O LEVEL

GEOGRAPHY

STUDY PACK
4TH EDITION

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PRELIMINARY CHAPTER

EXAMINATION SKILLS

Chapter Objectives:

This chapter seeks to give guidance and advice on the best methods to approach the O-level geography examination. Hence pupils should be able to:

a) Interpret and analyze examination questions.
b) Apply appropriate skills to tackle multiple choice questions.
c) Present their work in a neat, logical layout.
d) Select examination questions appropriately.
e) Manage time wisely and economically.

The Geography Examination:

The geography examination at 'O' level consists of two papers. These papers primarily test for an understanding of the scheme of assessment as stated in the subject syllabus. This stage gives guidance on the skills that should be acquired by an average learner at the end of the course. Thus as you cover the content matter of the subject, you are gradually acquiring skills that enable you to sit for the examination. Hence an understanding of what we should be able to do, and not only knowing simpler matters differentiates a weak answer from a good answer. In this section we attempt to equip students with skills necessary to effectively sit for the 'O' level geography examination.

Paper 1

The multiple choice questions require great skill. At most times we rarely give ourselves time to think about the questions for we believe the answer is right in front of us , and the result is poor performance. Multiple choice questions test the same skill as in the second paper, and success lies in a student being able to come up with an independent answer before going through the options. Thus the following hints are recommended for the paper I.

1. **Time Management**

   Speed is an essential component, for 40 questions have to be answered within one hour's time. Do not spend a lot of time on one difficult question.

2. **Guess work:**
   At all costs, avoid or desist from guesswork. Guesswork is a sign of unpreparedness, panic and question misinterpretation, Indeed there is a 25% probability of getting the answer correct, and getting 25% is not an option. Therefore always try to give each question total concentration.

Question Interpretation:
Read and understand the requirements or demands of the question. Once one has identified the demands of the question it becomes easier to choose the correct option.

Analyze given Graphs and diagrams
The geography examination uses a lot of diagrams that would come in many different forms. Certainly some of the illustrations would be fairly new to the student. Therefore try to identify the data that is shown and attempt to familiarize with the diagram first before going through the question.

Provide your own quick solution
It is advisable to always try to give answers to the questions before rushing to the question. Pretend that there are no answers given. Just like in a class exercise. Certainly if you understood the topic, you would find that task much simpler. This still prepares one to be in a better position to select the most appropriate answer, thereby reducing the occurrence of confusion and mixing up of answers.

NB: It is important to note that multiple choice answers usually have two answers that are almost similar. If one of these is removed then the remaining one would most probably answer the question. Therefore only a candidate who has fully mastered a particular topic would tell the distinction. Therefore it is important to be very much prepared for the examination.

Also a good student, who has taken time to analyze questions rarely change answers for he/she shall be sure of the answer you selected. However, students who lack sufficient understanding of the subject and question requirement, usually rush through the paper and start making amendments which at times will be unnecessary.

Geography paper 2
Paper 2 is a very critical paper as it carries more marks and thus it examines a number of skills. The issues outlined above for paper I, are equally as important, but they shall be explained now with particular reference to the second paper.

Principles of Examination success Geo paper II.

Question Selection
The most important thing in an examination is to choose questions appropriately. Remember we are instructed to answer a question from each section and one from any of the sections. This means that one should be well versed with all the three sections. The following tips may help one to choose questions appropriately.

1. Read through all questions quickly. Note the questions you are able to answer.

2. Note the marks allocated for each part question. This helps you to make judgment of your ability, and weighting for particular questions, for example:

Question X			Question V	
Part	(a)	5	Part (a)	7
	(b)	12	(b)	10
	(c)	8	(c)	8

In the above instances a candidate may choose question x because he has been attracted to part (a) worth five marks. The student will fail to answer part b and c, and hence will be forced to cross out his work and start all over or simply write a weak answer.

Another student who has carefully studied the marks allocation may choose question Y because he can confidently answer part (b) and (c), he may not be quite sure about part (a) but certainly such a student is better placed to do better.

Therefore the whole process of question selection is to identify and choose questions that would enable you to score more marks for the total question. It is indeed quite an ill-advised action to choose a question where one is not confident or certain with most of the issues raised in the question.

Question Analysis and interpretation.
The aspect was discussed earlier in this chapter and hence cannot be over emphasized. Candidates should give themselves adequate time to read and understand the requirements of the question before writing down their answers. Analysis basically includes

- An ability to understand what is being communicated i.e what does the question require one to do.
- An ability to identify the question phrase in the question statement. This is always expressed in verb form or an action that you should do e.g

Describe measures to reduce the effect of drought**.**

The above question requires you to describe

The understanding of the note of the question will enable one to respond appropriately

Application of Relevant Concepts
The Zimsec syllabus seeks to test knowledge of skills and the ability to apply what was learnt in class to new situations. Simple recall questions are very rare. This is an attempt to test one's reasoning and analytic levels. Let us take the following example into account.

Question 1:

i) What is weathering?

ii) Describe the advantages of weathering.
iii) Describe the landforms associated with weathering.

This is a fairly straight forward question that requires, little reasoning. A student who has studied the topic a few moments before start of examination, would certainly score some marks. Now let us consider the same question in this format: Study the diagram and answer the question that follows:

Question 2

(A*dopted from R. Bunnet)*

i) Name the feature shown in the diagram [1]
ii) Describe and exp̄lain how such a feature was formed [7]
iii) Name three advantages and three disadvantages for communities living near such a feature. [6]

Note that in the question above there is no mention of weathering but the question requires one to apply knowledge of weathering types and landforms, as well as making an assessment of the impact such physical features have on the human environment.

Such is the nature of geography questions. Therefore we should be in a habit of analyzing diagrams, graphs, pictures etc and equating them to geographical concepts, for geography is found in all aspects of our life. Therefore a geography student should be always observant of our surroundings, for always something relevant to geography is taking place.

Mark allocation:
It is important to always check for the number of marks allocated per individual question. It is advisable to state your answers in point or tabulated form. This enables one to be able to weight his answer against marks allocated.

Layout of Presentation:
Neatness and a well laid out answer gives an impression of order. It makes it easy for one to identify answers to part questions. The person marking your work should not hunt for your answers in a forest of unnecessary phrases and explanations, but the answers that you write should be well laid out.

Use of diagrams/sketches
At times you may be required to use diagrams to illustrate your answer. The diagram should serve its intended purpose, that is, it should be clear and well labeled.

Time management
Time is a precious resource that should be used wisely. One should spend an average of 35 minutes per question. However, at most times it is not always the case because students would want to spend more time on questions they are comfortable with. You should however, note that totalizing one question would not give us a passing grade, but an overall performance on the 4 selected questions.

Therefore you are strongly encouraged to allocate adequate time for all the questions. To do this, the following hints may help. Begin with the question you know best. You are bound to spend less time thinking about what to write and your mind would be in a great position to recall issues you know very well. Please note that you won't be penalized for beginning with question 9, followed by 1, then 6 then 8. What really matters is allocating enough time to all questions to give you the maximum possible marks.

Proper time management will save one from the finish rash, where one discovers that a few minutes are left before attempting the last question, and then he will attempt to scribble a lot of details without giving thought to the specific demands of the questions. Results of such action are often disastrous, a waste of time, and effort.

A famous saying states that, failing to plan is planning to fail. Therefore lust for subject matter with no proper planning and examination techniques is unhelpful, hence, a lot of preparation and practice is necessary.

CHAPTER 1

The Earth and associated landforms.

Chapter objectives

At the end of the chapter one should be able to:

a) Draw and label a diagram showing the internal structure of the earth.
b) Explain the theory of plate tectonics.
c) Describe landforms associated with plate margins.
d) Describe the processes of folding and faulting showing associated landforms.
e) Define vulcanicity and describe associated features.
f) Describe the nature of and origin of rocks.

Earth movements and rock structures

Internal structure of the earth:

Alfred Wegener and the continental drift theory:
A meteorologist by profession, Wegener, a German, carefully studied the fit of continents and assembled other evidence to make the strongest case he could for continental drift:-that is, in support of it. He showed that the continents could fit together to form a giant supercontinent which he called the Pangea.

Wegener showed that fossils of the Paleozoic age (a geological period) found on several different continents, were quite similar-e.g. the plant fossil Glossopteris found in rocks in South America, Africa, India and Australia.

Although these localities are now widely separated from one another, they fit closely together in Wegener's reconstruction of Pangea, in India, Africa, South America, Australia and Antarctica. All five localities contain rocks of the same type and their edges are overlaid by thick continental sedimentary rocks containing coal beds and glossopteris fossils.
The full scope of Wegener's theory can not be exhausted at this level.

What was the force behind the splitting and drifting apart of continents? To deal with this issue, a more scientific theory was developed- i.e. the Plate Tectonic Theory.

What is a plate?

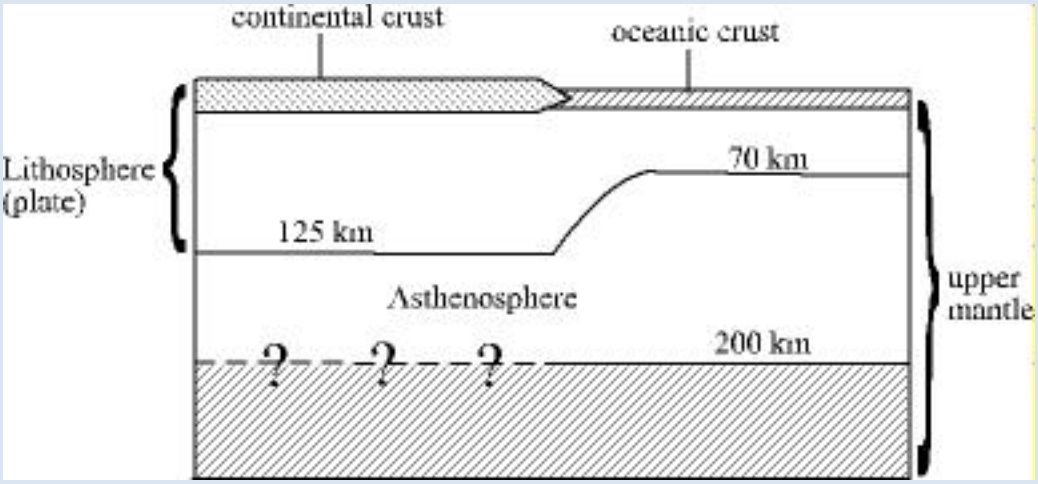
It is a large, mobile slab of rock that is part of the earth's surface. The surface of a plate may be made up entirely of sea floor for example the NAZCA plate. Or it may be made up of both

continental and oceanic rock for example the North American plate. Some of the smaller plates are entirely continental, but all the large plates contain some sea floor.

Plate tectonics theory has added some new terms based on rock behavior, to the zones of the earth's interior. The plates are part of a rigid outer shell of the earth called the lithosphere. The lithosphere is 70 to 125kms thick, so it includes the rocks of the earth's crust and uppermost mantle.

Below the rigid lithosphere is the asthenosphere, a zone maybe 100kms thick that behaves like plastic because of increased temperature and pressure. The plastic asthenosphere acts like a lubricating layer under the lithosphere, allowing the plates to move.

The asthenosphere, made up of the upper mantle rock, is the seismic low-velocity zone. Below the asthenosphere is the more rigid lower mantle. See diagram below.



(Adopted from McGreary. Plummer.)

Major plates of the world

Oceanic trenches: If the plate is made up mostly of sea floor (as the Nazca and Pacific plates) the plate can be subducted down into the mantle forming on a deep sea/oceanic trench and its associated feature.

If the leading edge of the plate is made up of continental rock (as in the South American plate) that plate will not subduct.

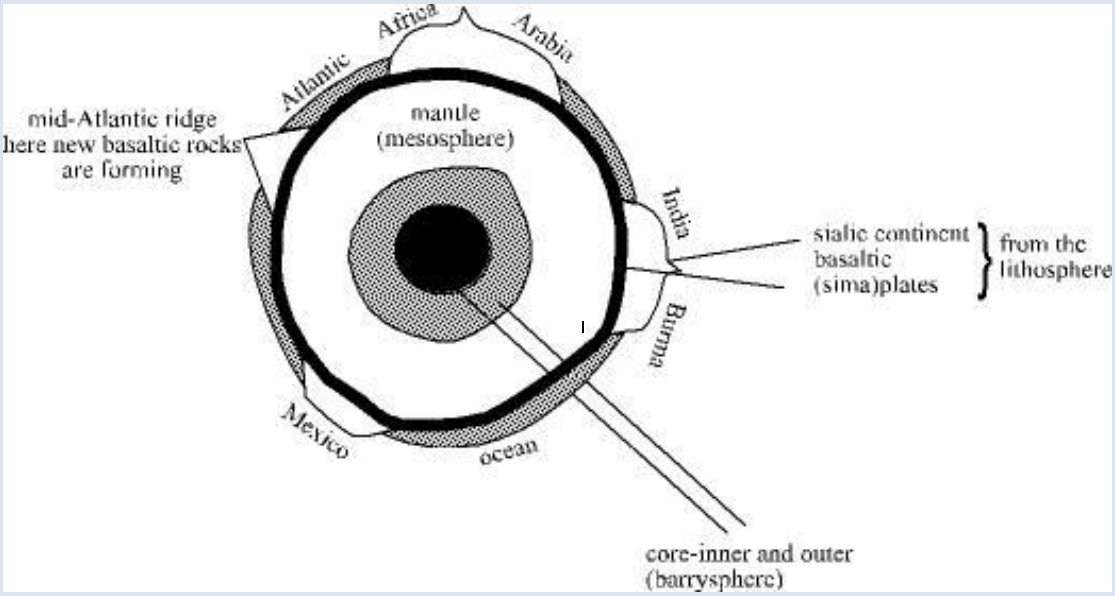
Exercise

1) What are the differences and similarities between Wegener's Continental drift theory and the modern theory of plate tectonics?

The internal structure of the Earth

The earth is one of the nine planets in orbit in the solar system. We are mainly concerned with the processes operating on the surface of the earth. However, to understand some of these processes we need to understand the nature of the processes operating inside the earth. As such we begin by making an evaluation on the internal structure of the earth.

Diagrammatic presentation of the internal structure of the earth.



As shown in the diagram, 3 main divisions of the earth's internal structure can be identified. Their characteristics are as follows.

Crust

This is also known as the lithosphere that forms the surface of the earth. The crust is made up of 2 types:

1. **Continental crust**
   This is also known as SIAL. (This is the short form for silica and magnesium). This forms the continental landmasses of the world.

2. **Oceanic crust**
   This is also known as SIMMAC. This is the short form for silica and magnesium. The oceanic crust is generally denser than the continental crust and it forms the floors of seas and oceans.

Mantle

This is the region below the earth's crust. It is also known as the mesosphere. It is made up of molten rock which is semi viscous in nature.

Core

This is the central part of the earth. The core is further subdivided into two regions the Inner core and the Outer core. The Inner core is made up of highly radio-active elements and is in solid form. The outer core is also made up of radio active materials and is in a semi-liquid state.

The Core of the earth is the region where the earth gains its energy. In other words most of the processes that occur on the earth's surface are a result of the energy released and transferred from the inner core.

Energy transfers within the earth

It has been highlighted that the core is made up of radio-active elements. This means that this element generate a lot of heat energy which is transferred throughout the month through conventional currents.

Process of convectional currents

When matter is heated, it expands and becomes less dense. Thus it rises and as it rises, the dense material above is forced to site and the convective cycle is in operation. These convectional cycles are responsible for the transfer of heat energy from the centre of the earth to all the other regions.

Exercise

1) (a) Briefly describe the main characteristics of the internal structure of the earth
   (b) Describe the differences between the characteristics of the following:
   i). Continental and ocean chest.
   ii). Inner and outer core.

2) Explain in your own words your understanding of the concept of convectional currents.

3) Why is the crust Lithosphere in a solid state, yet the mantle is in a semi-solid state?

The origin of present day continents and oceans.

Having looked at the present day distribution of continents and oceans on a world map, the question that arises is: what made these continents to be what they are? A lot of geographers have tried to come up with theories to explain the origin and development of the present day oceans and continents. One outstanding theory was put forward by a German physiologist, Alfred Wegener. His ideas are widely referred to as the Continental theory.

The continental drift theory:

A meteorologist by profession, Wegner, a German, carefully studied the features of continents and assembled other evidence to make the strongest case he could for continental drift. He

showed that the continents could fit together to form a giant super continent which he called Pangaea.

Wegener showed that fossils of the Paleozoic age (a geological period) found on several different continents were quite similar-e.g. the plant fossil Glossopteris found in rocks in South America. Africa, India and Australia.

Although these localities are now widely separated from one another, they fit closely together in Wegener's reconstruction of Pangaea, in India, Africa, South America, Australia and Antarctica. All five localities contain rocks of the same type and edges are overlain by thick continental sedimentary rocks containing coal beds and glossopteris fossils.

Wegener however, failed to come up with a logical explanation on the force behind the drifting of continents. During his time people did not take his findings very seriously. In the late 1950s, scientists made a further enquiry onto Wegener's ideas and with the help of new equipment, improved the continental drift theory and came up with the theory of plate tectonics.

Plate tectonics theory

It is believed that the earth's crust is suspended over a semi liquid material called the mantle. As such, the continents are floating continuously, also the convective currents we referred to earlier led to the crust breaking into many pieces referred to as continental or oceanic plates.

Exercise:

What are the differences and similarities between Wegener's continental drift theory and all modern theory of Plate tectonics.

Plate boundaries and associated landforms.

Plate boundaries are zones where two plates meet. It is important that we make an assessment of the different characteristics of plates:

The lithosphere is made up of two distinct plates, there is the continental plate which consists of aluminium and silica, (SIAL).This plate is less dense as compared to the oceanic plates made up of silica and magnesium as the elements. When the plates meet at plate boundaries, the following may occur:

1. Plates may move apart from each other to form a constructive plate margin. This is a zone where the earth's crust is being created as plates move apart due to divergence of convective currents which were explained earlier. This leads to the formation of a ridge due to the accumulation of magma which flows into the surface to fill in the space left by the diverging plates.
2. Plates may move towards each other. When this happens two scenarios may occur:
    a) If two plates of different characteristics meet i.e the oceanic plate meeting with a continental plate, the oceanic plate is forced to sink below the continental plate, creating a zone of subduction. This is a zone where the sinking plate is subducted or destroyed due to contact with molten magma and excessive heat created by friction.

There is a creation of a deep sea trench on a chain of volcanoes referred to as the **island area**. The continental crust will be forced to crumble up and forming a chain of fold mountains.

b) If two plates of similar characteristics meet, a collision zone is created. This is because the plates are of the same characteristics, and as such, they crumble up to form areas of folded structure. This occurs when two continent plates collide as they are similar in nature. The impact of their collision will force them fold upwards.

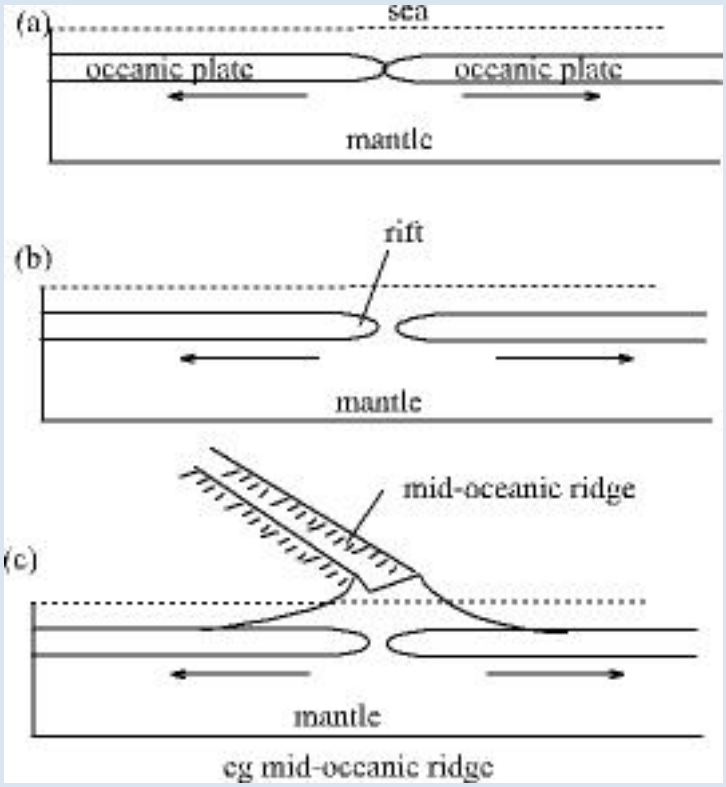
When two plates neither converge nor diverge, but slide past each other, a conservation or transform plate boundary is created. This is because no land is created or destroyed

Landforms associated with plate boundaries.
Plates boundaries are active zones of Landform building. The following are some common landforms associated with plate boundaries.

Constructive plate margins

The most common feature found in the region is the mid oceanic trench. This is formed due to the releases of magma onto the surface, forming a ridge like feature.

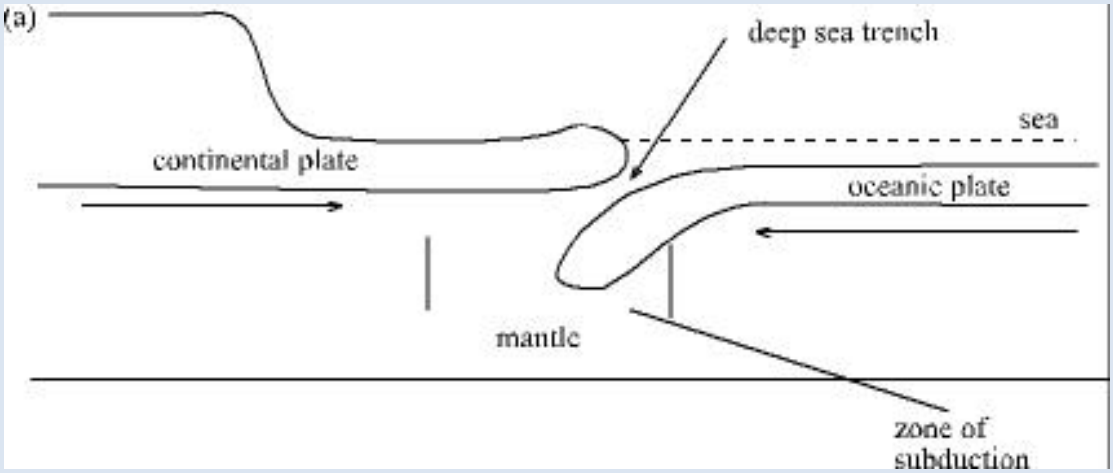
Also this area is characterized by volcanic mountains formed due to the violent releases of molten magma. At times these mountains are so large that the peaks or tops rise above the water, forming islands. A typical example is Iceland, which rises from the famous mid Altantic ridge.



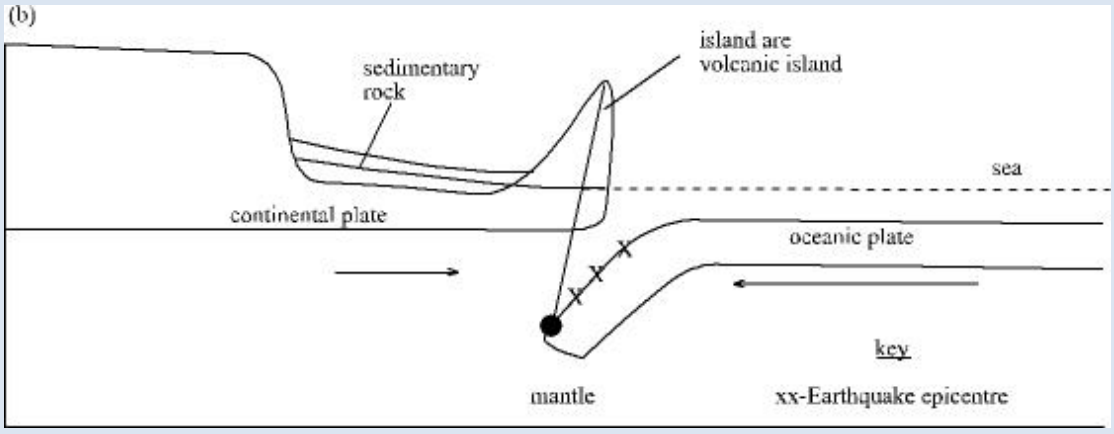
Destruction plate margin

This area is notable for a number of features.

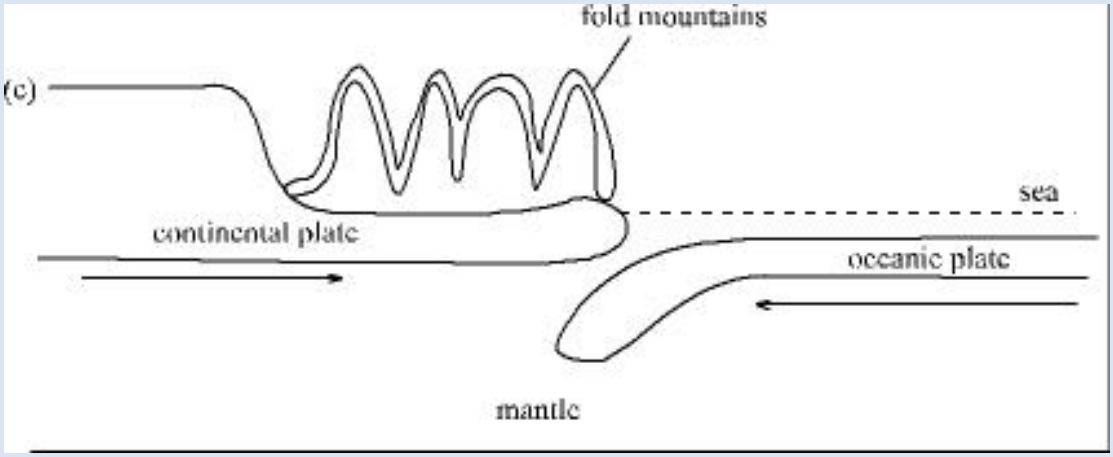
The most common is the deep sea trench formed through the subduction or bending downwards of the oceanic plate beneath the continental crust. The depression forms a deep trench as shown below.



(b)



(c)



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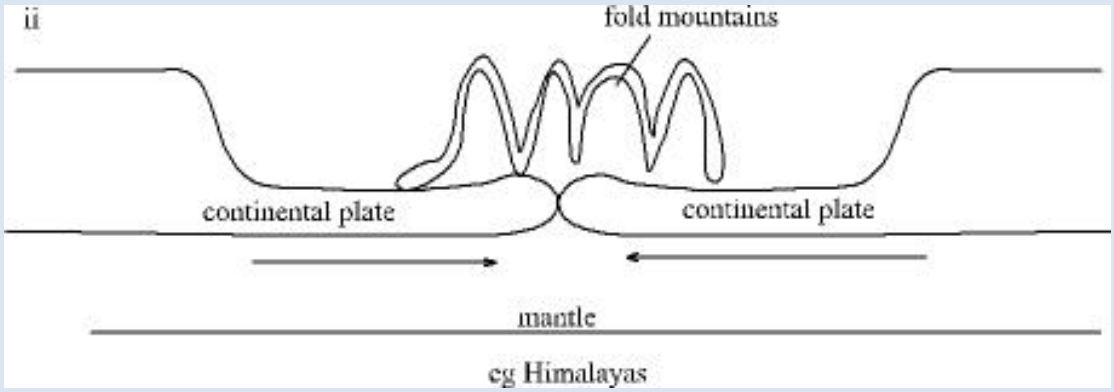


eg Himalayas

Typical examples include the Bolivia trench, the Chile trench and the Japanese trench, among others.

As the oceanic plates subduct or bend, large cracking or fissures develop. Magma from the mantle will rush in to fill this cracking. However, due to excessive pressure, volcanic eruptions will occur. This will form underwater volcanos or submerged mountain ranges: when these volcanic eruptions reach the surface, then a chain of volcanic peaks is created, leading to the formation of island arcs. Typical examples include Japan and News Zealand.

Due to the impact of the collision between plates, the continental plate cannot bend down wards, but is forced to fold upwards up fold. This leads to the formation of a line of Fold Mountains that runs parallel to the sea shore. At times the Fold Mountains are characterized by a lot of volcanic activity. This is due to magma and the melting of the subducted oceanic plate.

Collision zones:
As stated earlier, these are zones of the earth where two continental plates meet. Thus this leads to the formation of Fold Mountains due to the fact that these plates are of the same characteristics, such that at the point of impact, they will all crumble upwards (up folding). A typical example is the Alpinic and the Malign fold mountains which were formed in this way.

Conservative zones:
In this zone, the crust is neither created nor destroyed. Thus no landforms are found on this zone. This area is characterized by transformation faults caused due to excessive functional force.

Revision exercises

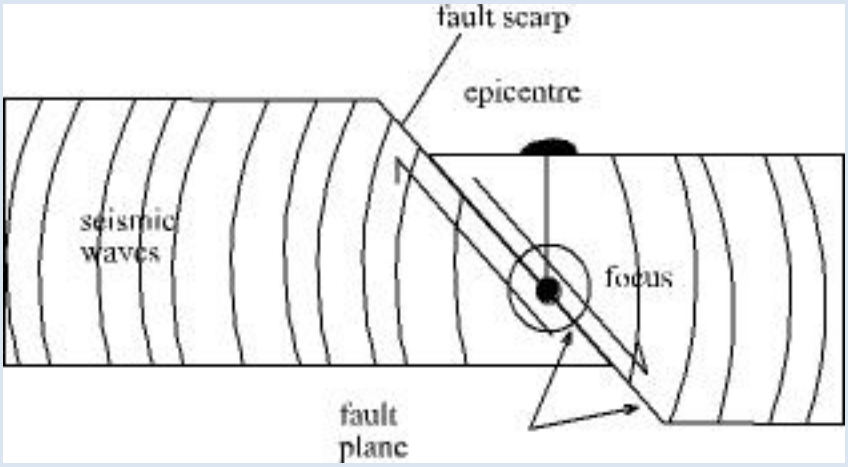
1) Write a paragraph on the causes of plate movement and the type of movements.
2) What is the difference between destructive plate margins and collision zones?
3) In which plate margins are, fold mountains, island areas, and deep sea trenches likely to occur? Give reasons for your answer.

Hazards associated with plate tectonics:
A hazard is a state of instability caused either by natural or man made causes. Some hazards can be detected and prevented while some cannot. Plate tectonics are associated with hazards that occur in response to the movement or drifting of the crust as well as their impact as they slide or hit against each other. The most common hazards are volcanic eruptions and earthquakes.

Earthquakes
An earthquake can be defined as the violent shaking or vibration of the earth's crust. Earthquakes can also be described in terms of its magnitude and intensity.

- Magnitude refers to the energy released by an earthquake, and intensity refers to amount of impact that the earthquake causes.

- Usually earthquakes occur at plate margins or boundaries such as destructive and conservative plate margins
- Shock waves are those sudden jolts of movement. Two terms usually used in the study of earthquakes are **focus** and **epicenter.**
- Focus refers to the point where the shock waves begin and epicentre refers to the point on the earth's surface above the focus where the shock waves are strongest.
- The force of the shock waves is measured by a seismometer and the readings are interpreted by a richer scale, where a higher reading shows a strong earthquake.



(Adopted from Mc Geary. Plummer).

NB: The focus of an earthquake is the point where the rock first breaks a fault; Seismic waves radiate from the focus. The epicenter is the point on the earth's surface directly above the focus.

Effects of earthquakes

These are: economic, social, and physical in nature

1. Loss of life.
2. Destruction of property.
3. Destruction of vital communication lines.
4. Landslides or mud flows.

Benefits of volcanic activities

a) When volcanic rocks are weathered, they produce fertile soils which are good for crop production.

b) Some volcanic rocks have within them precious minerals, which when exploited can lead to the development of the country.

c) Some volcanic landforms can be so scenic to the extent that they become tourist features. Geysers and hot springs are thought to have healing properties. They are also tourist features and this may lead to the economic and infrastructure development of the areas where they are found.

Revision exercise

a) Examine the effects of a recent earthquake that occurred. You need to make reference to newspaper/television, and other media.
b) How did the affected communities overcome the effects of the earthquakes?
c) Evaluate the role of the international communities in giving assistance to affected communities.

Volcanoes

Volcanic eruptions are very violent eruptions of magma into the surface of the earth. These eruptions often bring untold suffering to society. Volcanic eruptions like, earthquakes, have got social, economic and physical effects. These include the following:

When Earthquakes erupt violently, they force the earth's crust to shake violently.
In response to the violent eruption,

- Homes are buried.
- Destruction of crop land occurs.
- Blocking of roads and rivers.
- Destruction of communication networks.
- Loss of life.
- Causes tidal waves and air pollution (Tsunamis).

However, to a lesser extent volcanic eruptions have got positive benefits on society. Some of these benefits include.

- Creation of new land; when volcanoes erupt in the oceans new islands are formed e.g Iceland.
- When volcanic rocks are weathered they produce fertile soils that are good for crop production.
- Some volcanic rocks contain precious minerals, which can be exploited and benefit countries economically.
- Volcanic physical appearing may be tourist attractions which bring in a lot of foreign currency e.g mount Tenga, and hot springs found in the Zambezi valley.
- Areas of active vulcanicity can be used to generate geo-trend energy as is done in NewZealand.

Measures to minimize the impact of earthquakes and volcanos

Despite their destructive nature, man in his interaction with the environment is continuously seeking ways to reduce the negative impact of hazards caused by tectonic activities. These measures have saved a lot of life and expenditure. However, tectonic disasters cannot be totally eradicated. Some of the measures to reduce impact of earthquake and volcanic eruptions are discussed below.

- Introduction of early warning systems e.g electronic soners and seismographs that predict when and where earthquakes will strike.
- Early Evacuation of affected communities before disaster strikes
- Permanent relocation of communities from disaster prone areas.
- Use of new technology in construction of buildings e.g use of bamboo in Korea and buildings that move when the earth shakes.
- Establishment of international rescue agencies that assist affected committing with food and medical supplies.
- Introduction of wireless communication that can be used even during periods of disaster as compared to fixed communication networks e.g cell phones and the G.P.R.S.

Examination type questions

Multiple Choice

1. The Inner Core of the earth is made up of:
a) Liquid materials high in radioactive matter.
b) Solid materials high in radioactive materials.
c) Very hot volcanic dust.
d) Viscous is low in radioactive materials.

2) **A deep sea trench is formed when**
a) 2 plates of different characteristics collide.
b) 2 plates of similar characteristics diverge.
c) 2 plates of similar characteristics slide past one another.
d) Volcanoes erupt.

3) The following features are found at a destructive plate margin except
a) Fold mountains.
b) Deep sea trench.
c) Ocean ridge.
d) Volcanic arc

4) The mid Atlantic ridge was formed as a result of:
a) Convective currents.
b) Plates moving away from each other.
c) Plates moving towards each other.
d) The power of God.

5) A transform fault is formed when:
a) The earth crust breaks into two.
b) 2 plates collide .
c) 2 plates slide past each other.
d) 2 plates move from each other.

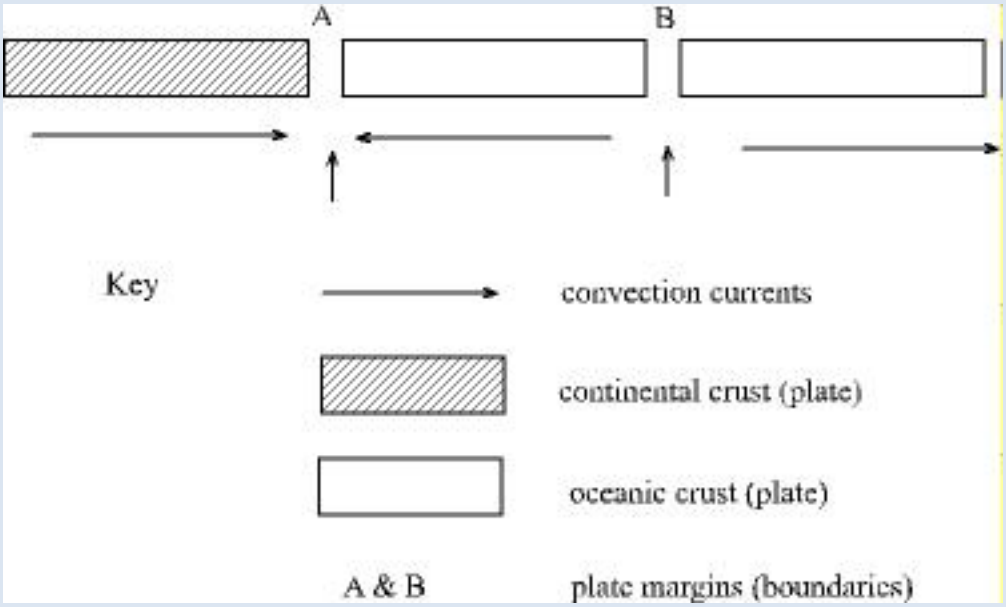
6) A Zone of subduction is most likely to be associated with:
a) Volcanic activity.
b) Earthquakes.
c) Fold mountains
d) All of the above..

7) Earthquake waves can be detected through the use of a
a) Earthquake meter.
b) Scientist.
c) Seismograph.
d) Seismometer.

8) **One way to prevent loss of life in earthquake prone areas is to:**
a) Evacuate people quickly.
b) Build a lot of hospitals.
c) Provide people with first aid tests.
d) Employ a lot of life savers.

Essay Question

1) Study the diagram below carefully



a) Briefly explain the theory of plate tectonics with reference to the diagram [5]
b) Describe and explain the processes operating at point A and B. [7]
c) Draw a diagram to illustrate the appearance of area A and B after a long period of time.[3]

2a) Describe the development of continents as stated by the continental drift theory.[4]

b) What evidence is there to support the theory of continental drift? [7]

3. Describe the Landforms that are likely to be found at a point where the continental crust meets the oceanic crust. [4]

4 Imagine you are a health officer living in areas located close to destructive plate margins: write a report explaining the dangers of living in such an area and what can be done to reduce the effects. [4]

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CHAPTER 2

Rocks, Weathering and landform development

Chapter objectives

By the end of this chapter, one should be able to:

a) Classify rocks according to formation.
b) Outline the main types and processes of weathering.
c) Describe the main factors influencing rate and type of weathering.
d) Outline the main landforms formed by both physical and chemical weathering.
e) Evaluate how weathering influences human activities.

Rocks

Rocks are generally classified into three different types according to how they are formed. These are igneous, sedimentary and metamorphic rocks.

Igneous rocks (Origins and Types)

There are three types of igneous rocks:

i) Volcanic igneous rock – resulted from volcanic eruptions. Resulting in solidification of lava into small crystals on the surface e.g. basalt.
ii) Hyper basalt igneous rock – small crystals on the surface e.g. Andesiter, resulted in the up - swelling of magma towards the surface and solidified.
iii) Plutonic and extrusive igneous rocks – deep seated mass of magma resulting in large crystals e.g. granite.

Intrusive Igneous rock

Intrusive rocks are rocks that appear to have crystallized from magma below the earth's crust surrounded by pre-existing rock. Bodies of intrusive rocks are exposed to the surface after erosion and usual uplift.

Classification chart for the most common Igneous rocks

Identification of Igneous Rock

Course Grained	**Granite**	**Dib rite**	**Gabbro**	**These are Intrusive**
Fine – grained	Rhyolite	Andesite	Basalt	These are extrusive
Mineral composition	Quartz, Mica, Feldspars	Feldspars, Mica	Mica, Feldspar	

Colour of rock	Light coloured	Medium grey or green	Dark grey to black	

Identification of extrusive rocks (igneous)
NB: Igneous rocks are named and identified on the basis of their composition and texture.

Composition
The amount of Silica in a larva strongly determines, not only the viscosity of lava and the violence of eruptions, but also which particular rock is formed. Approximate chemical composition of most igneous rocks can be determined indirectly by identifying the minerals present and the relative abundance of each mineral in the rock.

Extrusive igneous rocks are generally fine grained, so a microscope is usually needed for precise identification of the component minerals.

NB: We can guess the probable mineral content by noting how dark or light in colour the extrusive rock is.

Examples:
Rhyolite: Is usually cream – coloured, tan or pink. It is made up mostly of feldspar but always include some quartz.

Basalt: has a relatively low amount (about 50% by weight) of silica. Much of that silica is bonded to iron and magnesium to form ferromagnesium minerals such as olivine which is dark green or black. The remaining silica plus aluminium is bonded predominantly with calcium to form calcium-high feldspar (usually dark grey). Basalt does not contain quartz because no silica is left after the other minerals have formed. Basalt is dark grey to black because of the predominance of dark minerals.

Andesite: It crystallizes from an intermediate lava and can be recognized by its moderately grey to green colour. It is this colour because a little over half the rock is composed of light to medium – grey feldspar while the rest of components are ferromagnesium minerals. Silica is rarely sufficient in the lava for quartz to form in an andesite.

The rock cycle
This is a theoretical model of the constant recycling of rocks. As they form, they are destroyed and then reformed. We have looked at the primary rocks- igneous and now turn to sedimentary rocks.

NB: The earth changes because of its internal and external heat engines. If the earth's internal engine had died (and tectonic forces had therefore stopped operating) the external engine, plus gravity, would long, ago have leveled the continents and the resulting sediments would have been deposited on the sea floor. Everything would be at rest. Nothing would be changing-for there would be in balance and studies in rocks (geology) would be boring. But this is not the case. The internal and external forces continue to interact, forcing substances out of balance.

Thus, the earth has highly varied and ever changing surface. Minerals and rocks are changing as well. The rock cycle is a useful aid in examining these relationships.

Each rock type may form at the expense of another if it is forced out of balance with its physical or climatic environment by either internal of surface factors.

1. Magma is molten rock. Igneous rocks form when magma solidifies. If the magma is brought to the surface by a volcanic eruption, it may solidify into an extrusive igneous rock. Magma may solidify very slowly beneath the surface. The resulting intrusive igneous rock may be exposed later after uplift and erosion remove the overlying rock.

2. The igneous rock, being out of balance may then undergo weathering and the debris produced is transported and later deposited (e.g on sea floor) as sediments.

3. As the rock is buried by additional layers of sediments and sedimentary rock, heat and pressure increase. Tectonic forces may also increase the temperature and pressure.

4. If the temperature and pressure become high enough, usually at depth greater than several kilometers below the surface, the original sedimentary rock is no longer in equilibrium and recrystalizes.

5. The new rock that forms is called a metamorphic rock. If the temperature gets very high, the rock melts and becomes magma again completing the cycle.

NB: the cycle can be repeated, however, there is no reason to expect all rocks to go through each step in the cycle. For instance, sedimentary rocks might be uplifted and exposed to weathering creating new sediments.

