern refers to an arrangement of streams produced when they flow outwards from a central dome-shaped upland such as a volcano.



(c) **What is the difference between superimposed drainage system and antecedent drainage system:**

- Superimposed drainage refers to a system of drainage which developed on rocks that have since been removed by denudation, and was superimposed on the underlying rocks which are now exposed.

- Antecedent drainage describes a river system in which the original direction of flow has been maintained across land where uplift has taken place. it means that the river must be able to erode vertically its course at a rate that is fast enough to keep pace with the rising land.

**(d) State the significance of rivers to human activities:**

- They are a source of water for domestic used.
- Rivers are used for transport.
- Rivers are a source of fish rich in proteins.
- They are a source of water for irrigation.
- They are a source of water for industrial use.
- They are harnessed to provide hydro-electric power.
- River banks are sources of sand used for building.
- River features like waterfall create scenes that attract tourists hence foreign exchange.
- Rivers like Indus and Ganges in India are used for ritual functions.
- Some rivers are used for marking boundaries.

**29 (a) Explain various processes of wind erosion:**

- Deflation: This process involves the blowing away of loose or unconsolidated material, thus lowering the land surface.
- Abrasion: This is the process whereby particles of rocks especially the hard quartz grains are hurled by the wind against rock surfaces thus making them to be smooth and polished.
- Attrition: This is a process whereby wind-borne material which are in constant state of movement rub against each other and wear away.

**(b) (i) Apart from rock pedestal and zeugen, name other erosional features of a desert landscape:**

- Yardangs
- Deflation hollows.
- Ventifacts

**(ii) With an aid of diagram explain the meaning and formation of rock pedestal and zeugen:**

- Rock pedestal refers to a residual rock mass balanced upon a relatively slender neck and is composed of an alternative hard and soft rocks.
- It is formed by wind abrasion that attacks the rock outcrop wearing away the soft rock layers faster than the hard layer.



- Zeugen refers to a tabular rock mass which has a layer of soft rocks lying beneath a more resistant rock.
- It is formed by wind abrasion which attacks, deepens and widens the open joints to form furrows into a softer rock. The hard rock stands above the furrows as ridges (zeugen).



(c) **With an aid of a diagram, explain the meaning and formation of a Barchan (Barkhan):**

- A Barchan refers to a crescent-shaped sand dune and lying at right angles to the prevailing wind with the horns of the crescent projecting down wind caused by the sand being blown round the edge as well as over the top of the heap. Barchan vary in height up to more than 35m. The slope is gentle on windward side and steeper in the sheltered leeward side, where eddy motion assists in maintaining a slight concave slope.
- It develops from the accumulation of sand caused by a small obstruction such as a rock or vegetation.



30. (a) (i) **Apart from Inselberg and Mesa, name other features that result from the action of water in the desert:**

- Bajada                      - Playa                      - Wadi
- Butte                        - Pediment                - Castle kopjes

(ii) **Explain the difference between an Inselberg and Mesa:**

- An Inselberg refers to an isolated residual hill in a hot dry region (desert).
- Mesa is a flat, table-like upland, which fall away steeply on all sides. The word '*Mesa*' is a Spanish word which means '*table*'. The harder top layer of rock has resisted denudation and being practically horizontal, has maintained a uniform surface parallel to the stratification. In time a Mesa becomes reduced by dissection and erosion to a Butte.

(b) **State the significance of desert landforms to human activities:**

- Deserts have striking features which attract tourists.
- Desert landscape or region are important for spacecraft industry.
- Some important minerals like oil is common in desert regions.
- Desert regions provide safe places for testing weapons.
- Sand which is plenty in desert region is important in construction (building) industry.

31. (a) **Explain the difference between desert and desertification:**

- Desert refers to an almost barren tract of land in which the precipitation is so scanty that it cannot adequately support vegetation.
- Desertification refers to the encroachment of desert conditions into marginal land.

(b) **State the causes of desertification:**

- Prolonged absence of rainfall.
- Rainshadow effect of high mountain i.e. the Leeward side.
- Presence of a cold current on the path of rain bearing wind.
- Areas of anticyclones.
- Areas subjected to a constant dry land wind.
- Cutting down of trees without replacing them.
- Overstocking or overgrazing thus leaving the land bare.
- Overcultivation (continuous planting) in the one piece of land.
- Shifting cultivation.

32. (a) (i) **What is 'Glacier'?**

- Glacier refers to a mass of ice which moves slowly down a valley from above the snowline under the force of gravity.