The rock cycle can be used to understand the following aspects:

Sedimentary rocks

Sedimentary rocks contain numerous ties to their origin and environmental conditions that prevailed at the time of sediment deposition. Geologists find out this information from the size and shape of rock unite and from the sediment grains and sedimentary structures such as fossils, cross-beds, etc.

Sediment

Most sedimentary rocks form from loose grains of sediment. Sediment includes such particles as sand e.g a river sorts its sediment separating sand from gravel and silt and clay from sand. Sorting takes place because of greater weight of larger particles. Boulders weight more than pebbles and are more difficult to transport by the river. Similarly, it takes more of the river's energy to transport pebbles than sand and more for sand than for silt or clay.

Deposition

When transported material settles or comes to rest, deposition occurs. Sediment is deposited when running water, glacial ice, waves or wind lose energy and can no longer transport its load. Deposition also refers to the accumulation of chemical organic sediments, such as shells on the sea floor or plant material on the floor of the swamp, etc.

Lithification

It is the general term for a group of processes that convert loose sediments into sedimentary rock. Most sedimentary rocks are lithified by a combination compaction, which packs loose sediment grains tightly together and cementation in which the precipitation of cement around sediment grains binds them into a firm coherent rock. Crystallization of minerals from solution without passing through loose sediment stage is another way that rocks may be lithified.

Types of sedimentary rocks

Mechanically formed sedimentary rocks are formed from cemented sediment grains that are fragments of pre-existing rocks. The rock fragments can be either identifiable pieces of rock, such as pebbles of granite of shale or individual mineral grains, such as sand-sized quarts and feldspar loosened from rocks by weathering and erosion. Clay minerals formed by chemical weathering are also considered fragments of pre-existing rocks. In most cases the sediment has been eroded and transported before being deposited.

Sediment particles and sedimentary rocks.

Diameter (mm)	**Sediment**		**Sedimentary Rock**
256	Boulder		Conglomerate (round particles) or Breccia (angular particles)
64	Cobble	Gravel	
2	Pebble		
$^1/_6$	Sand		Sandstone

Examination type questions

Multiple choice

1) Mechanical weathering is concerned with

a) Breakdown of rock sites.
b) Breakdown of rocks with no chemical change.
c) Breakdown of rocks with chemical change.
d) Breakdown of rocks in limestone regions.

2) Exfoliation domes are common in deserts because:

a) Of high temperature variations.
b) There are a lot of rocks.
c) They develop in deserts.
d) All of the above.

3) Biological weathering is mainly concerned with:
a) Impact on plant growth and breakdown of rocks.
b) Weathering of rocks on formation of new soil.
c) Impact of climate on plant growth.
d) All of the above.

4) Metamorphosis is associated with:
a) Igneous rocks.
b) Metamorphic rocks.
c) Sedimentary rocks.
d) All rocks.

5) The following are characteristic features of limestone regions except:
a) Stalactite.
b) Cernoens.
c) Stalagmite.
d) Rock pavement.

6) Deep weathering is mainly associated with:
a) Chemical weathering.
b) Free thaw action.
c) Human interference.
d) Biological weathering.

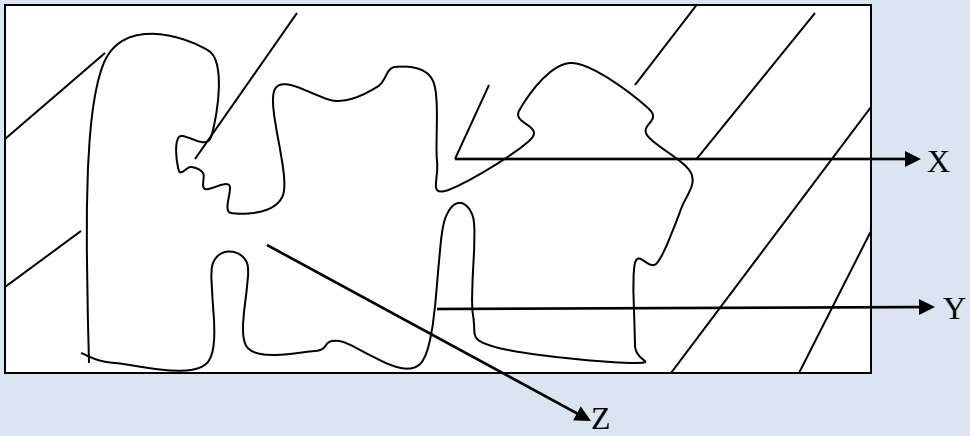
7) Humic acids are important in chemical weathering because:
a) They react with rocks buried underground.
b) They re-act with rocks on the surface.
c) They encourage chemical weathering.
d) They lead to the development of castle kopjes.

8) **Weathering is a very important process because:**
a) It leads to soil formation.
b) It breaks down rocks.
c) Leads to formation of tourism attractions.
d) It is a wonderful process.

Essay questions
1. Study the diagram and answer questions that follow:

a) Name the feature sown in the diagram?[1]
b) With the aid of diagrams, describe and explain how such a feature could have been formed? [7]
c) How can communities use such features for their benefit? [4]

2. Study the diagram and answer questions that follow:



a) Label features marked X, Y and Z.[3]
b) Outline how such a feature could have been formed. [7]
c) A feature similar to the one shown above exists in your area. Write a letter to your local member of parliament explaining how such a feature can be used to benefit locals.[4]

3) Outline the main characteristics of igneous and sedimentary rocks.[6]
b) Describe the main factors affecting the weathering of granite rocks. [5]

4) What are the main differences between physical and chemical weathering?[4]
b) How can both physical and chemical weathering processes influence the formation of the feature outlined below on fig 9? [6]

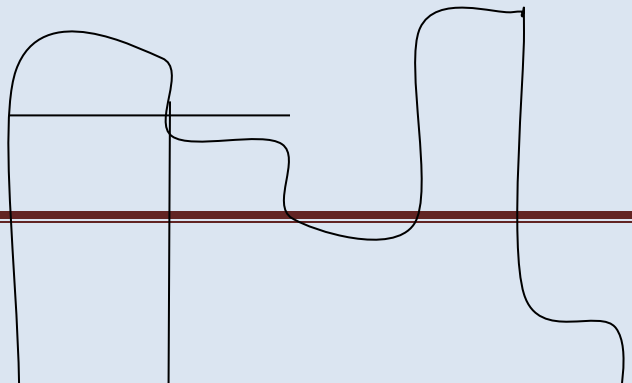


Fig 9.

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CHAPTER 3

Manufacturing industry

Chapter objectives

By the end of the chapter one should be able to:

a) Discuss factors influencing location of industry.
b) Assess nature of industrial production in developed and developing countries.
c) Account for the location of iron and steel industry in given region.
d) Discuss reasons for slow industrial growth in the developing countries.
e) Assess the role of small to medium enterprises in promoting industrial growth.

Industry

An industry is an activity that is carried out by human beings
ings in order to support their lives e.g. farming, manufacturing, fishing, and mining.

Industries can be divided into:

1. Primary: Extractive industries also known as first order industry.
2. Secondary Industry: Manufacturing or second order industries e.g. car assembly, cloth manufacturing, shoe manufacturing.
3. Tertiary industry: Service Industry or third order industries

1. **Primary industries**
   Mining, fishing, forestry agriculture; these are industries which are concerned with extraction of raw materials from the earth's surface or its interior.

2. **Secondary industries**
   These are industries involved in the changing of raw materials into completely new products. Manufacturing industries get their raw materials from the primary industry higher technology to change them into finished products e.g. iron and steel from Zisco Steel is processed by Willow Vale Car Assembly into a car.

3. **Tertiary industries**
   They provide services to both the primary and secondary industries e.g. banking, nursing, teaching, insurance, soliciting (legal practitioners).

Factors affecting industrial location

The location of an individual factory or industrial complex is the result of a set of decisions based on rational assumptions and information.

These factors affecting the location of a given industry are:-

i) Availability of raw materials
ii) Availability of markets
iii) Availability of labour
iv) Availability of transport
v) Availability of energy
vi) Government policy.

i) **Raw materials and energy**

As industry is concerned mainly with the processing of raw materials, its location will be governed by their location and costs of obtaining them e.g. Zisco Steel Zimbabwe.

- The degree of attraction exercised by these raw materials depends on their nature.
- If raw materials are perishable, then the industry will locate as near to them as possible e.g. Dairy Zimbabwe.
- If we look at the fruit and vegetable canning, preserving and freezing industries, they are found near the source of raw material.
- Close location avoids payments of transport costs on waste materials.
- Such location is vital for the iron and steel industry (Zisco) the manufacturing of sugar cane (Chiredzi, Triangle, Natal) the pulp and paper industry, the making of butter, cheese all of which lose large amount of weight during processing.
- Raw materials of high value can bear the cost of transport than raw materials of low value per unit weight – so such industries are located close to their raw materials to keep down transport costs. Such industries are said to be transport oriented.
- When more than one raw material is needed, a location which minimizes transport costs on all materials such as a port or another break-of-bulk point is usually a solution.

ii) **Markets**

- A market is important for industries producing goods which have high transport costs on distribution.
- If it costs more to move the product to the consumer than to move the materials to the factory, then it is better to locate as near to the consumer as possible e.g. furniture in many parts of Africa/or world.
- If the product increases in weight, bulk or fragility during processing, then the producer will locate near his market – examples include those industries which add water to their products such as breweries and soft drinks manufacturers; or those whose products increase in weight and perishability.
- If the finished product is more perishable, then a market – location is attractive e.g. industries producing ice-cream, bread, cakes etc.

- In some cases, specialized industries are associated with a particular type of market. For example firms producing textile machinery will usually be found close to important personal contact between producers and consumers. In this case a market-location is essential. An ideal example is the clothing industry.
- Today, a market-location is thought to be more advantageous to a major site of industries.
- The importance of a market-location is perhaps due to the general practice of charging higher transport costs on finished goods than raw materials.

iii) **Labour**

- The importance of labour on location varies from industry to industry. In some industries, labour scores high total costs, for example, in textiles, the clothing industry in Kadoma, the shoe industry in Gweru (Bata) and Bulawayo (G & D Shoes), some branches of engineering and in manufacturing of luxury goods such as jewellery.
- These are all industries which cannot be subjected to mass production techniques- hence are labour intensive.
- Industries which require only small labour supplies include the motor vehicle industry (car assembly in Mutare, Harare, and Johannesburg etc), in the meat packaging and flour milling and the oil refinery industries, thus we see that industries requiring high labour supplies will probably locate near their market where there is ready supply of labour.
- This, however is not always the case. Some industries can be grouped together as labour oriented industries.

iv) **Transport cost**

When moving either raw materials or finished goods there are costs involved; these freight costs which include costs of insurance on goods moved plus transfer costs, interest charges on their capital costs, loses due to deterioration and damage in transit and electrical costs.

- The type of transport determines the cost.
- Bulky and low value commodities can be moved most cheaply by water.
- Highly perishable goods must be moved quickly by road, rail or air transport which proves expensive.
- In terms of industrial location, the best location is one which minimizes the costs of both procurement and distribution.
- Thus we arrive at three situations:

a) If the product is more expensive to transport than the raw material production is most likely to be near the market e.g. cement manufacturing in Zimbabwe.
b) If the product is much lighter or less bulky than the material used, the industry will usually be attracted to the material source e.g. copper smelting in Zambia.
c) If an industry uses several raw materials and serves a wide range of markets, transport costs will not control location directly. The best example of such an industry is South Africa's Car Assembly which is located in Johannesburg and Cape Town (Port Elizabeth). Important parts e.g. engines, shafts, chassis, car

bodies, electrical equipment, wheels, tyres, tubes, doors, handles, etc, can easily reach Port Elizabeth which is on the coast.

- The other car assembly centres on the coasts are Toma (Ghana), Cotonou (Benin), Abijan (Cote d' lvoire), Mombasa (Kenya).
- Others such as Mutare and Harare in Zimbabwe are found inland. This is because Zimbabwe is a landlocked country.
- Others such as Thika and Nairobi, Johannesburg in South Africa and Harare in Zimbabwe are situated in big centres or densely populated areas where there is a ready market for motor vehicles.
- Despite high transport costs the availability of a ready market made the location of these industries very possible. All such centres are linked by efficient railway transport.

v) **Energy source**

The main energy sources we will be dealing with are coal, petroleum and finally hydroelectric power. The type of energy required by industry depends on the requirements of the processing involved.

- Some industries rely totally on energy form. For example there is no substitute for coking coal in the blast furnaces.
- Thus the location of the blast furnaces as Zisco Steel is strongly linked with the source of coking coal.
- Like-wise electricity is an economic solution of heating in the electrometallurgical and electro-chemical processes which require enormous amounts of energy. The best locations for such industries are hydro-electric generating station where energy is relatively cheap in large amounts.

vi) **Government activities/political influence**

Industrial location is affected by both direct and indirect government intervention for the following reasons:-

a) To assist national industries against foreign competition (e.g. the Growth Points in Zimbabwe). These are a way of encouraging local businessmen to establish industries in the communal areas e.g. Gokwe, Murambinda, Chivi, Maphisa, Mataga, Mupandawana etc.
b) To develop strategically important industries.
c) To avoid excessive and continuous unemployment.
d) To diversify the industrial structure of regional overdependence on a limited range of industries.

Characteristics of raw materials

a) Some raw materials are perishables e.g. vegetables, fruits, milk etc.
b) Some raw materials are bulky e.g. cotton, minerals.
c) Some raw materials contain a lot of waste material e.g. sugarcane and minerals.

- The nature of raw materials will determine the location of certain industries.
- Raw materials which are bulky e.g. cotton, tea, tobacco easily fill large spaces and therefore are expensive to transport over long distances

resulting in high transport costs.

- Some raw materials easily loose value if transported over long distances. This will reduce the quality of the raw material and reduce the profit margin e.g. sugarcane, tea and tobacco.
- Some raw materials contain a lot of waste materials which is not needed e.g. minerals contain a lot of sand and sugar cane contains a lot of unwanted roughage.
- Those industries which are located where raw materials are found are called raw material- oriented industries e.g. sugarcane production in Chiredzi, tea processing in Kwekwe, fruit canning in Mutare, fish processing in Kariba.
- The growing of a raw material like sugarcane, tea, tobacco and processing of that raw material at the same site in order to reduce transport costs and maintain the quality of the raw material is called beneficiation.

Markets

Any industrial activity needs consumers. Some finished products need ready markets or a large size of population which can use (consume) the finished product.

Characteristics of finished products

i) Some finished products are perishable i.e. they easily turn bad e.g. vegetables, fruits, opaque beer. Therefore such products need immediate consumption and a large market.

ii) Some finished products like beer gain weight during manufacturing because there is addition of water. Therefore the finished products become bulk and expensive to transport over long distances. This is the reason why breweries are located near large markets.

iii) Some finished products are packed in containers that are fragile (easily break), e.g. soft drinks, clear beer. This is why soft drinks manufacturers e.g. Coca Cola are located where there are a lot of people because if they transport over long distances this can result in breakages.

iv) Therefore most industries that are located near markets are called market base e.g. Dairiboard Zimbabwe Ltd, Delta Beverages (National Breweries), textile companies etc.

Labour

A lot of industries need a lot of labour and will locate where there is a large pool of labour e.g. Anglo - American processing industries like WillowVale in Harare.

- In German, a car assembly was located at the Frankfurt Mainz Con – bastion because there is a large labour force.
- Such industries that are located where there is a large labour force are called labour oriented.

Water

Water is a very important raw material in industrial activities.

- It is used for cooling machines and creating these machines.
- It is also a universal solvent, that is, many minerals dissolve in water.

- It is also important for domestic purposes.
- Therefore most industries will need to be located near water sources e.g. Zisco Steel is located near Kwekwe.

Transport costs

An industry should be located where transport costs are very minimal (least cost location).

- There should be low transport costs for transporting raw materials for processing and finished products to the market.

Power

Industries should be near sources of energy and communication such as electricity, roads and railway lines. Industries which need lots of power e.g. Bauxite smelting to aluminium should be located near power sources e.g. Bauxite smelting in Ghana near H.E.P plant.

Government policies

The government can influence the location of industries in a number of ways:-

i) Heavy industries such as Willow Vale Car Assembly should not be located near residential areas, because the noise that they make cause earth tremors (shaking of the earth) which can result in houses developing cracks.
Government can influence location of industries through the process of decentralization.

Decentralization is the development of industries in rural areas or remote areas in order to reduce rural to urban migration.

- Its main purpose is to develop industries in rural areas in order to create employment for rural people. This is why after independence the government of Zimbabwe created the growth points e.g. Mupandawana, Nkayi, Gokwe, Lupane etc.
- Government can provide incentives for industrialists to operate in rural areas e.g. free buildings, reduced tax, and infrastructure such as tarred roads and banks.

Problems of decentralization

- Poor infrastructure e.g. roads.
- Poor markets.
- Shortage of raw materials.
- Shortage of skilled labour.

Processing and manufacturing industries

- a processing industry is an industry which is involved in changing of raw materials into semi-finished products,
- In this case the raw material still maintains its original characteristics.
- Processing industries deal with raw materials that are bulky/heavy and which can easily loose value.
- These include raw materials such as cotton, minerals like iron, coal, and raw materials like sugar cane easily loose value.

- Industries which are involved in processing of agricultural commodities such as tea, tobacco, sugarcane, cotton are called Agro-processing industries e.g. sugarcane processing in Chiredzi, tea processing in Chipinge, tobacco processing in Marondera.
- Processing industries are usually located near raw material sources in order to Reduce the lose of weight of the raw material e.g. mining processing like coal processing in Hwange, Iron ore processing at Zim Steel (formerly Zisco Steel), asbestos processing in Zvishavane.

Therefore most processing industries are raw material based industries.

A manufacturing industry is an industry which involves the changing of semi-finished products from processing industries into a completely new and usable product e.g. processed cotton is changed into clothes by textile industries, processed tobacco is changed into cigarettes by tobacco manufacturing companies. Timber, which is processed, is changed into furniture by manufacturing companies.

Therefore in manufacturing, the raw material is changed into a completely new product with totally different characteristics.

Summary points

PROCESSING INDUSTRIES	MANUFACTURING INDUSTRIES
- Change raw materials into semi-finished products e.g. iron ore processing. - Usually they are raw material oriented because processing involves removal of unwanted material. - They are usually located in remote areas because that is where raw materials are found.	- They change semi-finished products into completely new and usable products. - Usually there are markets oriented because most of the products gain weight during manufacturing. - Usually they are located in urban areas because they need large markets.

NB: a least cost location is a location which minimizes transport costs and losses, but maximizes profit.

Light and heavy industries

1) A Light Industry - Is an industry which uses light raw materials and does not produce much noise and air pollution.

   These are industries which can be located even near residential areas e.g. bakeries, stationery manufacturing etc.

2) Heavy Industries – Are industries which use heavy raw materials and produce a lot of noise and air pollution.

- They can cause earth tremors.
- Therefore such industries should be located away from residential areas e.g. Willow Vale Heavy Industrial site in Harare.
- Other examples are mining and engineering companies.

Iron and steel processing at Zim Steel

Factors Affecting The Location Of Zim Steel

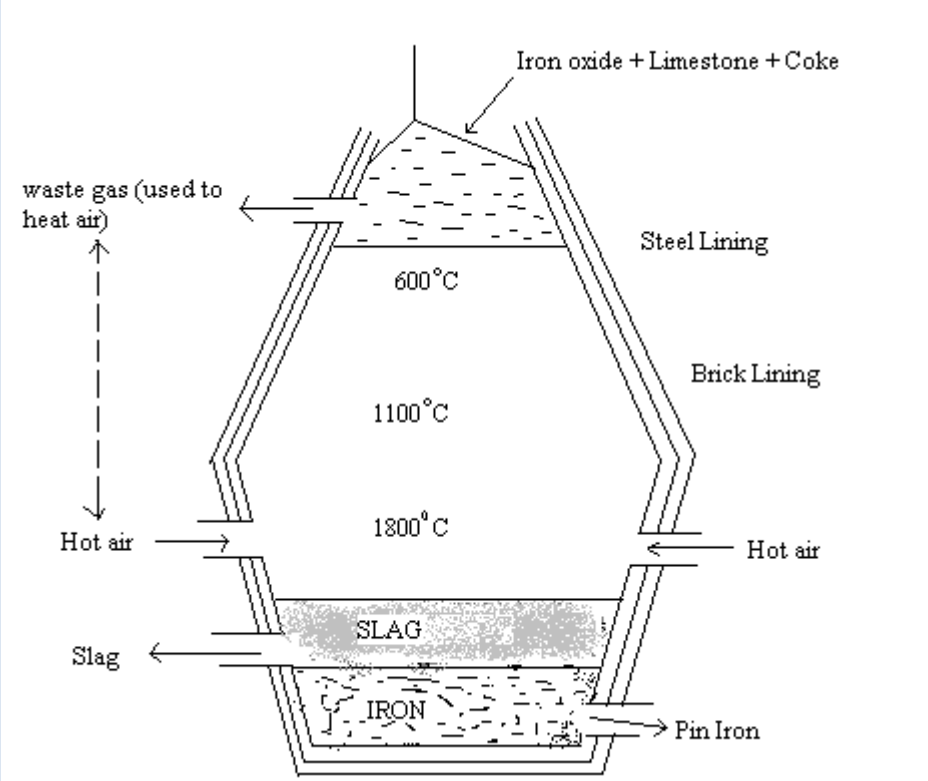
a) Availability of raw materials – Zim Steel is a raw material based industry. This is because most of the raw materials needed in the processing of iron ore to iron and then to steel, are found near Redcliff e.g. iron ore from Ripple Creek near Zisco, Limestone from Dan Mine and Manganese.
   However one raw material not found at Zisco is coal, but is less expensive to transport it from Hwange by rail compared to iron ore, limestone and manganese.

b) Availability of markets; Zim Steel is found in the Midlands province of Zimbabwe and therefore its centrally located. Therefore it is easy to transport finished, products to various parts of the country. For example Zimbabwe Alloys in Gweru, Nando's Enterprises in Chitungwiza.
c) Again the centrality of Zim Steel makes it possible to get a large pool of labour from the surrounding towns like Kadoma, Gweru and Zvishavane.
d) Good transport communication – Zim Steel is located along the main road and rail from Bulawayo to Harare.

   It is also linked to Buchwa by road and rail (Rutenga-Dabuka railway line). Therefore coking coal from Hwange is brought to Zim Steel by rail and supplementary (additional) iron ore used to come from Buchwa before the mine was closed..
e) Water supply - Zim Steel is located near Kwekwe river and there is Cactuspoort dam which supplies Zim Steel with water for cooling blast furnaces and other industrial processes.
f) Power - Zim Steel gets its power from Kariba through electricity cables, and also from Hwange Thermal Power Station.

Processing of iron ore at Zisco

The blast furnace



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During the processing of iron ore to iron, certain raw materials are needed which are;

i) Coking coal
ii) Iron ore
iii) Limestone

- Limestone and coking coal are used as reducing agents. This means that in the presence of heat inside the blast furnace iron ore is changed to iron.
- The impurities of iron ore combine with limestone and coking coal from slag which floats above the dense pig iron.
- The pig iron which is in a molten state is taken to the steel manufacturing plant where it is mixed with manganese to form steel.
- From the above, it can be noted that the processing of iron and the manufacturing of steel from pig iron is done at the same site. Therefore an iron and steel company where the processing of iron ore to iron and the manufacturing of steel is done at the same site is called an integrated iron and steel company. This results in beneficiation.

Advantages of integrated steel plants

a) Transport costs are kept at a minimum since most of raw materials for processing of iron and manufacturing of steel are found in the same proximity/near to each other.
b) Labour costs are reduced since labour can be shared between the processing plant and the manufacturing steel.
c) The high cost of re-melting of pig iron are reduced since iron can still be manufactured.

d) Water pipes and electricity cables cover a short distance between the processing plant and the manufacturing plant. Therefore the cost of constructing electricity cables and water pipes are reduced.

Problems faced by Zim Steel

i) Shortage of skilled labour: - Zim Steel has a shortage of skilled manpower.
ii) Shortage of foreign currency:- this is seriously needed in order to buy parts/components from other countries to maintain blast furnaces e.g. Zisco blast Furnace number 4 has not been working for a long time because of shortage of parts to maintain it.
iii) World prices of iron and steel are never constant. They are always fluctuating. Therefore when the world market is flooded with iron and steel, it means the price of iron and steel goes down resulting in lower profit margins.
iv) Problems of corruption, mismanagement and nepotism can also affect the industry.

Solution to problems at Zim steel

- The government can help Zim Steel through subsidizing e.g. reducing taxes for Zim Steel and even reducing import duties for Zim Steel when importing parts from other countries.
- Employ expatriate personnel/workers.
- The government must increase foreign currency allocation to Zim Steel.

Iron and steel production in South Africa

- Like Zisco, Iscor is a raw material based or oriented industry. This means that Iscor is located where raw materials are found, raw materials including limestone which is found at Thabazimbi and Marble Hill.
- There is also iron ore from Witbank. Dolo mine is found near Iscor, Dolomite is used as a reducing agent during the processing of iron or to iron. Iscor has a good transport network in the form of railway lines. These are used for transport iron ore and coking coal to the processing plant. Water is also available from the Vaal River Dam.

Car assembly industries

A car assembly industry is a heavy industry. This means that it is an industry which uses heavy raw materials in order to produce a car in Zimbabwe, we get our parts from countries like German and Japan. The major car assembly in Zimbabwe are Willowvale motor industry in Harare and the car assembly in Mutare.

Location of a car assembly

a) A car assembly is a labour intensive industry. This means that a lot of labour is needed. Skilled labour such as Auto-Electricians, mechanics and engineers are needed.

-Unskilled labour is also needed for the cleaning of cars.
-Therefore most car assemblies are located in large towns simply because the population is also large. This is the reason why Willowvale is found in Harare which is the capital city of Zimbabwe.

-The main car assembly in Germany was located at the Frankfurt-Mainz Conurbation because it is where two cities merge. The population is also large; therefore there is a lot of labour.

a) A car assembly is a market based heavy industry. This means that it is an industry which should be located where there is a large demand for cars e.g. Harare.

Transnational Companies (TNCs) or Multi-National Companies (MNCs)
These are very large companies which have operations in more than one country.

Characteristics

i) Usually foreign owned, for example, Coca-Cola.
ii) Have branches in more than one country e.g. Shoprite is in Zimbabwe, Botswana, South Africa, Swaziland etc.
iii) Their main objective is to realize profit.
iv) They may move out of any country anytime if the circumstances are not favourable to their operations.

Advantages of TNC's
They create employment for local people, for example, Shoprite in Bulawayo has employed many local people.
-Bring investment into countries where they are located in.
-May lead to an inflow of technical skills to the country where they are located.
-May bring into the country new and various products.

Disadvantages
Since they can move out of a country as and when they feel, it's not favourable as, this may in turn lead to short-term benefits of employment creation.
-Profits usually go to the mother country and not where they operate.
-They may out compete local industries to their closure or collapse.
-Sometimes they may exploit the workers by paying low salaries when they make very high profits.
-They may be involved in the politics of the country in which they operate.

Service industries
These are industries which provide a service such as banking, teaching and, information technology.

Information Technology
Information technology industries are involved in assembling computers, electronic gadgets as well as all telecommunication equipment. Information technology industries are growing at a faster rate particularly at the present time, both in developed and developing countries because of the fast changing technology demands as well as the fast changing tastes of people. For instance a computer is a necessary gadget just like a cell phone is these days.

Advantages of informative technology industries

- Communication is fast and efficient over longer distances, for example, the e-mail system.
- Storage and processing of information is fast, for example information about the operation of an industry and its expenditure. Its payroll can all be stored in a computer and easily retrieved as and when wanted.
- Has reduced manual labour.
- It is more efficient than people in whatever task.

Disadvantages

- Fast changing technology may soon render the technology obsolete.
- Information may be lost to information technology fraudsters and this may put industrial production secrets in danger.
- It is expensive, and as such, not accessible to everyone at least at the present time.
- Illiterate people may face problems in handling equipment.
- It will result in unemployment, for example, a task which could be done by one thousand people in the past can be done by one computer operated by one person.

Relocation of industry in The United Kingdom

- Although industries requiring high labour supplies will probably locate near their market where there is a ready supply of labour, this however does not always follow the same pattern as in Britain today, the old established industrial sites are declining in importance.
- They are now characterized by high unemployment rates.
- The new industrial sites were of little interest to the manufacturers until government policies made them additionally attractive.
- It can be seen that labour availability on its own is not a powerful influence. Again the type of labour requirement sometimes limits how an industry fist developed.
- Examples in Britain include the Sheffield Cutlery Industry, the Birmingham and the High Class Furniture and ladies tailoring traders in London. All these are labour oriented industries.
- In the labour oriented industries there is a modern trend to increase mechanization and reduce their dependence on labour. Thus we see that in modern times labour considerations are decreasing as a major factor in location decisions for many industries.
- Of great importance now are government policies which attract industry to areas where there is pre-existing labour force and high unemployment.
- The westward movement of population in UK resulted in the increase of Midwest market for inland steel, for making commodities like agricultural automobile.
- Other manufacturing industries arose in the region around Detroit and Chicago.
- This is part of relocation of manufacturing industries.
- The steel corporation decided that a new plant was necessary.
- Engineers are sought by actual calculation, to the spot where raw materials could be most economically be laid down and supplied in form of finished goods for the market.

- The final choice of engineers was from an inhabited area of sand dunes and swampy areas that had shortly before, been used as a desert setting for motion pictures.
- The corporation invested $50 000 000 in the building of a new city of Garg in Indiana.
- The wisdom was demonstrated by the growth of Gary population to 16000 in 1910 and 100 000 by 1930.
- The advantage and therefore the reason for relocating of the industry is its location in the midst of a tremendous steel market.
- The next thing, the accessibility to raw materials such as coal, iron and limestone.

Iron ore

- It is chiefly shipped by lake steamers from around the western end of Lake Superior.

Coal: (a raw material and fuel)

- It is easily brought by rail and water routes from the coal fields of Pennsylvania and West Virginia.

Limestone

Coming from 300 miles away at the northern end of Michigan Peninsula, it is brought to Gary by boat as cheaply as it could be sent 30 miles by rail.

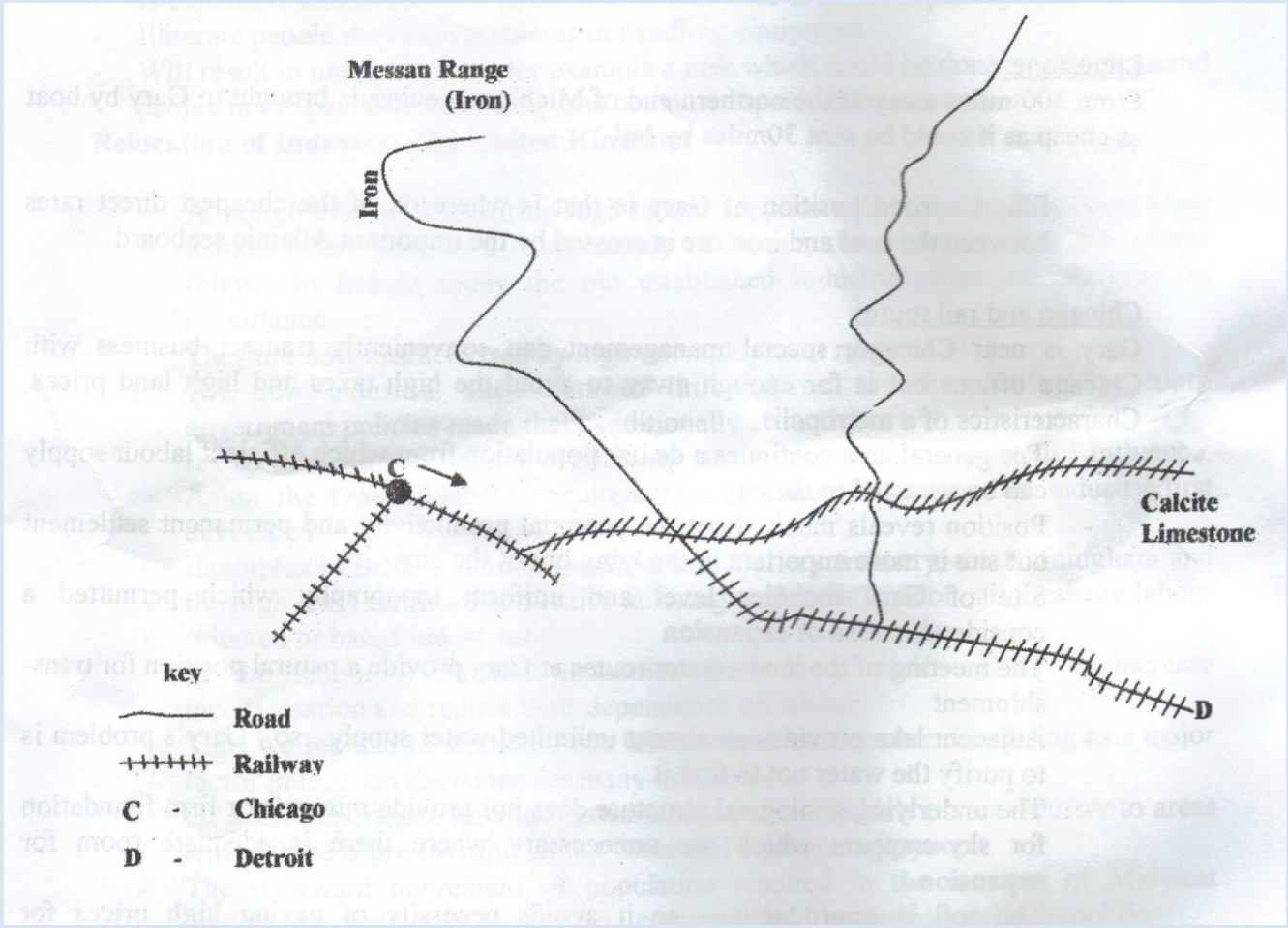
Illinos is on the road position of Gary that is where one of the cheapest direct routes between the coal and iron ore is crossed by the important Atlantic seaboard.

Chicago and rail routes

- Garry is near Chicago. Special management can conveniently transact business with Chicago offices but is far enough away to avoid the high taxes.
  - The general area continues to use the local population from which efficient labour supply can be attracted to the city.
  - The position reveals much about the potential productivity and permanent settlement but site is more important in the laying out of the city.
  - Site of Gary includes level and uniform topography which permitted a considerable area of expansion.
  - The meeting of the land and water routes at Gary, provide a natural position for trans-shipment.
  - The adjacent lake provides an almost unlimited water supply, so, Gary's problem is to purify water, not to find it.
  - The underlying geological structure does not provide minerals or a firm foundation for sky-crappers, which are necessary where there is inadequate room for expansion.
  - The soil is unproductive, so it avoids necessity of paying high prices for agricultural land.
  - The climate is stimulating due to the moderating influence of the lake.
  - It is not subject to such climate extremes as in more inland points.

Non – Geographical factors

- Taxes were lower and industrial laws stringent in Indiana than in adjacent Illinois
- Other industries failed to utilize the area because it required millions of dollars to build a new city on an underdeveloped site, but the steel corporation was rich enough to utilize the area.
- Capital was abundant.



Reasons for change of industrial location

In the 20th Century many of the traditional ore-fields had become exhausted and remote ore fields had to be mined to supply ore. The cost of transportation, especially of bulky ore and finished steel, became a vital consideration. A coastal location i.e. long sea-coast, rivers and lakes, is an advantage and many of the newest iron and steel mills were relocated to the cost e.g. in USA, Cleveland, Detroit and Chicago were located on the shows of the St Lawrence great Lakes.

Political and strategic reasons

Some governments prefer a dispersed pattern of location for their major industries.

- In Russia, in order to avoid over concentration of industries in Moscow and the Black Sea shore land and to develop the interior of Siberia, iron and steel works were set up in Urals using ores of Suerdlovsks and Magnitogorsk. Coal is brought 2250km from the Kuzbas coalfields in central Siberia. In return ore is transported to Kuzbas for the manufacturer of steel.

Examination types questions

Multiple choice

1) Processing industry is mainly concerned with

a) Extraction of raw materials.
b) Processing of raw materials.
c) Manufacturing of raw materials.
d) None of the above.

2) **Which group of activities is made up of tertiary industries only?**

a) Banking, research, farming.
b) Transport, food processing, marketing.
c) Marketing, transport, insurance.
d) Tourism, fishing, banking.

3) In developed countries, the iron and steel industries have relocated to coastal areas because:

a) Iron ore is mostly imported.
b) Coal is too bulky to transport.
c) Scrap metal is obtained in coastal towns.
d) Water is easily obtained from the sea.

4) The table below shows the percentage of workers in industry for four countries.

Country	Primary	Secondary	Tertiary
A	32	24	44
B	40	30	30
C	65	12	23
D	23	16	61

Which country A, B, C or D is least developed?

5) A town has the following facilities

- 27 chairlifts.
- 140km of slopes with a capacity of 22000 skiers per hour.
- Cross- country tracks.
- Ice skating tracks.
- Free parking.
- Bars and restaurants.

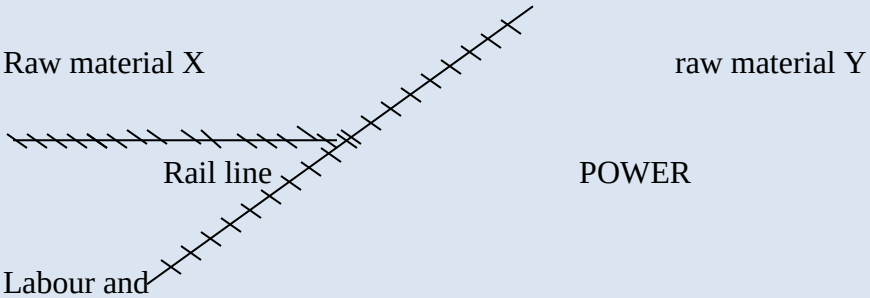
Which of the following service industry would find the town most ideal for its development?
A. Insurance.
B. Publishing.
C. Research.
C. Tourism.
6) Which one of the following industries are raw materials based?
A. Bakery.
B. Brewery.
C. Car Assembly.
D. Sugar milling.

7) Cottage industries are characterized by:
A. Low quality goods.
B. Very expensive goods.
C. Small scale production using simple tools.
D. Large scale production using simple tools.

Essay type questions

a) Define cottage industry.[2]
b) Describe and explain the contribution of small scale industry to the economy of Zimbabwe.[7]
c) What problems are likely to be faced by people wishing to set up industry in Zimbabwe?[4]

Study the following Diagram and answer questions that follow:



2a) State two raw materials used in the production of Iron and steel represented by x and y. [2]
b) As a planning officer, which site would you propose for the location of an iron and steel plant? Explain why? [4]
c) In what ways can the establishment of Iron and steel plants improve the economy of the country?[4]

3) Explain the terms industrial growth and de-industrialization.[3]
b) Outline factors that may cause a region to experience industrial growth.[4]
c) What can be done to revive industrial production in Zimbabwe?[3]

4) With reference to examples, distinguish between a car assembly plant from a car manufacturing plant. [2]
b) Describe the stages involved in the car assembly you have studied. [4]
c) What are the advantages of having a car assembly plant in a country or region? [4]

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CHAPTER 4

Agriculture

Chapter objectives

After studying the chapter, one should be able to:

a) Outline the main factors affecting agriculture.
b) Describe the different farming systems.
c) Evaluate the concept of a farm as a system.
d) Assess contributions of agriculture to economic well being of a country.
e) Assess the reason for land reform policy in any given region.

Agriculture or farming can be defined as the growing of crops or keeping of livestock either for sale or family consumption (to satisfy the needs of a family).

Agriculture forms the backbone of most economies. It operates as a system and the system is made up of three components i.e. inputs, processes and outputs.

Factors influencing farming or Agriculture

The type of agriculture practiced in any area is the result of many influences. Physical factors (climate, soil and relief) determine the broad characteristics of the agricultural pattern, but in most environments there is a wide range of crops and livestock in an area which is also the result of social and economic influences, either past or present. Other things being equal, farmers gradually produce crops or livestock which are in greatest demand and yield highest profit (Adopted from R. Knowles – 'O' Level and GCE Geography).

Physical influence on agriculture

As shown above, the physical influences on agricultural production fall into three basic groups:

i) Climate.
ii) Soils.
iii) Relief.

i) **Climate**

The elements of climate which influence agriculture include rainfall (the total amount and its seasonal distribution and intensity), evaporation rates, amount of sunshine, wind speed and temperature conditions.

The latter are particularly important. Plant growth normally ceases when temperatures fall below 5^0C, so thus the length of a growing season, or period with temperatures above 5^0C, is of critical importance.

In high-latitude areas the length of a growing season is too short for many crops. The occurrence of frost during the growing season can cause serious damage and crop losses.

ii) **Soil**

This is the medium in which seed germinates and crops grow and ripen, and as such, exercise a basic influence on agriculture. The features of soil which affect its potential for crop growth include its depth, composition and texture, as well as the depth of the water table. For many crops, especially cereals, deep well drained clay loams provide the ideal growing mediums, but other crops are less demanding and give satisfactory yields on soils of moderate quality.

iii) **Relief**

A number of elements of relief also affect agriculture. These include, altitude, gradient and aspect. Owing to the reduction of temperature with altitude, the length of a growing season decreases with an increase in height. In Britain, for example, most upland areas are given over to rough grazing and pastoral farming. Steep slopes restrict the use of heavy machinery and may necessitate the construction of terraces in order to bring them under cultivation. This is being practiced in the Eastern highlands of Zimbabwe.

Aspect or orientation of slopes influences agriculture through its control on temperature - e.g. in the Northern Hemisphere, south-facing slopes are facing the Equator, hence receive more sunshine than north facing slopes. The opposite is true for the Southern Hemisphere.

Social and economic factors

i) The type of farming, practiced in any area, is influenced not only by the physical factors described above.

ii) A number of social and economic factors such as:-

- Farm size.
- System of land tenure.
- Market demand.
- Availability of labour.
- Transport.
- Tariffs.
- Capital.
- Other government influences etc.

For example, in areas where farms are small and the land is fragmented into small plots, the farmer has no alternative to intensive production methods, which give a high return per hectare e.g. rice cultivation in South East Asia.

Where the land is cheap and readily available and farms are large, extensive methods of arable farming or ranching are more suitable e.g. the Canadian prairies or the Argentinian pampas. Different crops and livestock vary in their labour requirements. Where labour is costly or in short supply it may be necessary to adopt highly mechanized farming methods, provided that capital is available for investment in machinery.

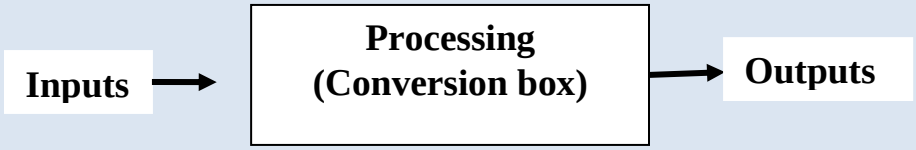
In recent years, government influences on farming have also become very significant. In Zimbabwe the government is redistributing land, training new farmers and assisting them in

getting inputs, in the form of seeds, fertilizers and loans. By imposing tariffs and quotas on agricultural imports, and by offering guaranteed prices and subsidies for particular crops, national governments are able to influence the pattern of production within their own countries (e.g. USA, and some European nations).

Individual initiative of the farmer must not be ignored. The farmer's assessment of what crops should be grown, may not necessarily be the correct or best evaluation for his particular farm. In making his decisions, he may be influenced by local traditions or incomplete knowledge about the range of alternatives available. For these socio-economic reasons, the actual pattern of farming in any area may not match up with the potential pattern offered by the physical environment.

The farm as a system

As already stated earlier, agriculture operates as a system



i) Inputs

These are the things that are needed by a farmer to produce outputs. These can be physical or human inputs.

Physical inputs
- Land.
- Rain.
- Soils.
- Sunlight.
- Minerals.

Human inputs
- Labour
- Knowledge
- Skills

Economic inputs
- Capital
- Infrastructure
- Machinery

ii) Processes

These are the activities carried out by farmers to produce outputs.
The process changes the inputs into final products. Examples of inputs are: harvesting, cultivating, irrigating, feeding, milking, grazing, dipping, and spraying.

iii) Outputs

These are the final products in a farming system e.g. maize, milk, sugarcane, yoghurt etc.

Farming systems

The farming systems can be divided into two broad categories; namely, subsistence agriculture in which crops grown for local/domestic use, and commercial agriculture in which crops are grown for sale or exchange. Subsistence agriculture is generally characterized by rudimentary (simple) traditional methods of farming, with a low level of mechanization, while commercial agriculture frequently employs modern, scientific methods to maintain soil fertility and improve yields, and is often capital - intensive and highly mechanized.

NB: Farming or agricultural systems are methods of organization of farming activity. Types of farming focus on the distribution of specific crops and livestock.

Types of farming

There are two types of farming:

a) Subsistence farming.
b) Commercial farming.

Subsistence farming

Involves the growing of crops or keeping of animals for family consumption. The main objective is to feed the family. The following are examples of subsistence farming:

(1) Traditional cattle rearing
(2) Peasant and crop cultivation

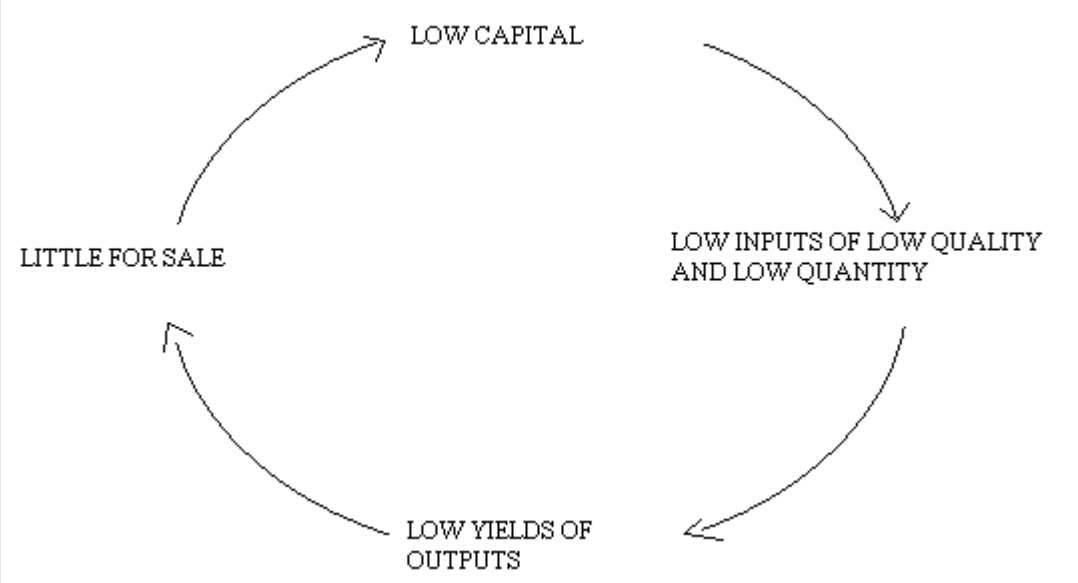
Characteristics

- Outputs are for family use.
- Use of low quality inputs e.g. manure, and seeds from previous harvests, use of draught power.
- Small holdings.
- Use of simple tools e.g. axes, hoes.
- Labour intensive - rely on family labour.
- Low capital.
- Lack of knowledge and skills.
- There is usually intense land fragmentation.
- Output per unit area is low.
- Poor infrastructure.

Problems of subsistence farming

- Shortage of capital.
- Poor infrastructure.
- Shortage of skilled labour.
- Lack of knowledge.
- Shortage of fertile land leads to poor yields (Frequent droughts). This results in a vicious cycle of poverty.

Poverty Cycle illustration



Solutions

- One can inject capital to these farmers in the form of loans e.g. money from banks (capital loans), loan schemes.
- There is need to train farmers on the field by deploying AREX offices in rural areas.
- Provide a good/sound infrastructure e.g. in Zimbabwe the rural electrification programme which is on-going.
- To encourage development of small scale irrigation schemes e.g. Mushandike irrigation scheme in Masvingo.
- Encourage development of small scale rural projects e.g. Chesa Ostrich farming in Chipinge, Mbashe fishing scheme in Binga, Timber production in Lupane

-Carry out resettlement of farming activities e.g. poultry, piggery, ostrich farming, gumtree plantations as at ; Fairfield, Masvingo, in order to generate capital.

Types of subsistence farming

1. Shifting Cultivation.
2. Bush fallowing.
3. Nomadic herding (pastoral nomadism).

1. **Shifting cultivation**

This is whereby a farmer rotates fields moving from one place to another. As a result a farmer does not stay at one place permanently. The movement from one place to another is meant to look for a place with more fertile soil and more vegetation.

A piece of land is worked on for about 3 to 4 years before moving or shifting on to another new area. This piece of land is left in order for it to regain fertility. The shifting cultivation is common in areas with a lot of woodlands/vegetation e.g. the Northern parts of Zambia - where they call it Chitemene.

Characteristics
A lot of trees are needed in order to produce a lot of ash, which becomes a natural fertilizer.

Inputs
- Axes.
- Hoes .
- Large vegetated piece of land
- Intensive labour.
- Seeds.
- Ash.
- Fire.

Processes
- Cutting down of trees .
- Wood burning .
- Cultivating .
- Harvesting .
- Seeding .

Outputs
- Maize .
- Sorghum.
- Cassava.
- Rapoko.
- Pumpkins etc.

Disadvantages
- It results in deforestation which results in soil erosion, which leads to soil infertility.
- There is too much family labour.
- There is land wastage and land mismanagement.
- It can only be carried out in sparsely populated areas.

Shifting cultivation is becoming less common in Africa for the following reasons:
- Increase in population controlled the free movement of shifting cultivators.
- African governments are beginning to train these farmers on modern farming methods e.g. crop rotation and grazing rotation.
- Government laws to reduce deforestation.
- Provision of loans e.g. grain loan schemes, by African governments.

2. **Bush fallowing**

This is a sedentary (settled) farming system whereby a farmer does not move from one place to another, but he leaves certain pieces of land to lie fallow for one or two seasons in order for that piece of land to regain fertility.

This is the most common type of farming in rural areas of Zimbabwe. These farmers do not have capital to buy fertilizers and therefore fallowing is the only way for the piece of land to regain fertility.

3. **Nomadic herding (pastoral Nomadism)**

It is a type of farming found in East Africa e.g. Tanzania, Kenya and also in West Africa e.g. Cameroon, and Northern Nigeria. These are areas which experience low and unreliable rainfall. Therefore crop production is very difficult because of harsh or unfavourable weather conditions.

As a result, these people move from one place to another in search of greener/richer pastures. In East Africa, they move between highlands and lowlands during different seasons.

Movement of the Maasai of Kenya and the Fulani of Northern Nigeria

Maasai

The movements of the Maasai are controlled by seasonal variations in rainfall. During winter seasons, they move their herds of tough Zebu cattle and goats, sheep, and donkeys up the slopes of the surrounding mountain ranges.

Up the slope the rainfall is higher and temperatures are cool, so grazing is available. In the wet season between November and April, they move their livestock down to the valley floor because there would be higher rainfall and greener pastures.

Fulani

The Sahel region of Nigeria supports cattle because this semi-arid region is largely free of tsetse flies. When the rains come, the cattle must move northwards.

- If it is the dry season, the tsetse flies retreat to humid areas, much further south. The cattle migration routes also take them southwards in search of green pastures free from disease.
- As the herds move out of the Sahel region into the wetter regions, their migration routes become quite complex.
- The dry season migration in Burkina Faso may start around October and lasts until the start of the rains in June.
- The Fulani also grow millet, and sorghum to meet their needs for grain. After the grain harvest in January, the animals move southwards to graze in greener pastures near the Black Volta river and Sourou river until the start of the rains, the herds must move frequently because of poor pastures.

Why Nomadic herding is in decline

- Population is growing very fast in Africa and therefore it is difficult for nomadic herding to move freely from one place to another.

- Introduction of modern farming methods e.g. irrigation. This means that the government is helping these farmers to start growing crops through irrigation e.g. the Gezira Scheme in Sudan.
- Introduction of paddocking: - governments of Sudan and Cameroon are slowly introducing cattle ranching on a large scale, through modern rotational grazing. This was done in order to reduce the fast spreading of diseases such as foot and mouth.
- The control of tsetse flies has resulted in more settled agriculture.

Types of commercial farming systems

i) Cattle ranching (beef production)
ii) Dairy farming
iii) Plantation agriculture (estate farming)
iv) Horticulture (market gardening).

Cattle Ranching: Beef Production

Examples of Beef Cattle

- Brahman.
- Hard Mashona
- Ngoni
- Zebu
- Tuli
- Simentater
- Afrikaander
- Abeeden Angus

Cattle ranching is large scale production of beef cattle for sale.

Inputs	**Processes**	**Outputs**
Stock Feeds such as: Molasses - Lucerne - Oats - Rye	 - Dipping - Feeding	- (Profit - Hooves - Hides etc.
Dip tank Labour Gazing lands Capital		

Case Studies:
Zimbabwe

Matabeleland

Cattle ranching is common in Matabeleland especially in Gwanda. Beef production in this area is extensive. Matabeleland received an annual rainfall of less than 70mm and the temperatures are usually high. Therefore, this region experiences hot and dry weather conditions.

Such weather conditions are not good for crop production. Beef production is possible in this region only because beef cattle such as the Brahman, Afrikaander, Hard Mashona, Tuli and Ngoni can resist harsh weather conditions. Because of harsh weather conditions, crop production in this region is difficult and most land lie fallow. As a result, this area is sparsely populated.

There is sufficient grazing land although the pastures are not good enough-thus resulting in extensive beef production in Matabeland. In the Zambezi Valley, beef production is mainly affected by tsetse flies and temperatures which are too high.

The other reason why beef production is common in Matabeleland is its proximity (closeness) to regional markets such as South Africa and Zambia. However, in extensive beef production, output per unit land is low mainly because there is little application of capital e.g. Liebigs Ranches in West Nicholson.

Harare, Chegutu, Marondera and Chinhoyi

- In more humid areas such as Harare, Chegutu, Marondera and Chinhoyi, beef production is carried out intensively.
- In these humid areas, crop production such as maize, tobacco and cotton is very common. The soils are good for farming. Therefore most of the land is used for production.
- There is therefore competition for land between crop farming and animal farming.
- Small pieces of land are left for animal grazing.
- However, surprisingly, beef production is higher around Harare than around Bulawayo, yet Bulawayo has more land for grazing – why?

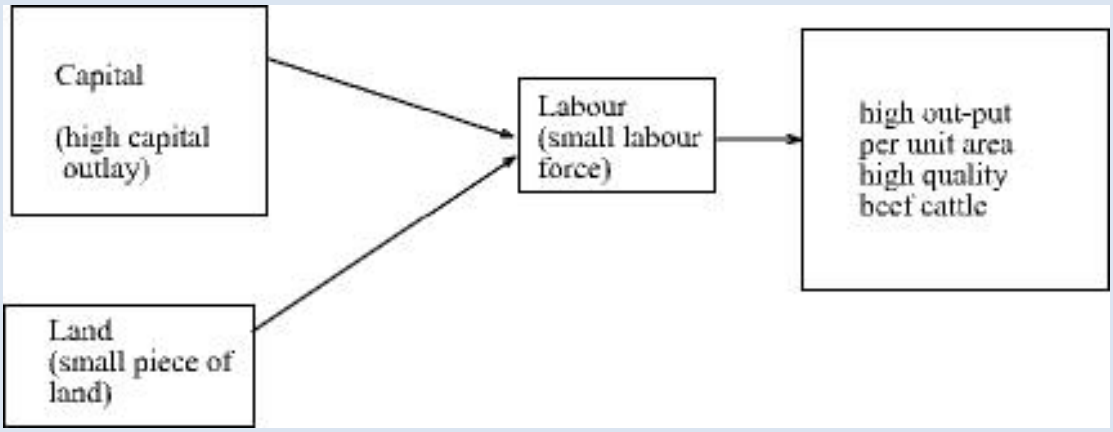
Explanation

- The climate conditions around Harare are good for crop production. The soils are good.
- Production densities are therefore high, leading to land shortage for grazing.
- As a result, beef production around Harare is carried out intensively and around Bulawayo extensively.

Intensive beef production

Intensive beef production as a system.

Inputs **processes** **Outputs**



Explanation

- Intensive production is the production of beef cattle on a small piece of land through application of a lot of capital to buy stock feeds e.g. rye, oats, molasses and loseine which have a lot of protein for cattle growth.
- Around Harare, there is not enough land for beef production. Therefore beef cattle are found on small pieces of land, but output per unit land is high.
- This is because a lot of capital is used to produce high quality output. Therefore intensive farming is capital intensive with high output per unit land.
- Around Harare waste material from crops such as maize e.g. maize silage is used to feed cattle.

Therefore in this region it is possible to carry out large scale mixed farming, since crop production benefits from cattle ranching, and cattle ranching benefits from production.

Problems of beef production in Zimbabwe

1. Outbreak of diseases e.g. foot and mouth, anthrax, nagana, especially in the Zambezi Valley.
2. Expensive stock feeds
3. Competition from other beef producers e.g. Botswana
4. Stock theft.

Distribution of beef cattle in Zimbabwe

- Beef production in Zimbabwe is carried out in areas such as Harare, Marondera, Chegutu, Mutare, Bindura and Chipinge.
- Most of the beef cattle are found in these regions which are regions 1 and 2.

- The reason why beef production is very common in these regions is the climatic conditions.
- The climate of these regions is favourable for beef production, that is cool temperatures and high rainfall.
- These regions are good for crop production such as maize, tobacco, cotton and groundnuts. Therefore population densities are high resulting in shortage of land for grazing
- As a result beef cattle are grazed on small pieces of land (intensive beef production).
- Intensive mixed farming is also common in this region since waste material from crops is used to feed cattle.
- In these regions, output per unit land is very high.
- In areas such as Gweru, Kadoma and Zvishavane (Midlands) beef production is carried out simply because temperatures are cool.
- However lower rainfall amounts reduce the number of beef cattle in this region.
- In regions four and five, that is areas around Bulawayo, Hwange, Zambezi Valley, Chiredzi, Beitbridge beef production is carried out extensively.
- These regions experience low rainfall and high temperatures.
- Therefore such weather conditions are not good for beef
- In areas around Bulawayo, drought resistant breeds such as Ngoni, Tuli and Hard Mashona are kept.
- This is because the area is not good for crop production and there is a lot of space for grazing cattle.
- The type of grasses found in this region are palatable (sweet).
- In areas such as the Zambezi Valley, Hwange and Chiredzi there are very few beef cattle because of too high temperatures.
- These also have a lot of tsetse flies and wild animals which can easily transmit diseases such as anthrax, foot and mouth and Nagana.
- Beef production is also common around main towns like Harare, Bulawayo, Mutare, Gweru and Masvingo mainly because these provide a good market for beef products.
- The infrastructure is also good for transporting beef cattle to the market at a lower cost.

Plantation Agriculture

This is the large scale production of crops such as sugar cane, tobacco, tea, coffee, wheat, barley and rubber.

Characteristics of plantation agriculture

- Plantation agriculture is monocultural – this is a system or culture of growing one type of crop on the same piece of land year after year e.g. sugar cane in Chiredzi.
- It uses large pieces of land.
- It is capital intensive e.g. for inputs and infrastructures e.g. electricity.
- It is labour intensive e.g. Chiredzi employs 6 000 people.
- It usually produces for export and produces cash crops only.

- Most plantation farms in Zimbabwe are owned by foreign companies or multi-national companies e.g. Lonrho, Anglo American Company.
- Most plantation farms are irrigated.
- The infrastructure e.g. electricity, piped water, housing, schools, roads, hospitals, banks is usually good.
- The growing of the plantation crop and the processing of that crop is usually done at the plantation farm.

This is because:

i) Most plantation crops are very bulky e.g. sugar cane, cotton and tobacco. Therefore it will be expensive to transport them over long distances.

ii) Most plantation crops like sugar cane, tobacco, and tea lose value if they are transported over long distances. Therefore, this affects the profit margin.

Merits/Advantages of plantation agriculture

- Plantation Agriculture creates employment e.g. sugar estates in Triangle employ around 6 000 people, tea in Chipinge employs a lot of people e.g. Rate Shoek Tea Estate, Jersey Tea Estate.
- It generates forex to the country e.g. Tobacco is called the "golden leaf" of Zimbabwe simply because it is one of the major forex earners in Zimbabwe.
- It results in infrastructural development e.g. piped water, roads airports, town e.g. Triangle or Hippo Valley.
- Provides food to the nation.
- It can help out growers in terms of skills and knowledge of growing certain plantations crops.

Demerits/disadvantages of plantation agriculture

- It uses a lot of land which can result in local people becoming landless.
- Most plantation farms are foreign owned and most of the profits are taken outside the country (Capital Leakage).
- The system of growing one type of crop on the same piece of land year after year (monoculture) can lead to soil infertility.
- Relying on one type of crop is not safe since if the price of that crop falls on the world market, a lot of profits will be lost.
- Relying on one crop can be affected by outside factors such as floods, and draught as well as world campaigns e.g. the world Health Organisation (WHO) Anti-Smoking campaigns have affected the tobacco industry in Zimbabwe,
- Plantation agriculture needs too much capital for it to work.

Question:

Chose one plantation crop which you have studied.

i) State and explain where and why it is grown (climatic and soil factors).

ii) Draw a sketch map to show where the crop is grown.

Horticulture (Market gardening)

- This is the intensive production of crops such as vegetables flowers and fruits.

- It is intensive because it is carried out on small pieces of land but output per unit land is very high.
- This is because a lot of capital is needed to buy farm inputs such as fertilizers, chemicals, highbred seeds, spraying machines and irrigation equipment.

Examples

- Around Bulawayo, Waterford, Esigodini.
- Around Harare, Mutoko, Chinamora, Seke.

Characteristics of market gardening

- It is capital intensive
- Its products or outputs e.g. flowers, fruits, vegetables are perishable (easily turn bad).
- It uses high quality inputs e.g. fertilizers, highbred seeds etc.
- Its products need needy markets, hence market gardeners are located close to urban centres. (products need immediate consumption).
- Some of the outputs are bulky e.g. fruits, vegetables and therefore market gardening has to be close to urban areas to minimize transport costs and increase the profit margin.
- Most of the products are needed on a daily basis in the urban centres, hence the reason why they are located on the urban periphery/urban outskirts.

Dairy farming

- Dairy farming is the keeping of dairy cows such as jersey, Gunsley and Friesland for the production of milk and milk products such as cheese, ice cream, yoghurt and butter.
- Again dairy farming uses small pieces of land, but a lot of capital is needed to produce high outputs per unit land.

Characteristics of dairy farming

- Products of Dairy farming are perishable e.g. milk and milk products.
- It is capital intensive. A lot of capital is needed to buy chemicals and stock feeds for dairy farms.
- It is usually located near major urban centres because the products are perishable and also because there are available markets for milk.
- Dairy farming requires a good transport network e.g. tarred roads.
- It is also labour intensive – labour is needed for grazing of animals, cleaning of machines, milking and transporting the milk.
- However dairy farming can also be carried out in areas which are far away from urban centres as long as the refrigeration system is good e.g. the Rusitu Dairy farming cooperation near Chipinge which uses the refrigerated milk tanker system.

Distribution of dairy farming activities in Zimbabwe

a) Dairy cows need cool temperatures, about 22^0C and good pastures.
   - Dairy farming is very common in region 1 of Zimbabwe which includes areas like Chipinge, Chimanimani, Mt Selinda and Mutare.

- These are highland areas with cool temperatures and a lot of rainfall for good pastures.

b) Dairy farming is also carried out around Harare through intensive farming.
   - Farmers buy stock feed to feed dairy cows in small pieces of land. This is because most of the land is used for crop farming.

c) Dairy cows do not need high temperatures such as those in the Zambezi Valley and areas like Chiredzi. These cows can easily be affected by disease such as Nagana.

d) Dairy farming is very common near urban areas such as Harare, Bulawayo, Gweru and Masvingo because:
   i) Milk is a perishable commodity and it needs immediate consumption.
   ii) Urban areas provide good markets for milk and milk products. Around areas like Gweru, dairy farming is common because the temperatures are cool and there is a lot of grazing land.

Importance of agriculture to the economy

i) Agriculture is one of the most important sources foreign currency. Tobacco and cotton.
ii) Most plantation farms generate a lot of employment e.g. tea in Chipinge and Sugar cane in Chiredzi employ more than 30 000 people.
iii) Commercial farming results in infrastructural development e.g. towns, electricity and schools.
iv) Agriculture provides food to the region.
v) Most agricultural output e.g. cotton, sugarcane, tobacco and skins of cattle are raw materials for other industries e.g. skins for Bata Shoe Company.

Five agro – ecological regions of Zimbabwe: The natural regions

REGION	AREA	WEATHER CONDITIONS	AGRICULTURAL ACTIVITIES
REGION 1	Chimanimani Mountains, Mt. Inyanga, Vumba Plateau and Chipinge	Law temperatures – annual mean temperatures less than 13^0C, high rainfall, more than 1000mm per year.	- Beef Production - Dairy Farming - Macadamia nut, tea, deciduous fruits, seed potatoes, maize, forestry plantation.
REGION II	Harare, Mutare, Bindura, Marondera and Kadoma	Cool temperatures and high rainfall which averages from 700-1000mm per year.	- Maize, tobacco, dairy farming, beef production, cotton, soya beans.
REGION III	Kwekwe, Gweru, Kadoma	Cool temperatures but lower rainfall between 600 and 700 per year. Effective rainfall is 400 –	- Beef production - Millet, soya beans, barley, maize - Dairy farming

		510mm.	
REGION IV	Bulawayo, Masvingo	Low rainfall. Annual rainfall is 450 -650mm and effective rainfall between 350 –450mm. High temperatures.	- Cotton, groundnuts, sorghum - Beef production - Crops, maize, millet
REGION V	Hwange, Beitbridge, Chiredzi, Zambezi Valley	High temperatures, low rainfall less than 600mm	- Sugarcane, wheat, citrus, cotton - Beef production - barley

Examination type questions

Multiple choice Questions

1) Which crops are mainly grown in the eastern highlands?
A. Citrus fruit.
B. Tobacco.
C. Sugar cane.
D. Tea.

2) The main problem faced by Zimbabwe in providing food security for its people is:
A. Lack of foreign currency.
B. Political unrest.
C. Lack of technical know-how.
D. Shortage of seeds.

3) The intensive cultivation of vegetables, fruit and flower crops on relatively small plots of land is called
A. Horticulture.
B. Permaculture.
C. Semi culture.
D. Viticulture.

4 **What advice would you give to a small-scale tomato grower on Zimbabwe's Highveld on a calm July evening with a clear sky?**

A. Harvest all ripe tomatoes.
B. Construct a wind break.
C. Apply fertilizer.
D. Water the tomato garden.

Essay type questions
1a) Distinguish between subsistence and commercial Agriculture. [4]

b) Why is it difficult for most subsistence farmers in Zimbabwe to venture into commercial farming? [4]
c) How can the challenges you have noted in (b) above be overcome? [3]

2a) Explain the terms "subsidy" and "price control" [4]
b) Give reasons why governments should control the price and marketing of strategic crops such as maize and wheat.[5]
c) What are the disadvantages of imposing government controls on agricultural products? You may refer to specific examples.[5]

3a) Why did the government of Zimbabwe embark on a land redistribution exercise?[3]
b) Describe and explain disadvantages of such a policy in the short term agricultural productivity of the country.[7]
c) What measures were put in place in an effort to redress the disadvantages you have outlined in (b) above. [4]

4a) In what ways are communal farmers important in easing food security in the country?[4]
b) Most communal farmers are unable to achieve their maximum potential in terms of agricultural yields.
c) What measures would you recommend to government to ensure that communal farmers produce maximum yields?[5]
5) With reference to one named commercial crop grown in Zimbabwe,
a) Describe how it is grown.[3]
b) How it is processed.[3]
c) State its economic value on national development.[2]

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CHAPTER 5

Natural resources

Chapter objectives

At the end of this chapter one should be able to:

a) Define natural resources.
b) Evaluate trends in utilization of resources.
c) Assess the positive and negative impact of natural resources utilization.
d) Describe measures for sustainable utilization of resources in a given region.

Natural Resources

Natural resources can be defined as endowments in the environment that humans can make use of in order to sustain their survival.

Classification of resources.

Broadly, resources can be classified into:

a) renewable resources.
b) Non-renewable resources.

Renewable Resources

These can simply be defined as resources which can be replaced. Therefore such resources can be used over and over again without being finished, and examples of these include, wind and solar energy.

Non-renewable Resources

These are resources which can not be replaced, meaning that once they are depleted (finished), this may mean the end of the resource.

Examples of these include: coal and petroleum.

Resource Exploitation

This involves the deliberate use and exploitation of a resource either to satisfy domestic or commercial needs.

In Zimbabwe an example of a renewable resource which is exploited on a large scale is wood. Wood in Zimbabwe is exploited for commercial purposes such as timber. In Zimbabwe there is the exploitation of wood for timber by exploiting the natural vegetation. In addition to this, there is the deliberate growth of forests for the purpose of harvesting timber, a case in point are the many forest plantations in the Eastern Highlands where the physical environment and climate conditions favour the growth and early maturity of forests. Generally, the western parts of the country also harvest timber in substantial quantities and it is as a result of the fact that there are many forestry estates in the western parts of the country.

Over and above the commercial exploitation of wood, there is exploitation of indigenous forests for domestic purposes. This is because people, particularly in the rural areas in Zimbabwe, depend on wood for fuel, and as such, there is the indiscriminate cutting down of trees so as to meet the fuel need. Electricity is not available in most areas, and if it may be available, it may be expensive and unaffordable for many people in rural areas. So they continue to cut down trees. Wood is also used in many rural areas for building i.e. roofing and fencing and in some of the country like closer to Victoria Falls indigenous forests are exploited on a large scale for craft industries like wood curving.

Population and resources

The Zimbabwean population has doubled since about 1980 and this rapid population growth has, in many ways, put pressure on many resources such as the following:

Soil

Due to rapid increase in population there has been over cultivation of the soil, particularly in communal areas where the soil is not good and fertile, therefore the over cultivation of the soils has destroyed them further. In some places this has led to increased soil erosion which has created gullies and dongas (badland topography).

Forests

The exploitation of forests has led to massive deforestation in the communal areas of Zimbabwe, wet forests (indigenous) are indiscriminately cut down for fuel wood and other domestic needs such as building houses.

Water

Increased population has inevitably led to the pollution of water resources. A case in point here is the pollution of water resources like Lake Chivero near Harare and Umguza near Bulawayo. Some of the pollutants come from the urban areas which are experiencing an increasing population. Waste from Harare has found its way to Lake Chivero and the wastes from Bulawayo's increasing population has found its way into Umguza Dam.

Wildlife

While we may not have exact or specific figures to the fact that wildlife is also being exploited, it is a fact that illegal hunting is taking place and inevitably this is reducing the number of wildlife. It is also time that increasing population in rural areas, has displaced wildlife and this displacement has been accompanied by the death of some of the wildlife.

Land

Increased population in Zimbabwe has been reflected by overcrowding in some rural areas (although the recent land reform program reduced this) and this has resulted in over-cultivation and the general over use of the land. There has also been the disposal of dangerous chemicals or wastes which also destroys the quality of the environment.

Resource Conservation

This is about using our resources, both renewable, and non-renewable carefully so that future generations could also benefit. The following are some of the resource conservation methods which can be implemented.

Forests/wood

- Afforestation.
- Re-afforestation .
- Education campaigns, for example, the National Tree Planting Day.
- Penalties against those people who indiscriminately cut down trees.
- Limiting timber extraction/harvesting.

Water

- Treat waste before disposing it into water courses.
- Avoid stream bank cultivation.
- Limit the use of chemicals on land, for example, fertilizers which cause eutrophication
- Recycling used water.
- Penalties for those people who carelessly use and or pollute water.

Land band gold panning

- Proper methods of farming.
- Land redistribution, so as to relieve pressure on overcrowded areas.
- Stiff penalties on indiscriminate dumping of wastes.
- Education campaigns so as to enlighten people about the need to use our only one and fertile land resource.
- Fencing off degraded/badland topography so as to protect it from further damage and thus lesson or limit the impact/damage.
- ban gold panning.

Examination type questions

Multiple choice

1. Which one of the following energy sources has large reserves, but is the dirtiest fuel?

A. Coal.
B. Natural Gas.
C. Oil.
D. Wood.

2. The table below shows the percentage of total energy consumption in a country.

Energy Source	**1970**	**1980**	**1990**
Coal	50.7	35.2	30.6
Oil	42.7	39.7	34.7
Natural gas	2.7	20.1	25.6
Nuclear	3.3	4.5	8.0

Which energy source has experienced the greatest percentage use from 1970 to 1990?

A. Coal.
B. Natural Gas.
C. Nuclear.
D. Oil.

3. Which of the following fossil fuels is the cleanest?
A. Natural gas:
B. Coal. .
C. Crude oil.
D. Uranium.

4. Which of the following mining methods would be most suitable for exploiting the coal seams located 30 metres below the surface?
A. Alluvial.
B. Drift.
C. Open-Cast.
D. Shaft.

5. The main aim of the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) established in 1986 is to:

A. Help locals manage, conserve and benefit from natural resources.
B. Protect natural resources by locals.
C. Market wildlife to earn foreign currency.
D Earns benefits for the department of natural resources and wildlife.

6. Coastal areas washed by cold ocean currents are usually rich fishing grounds because of:
A. Cold water currents which bring fish to the surface.
B. The presence of fog.
C. The presence of sheltered coasts.

Essay type questions

1a) What are the characteristics of renewable and non renewable resources? [4]
b) In what ways are non renewable resources important to the economic development of a country? [3]
2a) With reference to an area you have studied, describe and explain the exploitation of one natural resource. [7]
b) Explain the positive and negative impact of the resource you have outlined above.[5]
3) Why is oil an important natural resource in the world? [3]
b) Describe in detail, how oil is refined to produce other by products.[7]
c) What are the side effects of refining oil on the environment?[3]
4a) How can communities explore renewable natural resources in their communities?[4]
b) Describe methods used to conserve natural resources for sustainable development of communities? [2]

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CHAPTER 6

Biotic studies

Chapter objectives

By the end of the chapter, one should be able to:

a) Describe factors influencing vegetation growth.
b) Outline uses of trees.
c) Outline the main components of ecosystems.
d) Describe the various linkages existing between various components of the ecosystem.
e) Describe the characteristics of given ecosystems.

Biotic studies

Vegetation: Plants and their adaptation to soil and climate.

For plants to survive in a given environment, they need to fit in the area. The plants in a given zone must change their characteristic features to correspond with the changes which may be taking place in their environment. This ability to change in order to survive is what is known as adaptation. When the plants adapt to soil and climate, major vegetation zones are formed.

Vegetation varies from place to place. This is caused by different climates experienced in a given country. Apart from climate, prevailing in a country, soils also influence the growth of plants.

Zimbabwean examples

Gweru and Shangani areas.

- Grassy plains with scattered trees.

Plains between Harare and Mazowe Dam

- Covered with short grasses and very few trees.

Western Zimbabwe bordering Botswana

- Shorter trees- mainly thorny bushes separated by short grass.

The Zambesi, Save and Limpopo Valleys

- Covered by dense bushes and trees in most parts.

Climatic factors influencing vegetation growth

Availability of water/lack of it

Plant growth is determined by availability of water. Water is drawn up from the soil to sustain plant life. It dissolves mineral salts which are needed by plants. High rainfall results in more

trees e.g. the Eastern Highlands and its forests. Low rainfall discourages plant growth for example, in the desert parts of Botswana and Namibia.

Temperature

Germination of seeds and growth of plants require suitable temperature, and plants require optimum temperature for them to grow. Very low temperature may result in slow growth.

This factor together with underground water helps explain the dense bush and tree growth along the Zambezi, Save and Limpopo valleys.

NB: Rainfall and temperatures which are high explain why the equatorial regions are covered by very dense vegetation and support huge and many trees, while hot and very dry areas like the Namibi and Kalahari deserts cannot support much plant life.

Soils

Apart from climate, soils also influence the vegetation type in Southern Africa.

Shallow and rocky soils:- semi-arid and arid areas, such as deserts. The soils lack nutrients to support plants.

Water- logged soils:- may not support plants e.g. non-existence of trees in water-logged clay areas. Well drained soils which are permeable-support forests of indigenous type e.g hard wood, despite low rainfall received e.g. Kalahari sands between Bulawayo and Hwange.

The human influence on vegetation

Deforestation: Reasons for cutting down trees

- Wood fuel.
- Develop settlements .
- Tiling/cultivating the land .
- Furniture .
- Carving, etc.

Examples of heavy deforestation areas: Zimbabwe

Overpopulated communal areas of:

- Chivi (Masvingo)
- Mhondoro (Mashonaland West)
- Seke (Mashonaland West)
- Manyeme
- Gutu
- Ntabazinduna
- Zvimba

Large scale commercial farming areas:- Natural regions I, II, and III

Mining:

- Petroleum (Gabon, Nigeria) to
  Copper (Katanga and Zambia Copper belt
  and
- Coal (Hwange, Zimbabwe)
- Gold (Rand, South Africa)

} Led to large areas of land being cleared establish the mine, road, rail networks settlements.

Urbanization: Town and Cities

- Johannesburg.
- Harare .
- Lusaka.
- Nairobi.
- Accra .
- Kinshasa .
- Lagos .
- Da-res-Salam.

Of all the causes of deforestation, agriculture changes the largest areas of natural vegetation. Large tracts of land were used for agriculture on the African continent. As for the European continent, there is very little natural vegetation left due to agriculture in the countryside.

The system approach

This is the best approach to the study of climate and soil as factors influencing vegetation types. Vegetation and climate zones are natural systems with inputs, processes and outputs.

Physical inputs: Factors such as

Temperature, rainfall, humidity, soils, humus and fires caused by lightning.

NB: These inputs either help or disturb plant or vegetation growth.

Outputs (Products)

The products are found from the addition of the inputs above. The following can be included: Tall trees, short trees, firewood and timber etc.

The human factor

People influence the natural vegetation through labour, human energy, knowledge, money, equipment and development.

NB: Conservation or exploitation or destruction of forests and plants result from the human interference with this natural system.

- The tree is habitat for small animals and birds.
- Trees shade and protect soil (and people) from sun and heavy rain
- Roots, leaves, barks, make medicine.
- Roots hold soil together.
- Earthworms, mice and moles help aerate soil
- Humus nourishes soil.

The uses of the trees

- Fruits.
- Timber .
- Furniture .
- Paper.
- Wood fuel.
- Construction etc.

ECOSYSTEMS

Summary

This is an abbreviated term for 'ecological systems". Ecology is the study of plants and animals and how they fit into their environment. A system is a set of components connected together in an organized way. It is simply a series of materials, components (parts) or variables linked together by flows or processes.

Plants and animals together with their environment form a system. In the study of an ecosystem, focus is mainly on plant and animal life and the influence of the environment (natural and human) on them. For the ecosystem to remain intact, every component must play its part fully. Altering or changing any part of an ecosystem, especially a major one, the system's characteristics or behaviour will be changed greatly or even destroyed completely. For example, a sudden and prolonged change in climate might lead to the death of plants and animals. There is a delicate balance between plants and animals on one hand and the environment (air, climate, soils etc) on the other. This balance of nature is the main focus in the study of the ecosystem.

Types of ecosystems

1. Global ecosystem.
2. Equatorial rainforest ecosystem .
3. Tropical grassland (savanna) ecosystem .
4. Desert ecosystem .
5. Framing ecosystem.

Global ecosystem

Here the earth as a whole is examined i.e the land, plants, animals, the atmosphere, solar energy and the interactions between them. The human impact on the global ecosystem must be examined.

Inputs (things going into it)

- Heat or solar energy.
- Carbon dioxide from the atmosphere.
- Mineral salts e.g. calcium, nitrates, potassium. All these are used to make food for the plants. The inputs contribute to healthy trees, grass and other plants.

Outputs (things coming out of the system)

- The healthy plants resulting from the use of the inputs .

- More water vapour added to the atmosphere, that is through evapo-transpiration from plants .
- More surface water resources-leading to fish resources.
- Decomposed plants, litter or vegetation, adds to soil fertility and enables farmers to reap more crops.
- Pastures or food for animals, birds and insects come from trees and grass.
- Birds and insects help to propagate seeds and fruit resulting in more plant germination.

NB: The inputs and outputs are therefore important components of a global ecosystem. For the delicate balance to be maintained, little disturbance should be made to the ecosystem. However, human beings either help to maintain the balance or interfere with it in negative ways. Human beings/people must manage the ecosystem well.

Details

Ecology

The term ecology comes from the Greek word **Oikes** meaning 'home' adopted from (David Waugh). It refers to the study of the interrelationships between organisms' home or habitants in the biosphere. The Biosphere is the surface zone of the earth and its adjacent atmosphere in which all organic life exists.

Variation of each home (habitats)

i) Small micro-habitats e.g. under a stone, log of leaf
ii) Biomes e.g. tropical rainforests, deserts etc.

Central to the four ecological units below is the idea of environment

The environment is a collective term to include all conditions in which an organism lives e.g light, temperature, water, solid, gases, etc.

Ecological units	Ecological niche
Micro-habitat	specific location e.g. under a leaf, stone, log etc
Habitats:	More specific locations with a particular set of conditions and an appropriately adapted position of plants, animals and other organisms e.g. fresh water pond, hedgerow organism in the food chain.
Zones:	Units within biomes: e.g. three layers in the rainforest, the surface, deep ocean and inter-tidal zones of the sea.
Biomes:	Large areas cutting across continents, yet each with its own characteristic type of flora and fauna, e.g. Tundra rainforest and deserts.

The environment can be divided into two i.e.

1. The physical, non-living or biotic environment; it includes the following:

temperature, water, light, humidity, wind, carbon dioxide, oxygen, pH, rocks and nutrients in the soil.

2. The living or biotic environment, is made up of all organisms; plants, Animals, humans, bacteria and fungi.

Food chains and atrophics

A food chain results from the transfer of energy tapped in the carbon compounds initially produced by plants through photosynthesis through an ecosystem. There are usually, though not always, four links in the chain. Each link or stage is known as atrophic or energy level. Also, each link in the chain feeds on or obtains energy from the preceding (link) it. It is in turn consumed by and provides energy for the link which follows it e.g.

Level 1 → **level 2** → **level 3** → **level 4**

Grass → Worm → Blackbird → Hawk

(Adopted from David Waugh)

NB: The first link in the chain requires both energy from the sun and the other factors needed for photosynthesis in order to develop - e.g. water, carbon dioxide ($C0_2$), etc. Each link or stage is known as atrophic or energy level.

TROPHIC LEVEL	**ENERGY TRANSFER**
Antistrophes (self-nourishing green plants	Energy has only been transferred once i.e. from sun to plants.
Herbivores (primary consumers) consumers eating green plants.	Energy has been transferred twice i.e. from sun to plants; and from plants to herbivores.
Carnivores (secondary consumers) meat-eater consume herbivores which have consumed green plants.	Energy transferred three times i.e. from sun to plants; from plants to herbivores; from herbivores to carnivores.
Omnivores (diversivores) carnivores eating carnivores which have consumed plants.	Energy has been transferred four times.

Summary

Energy or atrophic level

It is occupied by producers or autotrophs (self-feeder) i.e. green plants. They produce their own food by photosynthesis.

NB: Consumers or heterotrophs occupy the remaining levels. The group is comprised of animals which get their energy either by eating green plants directly or by eating animals which have previously eaten green plants.

Trophic Level 2

The herbivores-: the primary consumers eating green plants.

Trophic Level 3
Smaller carnivores (meat-eaters) behave as secondary consumers eating herbivores.

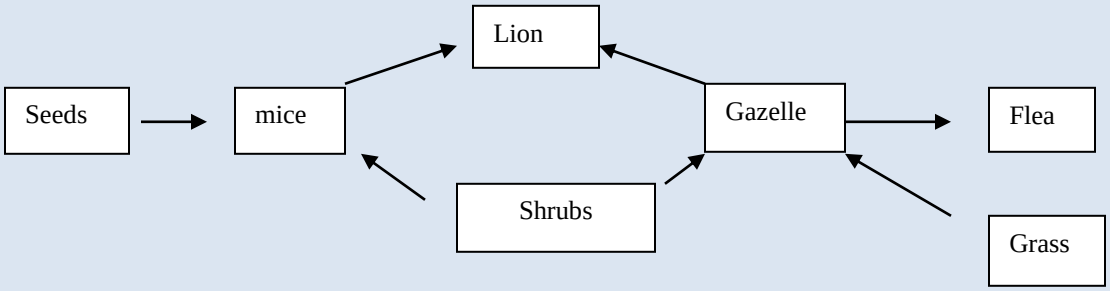
Trophic Level 4
Larger carnivores, the tertiary consumers (omnivores or diversivores) – humans included –eats both plants and animals, thus, they have two sources of food.