(ii) **Explain how glacier is formed:**

- Glacier is formed owing to the pressure of the immense depth of snow, which depresses the freezing point. The snow in the lower layer thus melts and then solidifies again into granular ice or 'Neve' being later transformed by the continued pressure into clear ice.

(b) **Explain the processes of glacier erosion:**

- Plucking: This refers to the quarrying process by which parts of the underlying rocks are frozen into the base of the ice and pulled away.
- Abrasion: This refers to the grinding process in which stones and boulders frozen into the moving ice are dragged over the underlying rocks polishing and scratching the surface.
- Sapping: This refers to the breakup of rocks by alternate freezing and thawing of water at the bottom of cracks between a mass of ice and the side and floor of a valley, or the side of a mountain.

(c) **With the aid of a well-labelled diagram, give the meaning and explain how various features of a glaciated highland are formed:**

*Pyramidal peak (horn):* This refers to a steep-sided mountain peak surrounded by three or more cirques with radiating systems of aretes. Pyramidal peak is formed at the junction of aretes by the backwall recession of two or more adjacent cirques.

*Arete:* Refers to a sharp or narrow, steep-sided rock ridge, separating two cirques. Arete occurs when two corries (cirques) lying adjacent to each other cut back hence producing an arrow and often knife-edge ridge (Arete). Or it is formed by the backwall recession of the cirques.

*Cirque:* It refers to a roughly semi-circular or armchair-shaped steep sided hollow (basin) cut into the side of a mountain and valley heads. Cirque (French) is known variously as corrie (Scottish) and Cwms (Wales/Welsh). Cirque is formed when a hollow within the highland area are filled with snow and ice to form Cirque glacier. It is gradually enlarged by erosion caused by the alternate thawing and freezing of the snow.

Overdeepening at the bottom of the cirque is caused by basal sapping. It owes its basin-shape to the grinding action of the moving ice and its embedded rock fragments which serve as cutting tools.

NB: Cirques usually contain small lakes or tarns (cirque lake).

- U-shaped valley (glacial trough): It refers to a steep-sided, flat-bottomed valley with a roughly U-shaped cross profile. It is formed when glaciers from different valleys join together thus having an increased erosive power. This results in the glacier deepening, straightening and widening the valley to give it a U-shaped feature.
- Hanging valley: This refers to a tributary valley of a U-shaped valley which ends abruptly, high above the flow of the U-shaped valley separated from it by an almost vertical slope.

33 (a) **Illustrating your answer with relevant diagrams, explain the differences between roches moutonnee and crag and tail of lowland glaciated landscape:**

ROCHÉ MOUNTONEE	CRAG AND TAIL

- Roche moutonnee: It refers to an outcrop of resistant rock smoothed by ice on the upstream side of the rocky projection by abrasion making it to be gentle but roughened the downstream side by its plucking action giving it a jagged slope.
- Crag and tail: It refers to a knob of resistant rock lying in the bed of a glacier and which is worn away on the upstream side and a gently sloping tail of moraine deposits in its lee or downstream side.

(b) (i) **Other than drumlin, name other depositional landforms of the lowland glaciated landscape:**

- Outwash plain
- Kames
- Erratics
- Boulder clay (train)
- Eskers
- Moraine

(ii) **What is the meaning of the term drumlin:**

- A drumlin refers to an elongated hill or ridge of boulder clay, usually oval and shaped like half an egg, lined up in the direction of the ice movement. The typical landscape formed by several of them is said to have a 'basket of eggs relief'.

(c) **Write a brief note on the term moraine. Illustrate your answer with a clear, well-labelled diagram:**

- When a valley glacier ( a stream of ice, originating in the neve field of mountain summit areas, which flows downstream by the easiest route) undercut the valley sides, and rock fragments fall on the sides of the glacier it forms a ridge of loose material called '**Lateral Moraine**'. When two valley glaciers meet, two lateral moraines join to form a '**medial moraine**'. At the end of a glacier, the accumulation of eroded material (moraine) form what is known as the '**terminal moraine**'.

- A: Lateral moraine
- B: Medial moraine
- C: Terminal moraine
- Direction of flow

(d) **State the significance of glaciation to man (or human activities):**

- Glaciation produced striking features that attract tourists.
- Rivers flowing over the hanging valley forming waterfall and hence creating sites for establishing hydro-electric power stations.
- Large glacial lakes form natural waterways.
- Moraine deposits provide fertile soils thus supporting agriculture.
- Glaciated landscapes provide natural fields for sporting activities such as skiing and other snow related sports.
- Fjord coastlines provide sites for natural harbour and are also good breeding sites for fish and hence fishing industry.