Material Cycling
Chemicals needed to produce organic material are circulated around the ecosystem and are continuously recycled. A number of chemicals can be absorbed by plants either as gases from the atmosphere or as soluble salts from the soil. Each cycle consists of plants absorbing chemical nutrients, which once they have been used, are passed on to the herbivores and then the carnivores which consume them. As organism at each of these levels die, they decompose and nutrients are returned to the system.

The cycle operates over land and sea. Today, the amount of carbon dioxide in the atmosphere is on the increase due to mainly the combustion (burning) of fossil fuels, resulting in global warming which is a serious threat to the earth.

Examination type questions

Multiple choice
The diagram shows a food chain in an ecosystem:



Which of the organisms is a secondary consumer?
a) Fleas
b) Gazelle.
c) Grass.
d) Lion.

2) The dominant vegetation in dry desert regions is:
a) Lichens Mangroves.
c) Elephant grass.
d) Vertiver grass.

3) Why are gum trees grown mostly in forestation programmes?
a) They grow faster.

b) They are easy to get.
c) They are drought resistant.
d) They offer medical purposes.

4) The main causes of soil erosion in Tropical regions is:
a) Poor cultivation method.
b) Low Income.
c) Too many droughts.
d) Civil conflict.

5) **Trees have adapted to savanna woodland vegetation through:**
a) Having long tap roots.
b) Having fleshy leaves.
c) Having pointed leaves.
d) All of the above.

6) Soil can best be conserved through:
a) Planting a lot of trees.
b) Planting a lot of grass.
c) Avoid over utilization of soil.
d) All of the above.

7) The food chain shows
a) Linkages between components of the ecosystem.
b) How lions eat other animals.
c) Energy transfers within the ecosystem.
d) None of the above.

8) Veld fires
a) Clear the land of dangerous snakes.
b) Make it easier to plant crops.
c) Destroy micro organism in the ecosystem.
d) Destroy the natural and artificial ecosystems.

Essay Questions

1a) List any three components of the soil. [3]
b) Describe and explain the importance of the soil to the ecosystem.[7]
c) What can be done to ensure that our soils are protected?[4]

2a) Describe and explain the process of soil erosion.[7]
b) What are the social and economic effects of soil erosion on a small community such as a village?[4]
c) You are an environment officer working in an area heavily affected by soil erosion. What measures would you put in place to minimize the rule and effect of soil erosion? [4]

3a) Outline the main components of a savanna grassland ecosystem.[5]

b) Describe with the aid of a diagram a typical energy flow chart likely to be found in Tropical savanna grassland.[5]

c) What can be done to ensure that sustainable conservation and utilization of Tropical savanna grassland occur? [4]

4a) Why are wetlands an integral part of the natural ecosystems.[4]
b) Describe and explain how human activities have led to the natural habitation of wetlands.[4]
c) What measures can be done to protect the natural ecosystems from destruction?[4]

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CHAPTER 7

Desert processes and landforms

Chapter objectives

By the end of the chapter one should be able to:

a) Define Desertification.
b) Outline the natural and man made causes of desertification.
c) Explain the stages in the encashment of desert conditions.
d) Describe the processes of wind action in hot deserts.
e) Examine the impact of running water in hot deserts.
f) Describe the main desert landforms found in hot deserts.
g) Assess ways to use desert environments for the benefit of mankind.

What is a desert?

A desert is an environment of extreme climatic conditions. There are cold deserts, where the area is characterized by low temperatures throughout the year, thus the area is always covered with snow. We are mainly concerned with hot environments characterized by hot temperatures and very little rainfall.

Causes of deserts

Deserts are caused by natural and human induced causes.

Desertification

Deserts may be formed through the process of desertification. This is the encashment of desert-like conditions to an area or region where such conditions did not exist. Desertification is caused by the following:

Natural factors:

Climate change:

When climate changes, the amount of rainfall received by an area will decrease, leading to the change of vegetation characteristics. At times temperatures may increase leading to drying up of surface storage. Over a long period of time, the area that had undergone climate change will gradually adapt climatic characteristics similar to desert environments; such an area would soon become a desert.

Exercise

Discuss the effects of the Elnino and how it may influence weather conditions, ultimately leading to desertification.

Draught:

If an area is hit by succession draughts, the area adopts drier characteristics similar to desert environments.

Human induced factors:
The greatest contribution to desertification can be attributed to human activities that have destroyed the natural state of the activities outlined below:

Deforestation
Overgrazing
Bush fires
Poor farming methods

Exercise
a) Outline how each of the factors outlined above may lead to the formation of a desert.
b) How can these effect be overcome?

Wind Action in Hot Deserts:

Wind is a very active process shaping up present day desert features. They are located on the western sides of continents because of the following reasons:
a) Continentally, when winds which have moisture travel over land for longer distances, they loose the moisture and when they reach the western sides of continents they are dry.
b) Rain shadow effects: for example, the Andes Mountains in South America, have led to the development of the Afacama Desert.
c) Effect of cold currents, for example, the cold Benguela current is responsible for washing away moisture laden on shore winds, hence the development of the Namibi and Khalahari deserts.

Wind Erosion
Wind erosion in hot deserts occur through the process of:
a) Wind abrasion- this is the sandblasting effect i.e. when sand and other rock particles hit against other rock out crops.
b) Wind attrition - particles transported by wind hit against each other and become eroded.

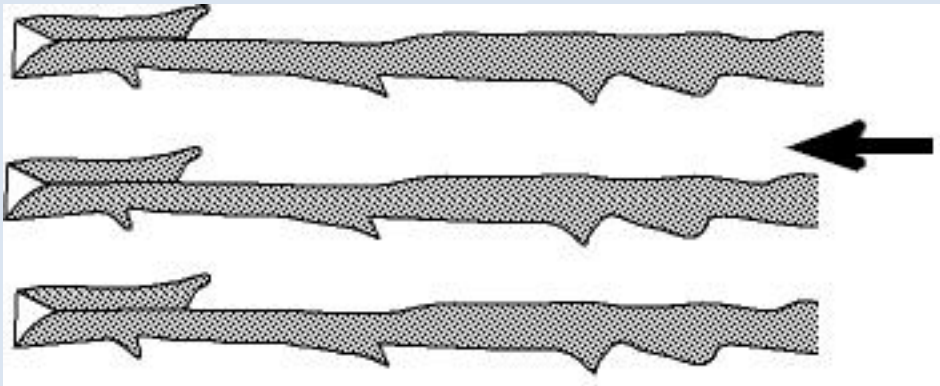
Wind Deposition
Wind is forced to deposit its load due to a number of factors. The most outstanding one is that wind will lose its capacity to transport load or an existence of an obstacle that will force the particles to be deposited.

Landforms of wind deposition
They include.
a) Deflation hollows.
b) Rock pedestals .
c) Yardangs .
d) Zeugens .
e) Ripples .
f) Seif dunes .
g) Barchans and dunes .

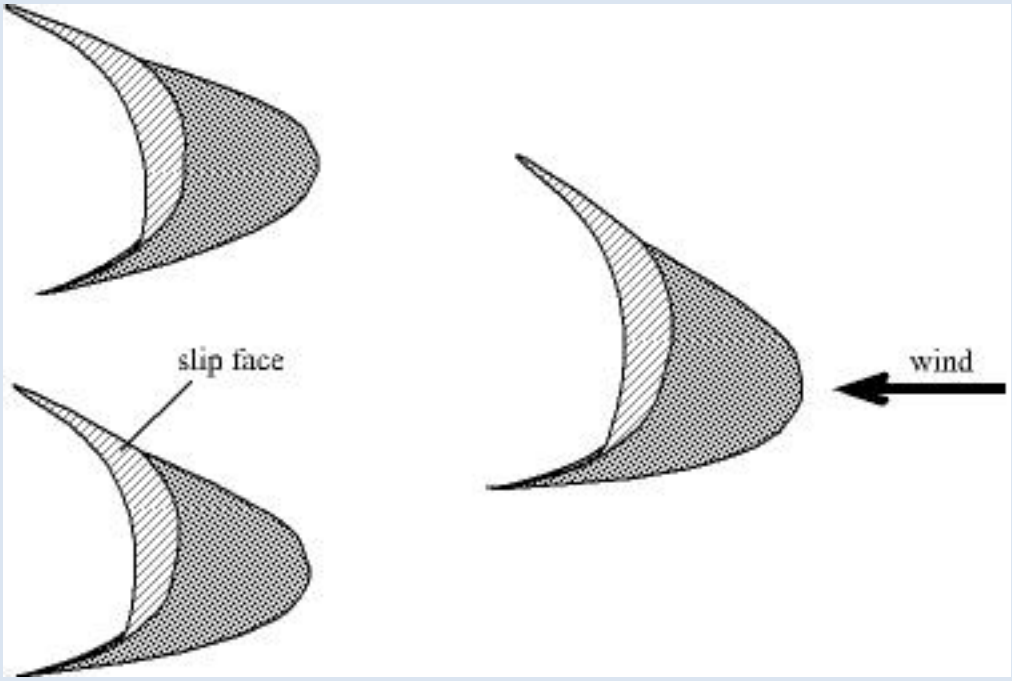
These are wave like features which form after the deposition of fine sediments after desert sandstorms.

Seif dunes

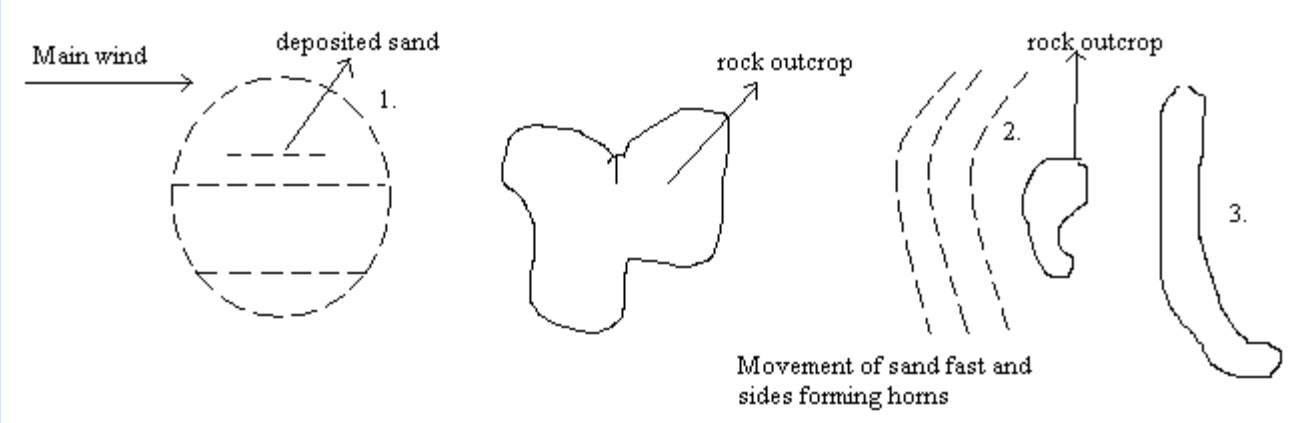
These are elongated mounds of sand which stretch over several hundred of kilometers.



Barchan sand dunes

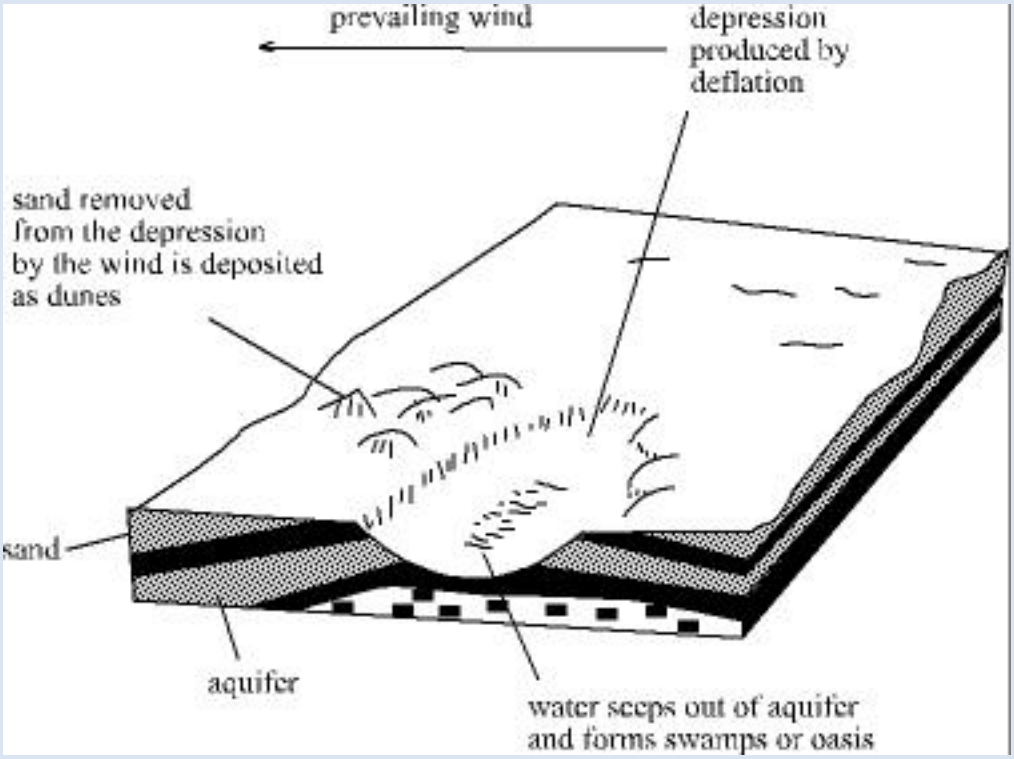


These are crescent shaped. It develops when wind transporting sand meets an obstruction like vegetation or rock outcrops. This results in the sand being deposited. The movement of the sand is slower at the centre of obstruction but highest at the side and this leads to the development of the crescent shape (horns).

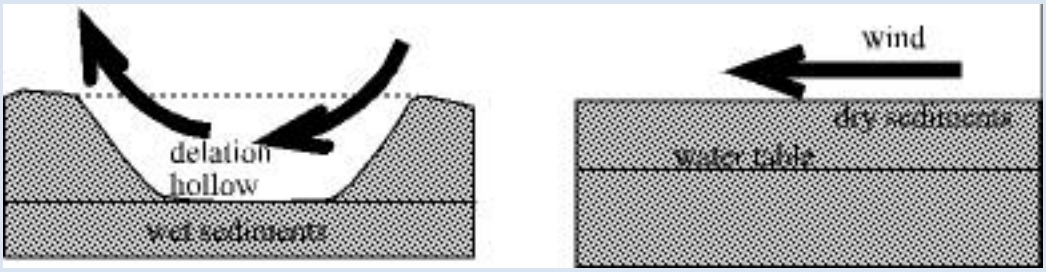


Deflation hollows

As wind blows it picks up sand, and if this is repeated over a period of time, depressions will be formed as the removal of sand forms 'holes' which are deepened to form deflation hollows, as shown on the diagram below.



(adopted from RB Bunnett)

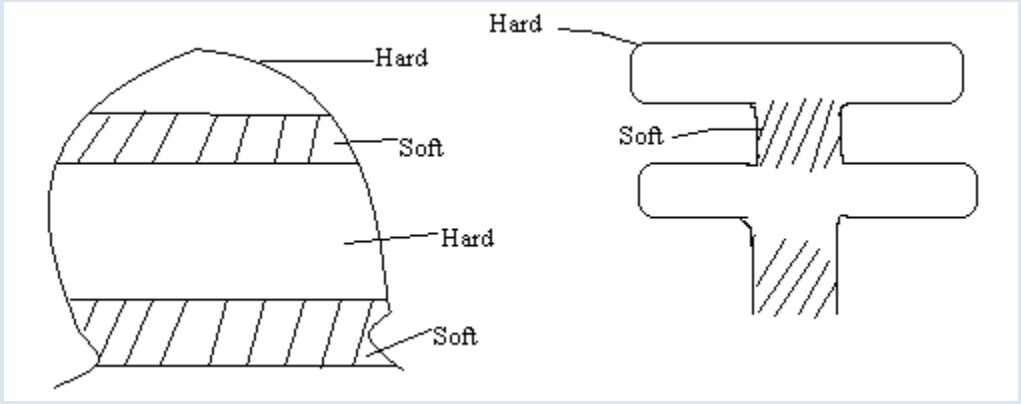


(Adopted from McGeary and Plummer)

NB: Deflation by Wind Erosion can form a deflation Hollow in Loose dry sediment. Deflation stops at the water table.

Rock pedestals

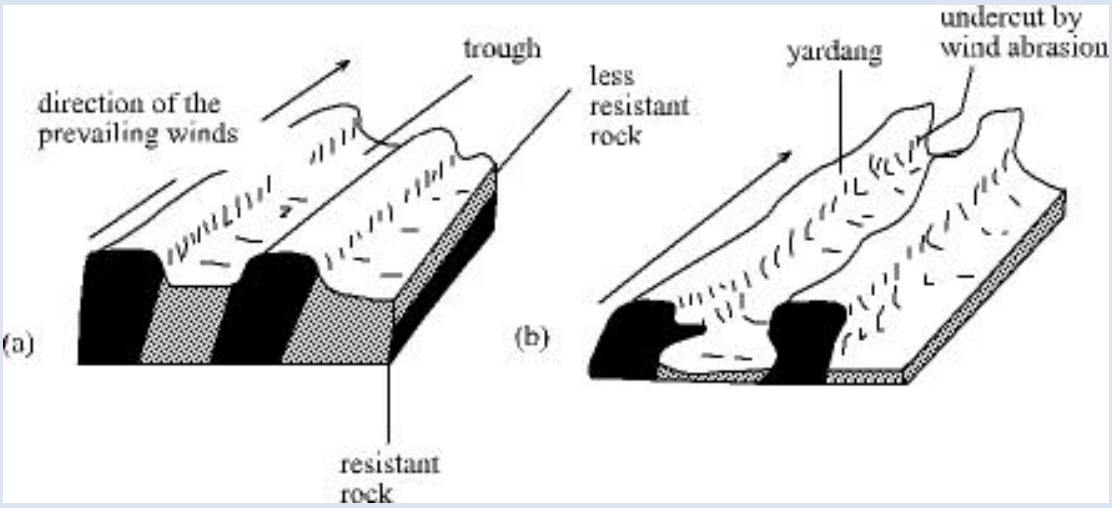
- It forms on rock outcrops which are made up of hard and soft rocks.
- As a result, when wind abrasion occurs, the weaker rock is eroded leaving the harder rock.



A classic example of rock pedestal is the Finger of God in the Namibian desert which collapsed in 1989.

Yardangs

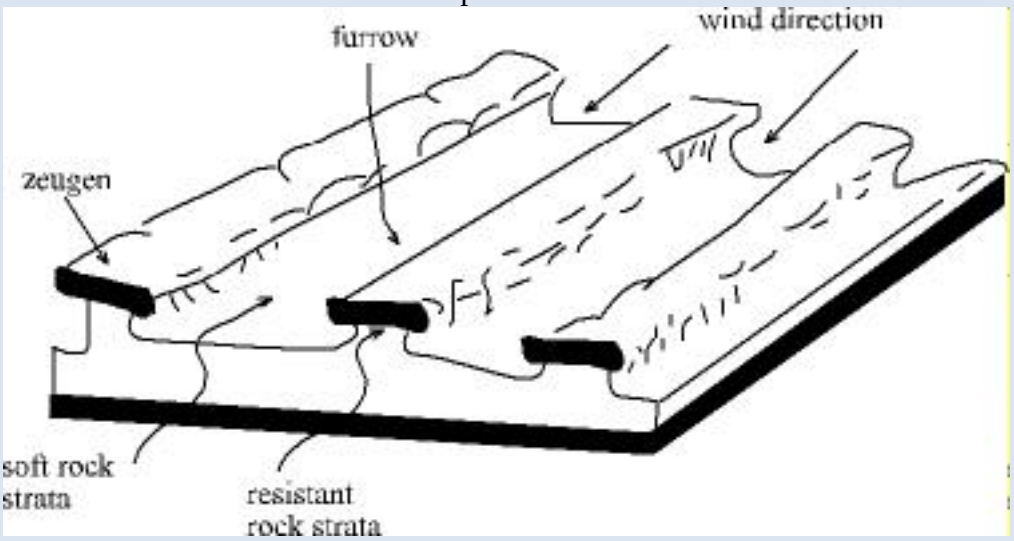
They form when there are alternating bands of hard and soft rocks which lie horizontally and parallel to the main wind. Wind abrasion will erode the softer rock leading to valley like features separated by highland areas.



Stages in the formation of yardangs:
a) Wind abrasion turns the belts of soft rocks into troughs.
b) Hard rocks are under cut and they remain upstanding as narrow ridges called yardangs.

1) **<u>Zeugens</u>**

They form when there are harder rocks on top of softer rocks, wind erosion will therefore result in tabular masses of hard rock on top of softer rocks.



At first it is weathering which opens the joints and the wind abrasion continues the work started by weathering lowering the zeugens and widening the furrows.

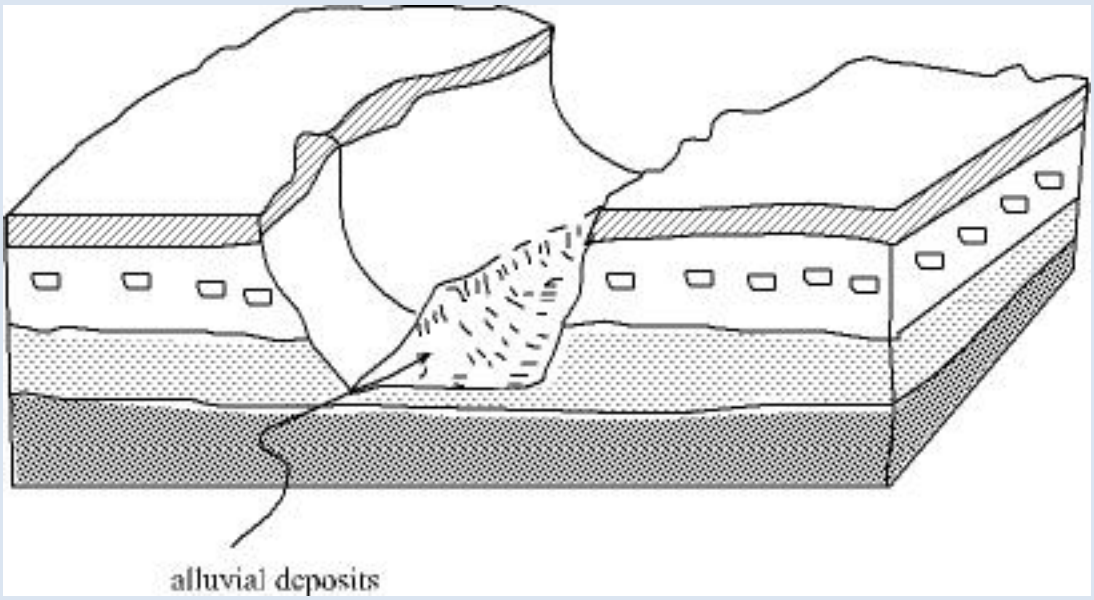
<u>Action of Water</u>

Even though the desert is very hot, there are periods where rainfall forms. These storms are of a very short duration and high intensity. These lead to the occurrence of flash floods and sheet floods. These floods have a lot of energy, meaning that they have led to the development of the following features in the desert region:

Features produced by water in desert regions

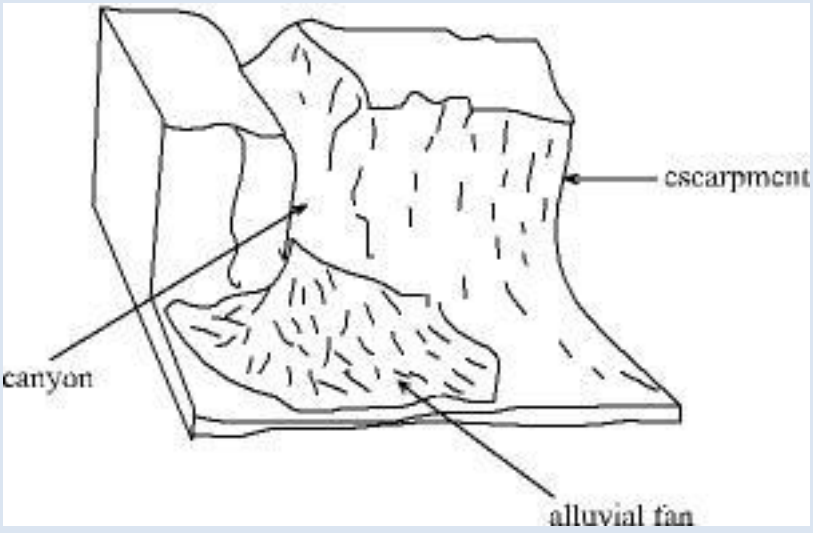
Wadis

These are steep sided valleys. They result from rare but heavy rain storms which give rise to rushing torrents on steep slopes and to sheetwash on gentle slopes. Run off on steep slopes is normally via shallow grooves called riles which connect with galleys. The galleys lead into deep, steep-sided valleys whose rocky walls rise from almost flat flows, that is wadis.

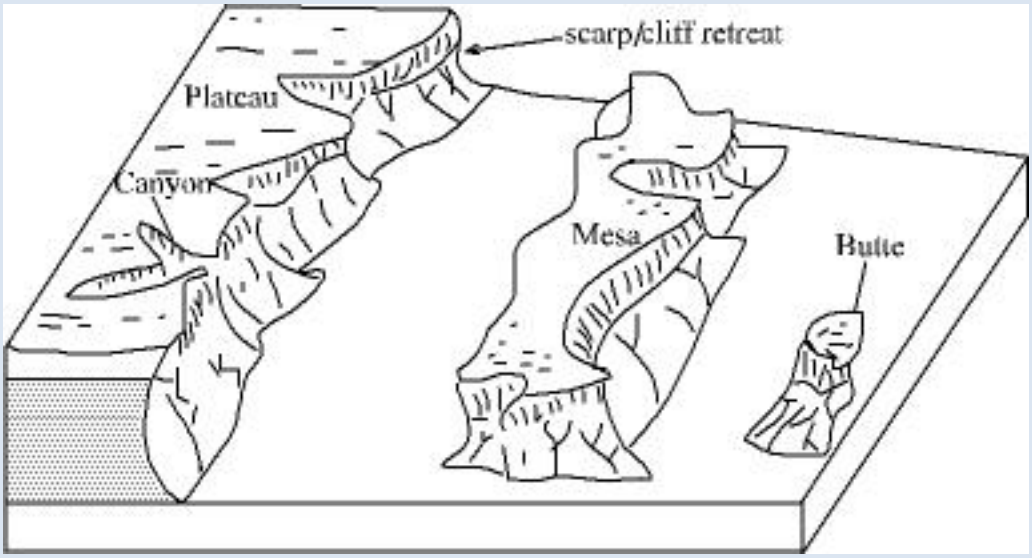


Alluvial fan

These are found within wadis and are formed by alluvial deposits.



Plateau Messas and buttes
These are outstanding uplands formed due to retreat of wad sides.



Adaptation of plants and animals to desert environment

Plants

- Have long tape roots so as to get water underground.
- Thick barks to store water .
- Thin/needle shaped leaves to reduce evapo-transpiration.
- Fur-like barks to reduce loss of water .
- Seeds lie dormant when there is no rainfall and only germinate when the rainfall is available.

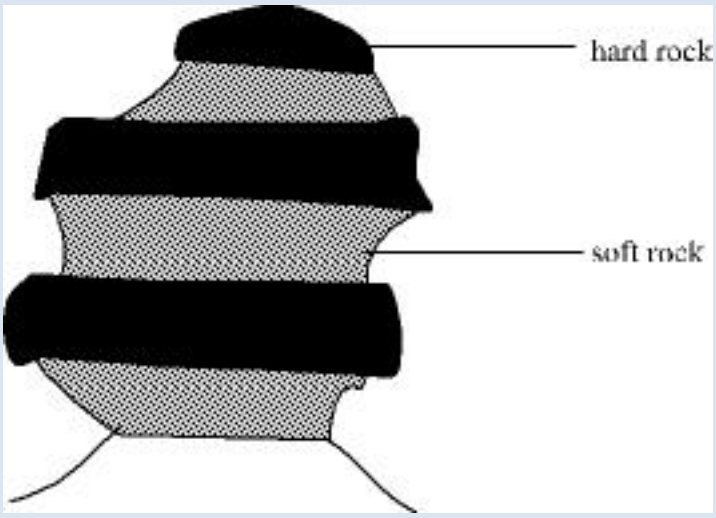
Animal

- Stay longer without rainfall.
- Store water of camels .
- Hibernate to survive severe conditions.
- Have hard or tough skins so as to survive these severe conditions .
- Have wide hooves so that they can easily walk in desert sand.

Essay Type Questions

Multiple choice

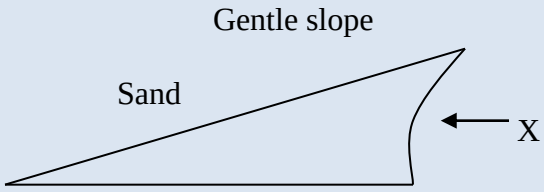
1. Study the diagrams showing a desert landform



Name the feature shown:
a) Yardang.
b) Zeugen.
c) Rock pedestal.
d) Seif dune.

2) The diagram shows a section through a desert feature:

Prevailing wind →



The process mainly responsible for the steep slope at X is:
a) Deflation
b) Abrasion
c) Eddying
d) Saltation

3) Which of these is produced by running water?
a) Wadi

b) Messa
c) Alluvial fun
d) Rock pedestal

4) Desertification is:
a) Planting of new trees in desert areas
b) Expansion of desert conditions on new areas
c) Growth of new plants in deserts
d) All of the above

5) Hot deserts are located on western sides of continents because:
a) The costs are washed by warm currents
b) There is drought all the time
c) The ITCZ is always there
d) Antyclonic conditions prevails

6) Which of the following processes usually leads to reduced visibility in hot desert
a) Deflation
b) Saltation
c) Traction
d) Suspension

7) Plants have adapted to Desert environments though:
a) Having fleshy stems
b) Having tap roots
c) Shedding leaves in winter
d) Having canopies and climbs

8) One economic activity suitable for desert regions is:
A. Sand harvesting
b) Agriculture
c) Processing Industry
d) Mining

Essay type questions
1a) Describe and explain why most deserts are found on the western side of continents?[7]
b) How has human activity increased the role of desertification (refer to known examples).[4]
2) Name three ways by which wind transports its load?[3]
b) Describe with the aid of diagrams, land forces that are formed as a result of wind transportation? [5]
c) In what ways can the landforms you have outlined in (b) above of benefit to human activities? [4]
3a) Explain briefly the effects of running water in hot deserts?[3]
b) Describe the main features of wind deposition in hot deserts?[6]
4) A lot of plants and animals have adapted to the harsh desert environment

a) Define the term adaptation? .[2]
b) Describe the various ways by which plants and animals have adapted to desert conditions.[3]
c) Have plants and animals managed to adapt effectively to desert environment? Give reasons for your answer? [4]

References

1) Bunnet R.B -Physical Geography in diagrams.
2) De Klerk , geography Module 1
3) Nhandara. Geography Today-Physical
4) Waugh D.- Geography-An integrated approach.
5) Weiss P. Focus on Geography Book 4.

CHAPTER 8

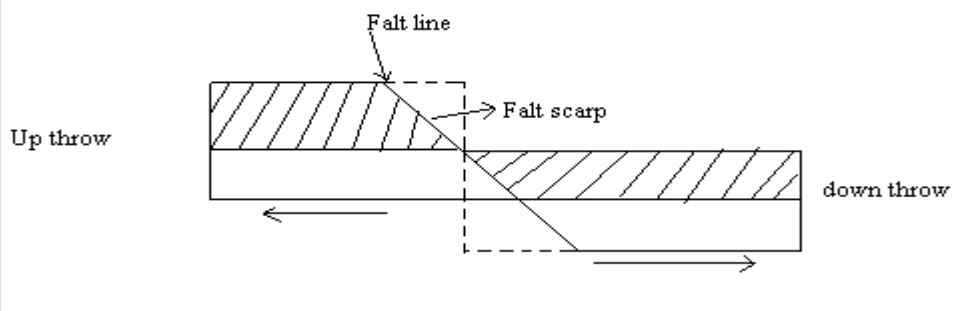
Tectonic processes and valcanicity

Chapter objectives
At the end of the chapter one should be able to:

a) Define the processes of folding and faulting.
b) Describe the main types of folds and faults.
c) Assess the role of faulting and folding in the development of global landforms.
d) Define vulcanicity and describe associated features.

Faulting
This can be defined as the breaking up or fracturing of the earth's crust due to tension or compressional force or tensional force. The crust will break or fracture, creating a line of weakness known as a fault.

Parts of a fault
The following diagram illustrates the parts of a fault:



Up throw: This is the part of the crust that is thrown up when the earth breaks or fractures.

Down throw: This is the part of the crust that moves downwards when the earth fractures.

Fault line: This is the point in the crust where the earth breaks up into two blocks.

Fault Script: Also known as the heave. Is the slope that is created due to the down throw effect of the faulting processes.

Types of faults

There are three man types of faults. Their characteristic features are outlined below:

1. **Normal Fault**
   This fault consists of a down throw and up throw. It is mainly caused by tension forces that cause parts of the crust to move apart.

2. **Reverse Fault**
   This is a fault in which one fault rides over the others, due to compressional forces. In other terms it appears as the opposite of the normal fault.

3. **Tear Fault**
   This is also known as a shear fault. It is caused by the sliding plates or by the fracturing of the earth in response to convective canoes moving in similar direction.

Self Assessment Exercise

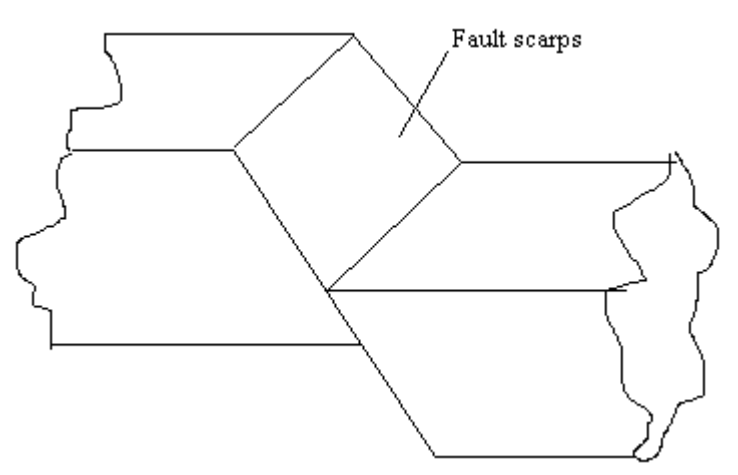
Briefly outline the differences between faulting types discussed above. Your discussion should take into account the physical appearance of each fault type and processes involved.

Faulty Landforms

The process of faulting has led to the development of a number of landforms on a global scale. Some of these landforms are outlined below:

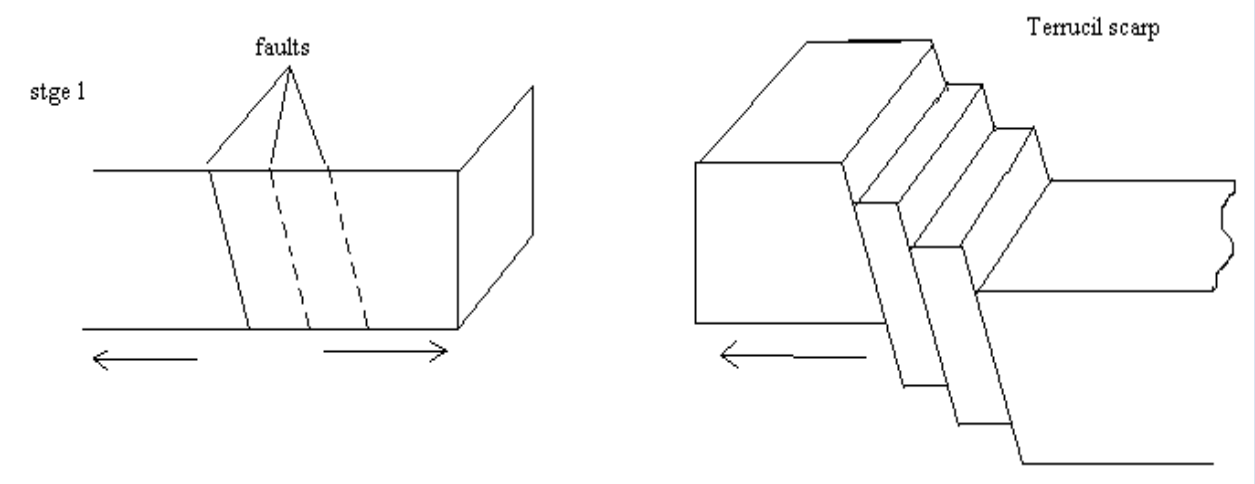
Fault Induced Scarps

These are steep slopes that have been formed as a result of vertical down throw. The slope's faces have been broken down by agents of weathering.



Tilted Blocks

This is a terraced landscape that developed due to the existence of a number of down throw crust blocks in one region. In other ways the crust will fracture and have a number of faults developing parallel to each other. When these blocks are down thrown they create a terraced structure. This is illustrated in the diagram below:



Rift valley

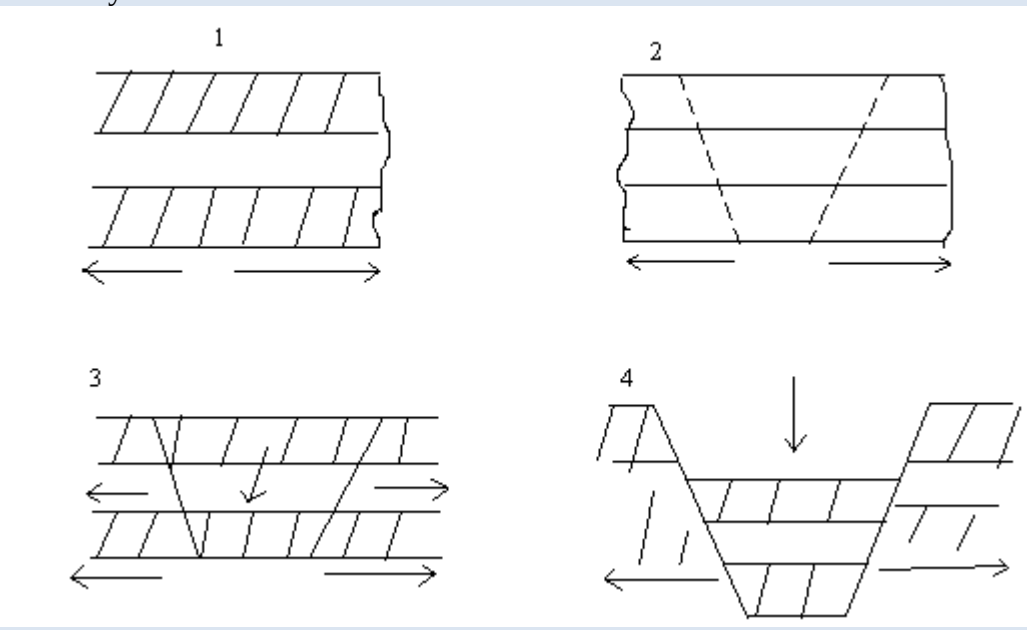
A rift valley is a low lying area characterized by steep sides rising from the flatland. The most famous is the great East African Rift Valley which cuts across East Africa and some parts of South East Africa. It is home to spectacular lakes such as Victoria, Tanganyika and Malawi among others.

Rift valley formation

The rift valley may be formed either due to compressional or tensional tectonic forces. These two theories are discussed at length below:

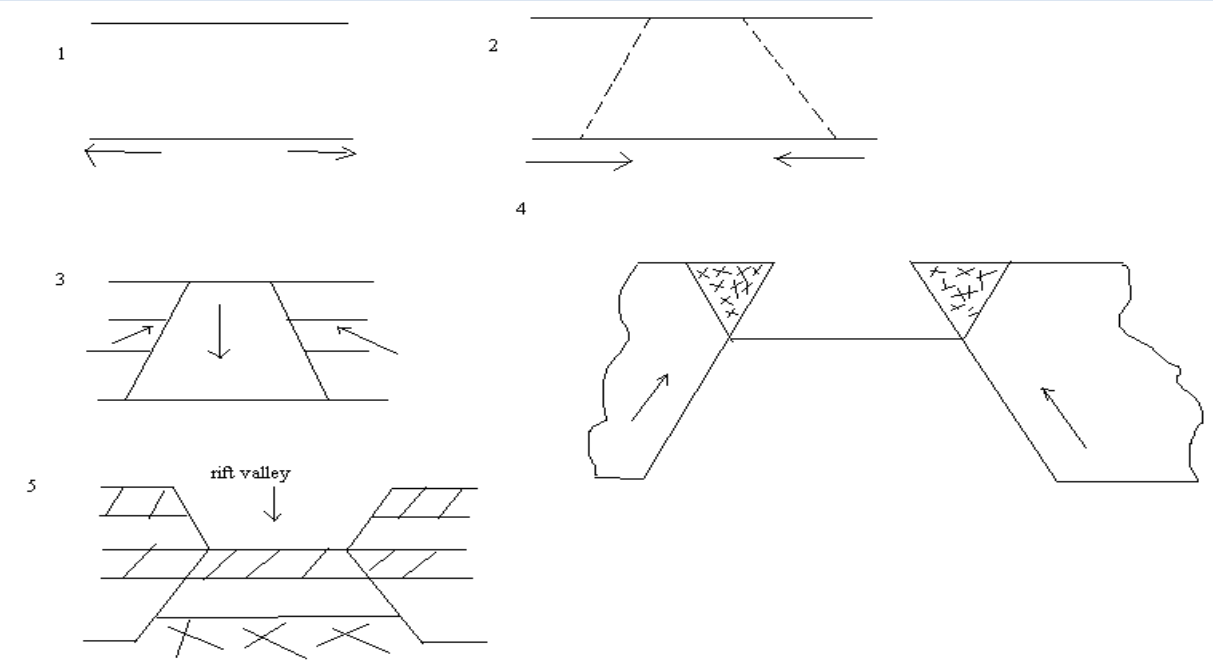
Tensional theory

This theory states that due to tensional effect of tectonic forces the crust fractures at 2 points. Further tensional force leads to the separation of the crust into 23 crystal blocks on the middle of unattached block is force to sink on subside, forming a rift valley. This process is explained diagrammatically below:



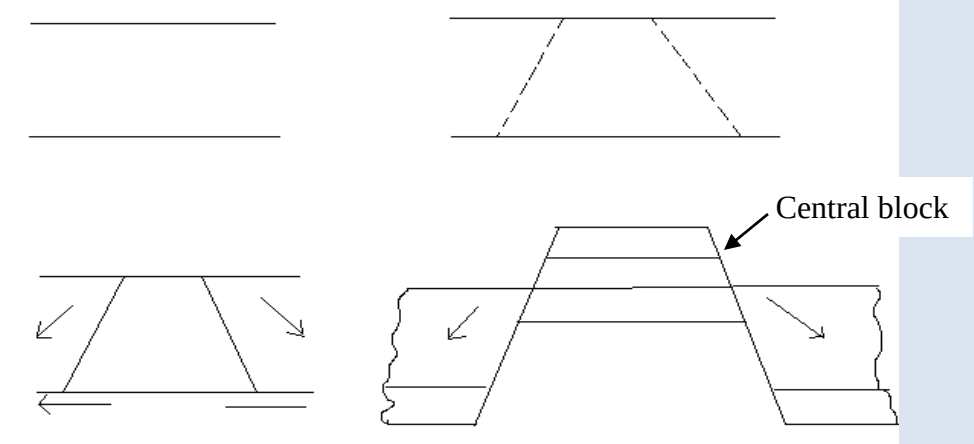
The Compressional Theory

This theory states that compressional forces operating lead to the development of parallel reverse faults. Further compressional forces subsequently lead to the breaking up of the crust into 3 blocks. Further compressional activity leads to the left and right crystal blocks sliding over the central block, further forcing it down. Agents of weathering and erosion eroded the edges of the other blocks and aligned them to the characteristic nature of rift valley sides. This can be illustrated diagrammatically as shown below:



Block Mountain

This is also known as a horst. It is a high rising area of land with steep sides (more of a high rising plateau). Block mountains are formed in the same manner as the tensional theory involved in the formation of Rift Valleys. However instead of the central crystal block sinking, other adjacent blocks slide downward, leaving the central block to be up standing. This is illustrating below:



Revision exercises

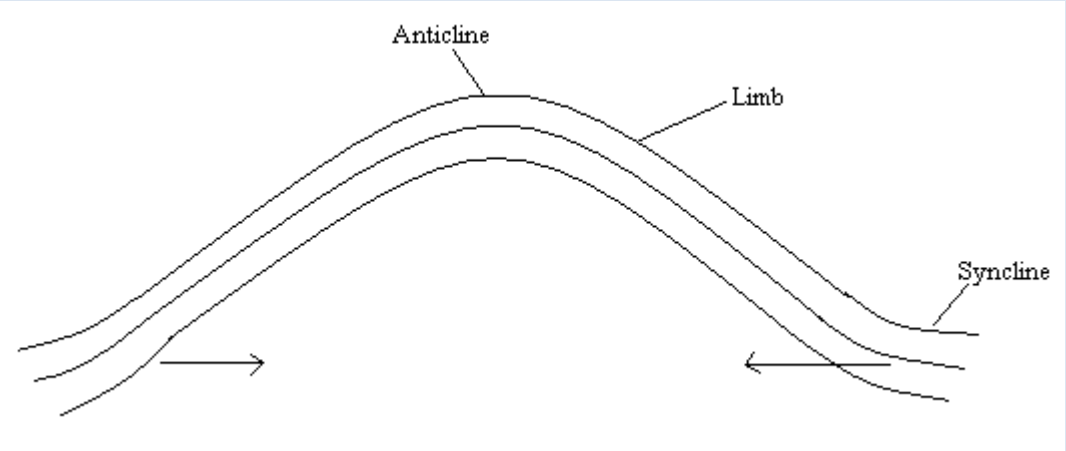
a) Using the tensional theory as a point of references, describe in your own words how a block mountain is formed.
b) What are the benefits and demerits of people living in the rift valley or area characterized by Block Mountains? Your answer should make reference to specific examples.
c) How can the hazard you have outlined in (b) overcome?

Folding

Folding can be defined as the bending upwards or downwards of the earth's crust due to compressional forces. This process of bending is referred to as warping.

Parts of a fold

The following diagrams illustrates the main parts of a fold:



Anticline: This is the upper part of the fold. It is also known as the up fold, or the crest.

Syncline: This is the lower part of a fold, also referred to as the down fold or trough.

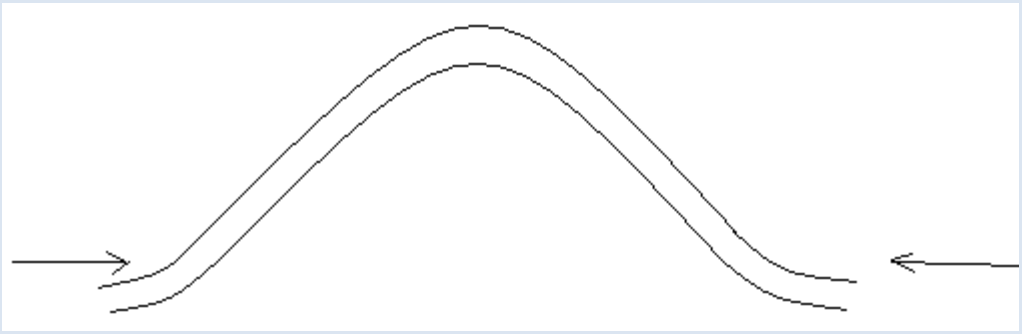
Limb: This is the side of the fold that links the crest to the trough.

Types of Folds

Folds may come in many different forms and types, but the most common are outlined bellow:

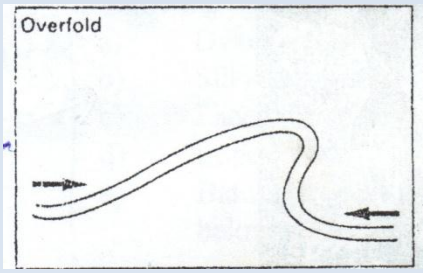
Simple Folds

This fold has equal limbs and a centralized crest. It is formed when equal forces of compression operate within a given piece of land. This will force the crust to bulge upwards.



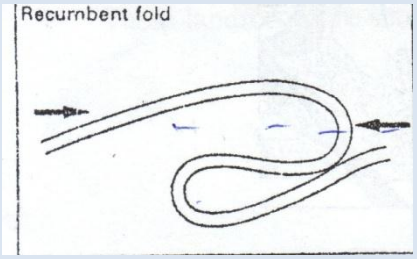
Over fold

This type of fold occurs when unequal forces of compression are exerted on a piece of crust. This forces one limb to be longer than the other. Also the crest is aligned towards the side of less force being exerted as shown in the diagram below;



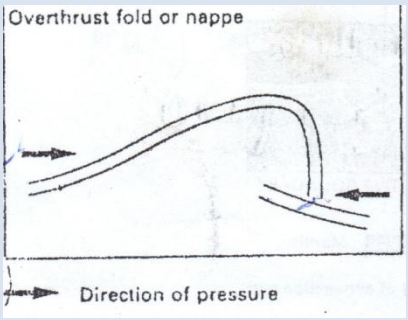
Recumbent Fold

This is a type of fold formed due to continuous excessive compression force being exerted on one side of the fold. This causes the crust to ride over the fold as shown below;



Over thrust Fold/ Nappe

This type of fold occurs when the fold, due to excessive force, has broken off from the continuous Patten. Thus the other limb breathes off and over rides the surface. Hence, as the name suggests, the fold has over thrust itself such that the other limb has broken off as shown in the diagram below;



Folding Landforms

Folding is associated with the formation of Fold Mountains. These are formed in a number of ways. The main ones are outlined below;

a) Tectonic convergence at destructive plate margins.
b) Tectonic convergence at collision zones

Summary point

Forces of compression and tension create some stresses within the earth's crust causing breakages or cracks known as faults. Magma from deep within the earth is at times formed into these cracks, and if these cracks extend to the surface, the magma will flow onto the surface. If these faults do not extend onto the surface, then magma will accumulate within the crust.

Vulcanicity can therefore be defined as the process by which magma enters the surface. It can be intrusive, when the magma has failed to reach the surface, or extrusive when the magma has reached the surface. When magma reaches the surface it is known as Lava.

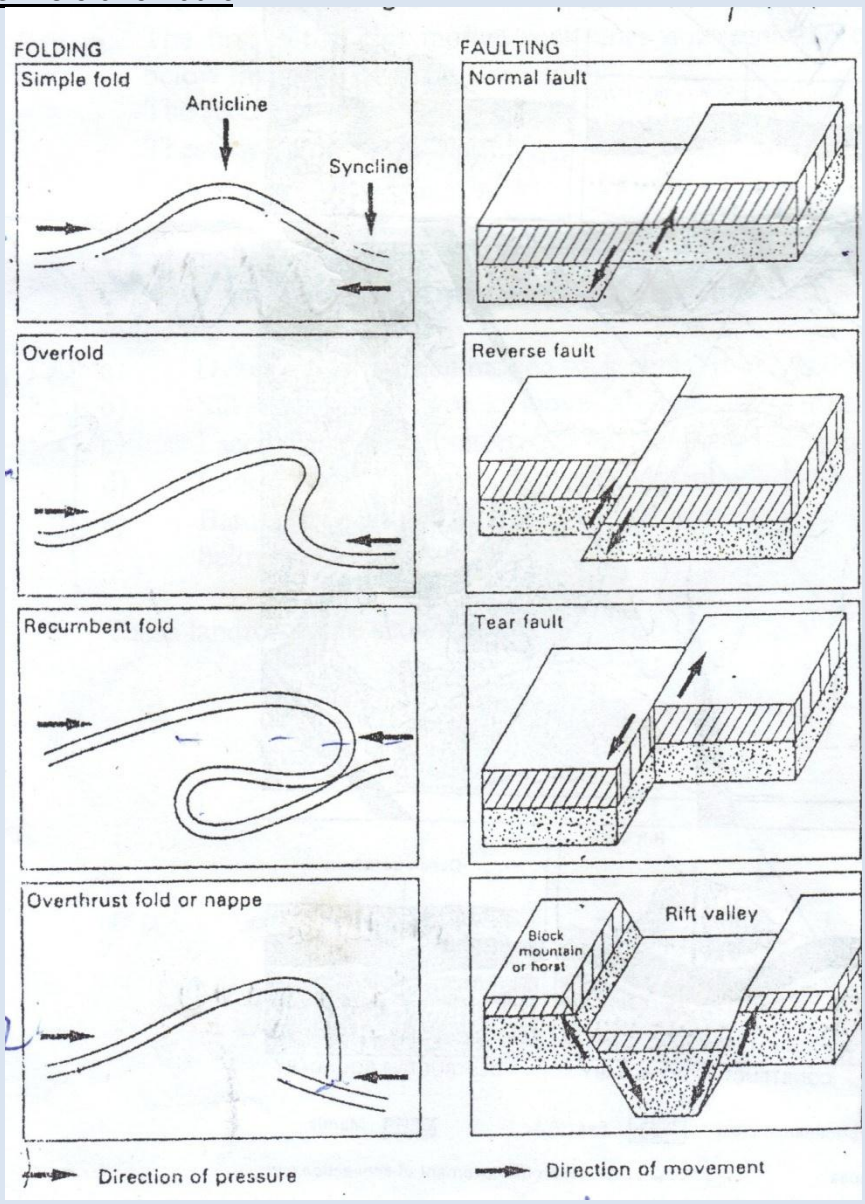
Revision question

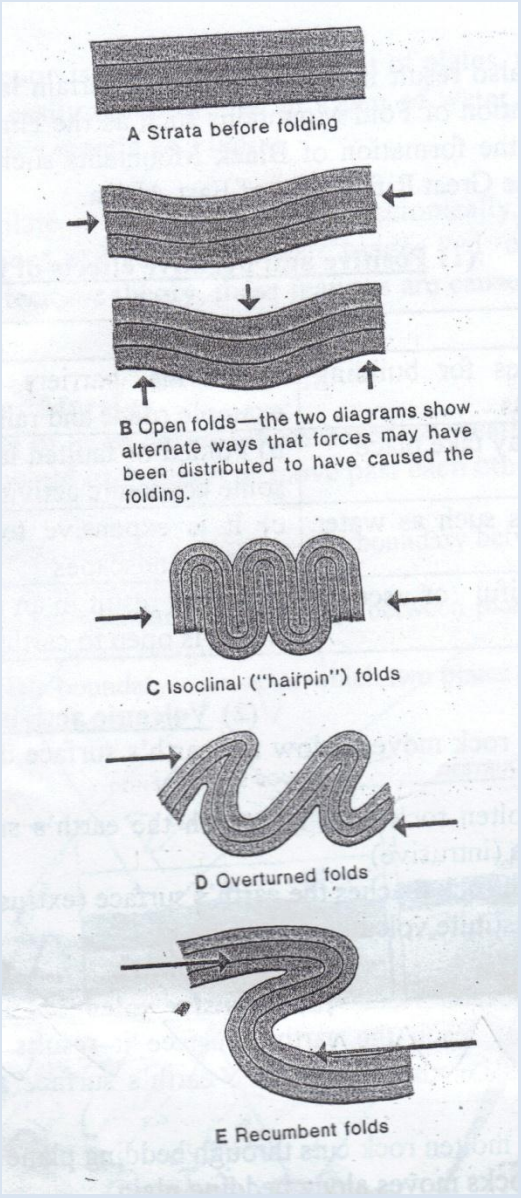
Explain, in your own words, the differences between intrusive and extrusive vulcanicity.

Features of Intrusive Vulcanicity

When the magma intruded into the crust, it cools leading to a rise to a number of features that were later exposed by erosion. Those are outlined below.

Types of Fold and Fault





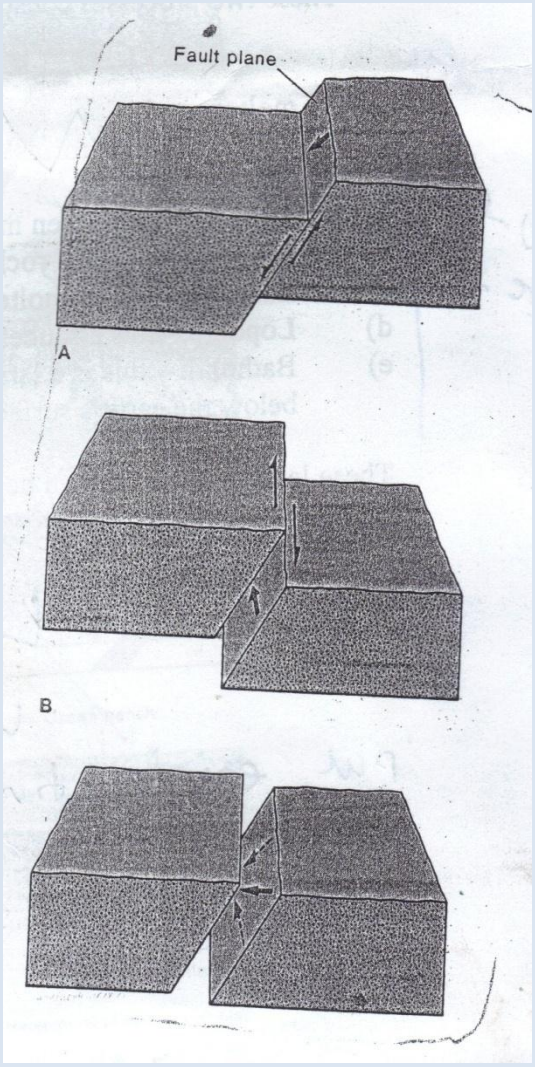
A Strata before folding

B Open folds—the two diagrams show alternate ways that forces may have been distributed to have caused the folding.

C Isoclinal ("hairpin") folds

D Overturned folds

E Recumbent folds



Folding and faulting may also result in the formation of certain landforms, for examples, folding results in the formation of Fold Mountains such as the Himalayas Mountains in India. Faulting results in the formation of Black Mountains such as the Sinai, it also forms rift valleys such as the Great Rift Valley of East Africa.

Positive and negative effects of folding and faulting

Positive	Negative
a) May provide good sites for building hydro-electric power stations.	Form barriers to movement, for example, roads and railways.
b) Recreational activities may take place.	Folded or faulted land is not suitable for some economic activities such as farming.
c) May form tourist features such as water falls.	It is expensive to build on folded or faulted landscape.
d) May result in beautiful or scenic landscapes.	It may result in an unstable environment which is open to earthquakes.

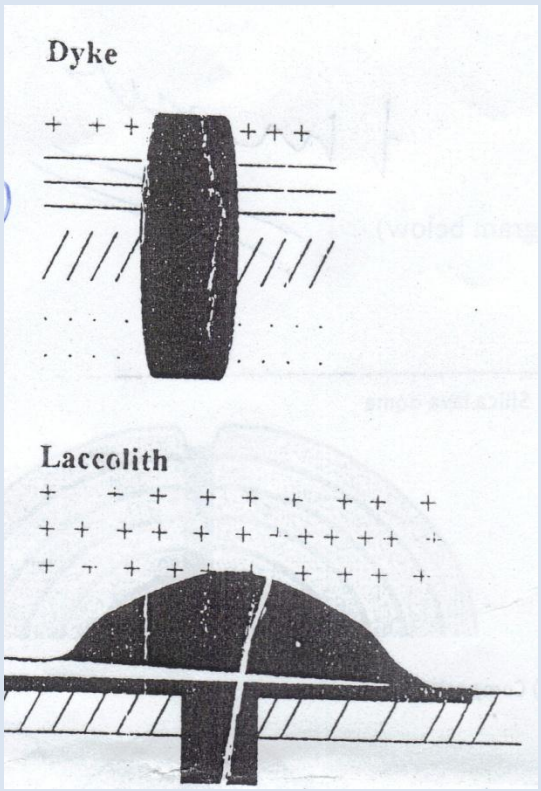
Volcanic Activities

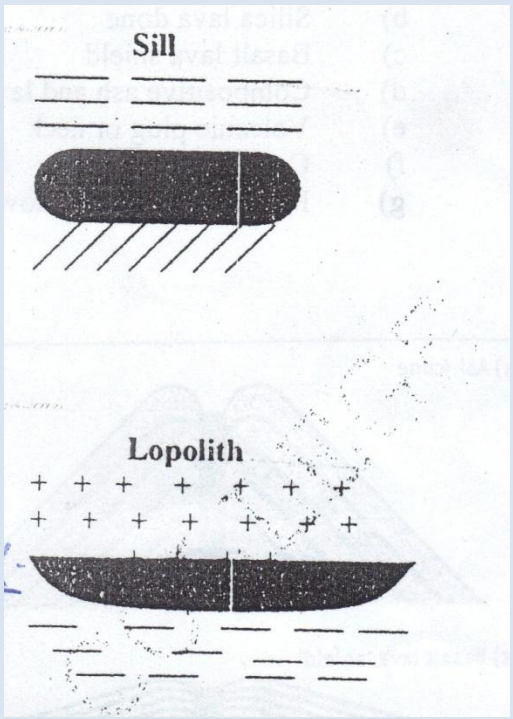
-When molten material/rock moves below the earth's surface onto the earth's crust, two main things happen.
-The first is that this molten rock does not reach the earth's surface i.e. it remains below the earth's surface (intrusive).
-The second is that molten rock reaches the earth's surface (extrusive)
-These two processes constitute the so called volcanic activities.

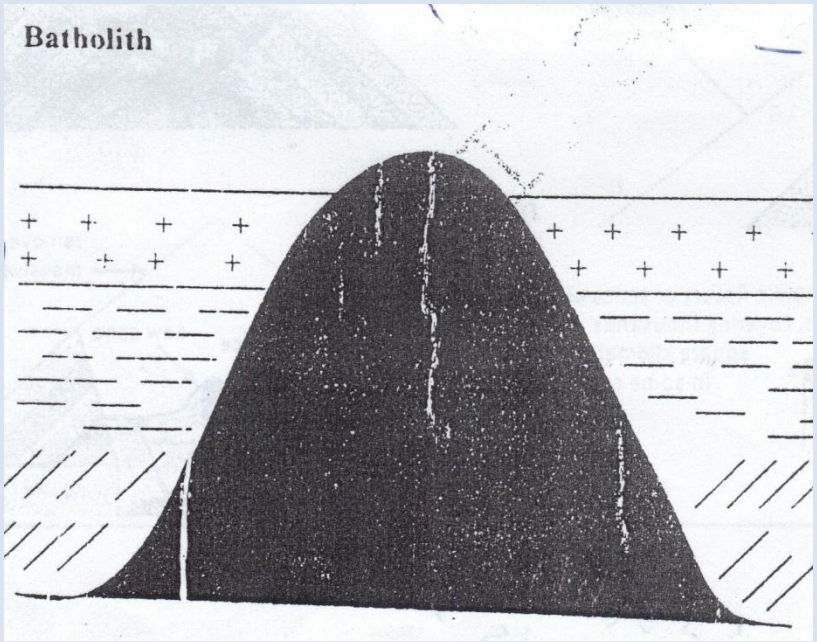
Intrusive volcanic landforms

a) Dykes: – this is when molten rock cuts through bedding plane
b) Sill :– when molten rocks moves along bedding plain.
c) Laccolith: – when molten rock move along the bedding plain and pushes upwards.
d) Lopolith :– this is a sauce shaped landform which develops along a bedding planes
e) Batholith :– this is a large scale mass of magma or molten rock which accumulates below the earth's surface.

These landforms are shown below:



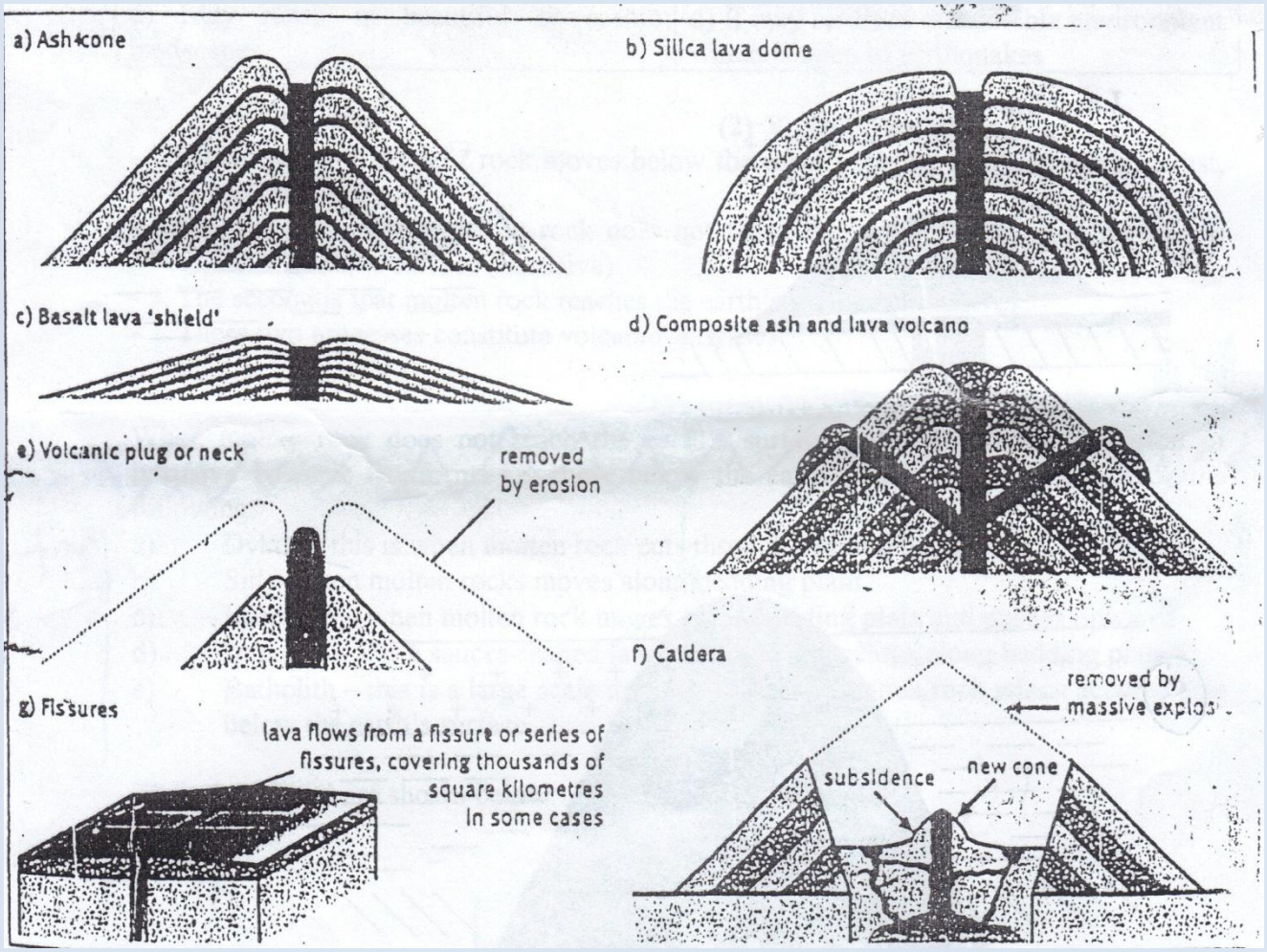




Extrusive Volcanic Landforms

When molten rock/magma reaches the earth's surface it is called lava. Extrusive volcanic landforms therefore develop when there are volcanic eruptions onto the earth's surface. When this happens different types of landforms are formed, such as:

a) The ash cone
b) Silica lava dome
c) Basalt lava shield
d) Compositive ash and lava volcano
e) Volcanic plug or neck
f) Caldera
g) Fissures (these are shown in the diagram below).

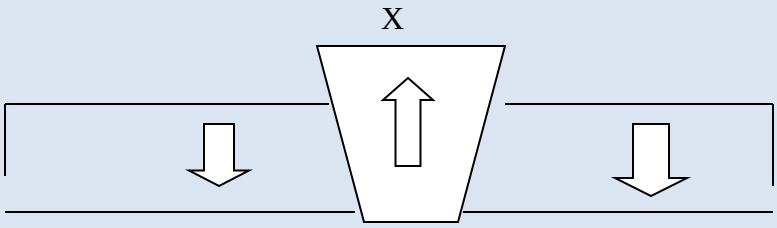


Examination Types Questions
Multiple Choice

1. Igneous rocks;

a) Are primary rocks formed from cooling of magma in the earth's crust?
b) Are secondary rocks formed from cooling of magma in the earth's crust?
c) Rocks formed under great heat and pressure
d) Rocks formed due to deposition of sediments over a long period of time.

2)



Feature x is
a) A rift valley
b) A Block mountain
c) A reverse faults
d) All of the above

3) Intrusive vulcanicity is responsible for the formation of the following except:
a) Dyke
b) Sill
c) Lava plain
d) Batholiths

4) **An example of sedimentary rocks is**
a) Sandstone
b) Limestone
c) Shale
d) All of the above

5) Faulting may be a result of
a) Tensional forces
b) Compression forces
c) Compression and tensional forces
d) None of the above

6) The great dyke in Zimbabwe was formed due to
a) Deposition of magma into the crust.
b) Vertical intrusion of magma into the crust and subsequent erosions of weaker rocks
c) Lateral intrusion of magma into the crust and subsequent erosion of weaker rocks
d) Deposition of magma onto the earth crust.

7) Communities living in the great dyke benefit from:
a) Farming activities
b) Fishing activities
c) Mining activities
d) Forestry activities

8) One disadvantage of volcanic eruption is
a) Magma is rich in minerals

b) It leads to the formation of relief rainfall
c) Eruptions are tourist attractions
d) Lives are lost

Essay Type Questions

1a) With the aid of diagram, explain the main components of a volcano.[5]
b) Briefly explain the forces responsible for the development of a volcano [4]

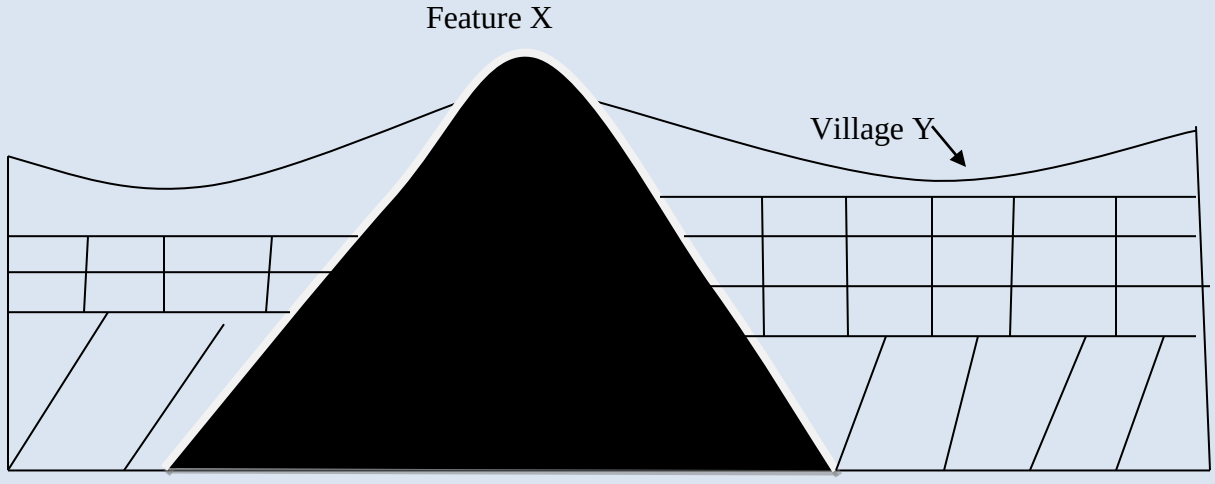
2) Draw diagrams to explain the formation of different types of volcanoes.[7]
3) Study the tables below and answer questions that follow
Volcanic eruption and damages incurred in area X over a period of time

Eruption	Houses destroyed	Lives lost
a) 1930	200 000	250 000
b) 1945	150 000	100 000
c) 1975	50 000	25 000
d) 1990	10 000	3 000

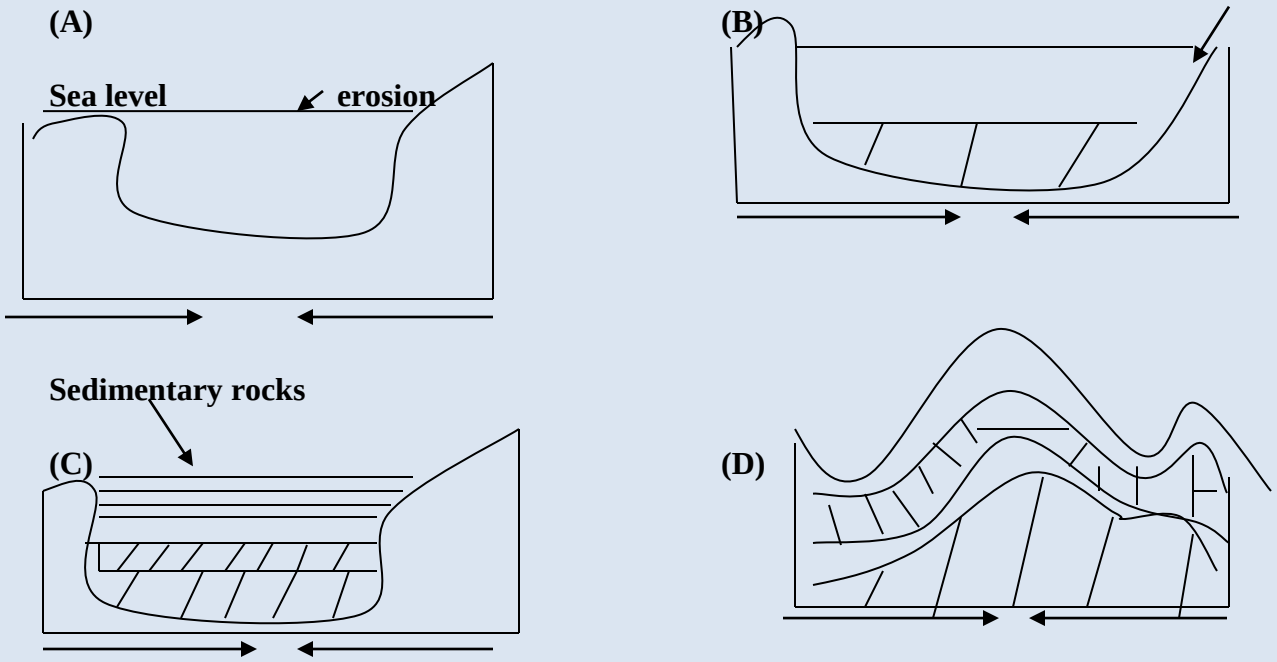
a) Explain the terms- Active volcano.[2]
: - Dormant volcano.[2]
-: Extinct volcano.[2]

b) Describe and explain the changes shown in the table. [7]
c) Describe other effects of volcanic eruption that are not shown in the table. [3]

4. Study the diagram and answer questions that follow:



a) Name of feature x.[1]
b) Describe and explain how feature x was formed. [7]
c) Briefly explain the advantages and disadvantages of feature x on village Y.[4]
5) Study the following illustration and answer questions that follow



a) Give two examples of Fold Mountains you have studied. [2]
b) Describe and explain the changes that have taken place from.
A- D. [7]

c) Explain the consequences of the development of the fold mountains on the natural ecosystem of the area.[4]

References

6) Bunnett R.B. Physical Geography in diagrams
7) McGary and Plummer Physical Geology
8) Nhandara. Geography Today-Physical
9) Small R.J Geomorphology and Hydrology
10) Weiss P Focus on Geography Book 3.

CHAPTER 9

RIVER PROCESSES

Chapter objectives
At the end of this chapter one should be able to:-

a) Describe the main processes of river transportation.
b) Outline the nature of channel profile in different parts of the river's course.
c) Describe the main processes operating in different parts of the river.
d) Account for the development of landforms associated with river processes.
e) Examine the causes and effects of flooding.
f) Evaluate the role of river systems in given communities.

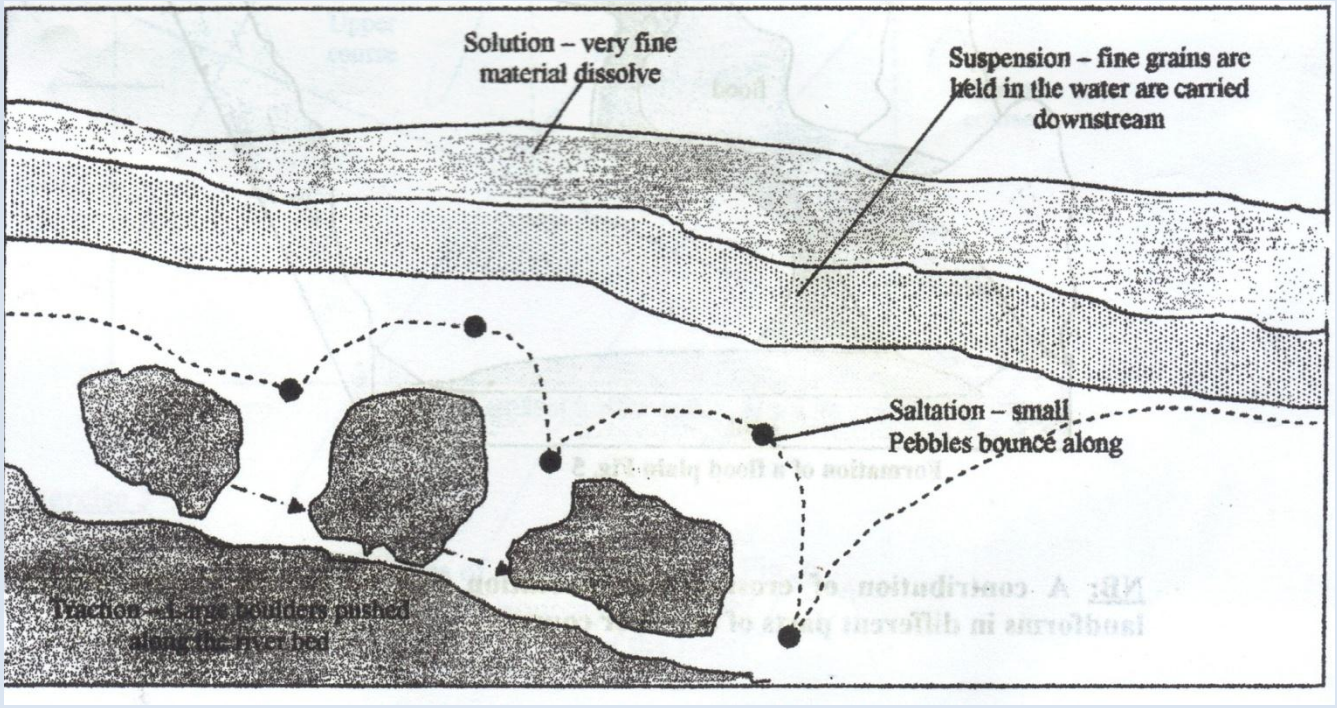
In a confined channel, rivers derive their energy from gradient. This means that water flows from a highland to a lowland due to forces of gravity. Secondly it needs to overcome the tension with the ground (i.e. the river bed and banks). Thirdly the volume of water within the channel leads to increase of velocity. The water in the upper part of the river pushes the water downstream giving the river further ability to transports its load.

Hydraulic Action
Water is very heavy. The huge volume of moving water in a river has the energy to move all loose material in its path and weaken solid rock by forcing its way into cracks. Hydraulic action is usually most active in the high mountains near the source of the river. At this stage the river does carry a load so there is not carry a load so there is not much erosion by other processes.

Corrasion
This is the erosion of the sides and bottom of the Valley by the load of river. Rocks and stones scrape the side and bottom of the valley as the water follows downstream.
In the mountains, large boulders can become stuck in cracks in the rocks. The fast flowing water causes the boulders to spin round and round and wear away a hole in the river bed i.e. a pothole.

Corrosion
Certain types of rock such as chalk and limestone dissolve when they react with acidic rock. This is called corrosion.

Attrition
This is the wearing down of the load. Large boulders continuously rub against reach other and water down into stones. By the time a river flows into the sea, its load consists entirely of tine – gained sand and silt.



Exercise 2

1. Name four ways in which a river transports its load.
2. Water in a river is usually clear and sparking in the mountain but often brown in the lowlands. Explain this in terms of transport.

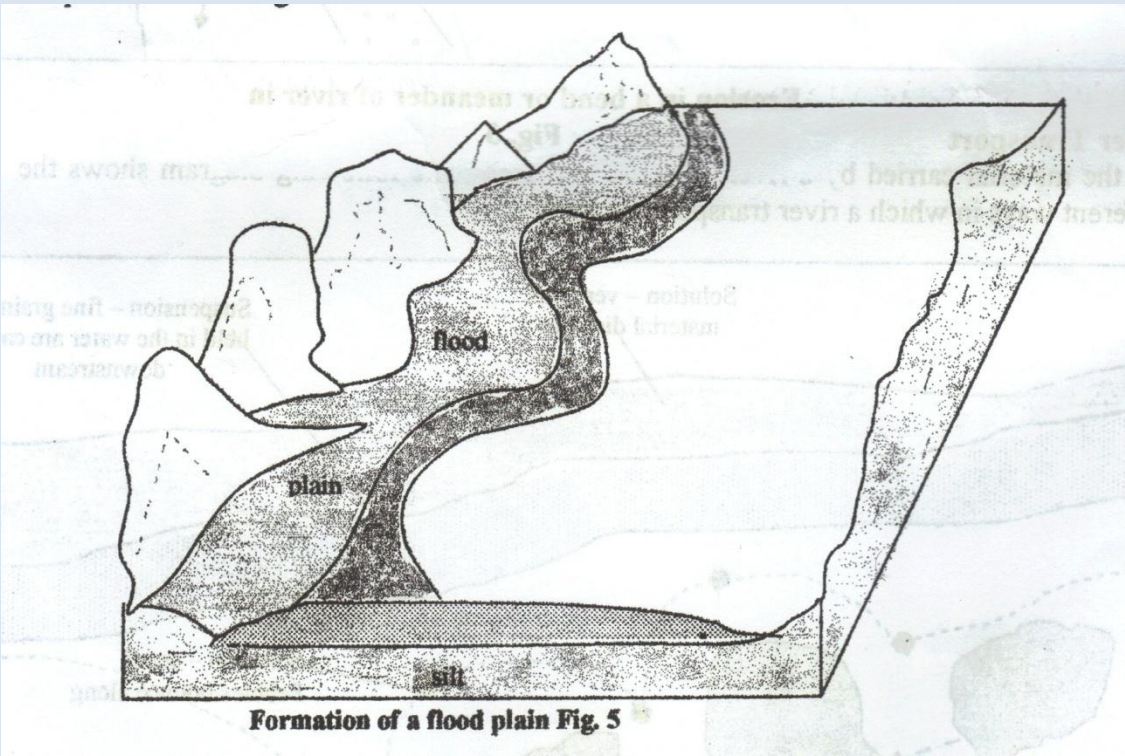
River Deposition

Deposition takes place when a river no longer has energy to carry its load. The load is constantly being transported and deposited and then transported and deposited again. In this way the load makes its way downstream. The heaviest material is deposited first, then the finer grained material and lastly the fine sediments called silt.

When water flows round a meander the water on the outside of the bend flows just and erodes the bank but the water on the inside of the bed flows very slowly and deposits its load.

In the lower course of a river flood plain is built up of deposited material. When a river is in flood a large part of the river water spreads over the land on either side of the valley.