34 (a) **State the factors influencing the evolution of coast:**

The appearance (character) of any coastline depends on the interaction of a number of factors which include:

- The work of waves, tides and currents which acts as agents of erosion, transportation and deposition.
- The nature of the land margin which is being subjected to these marine processes (i.e. whether the rocks are resistant or not, homogeneous or heterogeneous, regular or irregular).
- The existence of some special factors in coastal areas such as the growth of coral, effects of glaciers and volcanic activity.
- Various features which are artificial like the work of man can shape the coastline. E.g. the establishment of ports, construction of dykes, dredging of estuaries e.t.c.

(b) **State and explain the processes of wave erosion:**

The erosion work of the waves is fourfold, and they include hydraulic action, corrosion, attrition and solution.

- *Hydraulic action*: A mass of water has a direct shattering effect as it pounds the rock especially when it is thrown against a cliff by breaking waves. This suddenly compresses air in the cracks and crevices of the rocks, which expands when the waves retreat causing rocks to shatter.
- *Corrosion*: This occurs when the mass of fragments, ranging from sand to boulders are pounded by the waves against the foot of the cliff resulting in undercutting and breaking up of rocks.
- *Attrition*: This occurs when fragments are pounded against the cliff and against each other, as the swash forces material up the beach and the back wash drags it back again, so that the fragments are themselves worn down.
- *Solution*: This occurs in places where such rocks as limestone are present. The chemical solvent action of sea-water makes such rocks to get dissolved.

(c) **State the factors that determine the degree of erosion that takes place:**

- The degree of exposure of wave attack.
- The effects of coastal currents and ocean tides.
- The structure of the rocks.
- The action of man.
- The degree of resistance of the rock.

(d) **Name the following erosional features of the coast:**

- A: Stack
- B: Natural arch

- C: Cave
- D: Blowhole
- E: Geo

(e) (i) **Apart from Tombolo, name other depositional features of the coast:**

- Bars                                - Spits                                - Beaches
- Mud flats                            - Cuspate foreland                - Lagoons

(ii) **Define the term 'Tombolo':**

- It refers to a bar which joins an island to the mainland or joins two islands.

35 (a) **Name the types of coasts:**

- Submerged upland coasts
- Submerged lowland coasts
- Coral coasts
- Emerged upland coasts
- Emerged lowland coasts

(b) **Briefly explain the meanings of terms: Ria, Fiord, Longshore drift, Spit, Fetch and Coastline:**

- *Coastline*: Is the actual coastal outline of the land, cutting across narrow inlets and river mouths; it is marked either by the line of cliff or by the highest line reached by the waves (coast is that part of the land that borders the sea).
- *A Ria*: A long narrow bay or inlet into the sea coast, caused by submergence of a river valley.
- *A Fiord*: A fiord as it is known, refers to a long narrow inlet into the sea-coast, with more or less steep sides. It is generally held that fiord was formed when glaciers, making their way to the sea scooped out deep, trough-like valleys which may have been first cut by streams, so that the lower ends were filled by sea water.
- *Longshore drift*: The movement of shingle and sand along a seashore, due to the waves advancing obliquely up the beach.
- *Spit*: A ridge of shingle and sand that is attached to the land at one end and extending seaward or projecting into the sea.
- *Fetch*: Refers to the length of open water across which the wind is blowing and which largely determines the size of the waves.

36. (a) **State the conditions necessary for the formation of a coral reef (and hence coral coasts):**

Coral coasts, unlike other coasts are largely organic in origin. They form from minute sea organisms called polyps. When they die, their skeletons, which are made of calcium carbonate, accumulate with those of other organisms to form coral limestone. With time, large banks of rock are gradually built up called coral reefs.

Coral polyps thrive under the following conditions:

- Sea temperature of about 20°C to 28°C.
- Coral thrive best in clear salt water and well oxygenated.
- Constantly moving water is important.
- Plentiful and constant supply of plankton (microscopic life as food).
- Sunlight that penetrates to a depth of at least 50m (relatively shallow water).

(b) **With the aid of diagrams, explain the meaning of :**

- (i) **Fringing reef**
- (iii) **Atoll**

(ii) **Barrier reef**

- It refers to a coral platform joined to the coast, or separated from it by a shallow lagoon. It fringes the coast of the mainland or island, growing upwards and outwards from the bed of the shallow sea. It makes a rough platform at about the level of low water, and often leaves a shallow stretch of water (a lagoon) between it and the shore.
  