The river deposits a layer of silt all over the flood plain. Over the years the layers build up as shown in Fig. 5 below:

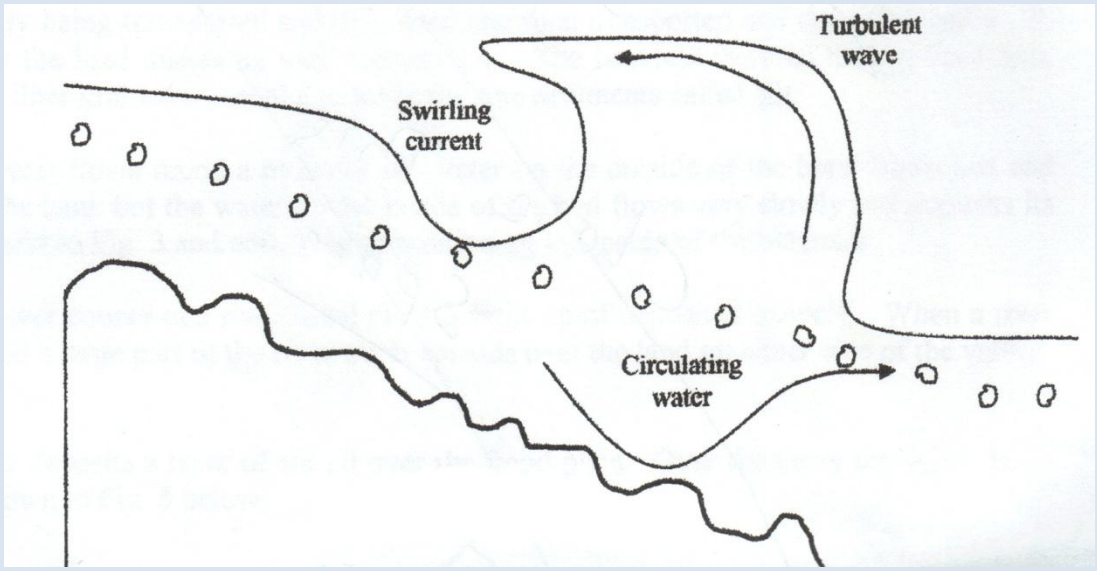


Formation of a flood plain Fig. 5

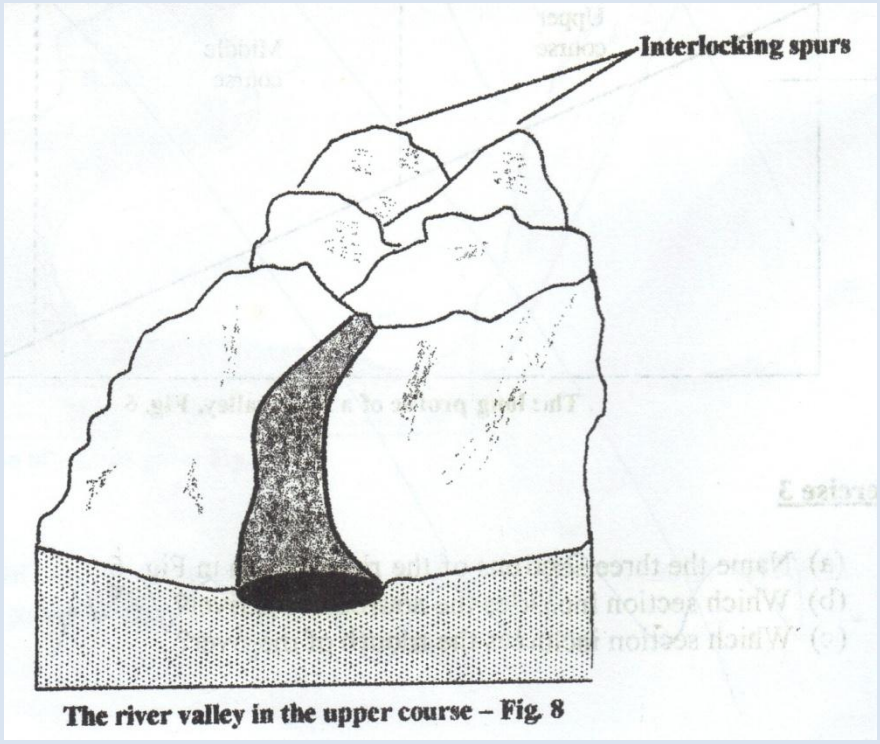
NB: A contribution of erosion, transportation and deposition results different landforms in different parts of the river course.

Landforms in the Upper Course

In its upper course a river has high energy since in flows down a steep gradient. The rocky floor and sides of the valley are known and cause friction. The water has to overcome this friction and tends to flow in a circular way with lots of splashes and eddies. This is called turbulent flow.



The river flows around rocks and boulders in its path making a winding course. Over time the bends become more pronounced since water flows more quickly on the outside the bends. Eventually this causes pieces of land called spurs to interlock.

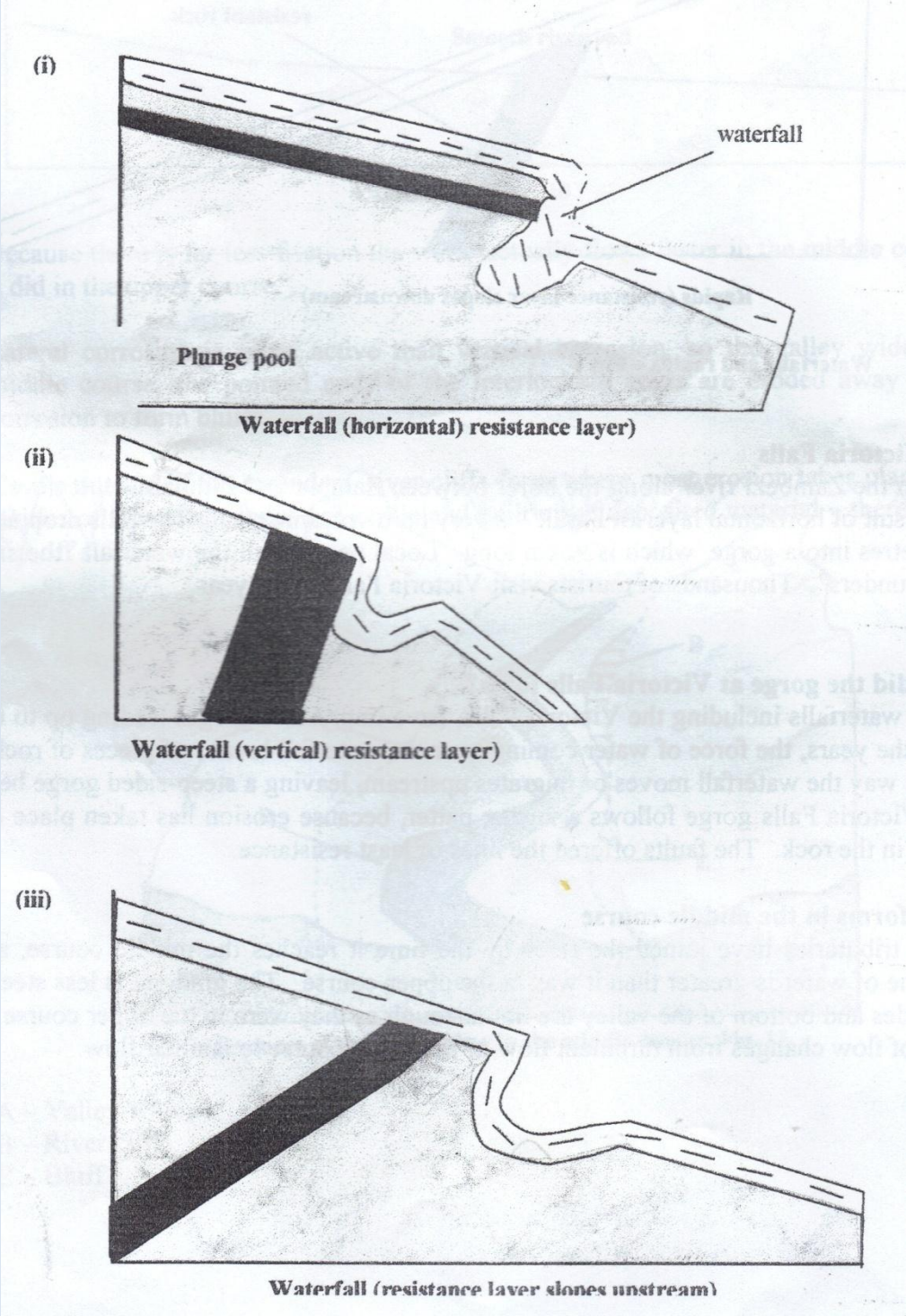


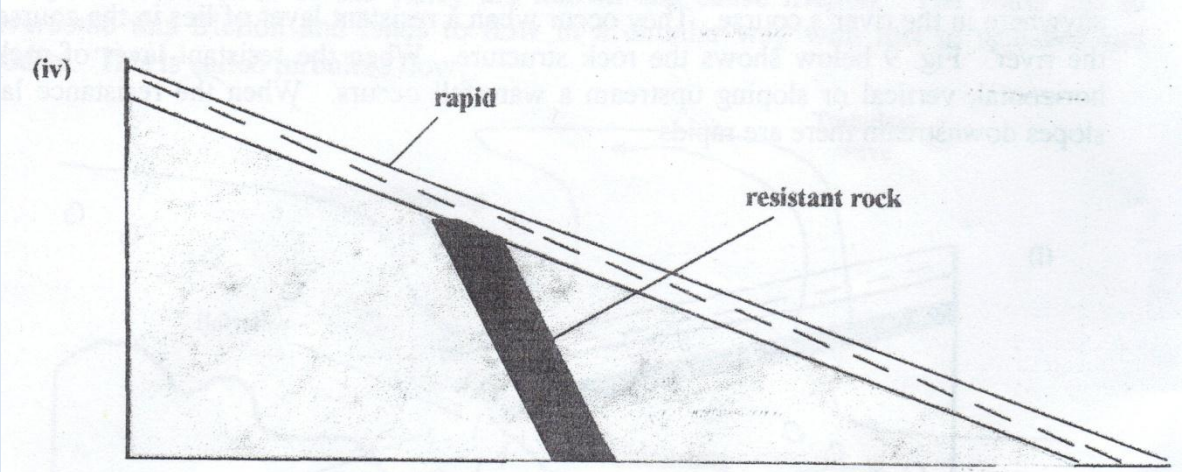
The river valley in the upper course – Fig. 8

Waterfalls and rapids

Waterfalls and rapids are most common in the upper course, although they can occur anywhere in the river's course. They occur when a resistant layer of lies in the course of the river. Fig. 9

below shows the rock structure. When the resistant layer of rock is horizontal, vertical or sloping upstream a waterfall occurs. When the resistance layer slopes downstream there are rapids.





Rapids (resistance layer slopes downstream)

Waterfalls and rapids – Fig. 9

The Victoria Falls

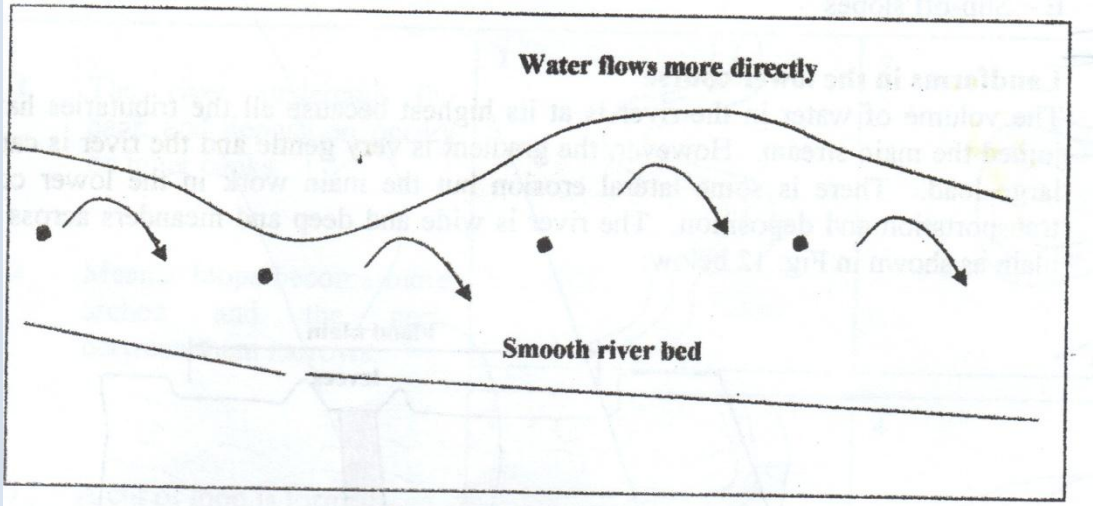
It is on the Zambezi river along the border between Zambia and Zimbabwe. It developed as a result of horizontal layer of basalt – a very had volcanic rock. The falls drop almost 110metres into a gorge, which is 96km long. Local people call the waterfall 'the smoke that thunders'. Thousands of tourists visit Victoria Falls every year.

How did the gorge at Victoria Falls form?

Many waterfalls including the Victoria Falls, have impressive gorges leading up to them. Over the year, the force of water coming over the waterfall breaks of pieces of rock and in this way the waterfall moves or migrates upstream, leaving a steep-sided gorge behind. The Victoria Falls gorge follows a zigzag pattern, because erosion has taken place along faults in the rock. The faults offered the lines of least resistance.

Landforms in the middle course

More tributaries have joined the river by the time it reaches the middle course, so the volume of water is greater than it was in the upper course. The gradient is less steep and the sides and bottom of the valley are not as rough as they were in the upper course. The type of flow changes from turbulent flow of the upper course to laminar flow.

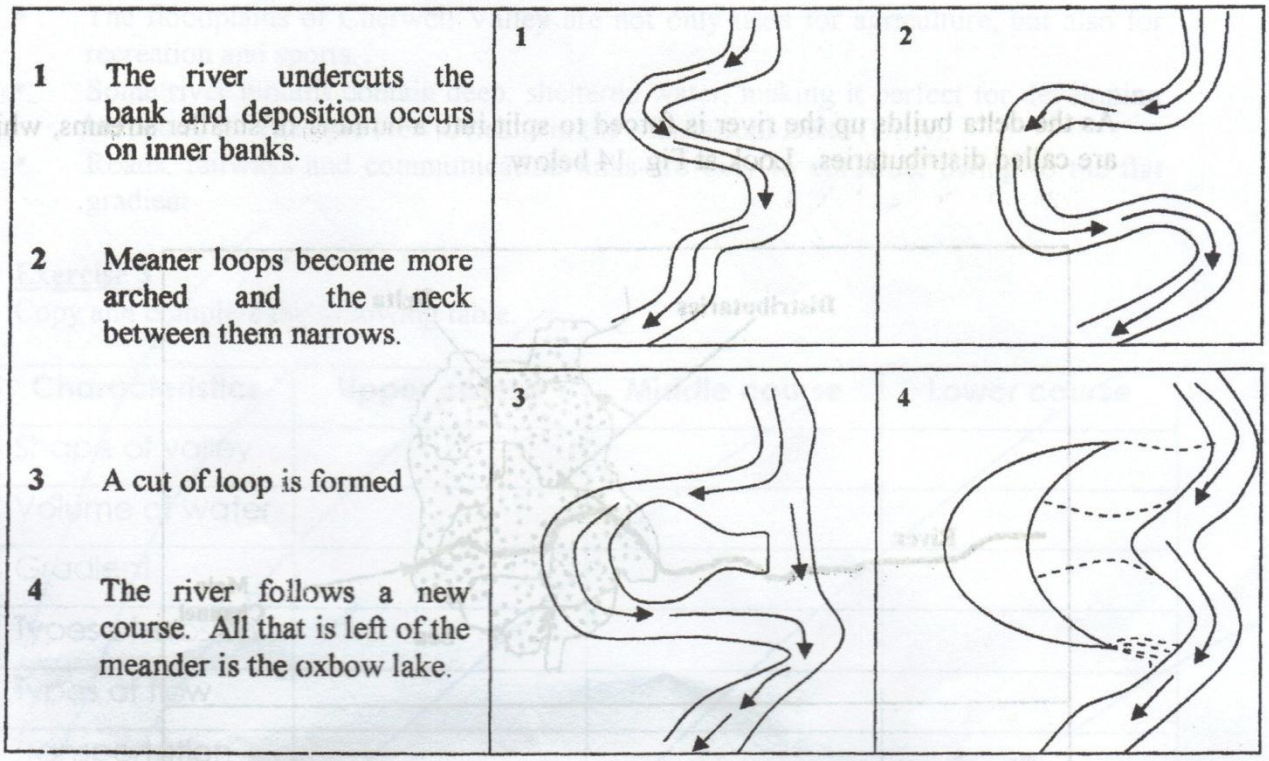


Laminar flow Fig. 10

Because there is far less friction the water actually flows faster in the middle course than it did in the upper course.

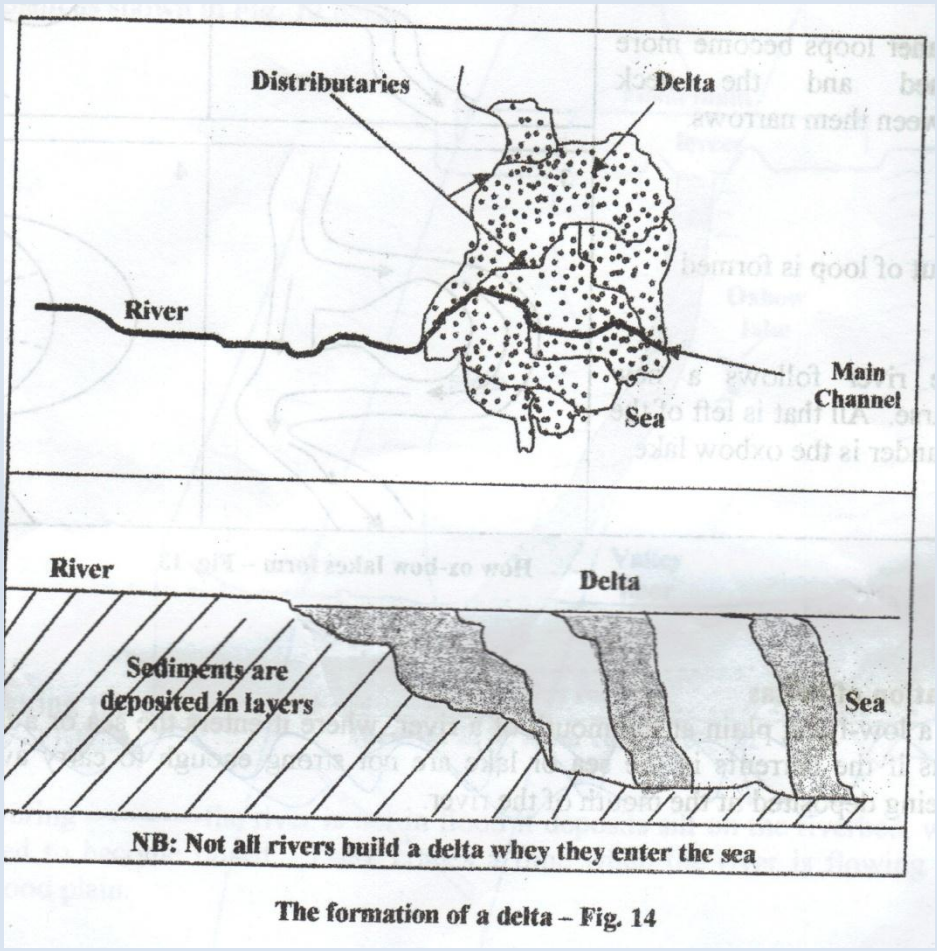
Lateral corrosion is more active than vertical corrosion, so the valley widens in the middle course, the pointed ends of the interlocking spurs are eroded away by lateral corrosion to form bluffs.

A- Valley widens
B- River Cliffs
C- Bluff
D- Meander
E- Slip-off slopes



How ox-bow lakes form – Fig. 13

As the delta builds up the river is forced to split into a number of smaller streams, which are called distributaries. Look at fig 14 below:



The formation of a delta – Fig. 14

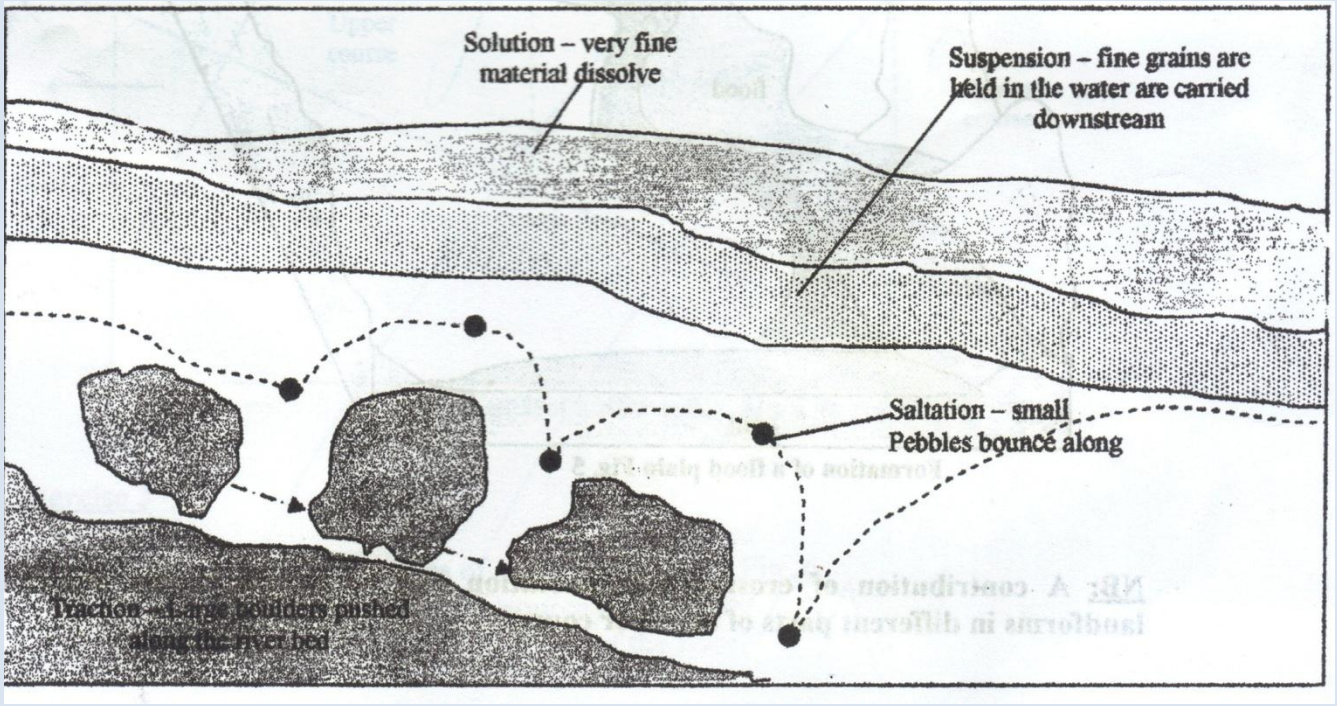
The benefits with the utilization and management of resources in wetland areas such as floodplains and deltas:

- Flood plains and deltas are very fertile as a result of the deposition of aluminum, and are excellent for agriculture, for example the areas surrounding the Nile River.
- The deltas of Youngtze – Kiang (China), Red River (Vietnam), Mokeng (Vietnam) and Indus (West Pakistan) are very important agricultural areas and are used for rice growing.
- The Hwang Ho Flood plains are farmed intensively due to the fertility of the soil.
- Certain riverine plains, for examples, the Nile, Tigris, Euphrates and Indus offer good sites for settlement.
- In Asia, flood plains are densely populated because they offer favourable settlement sites.
- Floodplains are also suitable for recreational purposes, foe example the floodplain in the river Thames in the UK.
- The floodplains of Cherwell Valley are not only used for agriculture, but also for recreation and sports.

- Some river mouths contain deep, sheltered water, making it perfect for developing harbours, for example New Orleans in the Mississippi Delta (USA).
- Roads, railways and communication links are easy to construct owing to the flat gradient.

River transportation

Transportation refers to all material carried by the river. This is referred to as river load. The diagram below summarizes the different ways in which the river transports its load.



1. Solution: This is load that is dissolved in water.

2. Suspension: This is load that floats or is suspended within a river channel.

3. Siltation: Some materials cannot be suspended in water all the time. Neither can they be drugged along the river bed. Therefore such materials bounce along the river channel. i.e. there are points when they are dragged on the bed and points where they are suspended.

Revision Exercise

Discuss the nature of particles that are likely to be transported by the processes outlined above.

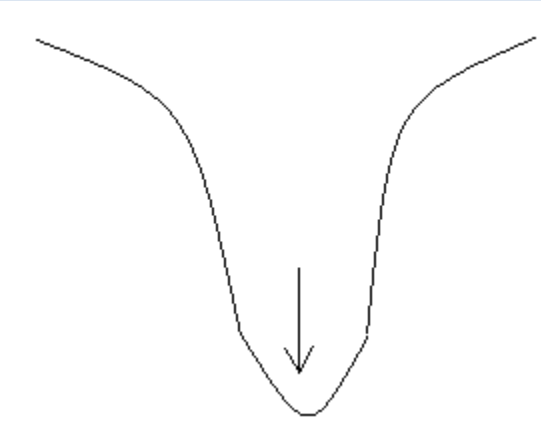
River erosion

Erosion refers to the eating away of the river channel. The load carried by the river gives it the ability to erode its channel. This is further aided by the availability of a suitable gradient. For example when you are running downhill you gather more energy than when running on a flat plain. Therefore water flowing over steep areas has got a greater ability to erode than water flowing over gently sloping areas.

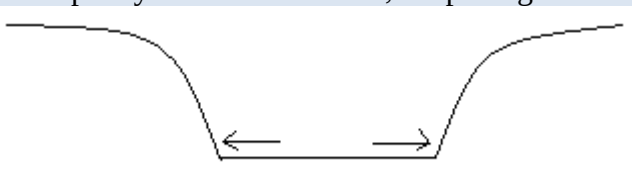
The main processes of river erosion are outlined below:

Types of erosion

Vertical erosion: This is when the river erodes its channel vertically, deepening its valley as shown below.



Vertical erosion is mainly a result of a river flowing over a steep area. Thus water will have the capacity to cut downwards, deepening the river channel.



Lateral erosion,

is mainly caused by a general drop in gradient coupled with increase in volume of water as well as load. The river will be forced to expand its banks in order to accommodate increased discharge.

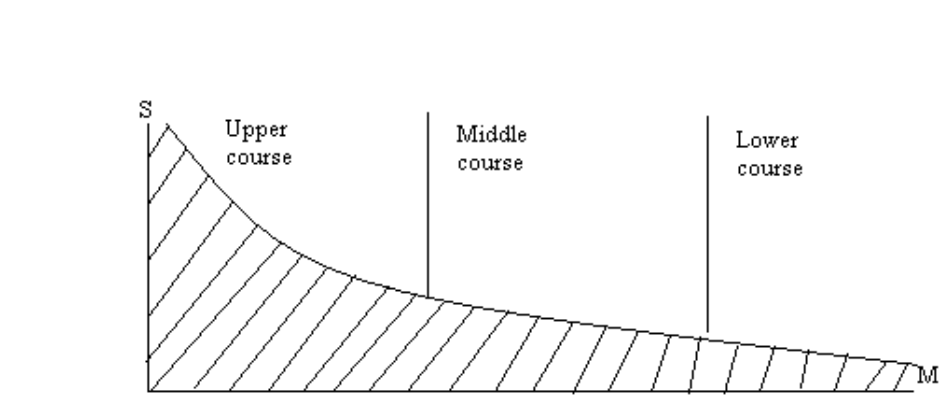
Head ward erosion: This is the bacterial cutting away of the river at its source. This leads to the river increasing its length.

River profiles

River profiling involves the study of the nature of a river from source to mouth as well as from bank to bank.

River long profile

This refers to the flow of the river from its source to its mouth. The river's long profile can be divided into 3 sections along a concave profile as shown below:

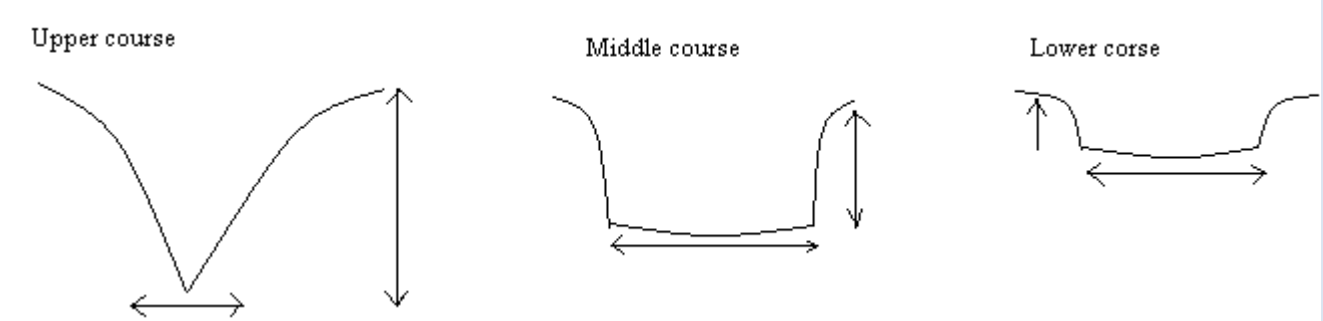


The intensity of various river processes varies within the 3 courses. As such different landforms are developed.

Landforms in the upper course:

River Cross Profile

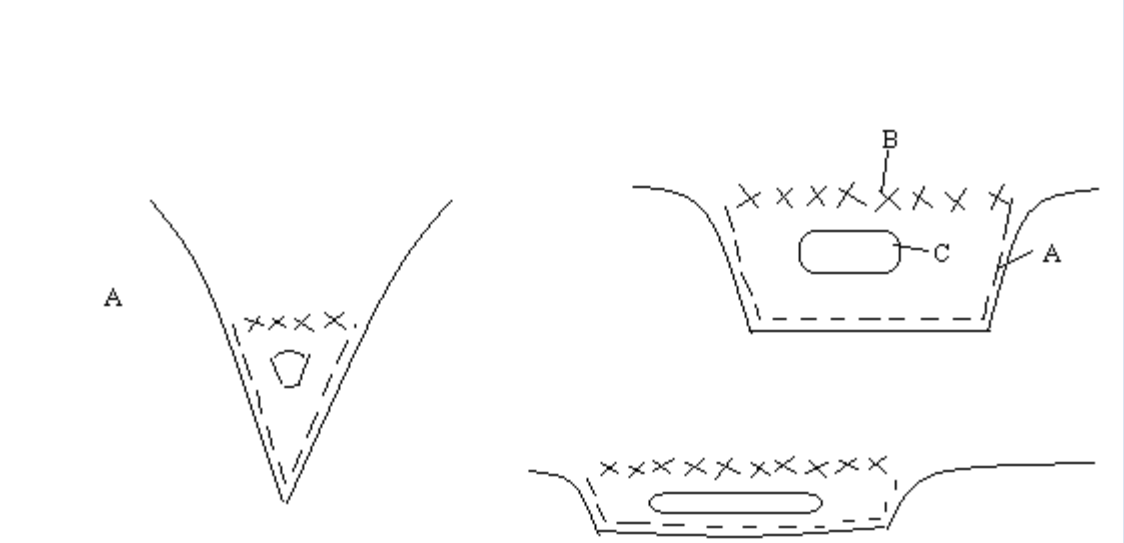
The river cross profile refers to the cross section of a river channel. Different cross sections profiles exhibit varying characteristics as shown below.



Revision Exercise

Describe briefly the channel characteristics shown in the diagrams above, what are the main causes of such variations.

Flow of water within a river channel (velocity) follows basically the same characteristics in all parts of the river. This is illustrated in diagram below:



At point A, the water has to overcome friction with the river banks and bed. This means that the flow is slowed down. In addition the water at this point is transporting load in through the processes of siltation.

At point B, the water has to overcome the friction with atmospheric pressure. As it does so its velocity is reduced.

At point C, which is the most central part of the channel, there is little friction to inhibit the flow of the river. As such water within a river channel flows faster in the middle section of the channel.

River deposition

River deposition refers to the point when the river no longer has the ability to transport its load. This process is very pronounced in the lower course of the river. This is due to a number of factors.

Reduction in gradient

The river in the lower cause is flowing in a generally gentle sloping terrain. It means that there is reduction of river energy. Therefore with reduce energy the river will begin to deposit its load so that it can continue its journey to the sea or mouth.

Example

An over loaded bus seems to move faster when traveling downhill. This is due to the force of gravity. However on a plain land or going uphill the bus struggles. If the load is reduced the bus will travel much faster because it will need less energy.

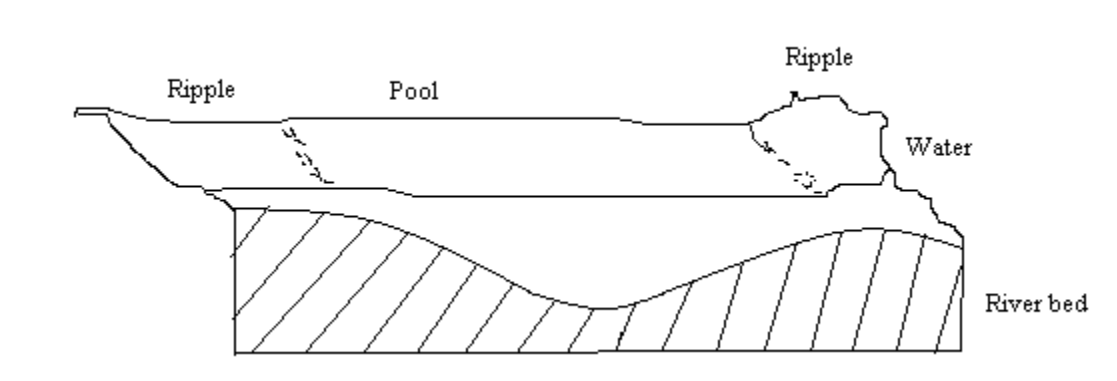
Increase in Load

The river at its lower course is characterized by transportation of heavy sediment load. This is because debutantes will have deposited sediments into the main river. It is this load that will be deposited within the cannel.

Reduction in volume

It is generally believed that the volume of water within a channel is at its greatest toward the month of the river. Equally true is the fact that the channel is widest and shallowest in this zone. This means that the surface area of the channel is very large and hence evaporation is at its maximum, leading to the loss of substantial amount of water to the atmosphere. This means that the load in the channel increases, leading to its deposition.

NB: It is important to note that the process of deposition occurs through out the flow of the river. There are points within the river channel where the river erodes its channel and at some points deposits the load. This leads to the development of ripple and pool sequence.

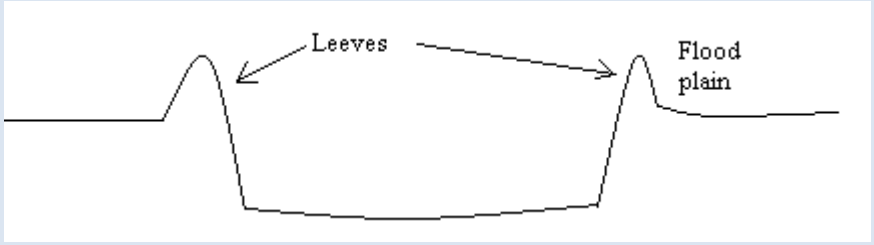


Features of river deposition

River deposition is associated with a number of features. The most common features are outlined below:

1. **Leeves and flood plains**

   A flood plain is a generally plain/flat area surrounding the river channel. When the river is in flood, water flows on the flood plain. Leeves on are raised river banks. These are formed when the river overflows its banks leading to the deposition of load on the banks of the river.



Meanders

Though not necessarily a feature of deposition, meanders are a characteristic feature of the river's lower course. Meandering refers to the winding or 'S' like nature of the river. This is caused by a number of factors.

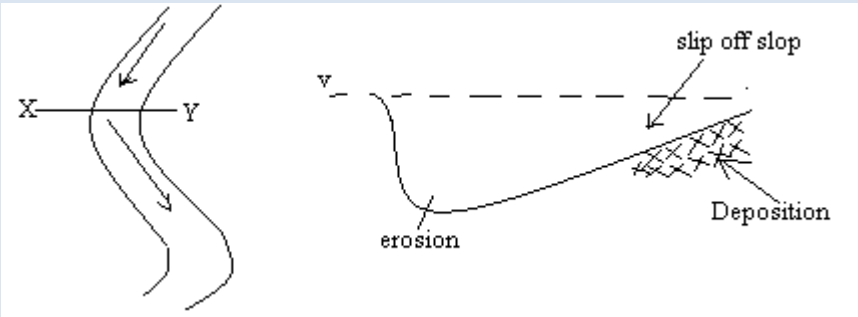
Examples: What makes it impossible for (i) a drunken person to move in a straight line.

(ii) Why is it difficult for a person to walk straight when carrying a heavy load?

The river in the lower cause is flowing over a fairly flat area. It has a lot of load. There is less energy generated from flowing down hill due to reduction in gradient. As a result the river is forced to swerve from side to side. As it does so it creates energy to flow.

Slip off slopes

These are formed at the inner edges of meanders as a result of deposition. Note that the edge of the meander is a zone of active erosion.

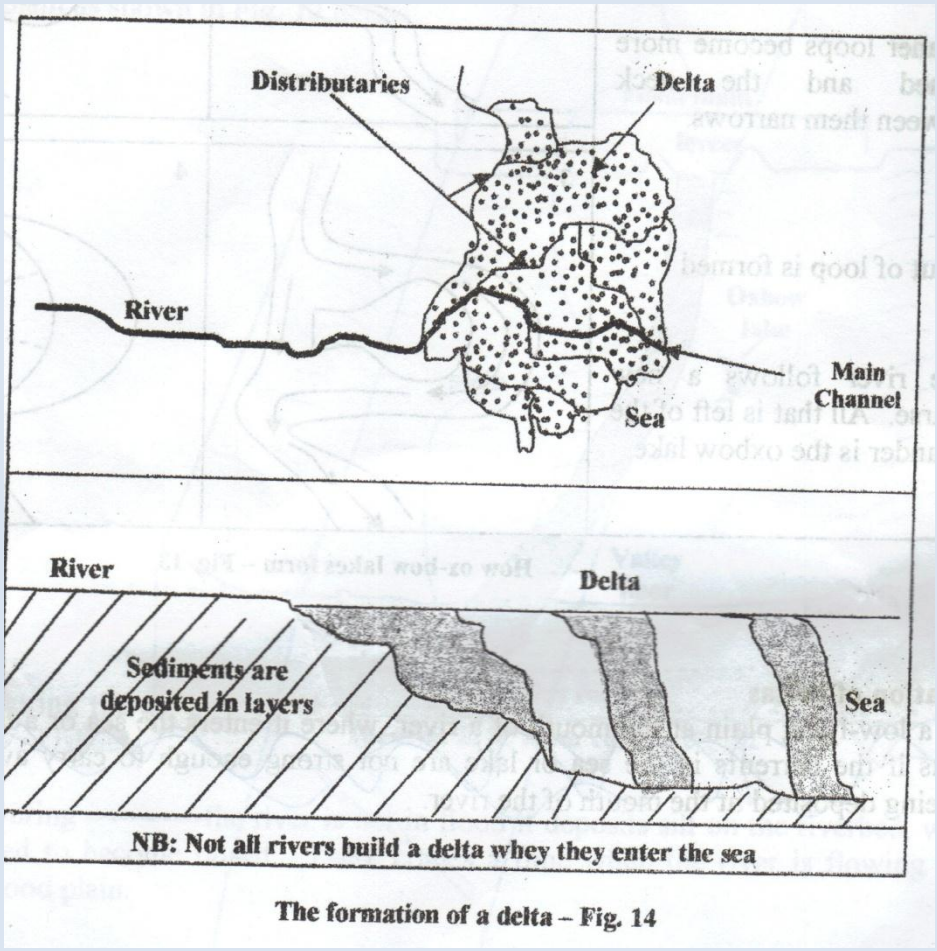


Ox bow lakes

An ox bow lake is a meander that has been cut off from the main stream. The process of ox-bow lake formation is explained in the illustration below:

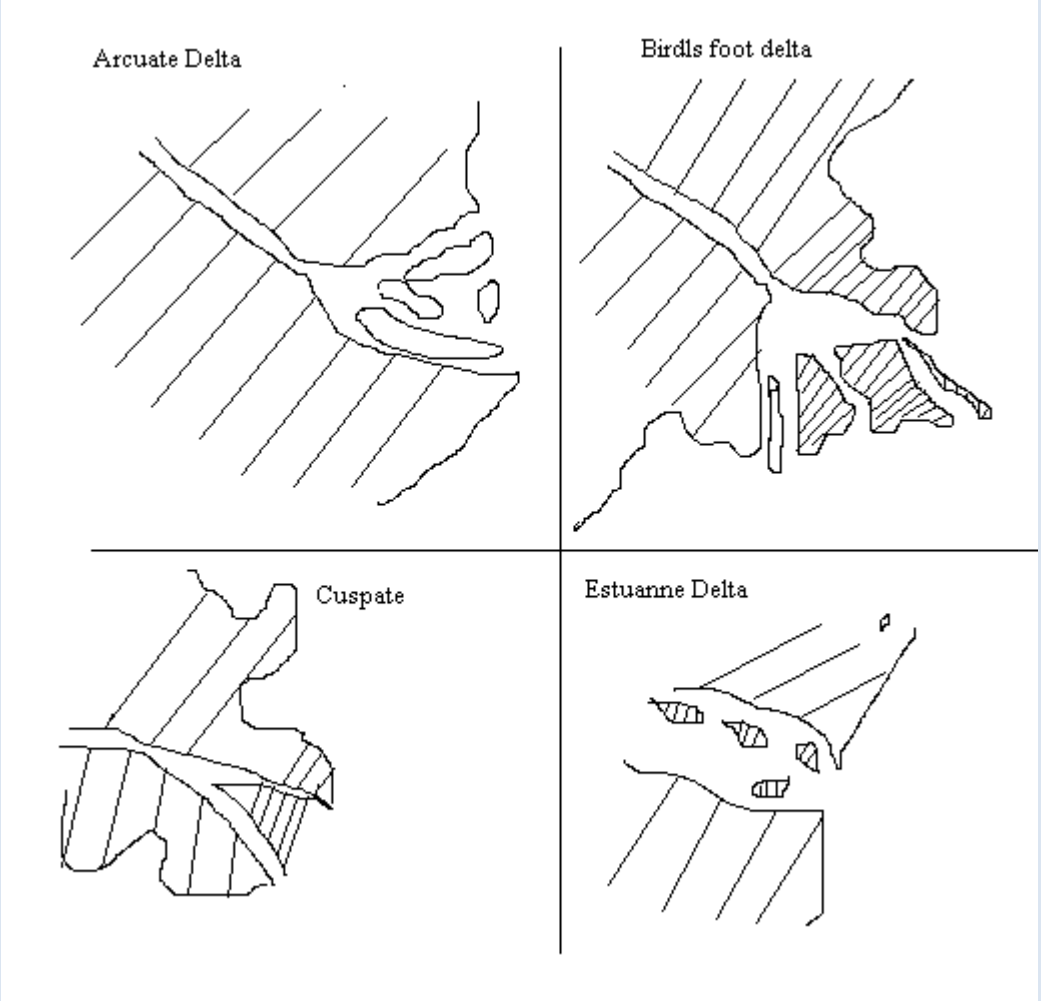
Delta

A delta is a low lying plain at the foot mouth of the river. It is formed as a result of continuous deposition of load within the channel with little interference by strong ocean currents which may wash away deposited sediments. Deltas take many characteristics. These are classified according to the type of deposits and the shape of the delta.



The formation of a delta – Fig. 14

Types of deltas



Revision exercise

Describe the difference between the deltas outline above. Suggest possible causes for the difference you have noted.

Benefits of utilization and management of resources in wit land areas such as Deltas and wetlands.

Flooding

Flooding is a condition that exists when excessive water flow in a river channel. The flood water causes water to flow high above the banks or to spill over. Flooding has got some advantages and disadvantages.