  - Barrier reef is the same as fringing reef except that it lies several distances from the shore and is separated from the coast by a lagoon which is both wide and deep.
  
  
  
  
  
  
  
  
  
  
  - Atoll refers to a roughly circular coral reef which encloses a shallow lagoon but without an island in the middle of the latter (or a low circular coral islands each with a central lagoon of shallow water). According to Darwin's theory, an atoll began as a fringing reef round an island, then the island became submerged owing to subsidence, leaving only the ring-shaped reef enclosing a lagoon.
- (c) **State the significance of coastal features to human activities:**
- Coastal features are tourist attraction hence foreign exchange.
  - Coral limestone provide raw material for cement production.
  - Shallow continental shelf provide good fishing ground.
  - Fiords and rias provide natural sites for port construction.
  - Animal shells are used for ornamental purposes.
  - Coral rocks are used for building.

37 (a) **What is a 'Lake':**

- A lake is an accumulation of water in hollows on the earth's surface. When it is drained by rivers their waters are fresh, but when they have no outlets they are salty.

**(b) Giving example of each, describe the classification of lakes according to their origin:**

Lakes may be classified according to the mode of origin of the hollows which contain their waters. These include the following categories: by earth movement, by erosion, by deposition, by volcanic activity and artificially by man.

- Earth movements cause lake formation when there is subsidence or warping of the land. Hollows or depression so formed in the earth's crust may contain water and hence lakes. This is most easily seen in rift valleys. Example of a rift valley lake is Tanganyika while a good example of a down warped lake is Lake Victoria.
- Erosional lakes are as a result of different erosional activities. E.g. Ice sheets and valley glaciers may scoop out hollows to form a basin and when water collects it create a lake known as tarns, cirque lake or ribbon lake.
- Lakes produced by deposition. Barriers across a river valley hold back the water which forms a lake. Again Oxbow lake (e.g. Lake Kanyaboli) are formed from the meanders of rivers. The deposition of silt at the two ends of 'Ox-bow' closes the channel between the main river and its old loop. Last, sometimes large estuaries are partially filled with silt. In the portions not so filled are large shallow lagoons (lakes).
- Lakes produced by vulcanicity. They lakes are often formed by the accumulation of water in the crater of extinct volcanoes. The best example is Lake Toba in northern Sumatra whereas a local example in Kenya is Lake Simbi in Nyanza province.
- Man-made lakes. These are lakes that are deliberately formed by building a dam across a river valley for the purpose of generating hydroelectricity and/or for irrigation.

**38 (a) With the aid of diagrams, explain how the following lakes are formed:**

- (i) Ox-bow lakes
- (ii) Crater lakes

- Ox-bow lakes: Is formed when a meandering river, having bent in almost a complete circle, cuts across the narrow neck of land between the two stretches, and leaves a backwater. Silt is gradually deposited by the river at the entrances to this backwater, till the latter is finally separated from the river and becomes a lake as shown below:

- Crater lakes: Refers to a mass or sheet of water in the crater of an extinct volcano. It is formed as follows: Volcano may be subjected to a violent eruption which blows off its top. This leaves a circular funnel-shaped depression on top of a volcano. The depression later fills with rain or ground water to create a crater lake as shown below:

**(b) State the characteristics of Rift valley lakes:**

They are basically elongated (long and narrow) in shape.

Most of the rift valley lakes are deep.

Most of them have steep sides.

They are basically saline or salty.

They have inlets but no outlets making them to be saline.

**(c) State the significance of lakes to human activities:**

On the whole, lakes are of great advantage to man. When large system of lakes occur, the following will be the advantages:

- They provide a cheap and easy means of transport especially for bulky commodities.
- Lakes help to regulate the flow of rivers, preventing the possibility of excessive flooding.
- Lakes are of great value for water supply for both domestic and industrial use.
- Large scale irrigation project is possible with the existence of a lake which provide water for use in dry seasons or in place with little rainfall.
- Large lakes help to moderate the climate of the surrounding regions due to the breezes.
- The beds of old lakes are of great importance agriculturally, because of the deep, rich, stoneless soil.
- A lake can provide a good head of water for the generation of hydro-electric power.

**39. (a) What is 'Climatology'?**

This is the science which treats of the various climates of the earth, and their influence on the natural environment.

**(b) What is the difference between weather and climate?**

- Weather is the state of the atmosphere at a certain time on a particular day in a given place.
- Climate describes the average weather condition over a large area for a long period of time say 35 years.