Advantages

1. Brings water to dry areas (improving water security).
2. The sediments deposited are rich in nutrients, which lead to improved agricultural production e.g. the fertile lands of the Nile flood plan are a result of sediment deposition.

Disadvantages

- Leads to loss of life
- Damages property
- Communication networks are destroyed.
- Bridges and roads are washed away.
- Agriculture produce is destroyed leading to wide spread suffering.

Flooding occurrence has been increased by human activities such as;

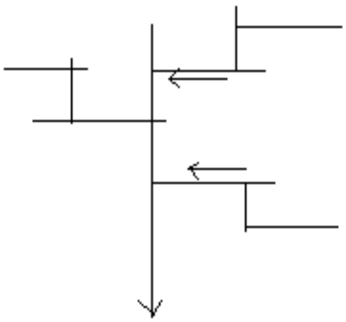
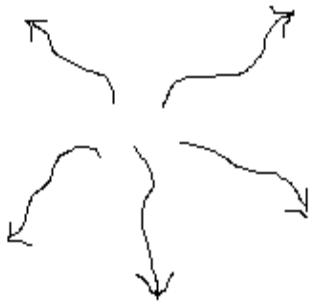
1) Deforestation
2) Poor agricultural practices
3) Panning for gold.
4) Construction of concrete structures i.e. tarmac surfaces
5) Cloud seeding.

Revision exercise

Explain in your own words how the activities listed above may lead to the occurrence of flooding.

Drainage Patterns

This refers to the nature of the streams as they join each other. Drainage pattern development is a reflection of the nature of base rock, the area through which the river flows. The most common are illustrated below:

Dendnticc It has a pattern similar to branches of a tree. 	Trillis Rivers join each other at night angles 
Radial Streams start from the same points and move outwards 	Centripetal stream flows toward a central point 

Revision exercise

Explain the causes of the development of drainage patterns noted above.

Drainage in limestone region

Limestone is made up of calcium which easily dissolves in water. Therefore rivers flowing over limestone regions experience a number of processes caused by structure,

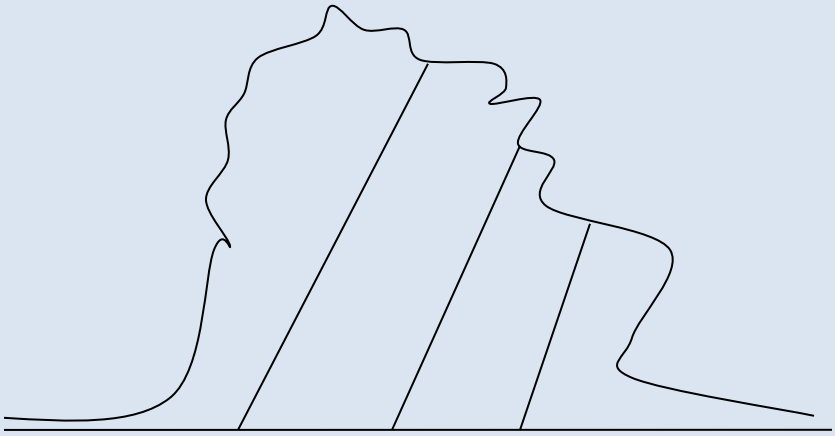
1) The most dominant drainage pattern is trellis. This is because limestone is a well joined rock. Water takes advantages of the joints on limestone leading to the development of trellised drainage.
2) Sink hole: Limestone regions are characterized by disappearing rivers. These rivers would flow beneath the ground as underground streams and appear as springs.
3) Dry valleys: when rivers disappear their valleys no longer have water flowing hence they are dry valleys.
4) Over time the surface of limestone regions would collapse leading to the formation of deep valleys in limestone regions.

Examination type questions

Multiple choice.

1. Which of the following is a river depositional feature?
A. Levee
B. Pot hole
C. Waterfall
D. Cliff

2. The diagram below illustrates a relief feature



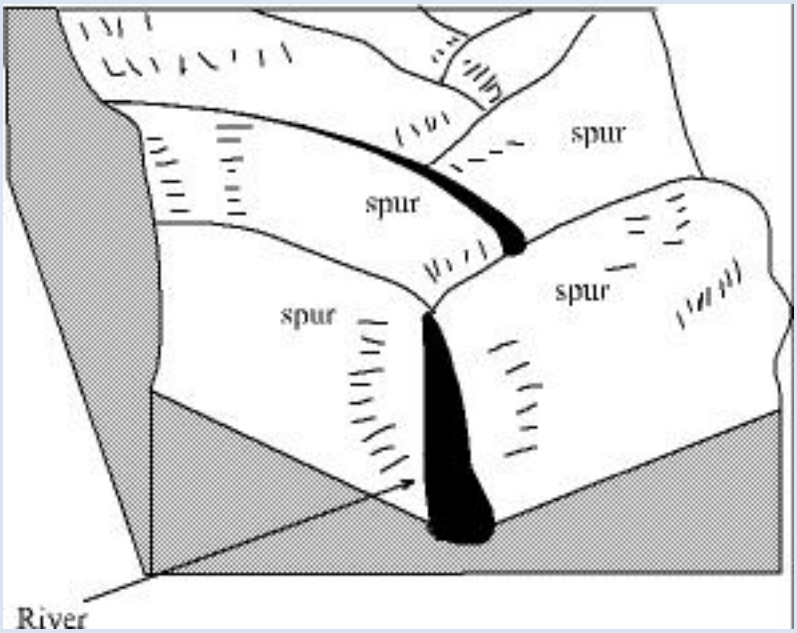
The drainage pattern likely to develop in this area is:

A. Dendric
B. Parallel
C. Radial
D. Trellis.

3. The drainage pattern that is most likely to develop in area of highly fractured rock structure is:

A. Centripetal
B. Dendric
C. radial
D. rectangular

4. The diagram below shows part of a river valley:



The features outlined are mainly a result of:
A. Weathering
B. Vertical erosion
C. Lateral erosion
D. River deposition

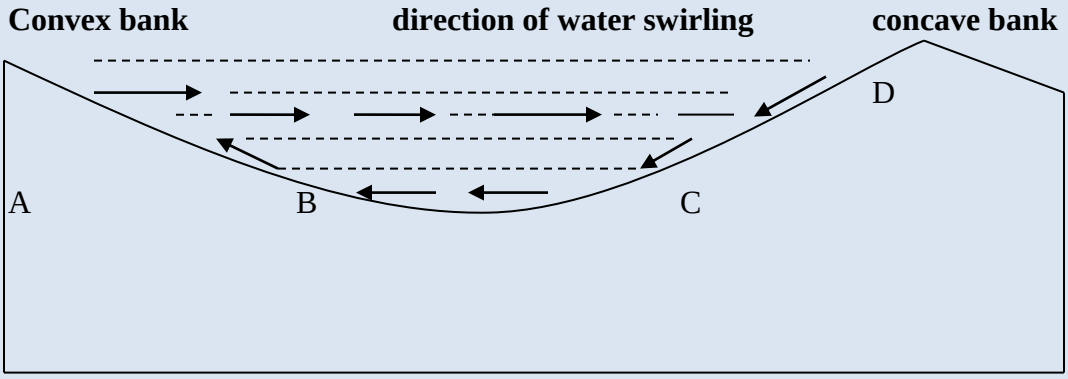
5. Which one of the following processes is mainly responsible for the formation of potholes on a river bed?
A. Corrosion
B. Attrition
C. Solution
D. Deposition

6. A river that has lost most of its energy is usually identified by the presence of:
A. Braiding
B. Potholes
C. Rapids
D. V-shaped valleys

7. A delta that consists of silt and has a few long distributaries is called:
A. Accurate
B. Bid's foot
C. Estuarine
D. Lagoon

8. The transportation of sand particles in leaps and bounces along a river channel is called:
A. attrition
B. Saltation
C. Traction
D. Suspension.

9. The diagram below shows the cross section of a river channel at a meander bend.



At which points A, B, D or C is erosion greatest?

10. Which one of the following drainage patterns develops on rocks of uniform structure and hardness:

A. Angular
B. Dendritic
C. Radial
D. Trellis

Essay questions

1a) Outline the main processes of river erosion.[7]
b) Describe and explain the characteristics of a river flowing in the upper course. [7]
c) How can humans make use of the river flowing in the upper course for their benefit? [4]

2) Using diagrams describe the formation of waterfalls and rapids.[5]
b) In what ways can human beings benefit from features formed by waterfalls and rapids? [4]

3) State three factors that cause the river to deposit its load.[3]
b) Describe the formation of any two features in the river lower course.[5]
c) What problems are likely to be faced by people living in a river's flood plain? [4]
d) How can the problems you have outlined be minimized? [4]

4) What are the main causes of flooding in Zimbabwe? [4]
b) Describe the effects of flooding? [4]

c) How can flooding be minimized? Your answer should refer to attempts that have been made in your locality or area and one other region? [4]

References

11) Bunnett R.B. Physical Geography in diagrams
12) McGary and Plummer Physical Geology
13) Nhandara. Geography Today-Physical
14) Small R.J Geomorphology and Hydrology
15) Weiss P Focus on Geography Book 3.

CHAPTER 10

THE WATER CYCLE AND ASSOCIATED PROCESSES

Chapter objectives

At the end of this chapter one should be able to**:**

a) Draw a fully labeled diagram to show the water cycle.
b) Describe the main processes of the hydrological cycle.
c) Identify the main systems and linkages within the system.
d) Account for the formation of springs.
e) Assess ways to minimize negative impact of human activities in the hydrological systems.

The amount of water in the world is never changing. However some areas receive a lot of rainfall while some areas have got great rainfall deficits. All this can be attributed to the global cycle of hydrological transfers and processes that transfer water from one point to the other. The hydrological cycle therefore explains how water is distributed to different areas of the world. The hydrological cycle:

From the cycle the following aspects can be identified:

Storages: These are points where water is stored. These include ground storage where water is stored in liquid state in rivers, lakes, oceans etc. Then there is atmospheric storage where water is stored as vapor in the form of clouds, mist etc. Some water is stored underground as underground water storage.

Processes: The main process is evapotranspiration which is the loss of water surface storage and plant leaves. There is condensation which is responsible for changing water into liquid state.

Inputs: The main inputs into the hydrological system are precipitation; which brings water into the system and solar energy which gives the cycle energy to operate.

Transfers: These are mechanisms which are responsible for movement of water within different areas of the cycle. These include:

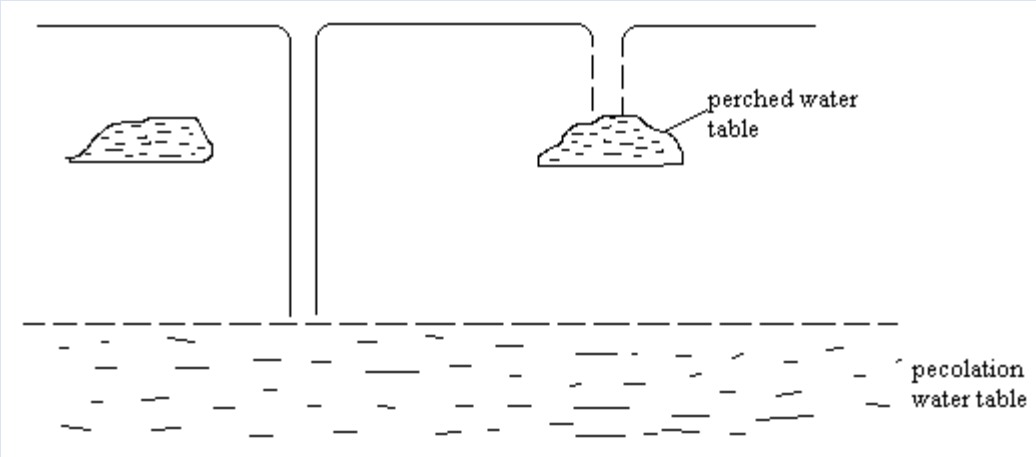
- Infiltration
- Runoff- overland flow
- Percolation
- Base flow

Exercise

Show how the transfers named above are responsible for the movement of water.

Ground water.

The water table.
When ground water forms on underground storage, this is generally referred to as the water table. The water table develops in areas of permeable rock which allow water to percolate through the pores. When these points are saturated water will flow horizontally downwards as base flow. Two types of water table can be identified: the naturally occurring water table, known as percolation water table and the perched water table. This forms when a band of hard impermeable rock lies within permeable rock structure.



Springs
When water from underground storage finds its way to the surface, a natural outflow of water, known as springs, occur and are mainly influenced by geological structure.

Revision exercise:
Discuss the benefits of ground water
a) To human beings.
b) How many human activities reduce the discharge of springs.

Drought
Exercises
Using examples from areas you have studied discuss ways in which effects of drought can be minimized.

Ground water, the water table and springs

Ground water
Water infiltrates the rocks beneath the soil to be stored in pores, joints or cracks are called underground water. Water can infiltrate rocks if the rocks are porous or pervious. Porous rocks have air spaces between the particles, for example sandstone.
Pervious rocks have lines of weakness which allow water to penetrate, for example granite. The lines of weakness can be joints or faults.

Rocks are permeable if they allow water to pass through them. Sandstone and granite are examples of permeable rocks. Rocks are impermeable if they don't allow water to pass through them. Clay and shale are examples of impermeable rocks. When water has failed all the available spaces (pone spaces) between the particles of rock, the rock is saturated.

Types of ground water

Meteoric ground water: results from infiltration of rain into soil and then percolates into the rocks below.

Magmatic ground water: it comes from the water formed during the formation of igneous rocks.

Connate ground water: water that was between the rock particles when sedimentary rocks were being formed.

Ground water is a very important source of water for farmers and for towns. People sink boreholes to reach the ground water supply and pump the water to the surface using a wind or a diesel pump.

Drought

A drought occurs when there is a long period of time with less than average amount of rain. In Zimbabwe droughts are very common, with the 2007 to 2008 being a good example. Too little rain has a direct effect in farmers, especially subsistence farmers. Subsistence farmers grow only one food to feed their families and do not have a surplus to sell. They have no money to buy food and are therefore completely dependent on what they can grow.

The minimum amount of rainfall needed to grow crops without irrigation is 500mm a year. It is possible to graze sheep and cattle (pastoralism) with less rain. Crops and animals would die and families would starve.

How can people contribute to the occurrence of drought?

Some human activities can help cause drought. These activities decrease the amount of water vapour released into the atmosphere. This results in fewer clouds and less rain. Deforestation (the removal of vegetation) leads to the decrease in the amount of rainfall. Vegetation releases water vapour into the atmosphere by process of transpiration.

Deforestation also results in bare soil. Soil absorbs and reflects more heat than vegetation- as a result the air above the ground becomes hotter. This means the air will have to absorb a lot more water vapour before it becomes saturated and water vapour can condense and form clouds.

The effects of drought

i) Droughts destroy food crops as a result of lack of water (moisture stress)
ii) Livestock (cattle, goats and sheep) also die.
iii) In communal areas, particularly the very aged, are weak from hunger and easily fall sick.

Multiple choice questions

1) Percolation involves:
a) The entry of water into the soil
b) The downward movement of water in the ground
c) Water flowing on top of the water table
d) Water that is in the atmosphere.

2) The water cycle obtains its energy from:
a) Tectonic forces
b) The solar radiation
c) Water flowing downstream
d) All of the above.

3) Water is neither created nor destroyed, it:
a) Changes its state
b) Always flows downhill
c) Is used by plants and animals
d) Is very important in our lives.

4) Trees are important in a hydrological basin as:
a) They promote infiltration
b) They protect the soil
c) They provide nutrient
d) They are a source of medicine

5) Runoff is generated when:
a) The soil is saturated
b) Water flows on the surface
c) Water sinks into the soil
d) Rivers are in flood

6) Springs are:
a) Natural outflows of water
b) Water flowing underground
c) Water flowing downslope
d) Water coming out of boreholes.

7) Human activities can disturb the water cycle through the following, except
a) Drilling of boreholes
b) Dam construction
c) Cutting down of trees
d) Uprooting of rocks.

8) The biggest cause of water pollution in urban areas is:
a) Industrial waste

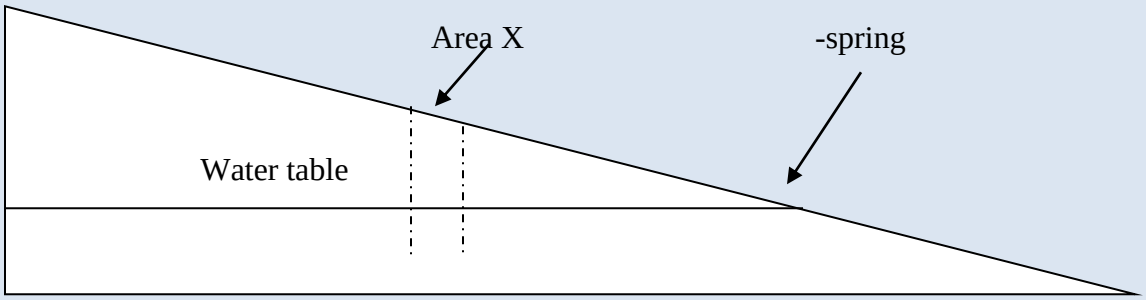
b) Litter
c) Burst sewer pipes
d) Acid rain

Essay type questions

1) Name the main processes, operating within the water cycle? [5]
b) Describe and explain the importance of water on the development of the country?[7]

2) What are the main causes of water pollution? [4]
b) Describe and explain the effects of water pollution on the hydrological cycle? [7]
c) What measures can be put in place to minimize the effects of water pollution? [4]

3)



a) Why are springs important in a natural ecosystem?[3]
b) If a borehole is to be drilled in area x what would be the effect of drilling the borehole on:
i) Ground water storage?[2]
ii) Discharge of springs? [2]
iii) Natural ecosystem? [2]

4) Describe and explain ways in which humans may increase the amount of runoff? [7]
b) As an environmental officer, what measures would you propose to the following to conserve water?
i) Urban councils [2]
ii) Rural communities. [2]

References

1) Bunnett R.B. Physical Geography in diagrams
2) McGary and Plummer Physical Geology
3) Nhandara. Geography Today-Physical
4) Small R.J Geomorphology and Hydrology

CHAPTER 11

WEATHER STUDIES.

Chapter Objectives:

By the end of the chapter, one should be able to;

a) Describe the man weather elements and units of measurement.
b) Outline the characteristics and operation of the main weather instruments.
c) Describe the basis for the classification of clouds.
d) Describe the main types of rainfall.
e) Outline the weather associated with the inter-tropical convergence zone ITCZ.
f) Discuss the nature and effects of weather hazards associated with tropical regions.

Definitions:

Weather is the state of the atmosphere at a place at a given time. The basic weather studies were carried out at junior secondary school, hence at this level weather studies are not concerned with weather elements, but with how weather systems have affected human habitation.

Weather elements.

The main weather elements are summarized in the table below.

The operation of various weather instruments are summarized below:

Rainfall.

Rainfall is the amount of rain received at a given time in millimeters. The rain gauge is used to measure rainfall. The rain gauge can easily be presented in the following format.

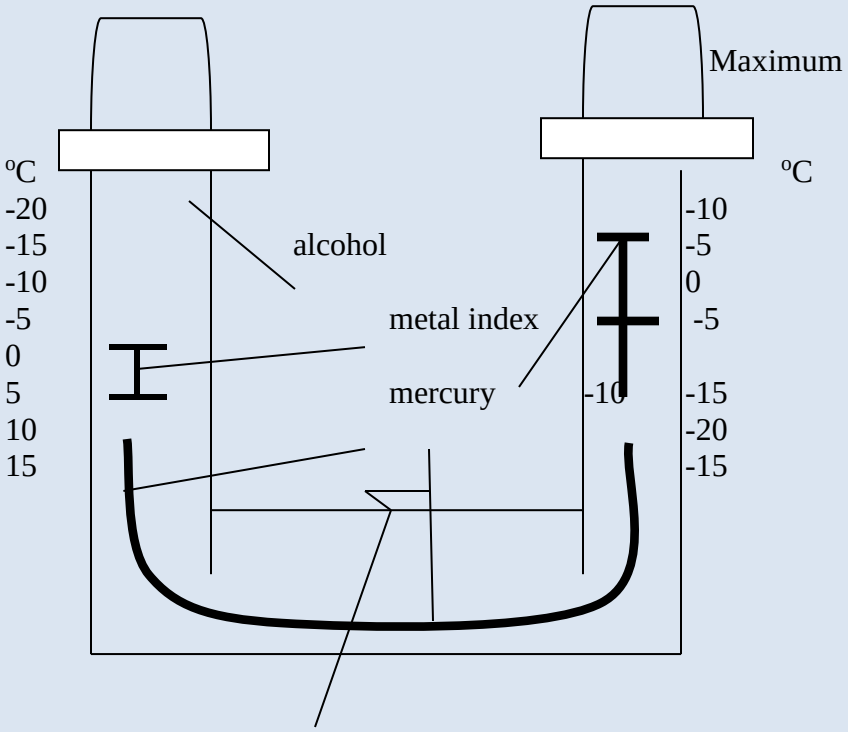
The following characteristics of the rain gauge are of primary concern:

i) It is made up of copper or plastic to protect it from rust.
ii) It should be placed at least 30cm above the ground because it should capture through falling rain, not water that may splash from the ground.
iii) It should be placed in an open space devoid of vegetation cover for accurate results.

Temperature.

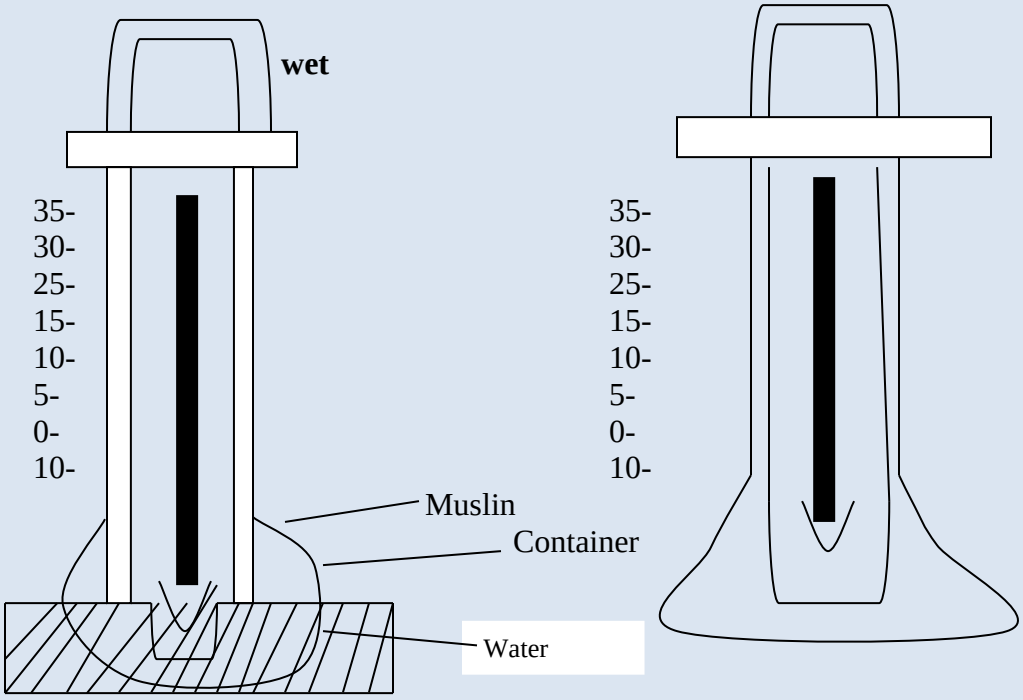
Temperature is the degree of heat or coldness of the atmosphere.
Temperature is measured in °C. The six's minimum and maximum thermometer is used to record T°.

Six's Thermometer
Minimum



Operation of six's thermometer.
When it is hot the alcohol in the left arm expands and pushes the mercury down and up the right arm of the thermometer. This pushes the metal index upwards and the maximum temperature is read by looking at the bottom of the metal index. When temperature falls, the mercury contracts and pushes downwards and up the left arm and this pushes the metal index upwards. The minimum temperature is read at the bottom of the metal index.

Humidity



Humidity is the amount of water vapor in the atmosphere and the instrument used to measure humidity is called a hygrometer (wet and dry bulb thermometer).

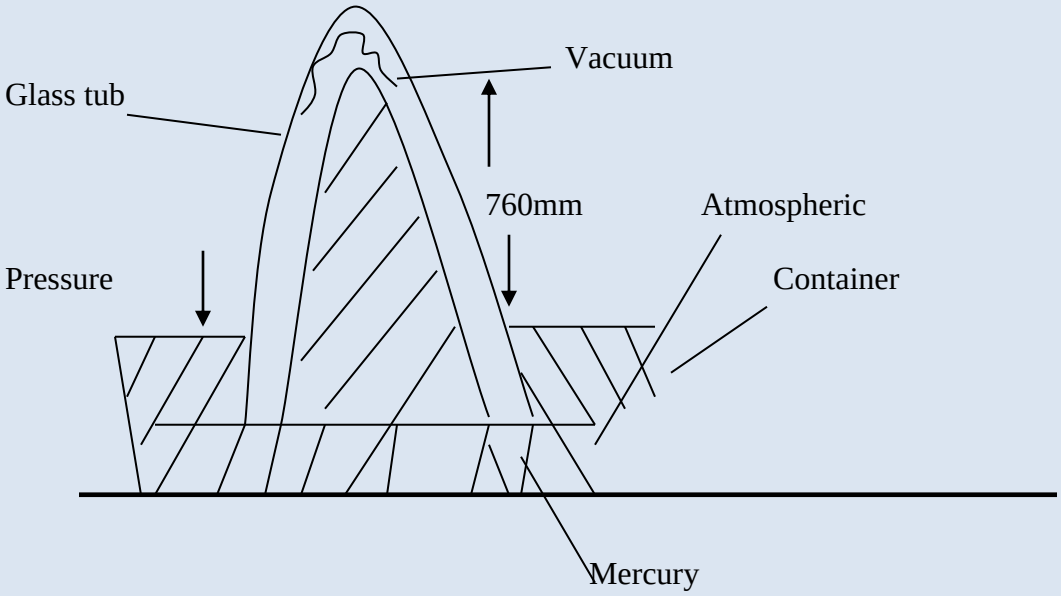
- The hygrometer is made up of a thermometer covered by a piece of cloth (muslin) and placed in water. This has a cooling effect on the thermometer
- The difference in the readings between the two thermometers is used to calculate humidity as illustrated below.

No difference	-	air is saturated
Minor difference	-	high humidity
Big difference	-	low humidity

Pressure.

The instrument used to measure pressure is a barometer. The mercury barometer measures pressure on the assumption that pressure can support mercury up to a particular height. If pressure is high, mercury is forced up even higher.

A barometer diagram



Recording weather data.

Weather data is captured and recorded at a weather station, very experienced people take readings from the instructions outlined above on a daily basis at 8.am and 16.00 hrs. These are then recorded in specialist weather charts using international weather symbols.

Revision Exercise

Outline the weather symbols that are commonly used. Refer to television weather reports for general ideas.

International weather symbols:

The following chant summarizes the international weather symbols that are used at a weather station.

Classification of Clouds

Clouds form an important element in the analysis of weather conditions. Clouds are classified according to:

1) Height: There are high level clouds, middle level clouds and low level clouds.
2) Physical appearance: Clouds appear in many different forms. Some are wispy, some are fluffy and some are larger. In addition some clouds are very dark and others are not.
3) Rain bearing capacity: some clouds bring great amounts of rain while others bring light showers or no rain.

The rain bearing clouds
There are primarily two main types of clouds that bring rainfall. These are linked to different weather conditions that affect an area.

Revision exercise
Briefly describe the nature of rainfall periods that you have experienced in your area. Your discussion may dwell on the conditions prevailing before the start of the rainy period and characteristics of such rainfall.

Cumulonimbus:
This is a cloud that is characteristic of high atmospheric turbulence, mainly associated with tropical thunder storms. As such it is associated thunder and lightning. This is caused by rapid uplift of our currents. The cumulonimbus cloud is a high towering cloud that can cover a vertical extent of about 4km. in other words it has its base in the lower level clouds and its apex known as the Anvil.

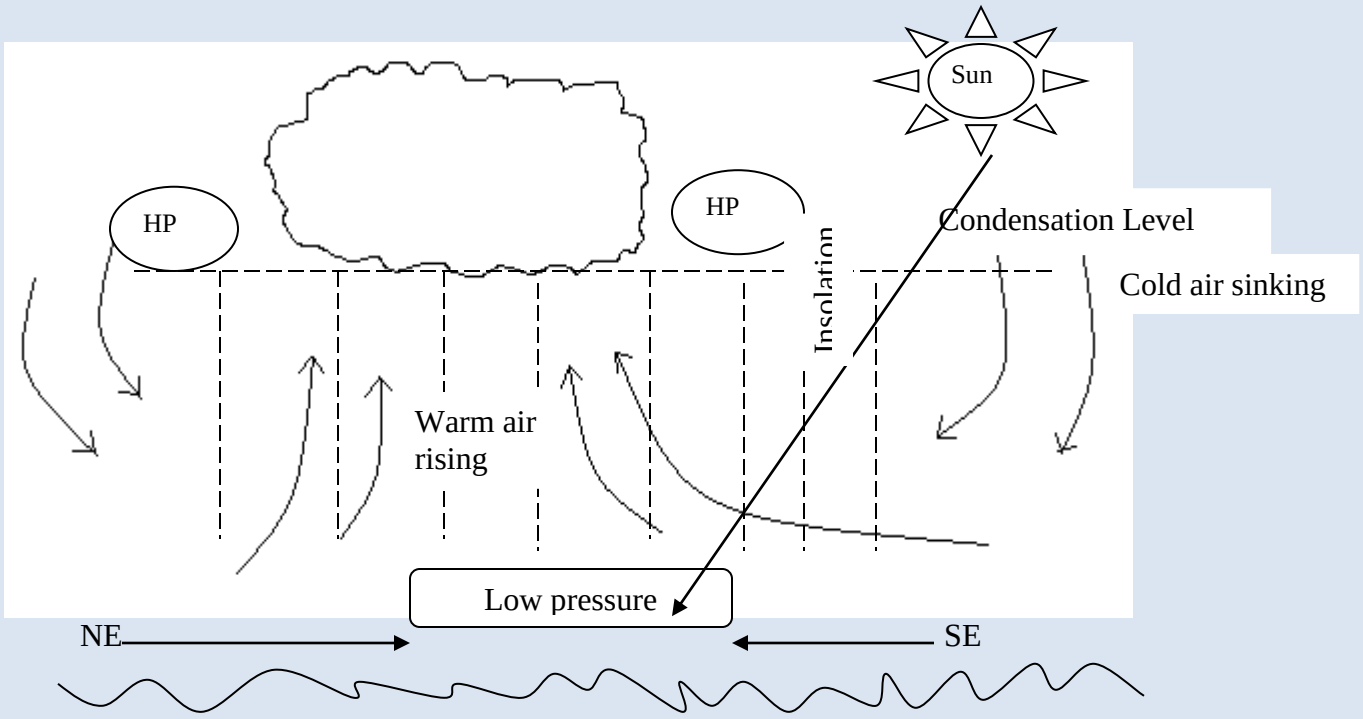
Cumulonimbus type of clouds are associated with high temperatures followed by very strong winds and down pour which at times occurs as hail. The rainfall is of high intensity and short duration. In most cases rooftops are blown, houses are destroyed and flash floods occur especially in low areas or people staying close to rivers.

Nimbostratus cloud.
Have you noticed that some times rain falls without thunder or lightning but is equally of high intensity and of a longer duration. This type of rainfall is associated with a lot of rainfall with drop in temperature in between when temperatures rise again the rain storm will start. This may continue for a period as long as 2 weeks. This type of rainfall is brought by nimbostratus clouds. These are high towering clouds that are formed as a result of a gradual or steady uplift of convectional currents.

Exercise:
Identify the main differences between weather associated with nimbostratus and cumulonimbus clouds.

Types of rain.
Generally speaking there are 3 types of rainfall. These denote then names from how the air currents responsible for their occurrence are uplifted. These are briefly described below.

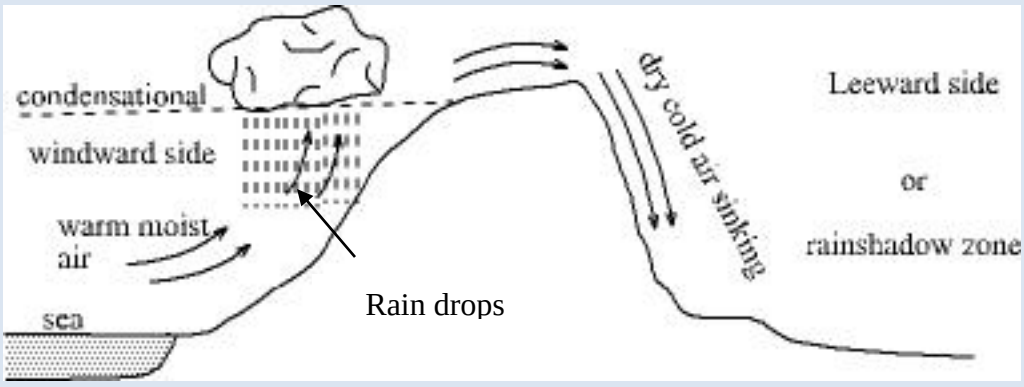
Convectional Rainfall.
When air is heated it becomes less dense and would subsequently rise. When air containing moisture on the ground is heated it rises and cools when condensation level is reached. This will lead to the formation of clouds and rainfall. This type of rainfall is common in the tropical and equatorial regions due to the abundance of moisture and very high temperatures.



When the warm air has been removed from the area cold, air remains. This is known as frontal occlusion or decay. This is because there is no warm air left to be uplifted and hence there would be no further uplift of warm air.

Relief rainfall.

When an air mass blows over an area, with an obstacle such as a mountain range, it is forced to rise, as it rises it cools leading to the formation of clouds and rainfall on the windward side of the mountains. The air masses would continue on the leeward side of the mountains with reduced moisture, this crates a rain shadow area on the leeward side of the mountain. This is because a lot of moisture is lost on the windward side of the mountain.



Exercise

1) Describe the weather conditions associated with the development of:

a) Frontal, relief and convectional rainfall.

2) Describe weather conditions likely to occur at the leeward sides of a mountain.

3) Discuss effects of high rainfall intensity over a short period of time.

Condensation of water vopour at or near the ground surface.

At times water vapour does not evaporate to condense into clouds in the sky. At times water would condense at the ground or just above the ground. This occurs mainly during the colder months of the year or early in the morning. When this occurs the following occurs:

I) Frost
II) Dew
III) Fog
IV) Mist.

The inter tropical convergence zone (ITCZ)

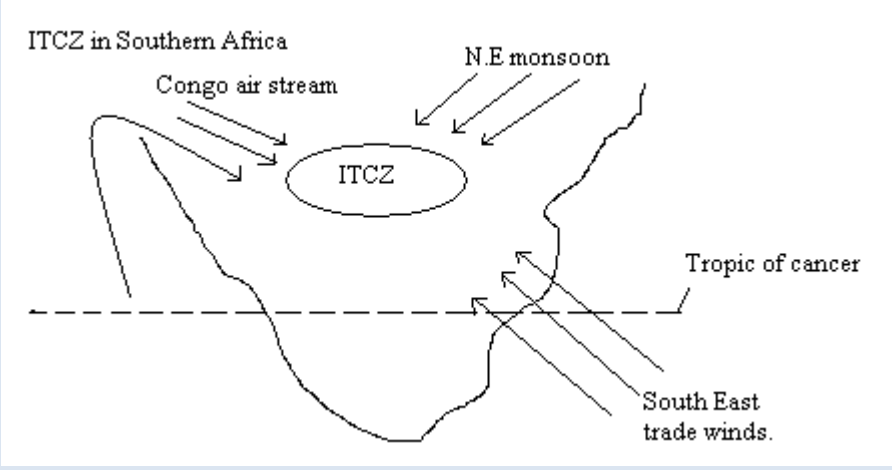
When 2 air masses of different characteristics converge, a front is formed, however when air masses of almost similar characteristics meet they converge or mix. This mixing leads to very high atmospheric turbulence. Thus the Inter Tropical Convergence Zone is a zone within the tropics characterized by the mixing of air masses that originate within the tropics or are modified so that they all have similar characteristics.

Causes of ITCZ.

During June the sun is overhead the tropic of cancer in the northern hemisphere and in December the sun is overhead the tropic of Capricon in the southern hemisphere. When the sun is overhead temperatures increase greatly creating a region of low pressure, winds will blow toward this region, they mix, become heated further, forcing them to rise forming huge convective clouds that bring a lot of rainfall in that region.

The ITCZ and the southern Africa.

Southern Africa receives much of its rainfall between November and February. This is because temperatures are very high, thus forcing the south east trade winds, which are laden with moisture from the Indian Ocean to blow into the region. (The S.E trade winds are responsible for the weather venations within Southern Africa). Also the N.E monsoon trade winds blow into the region and so does the cargo of airstream, which initially began as the cold Benguela airstream but is modified as it flows over the equatorial region. These air masses will meet and mix. Further high T° creates a zone of intensive mixing of air masses and great atmospheric turbulence.



Exercise

Outline the advantages and disadvantages and disadvantages of the ITCZ in your area.

Examination type questions

Multiple choice

1) Convectional rainfall is associated with:

a) Thunder and lighting
b) Light showers
c) Cirrus clouds
d) Heavy showers associated with nimbostratus clouds.

2) An occluded front occurs when:

a) A parcel of warm aim has been totally removed from an area by cold air
b) A parcel of cold air has been removed totally from an area by warm air
c) A parcel of warm air overrides cold air
d) A parcel of cold air undercuts warm air

3) An agricultural drought is caused by:

a) Excessive rainfall, low rainfall leading to crop failure
b) High temperatures leading to crop failure
c) Good rainfall and unavailability of fertilizer
d) Low temperature leading to crop failures.

4) Doldrums can be defined as:

a) An area of low pressure in the tropics
b) An area of high pressure in the tropics
c) An area of low pressure in the equatorial regions
d) An area of high pressure in the equatorial regions.

5) An example of a low level cloud is:

a) Stratus
b) Cirrus
c) Cumulus
d) Cumulonimbus

6) Cumulonimbus clouds are associated with:

a) A lot of rainfall characterised by thunder and lighting
b) High rainfall with no thunder and lighting
c) Low rainfall and cold temperature
d) No rainfall.

7) A cup anemometer measures

a) Wind speed in knots
b) Wind speed in meters
c) Wind direction

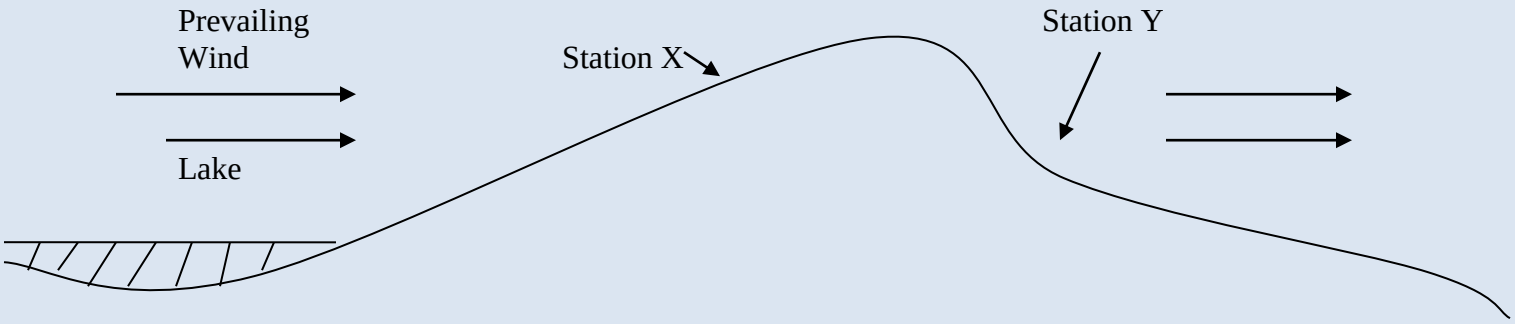
d) All of the above.

8) Weather forecasting involves:

a) Prediction of future weather patterns based on past trends
b) Prediction of future weather patterns based on past weather trends and present satellite images
c) Prediction of past weather patterns using future weather maps
d) Prediction of future weather maps using past weather patterns

Essay type questions

1. Study the diagram and answer questions that follow



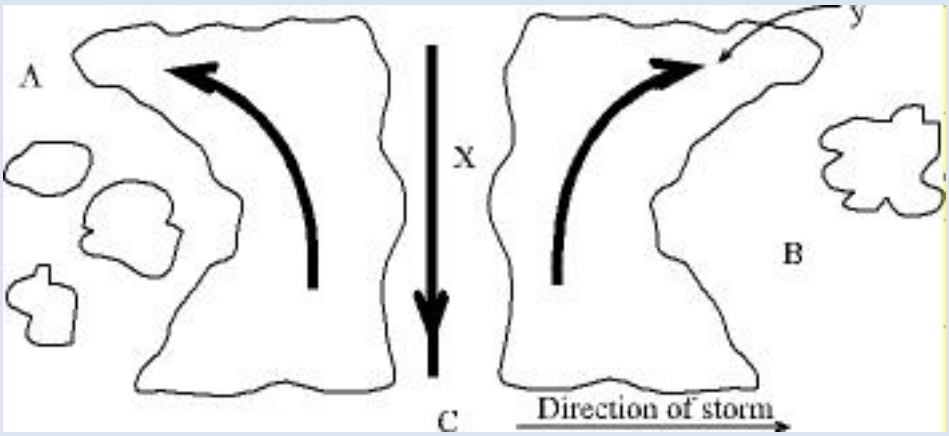
Weather recordings for station x and y

X	J	F	M	A	M	J	J
Rain fall	300	50	75	25	100	80	70
Temperature	15	22	28	15	20	22	25

Y	J	F	M	A	M	J	J
Rain fall	300	50	75	25	100	80	70
Temperature	15	22	28	15	20	22	25

a) Briefly explain the formation of relied rainfall[4]
b) Describe and explain the differences weather conditions between station x and y.[5]
c) As an environmental officer what economic activities would you recommend for people?[4]

2) The diagram shows a cross section through a tropical cyclone



a) Label feature marked X [1]
ii) Name the cloud marked Y [1]

b) Describe the weather conditions likely to be experienced by people living in points A, B and C. [4]

c) What weather hazards are likely to be experienced by people living in areas affected by tropical storms? [4]

3) You are an environmental officer in an area affected by drought. Write a report to the local newspaper highlighting the caused effects and what measures communities should take to minimize the negative impact of drought. [5]

References

(1) Bunnett R.B. Physical Geography in diagrams
(2) McGary and Plummer Physical Geology
(3) Nhandara. Geography Today-Physical
(4) Small R.J Geomorphology and Hydrology
(5) Weiss P Focus on Geography Book 3.