**(c) List the various elements of weather:**

Rainfall                      - Temperature                                      - Humidity  
Cloud cover                      - Atmospheric pressure                                      - Sunshine  
Wind direction/speed

**(d) Explain the factors that influence climate of a place (or factors influencing temperature):**

The climate (or temperature) of a place depends on the following factors: Latitude, Altitude, Distance from the sea (continentality), Prevailing winds, Ocean currents, Slope of the land (aspect) and Mountains:

- *Latitude*: On an average, temperature decreases from the equator to the poles. That is the higher the latitude or the further north or south you get from the equator, the colder the climate. This is because as we go nearer the poles the sun's rays fall more obliquely on the earth's surface, thus making the amount of solar energy per unit of area to decrease.
- *Altitude*: Altitude is the term used to describe the elevation of an area above sea level. The average temperatures in high altitude regions are lower than those of low altitude regions. That is, temperature usually decreases with increase in altitude roughly at the rate of 1°C for every 100 metres of ascent. Rainfall is higher in higher altitudes than lower altitudes.
- *Distance from the sea*: Areas located near large bodies of water have different climate than those areas located in the interior of continents. Water does not heat or cool as fast as land. This means that coastal areas do not have as wide a range of temperature changes as inland areas. The same applies to rainfall.
- *Prevailing winds*: The effect of prevailing wind in determining the climate (or temperature) of a place depends on the nature of the region from which the wind blows. A wind from the sea lowers the summer and raises the winter temperature. A wind from the land lowers the winter temperature and raises the summer temperature.
- *Ocean currents*: Ocean currents modify the temperature of winds blowing over them, i.e a wind which has passed over a warm current will have its temperature raised, and one which passes over a cold current will have its temperature lowered.
- *Cloud cover*: Dense cloud cover, obscures the sun and thus reducing the temperature. On the other hand, in regions of little cloud and free radiation, such as desert areas, very high day temperatures are recorded.
- *Aspect (slope of the land)*: South-facing slopes are warmer than north-facing slopes, partly because the northern slopes are exposed to cold north winds while the southern slopes are sheltered from them and partly because the rays of the sun strike south-facing slopes at a steeper angle than they do the northern slopes.



- Mountains: Mountains provide natural boundaries between different climates. The weather to the windward side of a mountain is characterised as a moist climate. As the moist bearing wind reaches the mountain, it rises, cools and losses is moisture. This process creates a much drier climate on the leeward side of this mountain range.

40. (a) **Explain the meaning of the following terms:**

- (i) Atmospheric pressure
- (ii) Relative humidity
- (iii) Absolute humidity
- (iv) Temperature inversion

- *Atmospheric pressure*: This is the pressure at a point due to the weight of the column of air above that point.
- *Absolute humidity*: The amount of water vapour present in unit volume of air, usually expressed in grams per cubic metre.
- *Relative humidity*: The ratio between the actual amount of water vapour in a given volume of air and the amount which would be present if the air were saturated at the same temperature, usually expressed as a percentage.
- *Temperature inversion*: This is the opposite of lapse rate. Under temperature inversion, temperatures increases with height upto certain limits and since the colder, heavier, air is at the bottom, convection currents do not form.

40. (a) **State the characteristics of:**

- (i) **Desert type of climate.**
- (ii) **Tropical continental type of climate.**

***Desert type of climate:***

- The temperatures are always very high.
- The diurnal range of temperature is large.
- The annual rainfall amount is very low and falls maybe once after five years.
- When rain does fall the showers are often torrentail.
- High annual temperature range.

***Tropical continental type of climate:***

- Has moderate rainfall between 750mm - 100mm.
- Has hot summers and cold winters.
- Experiences convectional type of rainfall.
- It has high humidity.
- The annual temperature range is high.

(b) **Account for the characteristics of the equatorial type of climate:**

- The temperatures are high throughout the year because the sun is always overhead.
- There is high humidity brought about by high evaporation rate.
- There is thick cloud cover due to the prevalent high relative humidity and convection.
- There is high rainfall throughout the year because the region lies along an area of low pressure system.
- There is small range of temperature caused by almost constant length of day and abundant cloud cover.

41. (a) **Explain the difference between:**

- (i) **Chinnok and Fohn winds:**

Chinook is a warm dry wind blowing eastwards (i.e. Westerly wind) across the prairies of North America from the Rockies and is capable of melting the snow thus making pasture available for animals.

Fohn is a warm, dry wind which blows down the lee slopes of mountains in the Alps, chiefly in spring. Being warm it raises the temperature and melts snow thus make pasture for animals available but increases risks of avalanches.

(ii) **Cold front and warm front:**

A boundary between two different air masses having different characteristics is called a FRONT. When a cold air mass enters an area of warm air, the cold air pushes the warm air upwards and the boundary area is known as COLD FRONT. When a warm air mass enters an area of cold air, the warm air moves a head of and over the cold air. This boundary area is known as a WARM FRONT.

**NB:** When a cold front is moving fast enough to overtake a warm front OR when a warm sector has been lifted clean off the ground, a new type of front is created called an OCCLUSION or OCCLUDED FRONT. A type of front that occurs when the air masses stop moving is called a STATIONARY FRONT.

(iii) **The difference between Tornado and Cyclone (Hurricane, Typhoon):**

- A Tornado is a violent whirl wind, chiefly in central U.S.A., covering a relatively small area, causing great destruction as it moves across country. Wind speed is exceptionally high and near the centre may exceed 300 km per hour.
- Tropical cyclone is a violent storm, originating in the tropics in form of a small but highly intense depression. Winds of cyclone strength circulate round the centre or "eye of the storm", accompanied by dense cloud and torrential rain known in different regions as cyclone, hurricane, typhoon, willy-willy.

(iv) **The difference between Katabatic and Anabatic winds:**

Katabatic wind refers to a local wind caused (often at night) by the flow of air, cooled by radiation, down mountain slopes and valleys.

Anabatic wind is a local wind caused by the flow of air during the day up valleys and mountain slopes. The slopes become heated by the sun, the warm air above rises in a convection current and the air of anabatic wind moves in to take its place. Anabatic winds thus often alternate with the night time Katabatic wind.

42. (a) **Apart from Orographic (Relief) rainfall, name two types of rainfall:**

- Convictional rainfall
- Frontal/cyclonic rainfall.

(b) **Explain the formation of Orographic (Relief) type of rainfall. Use a well labelled diagram to illustrate your points:**

**FORMATION:**

- Moist onshore air or winds rise up over a mountain.
- The warm rising air cools.

- Condensation occurs and clouds are formed.
- Later rain falls on the windward side of the mountain.
- The leeward side is often dry caused by descending warm dry wind.

43. (a) (i) **Define the term 'Vegetation':**

- The term 'Vegetation' refers to the plant life.

(ii) **Apart from Relief (altitude), name other factors that influence the distribution of vegetation in the world:**

- Climate (rainfall and temperature).
- Type of soil.
- The nature of the drainage.
- The role of aspect.
- Man's action.

(b) **With an aid of a well labelled diagram, show how variations in altitude have brought zones of natural vegetation on Mt. Kilimajaro or Mt. Kenya:**

1. Savana(grassland & woodland)
2. Rain forest
3. Bamboo forest
4. Heath and moorland
5. Snow and bare rock

(c) **State the uses of vegetation to man:**

- Source of wood fuel (firewood and charcoal).
- Source of timber for building industry.
- Source of food in terms of wild fruits and nuts.
- Some plants act as source of medicine.
- Some plants produce tannin substance used in leather industry.
- Vegetation creates a micro-climate.
- Some vegetation have aesthetic value and creates places for recreation.

44. (a) **State the characteristics of the following vegetation types:**

(i) ***Equatorial rain forest:***

- The trees are evergreen i.e. they never shed their leaves.
- It contains very many species of trees.
- Majority of the trees are hardwood type.
- The trees form three distinct layers.
- Due to high temperature and rainfall, trees grow very rapidly.
- Most trees have large buttress roots.

(ii) ***Coniferous forest:***

- The trees are basically evergreen.
- Trees have long tap roots to give them stability.
- The leaves are needle-like.
- The trees are conical in shape to help shed-off snow.
- The species of trees are very few and mainly softwood.
- The trees are slender but tall and straight.
- The trees grow at a slow pace due to low temperatures.

(b) **Explain how desert vegetation adapt to the harsh climatic conditions (hot and dry):**

- Most plants have long tap roots which enable them to reach down the water table level.
- Some vegetation have thick stems and leaves which act as water storage organs.
- Some plants have thin or needle-shaped leaves which reduces the amount of water lost through transpiration.
- Some plants shed off their leaves (i.e. are deciduous) during extreme drought season to reduce the rate of transpiration.
- Some plants have seed that can lie dormant until rain comes when they quickly germinate.
- Some have few stomata to help in reducing the amount of water lost through transpiration.
- Some plants have thorns instead of leaves and this help in curbing the amount of water lost and to protect them from being damaged by say animals.

45. (a) (i) **Define the term 'Soil':**

Soil is the loose material which forms the upper layer of the mantle rock, consisting mainly of very small particles.

(ii) **Explain the soil formation processes:**

Soil is the product of two processes, namely:

1. The weathering and decomposition of rock.
2. The decay of plant and animal life.

The formation of soil is a very slow process. When rock is weathered by physical and chemical forces, the remaining fragments combine with decayed plants and animal material to form the complex substance that we call soil.

(b) **Explain the properties of soil (i.e. its composition):**

Soil is composed of two major categories of materials:

- *Organic matter*: This is the result of plants and animal decay. This organic material is changed by bacteria into a substance known as humus.
- *Inorganic mineral matter*: This is produced from original rock material by weathering or simply the weathered remains of rocks.
- *Other minor properties*: These are liquid (water) and gaseous (air) components found in the pore spaces of the soil. Living organisms too are part of the soil.

(c) **Name the major soil types (group) of the world:**

- Red soils                      - Black soils                      - Desert soils
- Chernozem soils              - Tundra soils                      - Podzol soils
- Brown soils.

**NB:** The type of soil found in a certain area is determined by climatic conditions within a region. The amount of humidity (moisture) is the most important variable. Temperature also plays an important role in determining soil types.

46. (a) **Explain the difference between:**

(i) **Soil catena and soil erosion:**

- Soil catena is the sequential arrangement of soil down a slope and varies with relief and drainage.
- Soil erosion is the term used to describe the wearing away and loss of topsoil, mainly by the action of wind and (or) running water.

(ii) **Soil texture and soil structure:**

- Soil texture refers to the character of a soil with respect to the size of the particles. These may include clay, sand, silt etc. a clay soil may thus be described as fine, a sandy soil as coarse, while a silt soil is intermediate.
- Soil structure refers to the characteristic arrangement of the soil particles.

(b) **Illustrating your answer with clear, well-labelled diagram give the meaning of soil profile and describe how it is formed:**

- A typical soil profile:

Soil profile refers to a section through the soil showing the different horizons or layers, usually designated by the letters A, B and C which extends downwards from the surface to the parent material.

Soil is deposited in specific layers called horizons. Individual horizons can be distinguished by their characteristics and properties. The uppermost layer of soil is called the A HORIZON. The A Horizon is commonly called TOP SOIL and contains humus, sand and clay. The primary colour of the A Horizon is grey and black.

When the A Horizon is allowed to decompose over thousands of years, another layer is formed immediately below it called the B HORIZON. This section of subsoil is formed when dissolved minerals from the A Horizon are carried further into the ground. This horizon is composed of small, closely packed particles which makes the B Horizon difficult to penetrate. This horizon has a reddish brown colour due to the presence of iron oxide formed by chemical weathering.

A third layer that makes up the bottom layer of soil is called the C HORIZON. This layer is the lowest soil zone and is composed of bedrock and weathered bedrock. The bedrock (unweathered rock) is sometimes given as zone 'D'. The colour of the C Horizon is determined by the colour of the bedrock.

(c) **Explain the factors influencing the formation and nature (type) of soil:**

The principal factors upon which soil formation and type depend are:

- *Climate*: climate affects the soil type both directly through its weathering effects and also indirectly as a result of its influence upon vegetation.
- *Parent rock*: The influence of the parent rock is very marked in the case of young soil which has not had time to develop. The nature of the rock influences the rate of weathering.
- *Vegetation (plant) and animal*: Both plants and animals influence the development of soil. The influence of animals on the soil is largely mechanical. They assist in the breaking of rocks while some animals are of particular importance as they change the texture and chemical composition.
- *Topography*: The steepness of slope normally influence soils. Steep slopes encourage soil erosion and weathering. Consequently steep slopes tend to have thinner soil whereas gentle slopes have deep soils.
- *Time*: All soils need at least some years to become mature and develop a permanent profile which remains essentially the same with the passage of time.

47. (a) **Explain the meaning of the following soil orders:**

- (i) *Zonal soil*: this refers to a mature soil with well developed profile. Mature soil contains all three horizons A, B and C. It is mainly found on gentle slopes and where the area is well drained. Its formation is mainly influenced by climate and vegetation.
- (ii) *Azonal soil*: A soil which has not been sufficiently subject to soil forming processes for the development of a mature profile and so is little changed from the parent rocks material. It is described as young soil which contains only the A and C Horizons. The B Horizon has not had time enough to form. They are thin and mostly found on steep slopes.
- (iii) *Intrazonal soil*: A soil which has been influenced in its development less by climate and vegetation than other factors, such as defective drainage, excessive evaporation or an unusual parent material. Its profile is not fully developed.

(b) (i) **State the causes of soil erosion (degradation/impoverishment):**

Ploughing of land up and down the slope.

Over-stocking which leads to overgrazing.

Shifting cultivation (burning of grass and other soil covers).  
Monoculture - growing one type of crop on a piece of land year after year.  
Cutting down of forests (deforestation).

(ii) **State the possible effects of soil erosion:**

- Lowering of crop yields.
- Reduction of water supplies.
- Silting up of river dams or reservoirs.
- Negative effect on H.E.P. production, water transport e.t.c.

(iii) **State the types of soil conservation:**

- Terracing
- Contour ploughing
- Planting of shelter belts
- Building gabions
- Destocking (controlled grazing)
- Afforestation
- Planting of cover crops
- Crop rotation
- Mixed farming
- Mulching
- Fallowing
- Application of manure

(c) **State the uses of soil:**

- Soil provides food for plants.
- Soil is used for building in form of mud.
- Soil is used for making bricks and tiles for building.
- Soil is used in Art work e.g. pottery.
- Soil has some medicinal value especially for expectant women.

48. (a) (i) **Define the term ocean:**

The sheet of salt water which surrounds the great land masses of the earth and which covers 71% of the earth's surface OR the huge sheet of water covering great hollows on the face of the world.

(ii) **Explain the meaning of ocean currents:**

It is the movement of the surface water of the ocean some being warm while others are cold. The terms 'warm' and 'cold' for a current denote their temperature relative to that of the neighbouring atmosphere.

(b) **State the causes of ocean current (movements of ocean waters):**

Of various causes of ocean currents, the most important include:

- The rotation of the earth.
- The effects of the prevailing winds.
- Temperature differences causing differences in densities.
- Variations in salinity.
- The shape of the land masses.

(c) **Name the physical features of the ocean. Use a well-labelled diagram to illustrate your answer:**

- (1) The continental shelf.
- (2) The continental slopes.
- (3) The deep ocean/sea plains.
- (4) The ocean ridges.

(d) **State the types of ocean water movements:**

The ocean waters move two different ways namely:

- The vertical movement.
- The horizontal (surface) movement.



49. STUDY THE WORLD MAP SHOWN BELOW AND ANSWER THE QUESTIONS THAT FOLLOW.

**OCEANS, SEAS AND OCEANIC CURRENTS.**

**SEAS**

- i) Baltic
- ii) Adriatic
- iii) Mediterranean
- iv) Black
- v) Caspian
- vi) Red

**KEY**

-  Cold
-  Warm

**OCEANS.**

- A Pacific
- B Atlantic
- C Indian
- D Arctic

**CURRENTS.**

- 1. Californian
- 2. Gulf Stream
- 3. Peruvian
- 4. Brazilian
- 5. North Atlantic Drift
- 6. Guinea
- 7. Benguela
- 8. Mozambique (Agulhas)
- 9. Kuro - Siwo
- 10. Labrador

**(a) Name the oceans marked:**

- A - Pacific      B - Atlantic      C - Indian      D - Arctic

**(b) Name the ocean currents marked:**

- (i) Baltic
- (ii) Adriatic
- (iv) Black
- (v) Caspian

(iii) Mediterranean

(vi) Red

50. (a) **Define the following terms:**

(i) **Oceanography:**

this is the study of the oceans, including the nature of the water, its movements, its temperature, its depth, the ocean bed, the flora and fauna.

(ii) **Tides:**

- The alternate rise and fall of the surface of the sea, approximately twice a day. The average difference in water level between high and low tide of a place is called tidal range.

(b) **What are the causes of tides?**

- The gravitational pull of the moon.

- The degree of the sun.

### **PREFACE.**

This book is designed to meet the needs of the current education trends. To be specific, it is designed to help Geography students who are preparing for public examinations for Secondary school. Exposes both Geography teachers and students to the specific type of questions with answers resembling those of the questions set in real exams.

The approach the book has taken has been lacking in the market. Each topic in Geomorphology is amplified with numerous self-testing questions which contain detailed information (answers) stripped of unnecessary padding making it very attractive to candidates especially when exams are nearing and time is scarce.

In short, the book, a self contained study supply information which are arranged carefully to suit the reader. It supplements abundantly the current leading textbooks in the market. It is therefore an invaluable text for pre-examination revision.

***George H. Odongo***



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I do absolve anyone I have named above from any responsibility for either the views or the errors the book might contain.

**George H. Odongo**