CHAPTER 12

Climate Studies

Chapter Objectives

By the end of the chapter one should be able to:

a) Explain how climatic data is collected.
b) Draw and interpret climatic graphs.
c) Describe characteristics of different climatic changes.
d) Assess effects of climatic change and efforts to minimize them.

Climate is simply the study of weather conditions of a particular place over a given time period. Such weather conditions will give us a general idea on the nature of climate in such an area. They influence the vegetation and animal life of areas. Thus it is mainly influenced by the relationship between temperature and Rainfall, as well as seasonal variations.

Climatic Graphs

Climatic graphs are used to show different characteristic of climates. Most students fail to interpret graphs appropriately. We shall briefly look at how climatic graphs are constructed

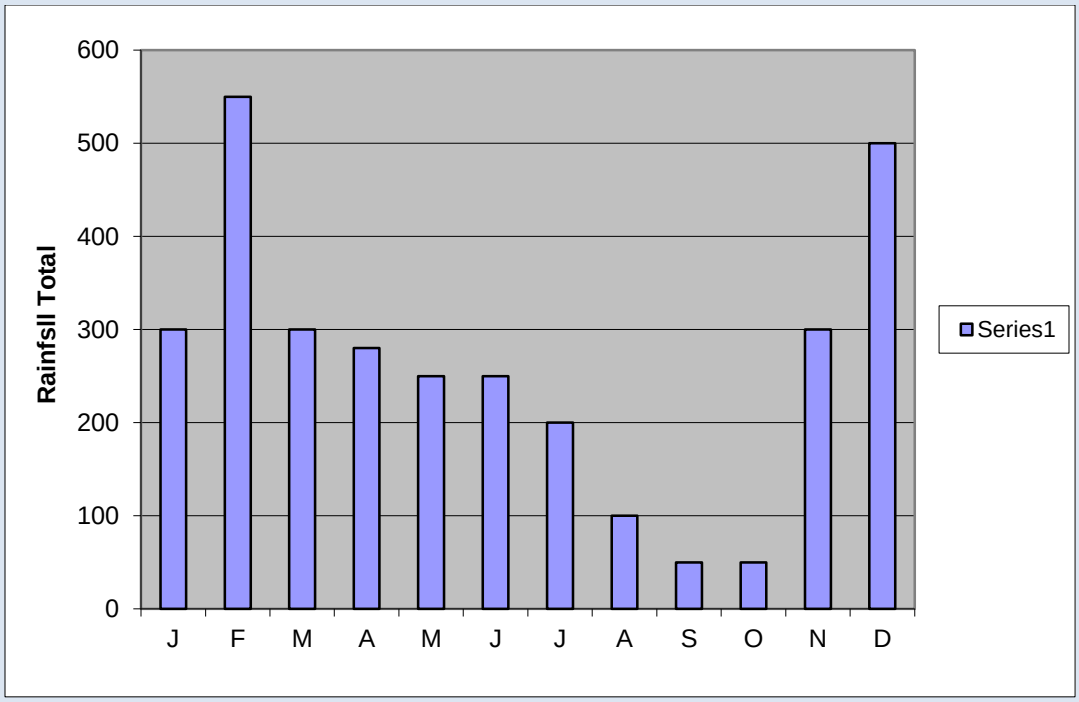
Below are rainfall and temperature readings taken from imaginary station x for year 2008.

Rainfall

J	F	M	A	M	J	J	A	S	O	N	P
500	5400	300	280	250	250	200	100	50	50	300	500
33	32	30	28	25	25	22	20	15	15	28	28

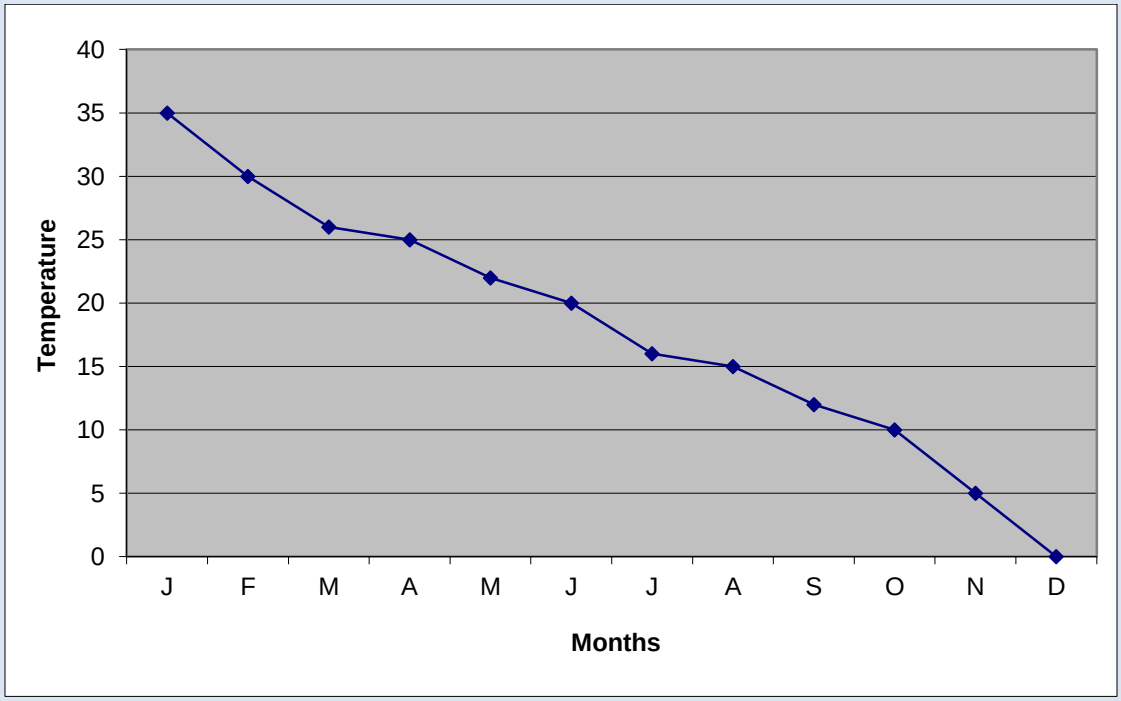
Temperature

A histogram is used to show rainfall figures as shown below:



It can be noted therefore that the same rainfall data has been graphically presented so as to give it a clear visual impact. In other words we can tell the differences from the different heights of the bars.

Temperature:
Temperature is presented using a simple line graph. As shown below.



As we can see points are first plotted and a line is drawn to link all plotted points.

A climatic graph therefore is a combination of a rainfall and temperature graph to create one graph that shows both weather readings. This makes it easier to assess the relationship between rainfall and temperature in a given region.

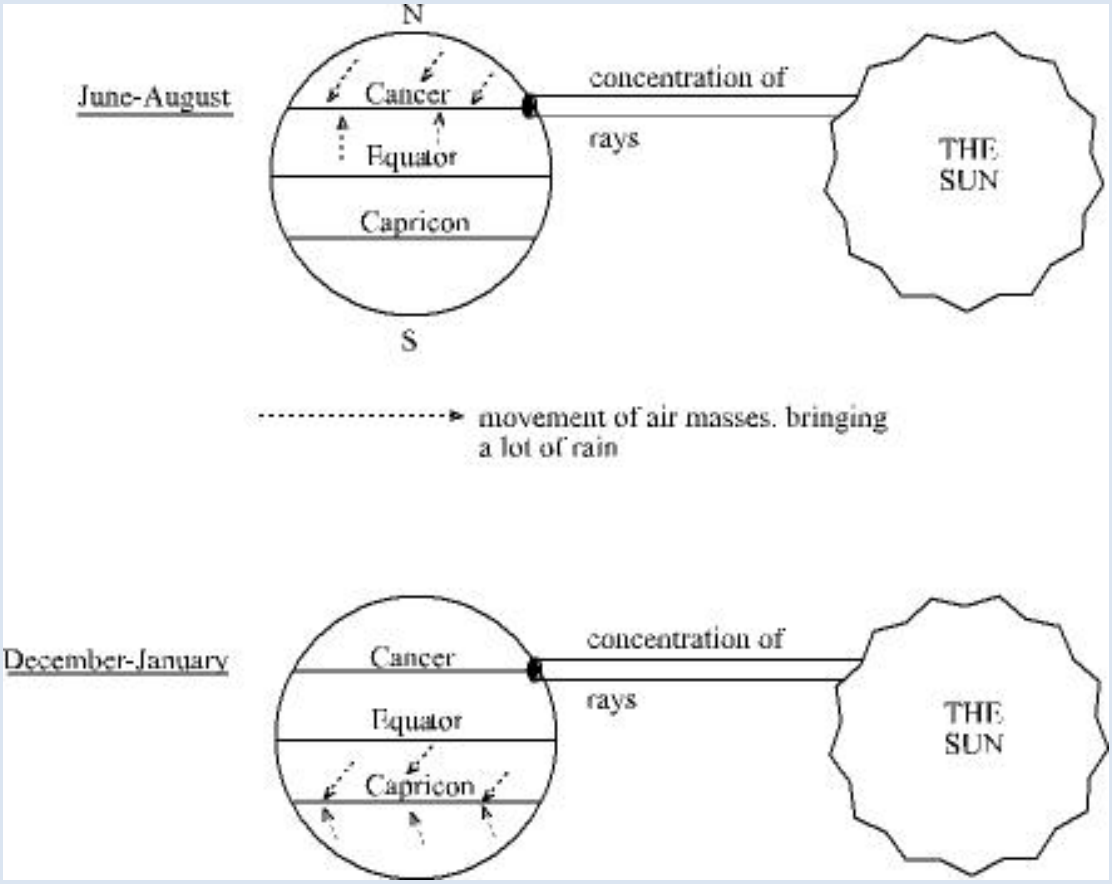
Climate and seasonal changes

It is important to note seasonal variations in order to understand climatic characteristics. The earth is divided into two hemispheres. These experiences opposing climatic characteristics, i.e. an area in the Savanna climate will experience rainfall in November to March in the southern hemisphere where temperatures and rainfall is high. During the same period, in the Northern hemisphere, they would experience cold temperatures.

During June- August the sun's rays are directly overhead the tropic of Cancer meaning that temperatures will be very high in that region. It means that the areas in the southern hemisphere will be having cooler temperatures.

During December-January the sun will be overhead the tropic of Capricon in the southern hemispheres. This means that temperatures will be high. The areas in the northern hemisphere will be experiencing cooler temperatures.

This can be shown diagrammatically below.



It can be observed from the two diagrams that the position of the sun influences weather conditions of a particular area which have a huge bearing on the nature of climatic characteristics of a given region. Therefore it is always important to always determine the location of a weather station/or climatic region in terms of different hemispheres. This concept shall be explained further with reference to particular climatic types.

Exam type questions

Multiple choice

1) Polar climates are characterised by:
a) Rainfall through out the year
b) Very strong winds
c) Low temperatures through out the year
d) High temperatures through out the year

2) In the northern hemisphere the savanna climate receives highest rainfall in the month of:
a) December
b) March
c) June
d) September

3) In December the sun is overhead the Tropic of:
a) Greenwich
b) Cancer
c) Capricorn
d) Equator

4) Desert plants have adapted to the dry conditions through:
a) Having fleshy stems
b) Storing a lot of water
c) Having thorny leaves
d) All of the above.

5) Mediterranean climates are characterised by:
a) Rain when temperatures are high
b) Rain when temperatures are low
c) When there is rain through out the years
d) No rainfall at all.

6) Human beings have negatively impacted on the equatorial climate through:
a) Overgrazing
b) Bush fires
c) Deforestation
d) Soil erosion

7) People living in Savanna regions can increase agriculture production through:

a) Flood control
b) Irrigation
c) Desalinization of Sea water
d) Planting more trees.

8) The green house effect is:

a) The increase in global temperatures
b) A sign that the world is coming to an end
c) The formation of a hole in the ozone layer
d) Global destruction of the environment.

Essays

1) With the aid of a climate graph, describe the climatic characteristics of Equatorial regions? [5]
b) Outline the economic activities likely to take place as a result of the characteristics you have outlined above. [4]
c) How have human activities led to the destruction of the Equatorial ecosystem? [4]

2) Define Climate Change. [2]
b) What problems are likely to be experienced by Zimbabwean farmers as a result of climate changes? [4]
c) As a government official, what measures would you propose to address the problems mentioned in (b) above? [4]

3) Zimbabwe has experienced successive droughts over the past few years:
a) What are the climatic causes of drought? [3]
b) Describe the effects of drought on the social and economic ell being of communities? [4]
c) How successful were the measures implemented by the government in the last 10yrs to reduce impact of drought? [3]

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1) Bunnett R.B. Physical Geography in diagrams
2) McGary and Plummer Physical Geology
3) Nhandara. Geography Today-Physical
4) Weiss P Focus on Geography Book 3.

CHAPTER 13

SETTLEMENT

Chapter objectives

By the end of the chapter one should be able to:

a) Account for site and situation of different settlements.
b) Describe factors affecting location of settlement.
c) Describe different settlement patterns
d) Explain different functions of settlements and apply the rank-size rule.
e) Explain different models as used in settlement geography.
f) Discuss the concept of urbanisation and problems associated with it.
g) Assess the relationship between quality of life and settlement dynamics

Definition:

A settlement can be simply defined as a place where people stay. This can be a small isolated dwelling unit, or it can be a large village, or it can be a city, and indeed a large urban area.

Factors influencing the location of settlements

There are physical, economic, social, political, and sometimes cultural factors which determine where people stay. Before we can look at these factors we need to understand the meaning of the following terms:

a) Site of a settlement.
b) Situation of a settlement.

Site of a settlement

This is the actual point, that is, land on which a settlement is located.

Situation of a settlement

The relationship between a settlement and its surrounding areas is what constitutes the situation of a settlement.

Physical factors

Water supply – people tend to settle in areas where there is a good supply of water and they avoid areas where there is less or two much water.

Defence – This was the case in the past when settlements were located on highland areas for defensive purposes.

Relief – generally, settlements tend to be located on low lying areas because it is easy to build here and also for purposes of agriculture.

Soil – where the soils are good, people are many, for example, the Nile River Valley in Egypt has good and fertile soils hence many people settle here. People will avoid areas where the soils are poor and infertile and where it's generally rocky and mountainous.

Temperature – when it is too hot or too cold people find it difficult to stay in such places.

Rainfall – the rainfall should just be adequate for the seeds of the people. It should not be too much or too little.

Economic factors

- Availability of resources, for example, minerals will attract a lot of people such that those places with plenty minerals are characterized with many people, for example, mining towns which have grown and continue growing because of the availability of minerals.
- Fuel supply: In the past when wood and coal were, the main sources of fuel or power, settlements would locate at or close to them. Communication:-Even at the present time people want to stay at or near lines of communication such as route centres like roads. This is because lines of communication enable the easy movement of people from one place to another.

Social and cultural factors

Sometimes people who have a common history and ties tend to settle close to each other. This may be because there is a lot that they share in common or because there is security that they feel when they are settled close to one another. For example, the Fengu people at Mbembesi near Bulawayo city.

Political factors and government policy

The government may decide to settle people in certain places for certain reasons. For example, during the colonial era people were removed by the colonial government from places with fertile soils and thrown into the margins of the country such as in certain places in Gokwe and Zambezi Valley where the soils were and are still poor. After independence in 1980 up to now the government has attempted to correct this historical injustice by resettling people on areas where it's good for farming.

Settlement patterns

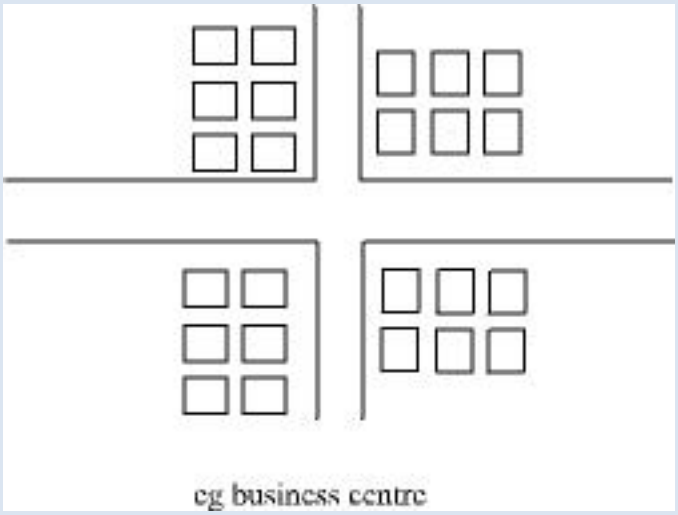
The following are the common types of rural settlement patterns.

a) Haphazard / Dispersed / Scattered settlements

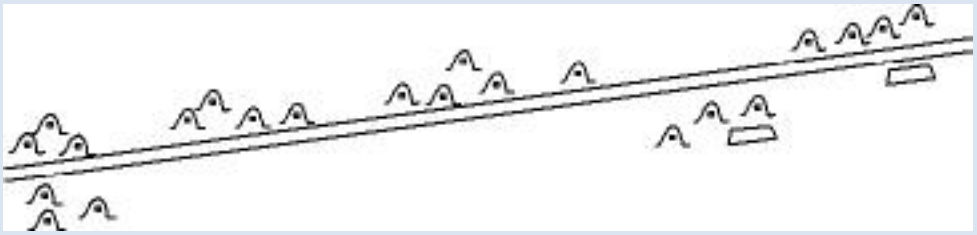
They it usually develops in areas where the soils are poor and as a result people settle as far away as possible from each other so as to maximize on land which could be used for agriculture. So the homesteads are dispersed.

e.g commercial farming area

b) **Nucleated settlements**:– usually develops where there is a limited resource in a low lying area with fertile soils, where people will cluster on this area, hence buildings are closer to each other. It can also develop where there is a shortage of land.



c) **Linear settlement:** – this is by far the most common settlement pattern which develops as a result of both economic and physical factors, for example, people settle along a river for purposes of water supply and they also settle along the road for purposes of transport and communication.



e.g along a road, river valley or along a range of mountains

d) **Radial** – dwelling units radiate outwards from a central point. This kind of settlement pattern would develop from a growth point or service centre where roads go in different directions from this service centre as shown below:

Urbanization

This is a process which describes an increase in the proportion of the number of people who stay in urban areas in a country. For instance, if many people in a country stay in urban areas, such a country will be described as being urbanized.

Causes of urbanization

Why do increasing numbers of people stay in urban areas? The following is an answer to this question.

- Mechanization of agriculture: – if machines replace human labour in rural areas, the farm labourers will be unemployed, hence they will move to urban areas leading to urbanization.
- Industrialization: – the growth of industries in urban areas has created the need for labour such that people move from rural to urban areas.
- Increased education: – the more people are educated, the more they prefer to stay in urban areas where they believe they can get jobs.
- Increased transport and communication: – this has led to a reduction in distance between urban and rural areas. Because of improved and efficient transport and communication systems, urban areas are no longer unreachable like was the case in the past, hence many people are now staying in these areas.
- Services are better and more in urban areas which makes people prefer staying here than in rural areas.
- Natural increase of population: – People staying in urban areas are reproducing themselves leading to an increased rate of urbanization.

Results of urbanization

In developing countries like Zimbabwe, the results of urbanization have been more negative than being positive.

- **Overpopulation:** – this is because there has been an increased number of people in relation to the available resources in urban areas.
- **Overcrowding:** – especially in old residential zones like Makokoba in Bulawayo and Mbare in Harare where many people are crowded in smaller houses.
- **Unemployment:** – the many young and sometimes middle aged people who move from rural areas in Zimbabwe to the two main towns Harare and Bulawayo in the hope of finding jobs have found life tough in urban areas. This is because jobs are not there, hence they become unemployed. This lack of employment especially in Harare and Bulawayo has contributed to a lot of social ills like prostitution, increase in the number of pickpockets. Significant unemployment in Harare and Bulawayo has led to the growth of the informal sector such as street vending and flea markets. It is at these informal sector sites that lot of illegal and sometimes criminal activities are done.
- Pressure on public facilities and services: – increased numbers of people have led to serious pressure on hospitals and schools which are failing to cope. Primary and secondary schools

in towns may have an excess number of pupils because of urbanization, so is the case in the clinics and hospitals.

- Congestion: – this refers to both the vehicles and human traffic. In Harare, especially during the morning and evening rush periods, there is a lot of congestion of vehicles and people and this shows that there is an excess of people
- Pollution – in Bulawayo the most evident form of pollution is land pollution where garbage is dumped where it is not supposed to be. This may indicate the fact that the city council is not coping due to the fact that there are many people relative to the capacity to properly collect and dispose garbage.
- Shortage of housing is a serious result of over urbanization and it is shown by an increasing numbers of tenants common called (lodgers). These people cannot get accommodation because there are just too many. This shortage of housing has also led to the growth of squatter settlements in Bulawayo such as those in Killarney and Ngozi Mine near Cowdray Park. These people have decided to stay, in these shacks because they have nowhere else to stay because they cannot afford proper accommodation.

Solutions to the urban housing problems in Zimbabwe

a) Site and service scheme (stands): – people buy these stands and develop them at their own time, for example, Emganwini and Cowdray Park in Bulawayo
b) Building societies:-they have also tried to provide housing in Zimbabwe by helping people to purchase houses:-
c) Operation Hlalani Kuhle / Garikai: – this helped many people throughout the country to get stands and houses and this has helped reduce the number of homeless people.

Urban structure

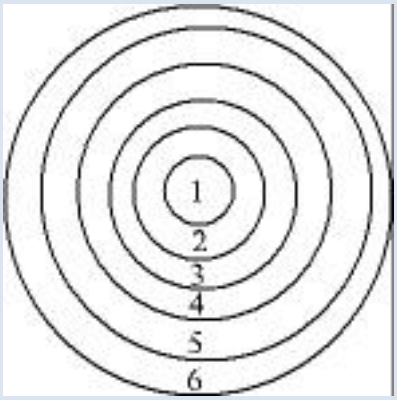
As cities grow, they do so forming different types of shapes and geographers have tried to explain how cities grow. As a result of this, three theories can be identified.

a) The Concentric model by (Burgess in 1924):
b) The Sector Model by (Hoyt in 1939)
c) The Multi Nuclei Model by (Harns – Ulman in 1945)

Concentric Model

It states that a city grows outwards in the form of rings or circles of land use around the central part of the city (Central Business District [CBD]). This is shown in the fig below:

Concentric model- Burgess

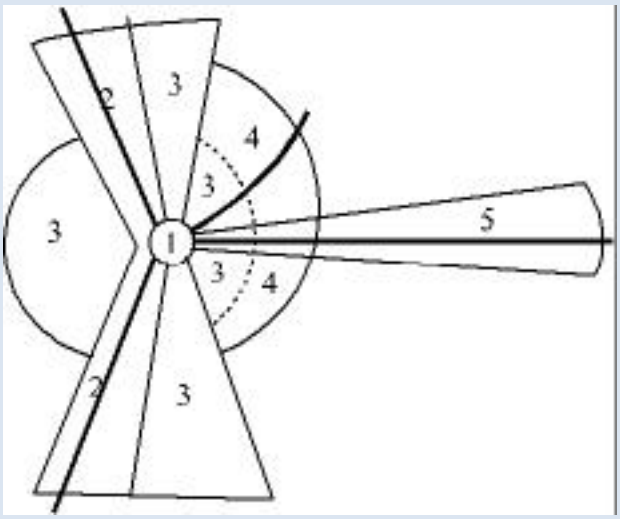


Zone 1. Central Business District (CBD)
Zone 2. Light industries, old private houses and residential flats (immigrant ghettos)
Zone 3. High Density residential (Low class housing)
Zone 4. Medium density (middle class housing)
Zone 5. Low density (high class housing)
Zone 6. The commuter zone

However, it is very rare to find a city with circular or uniform land-uses around the CBD.

Sector Model
It states that a city grows outwards in the form of sectors of land-use, for example, in Bulawayo there is a sector of industrial land-use in the Belmont area, a sector of high density residential in the western areas, a sector of low density in the eastern parts of the city and a sector of medium density in the northern suburbs of the city.

The diagram below illustrates this theory



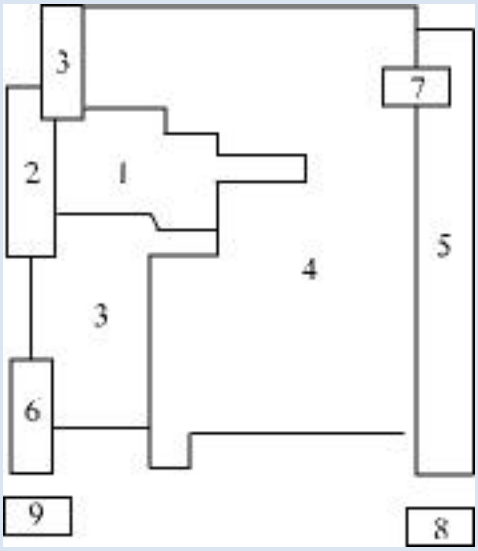
——Major transport roots
(1) CBD
(2) Wholesale and light industry
(3) Working class
(4) Middle class
(5) High class and commuter zone

Multi Nuclei

It states that a city grows from several CBDs, not one. For example, in Bulawayo we have smaller CBDs like Hillside, Bellevue, Ascot, Nkulumane and Entumbane shopping complexes.

- According to this theory, the city will grow from these several smaller CBDs (nuclei) till one large city is formed.

The diagram below shows this theory:



1) CBD
2) Wholesale light manufacturing
3) Low class residential
4) Medium class residential
5) High class residential
6) Heavy manufacturing
7) Outlying business District
8) Residential suburb
9) Industrial suburb

This theory is fairly realistic and can fit the structure of those big cities in developed countries.

When we study these theories of urban structure, we should try and apply them to cities of which we have personal knowledge.

Urban sphere of influence

- An urban sphere of influence (the hinterland) is an area which is dependent on the urban area for its goods and services. For example, if places such as Gwanda, Plumtree, Esigodini, Nkayi, Lupani, Hwange and Tsholotsho get their goods and services from Bulawayo, they become the sphere of influence of Bulawayo.
- They may depend on Bulawayo for furniture, groceries, electrical goods, newspapers, transport etc.

Quality of life

Quality of life can be described as being high or low depending on the availability and quality of goods and services which people should use. The following can be used to measure the quality of life:

- Education: -if the level of education is low, it may indicate a low quality of life. For example few schools, teachers and other educational resources are indications but if the level of education is high and there are good educational resources, then the quality of life may be described as being high.
- Health: -low standards of health certainly point to a low quality of life, and high health standards point as a high quality of life.
- Nutritional value: – if nutritional levels are high it may indicate a well fed people, suggesting a good quality of life as opposed to low quality of life where there is starvation and malnutrition.
- Water facilities: – if there are good and safe sources of water, it suggests a good quality of life as opposed to a situation where there are unsafe sources of water.

Examination type questions

Multiple choice

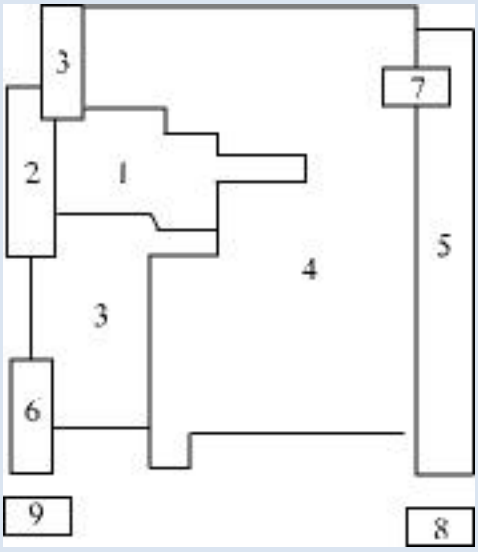
1. Which one of the following is most likely to be observed in a city's Central Business District (CBD)?

A. Cemetry
B. Manufacturing

C Vertical zoning
D Warehousing

2. The most common settlement pattern in Zimbabwe's communal areas is:
A. haphazard
B. Linear
C. Radial
D. Rectangular

3. The diagram below represents a land-use model of a town.



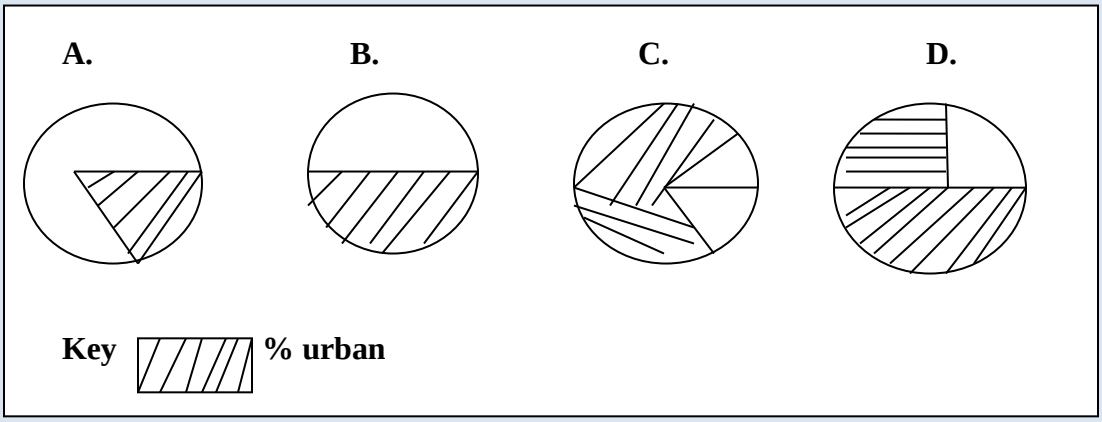
1. Central Business District
2. Wholesale, Light Manufacturing
3. Low class residential
4. Medium class residential
5. High class residential
6. Heavy manufacturing
7. Outlying Business District
8. Residential suburb
9. Industrial suburb

Which of the following land-use zones would represent the residence and place of work of an unskilled worker employed at a large metal smelting plant?
A. 3 and 1
B. 4 and 2
C. 4 and 7
D. 3 and 6

4. Which of the following health problems would affect volunteer workers at flooded settlement following a tropical cyclone?
A. Measles and river blindness
B. Malaria and cholera
C. Sleeping sickness and chicken pox

D. Polio and hepatitis B.

5. Study the pie charts below showing proportions of population living in urban areas for four countries.



Which of the countries A, B, C or D is most urbanized?

6) The pattern of settlement likely to develop in an area with one main road is:

A. dispersed
B. Clustered
C. Linear
D. Radial.

7) The role of housing co-operatives is to:
A Assist government to ease housing backlog.
B. Resettle landless black Zimbabweans
C. Collect money from home seekers
D. All of the above

8) Shanty settlements are characterised by:
A. Overcrowding
B. Few people
C. Good houses
D. Electricity cables.

Essay type questions

1a) Define the term growth point?[2]
b) Why did the government adopt a policy of growth points in Zimbabwe? [3]
c) Explain why most growth points have failed to develop.[4]
2) Describe and explain the nature of high density and low density settlements in an area you have studied.[7]
b) What problems may be associated with housing development in Zimbabwe?[4]
c) How can the problems you have outlined in (b) be overcome? [3]
3) What factors promote the development of shanty settlements in urban centres? [4]

b) Describe and explain the problems associated with sharing settlement in an area you have studied? [7]
c) What can be done to overcome the problems of shanty settlements you have outlined in (b)? [4]
4) Describe the characteristics of the CBD and the urban fringe. [5]
b) Describe and explain the variation in nature of the land use as you move from the centre of the city to the periphery? [7]
5) What is urbanization? [2]
b) What factors have promoted a high rate of urbanization in most developing countries? [5]
c) Outline problems associated with rapid urbanization in a region you have studied. [5]
d) How can the problem you have outlined above be overcome? [4]

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2) Nhandara. Geography Today-Physical
3) Waugh. D, Geography: An integrated Approach
4) Weiss P Focus on Geography Book 3.

CHAPTER 14

POPULATION STUDIES

Chapter objectives

By the end of this chapter one should be able to:

a) Define population distribution and density.
b) Describe factors affecting distribution and density.
c) Define terms associated with population study.
d) Outline the variations between population structure of developing and developing regions.
e) Show working knowledge of the demographic transition model.
f) Examine the relationship between population and resources.
g) Explain the nature and effects of short term and long-term population movements. (migration).

Population studies are mainly concerned with how people are spread over a particular area, and how people are generally populated i.e. their particular characteristics in terms of age and sex movements.

Population Data

Population Data is collected through a population census that is carried out once every ten years. The United Nations Population fund (UNDP) oversees running of such census in all the countries. This helps the world body to make population projections on world population growth trends. At a localized scale population data can be obtained through hospital births and deaths records, school registers and other records associated with population data.

Population density and distribution

Population Density is the number of people within a given unit area some areas are densely populated and others are sparsely populated. Population distribution refers to how people are spread over a particular area.

Population density can be calculated by using the formulae.

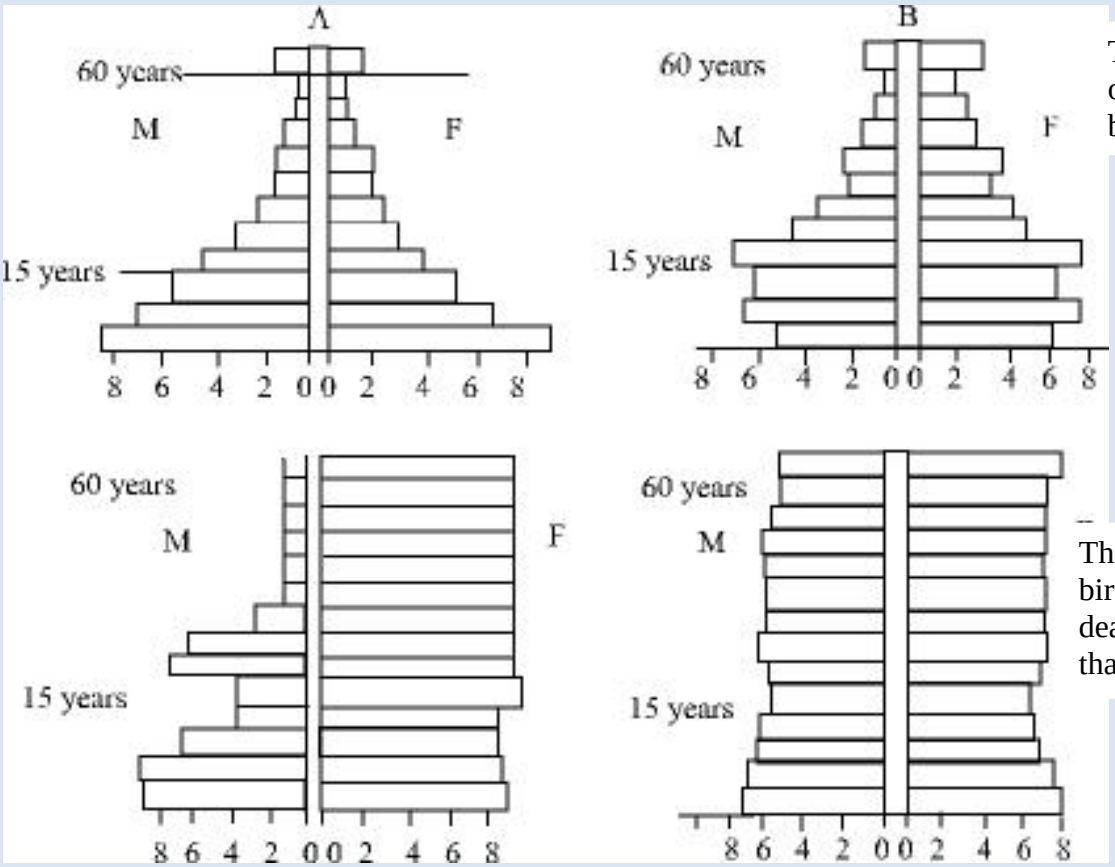
$$\frac{\text{Total Number of pupil in a given area/country}}{\text{Area/ unit per square kilometre}}$$

The age sex pyramid

The age sex pyramid is a graph that shows the composition of the population of a particular society. It shows the demographic characteristics of population structure. Before we look at Age sex structure in detail, we need to be well versed with the following terms.

Types of Age sex structures

The subsequent shape of an age sex structure depends mainly on the interaction between death rate and birth rates. Most countries in the world fall into the population structure shown below.



This shows a counting of an area with a high birth and death rate.

This shows a high birth rate, decline in death rate. It means that babies born live

Age sex structure therefore gives us an indication of the nature of birth rate created as well as growth projection for a particular region.

<u>Demographic transition</u>

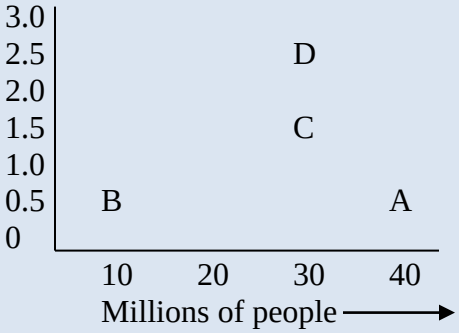
Developed countries are characterized by low birth and death rates signifying higher life expecting. On the contrary developing nations show the opposite characteristics. It is believed that as developing nations learn to cope with challenges in health and modernization, they would assume population characteristics of the developing countries. Such a pattern of growth is explained through the use of a demographic Transition model.

This model identifies 4 stages of development through which countries are believed to go through.

Examination type questions

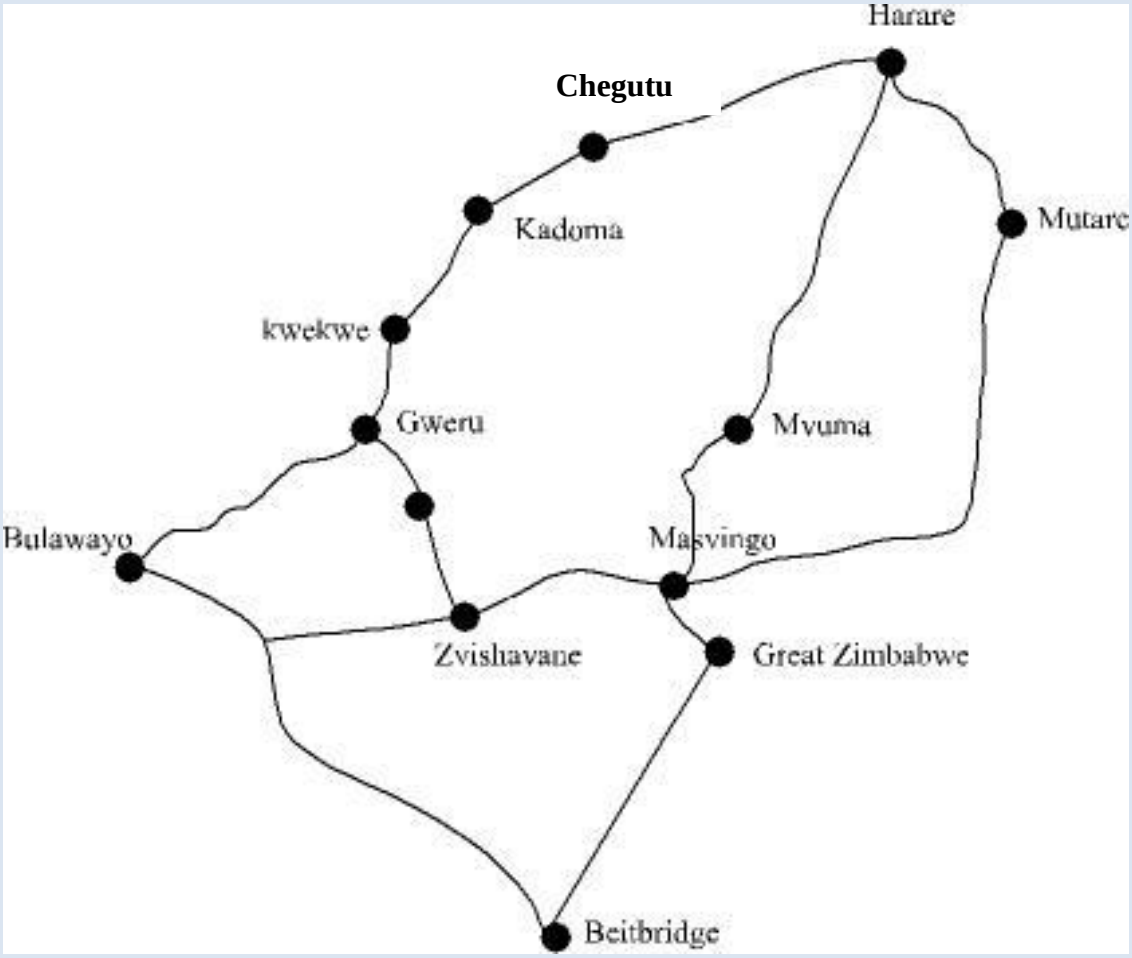
Multiple choice

1. Study the diagram below:



Which one of A, B, C, or D, has the highest population density?

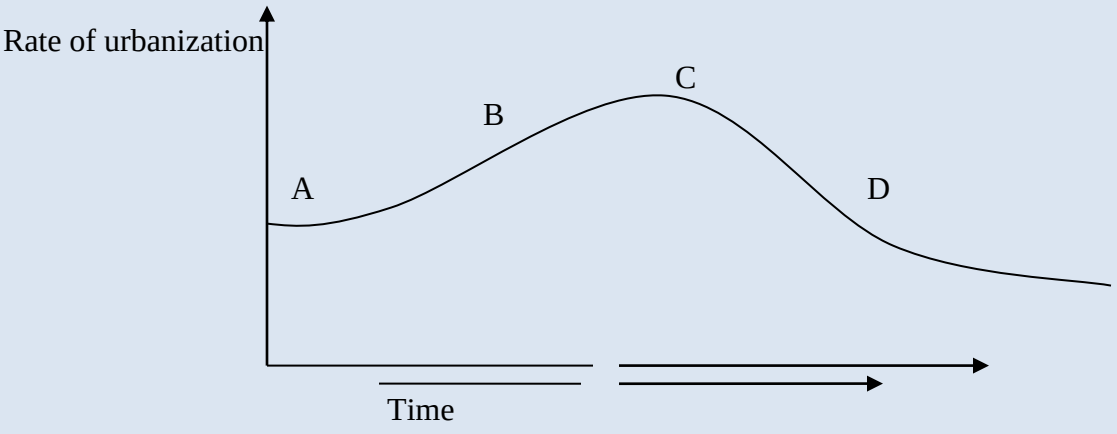
2. The topological diagram below shows the wide tarred roads servicing four towns in Zimbabwe.



Which of the following towns is best saved by wide tarred roads?

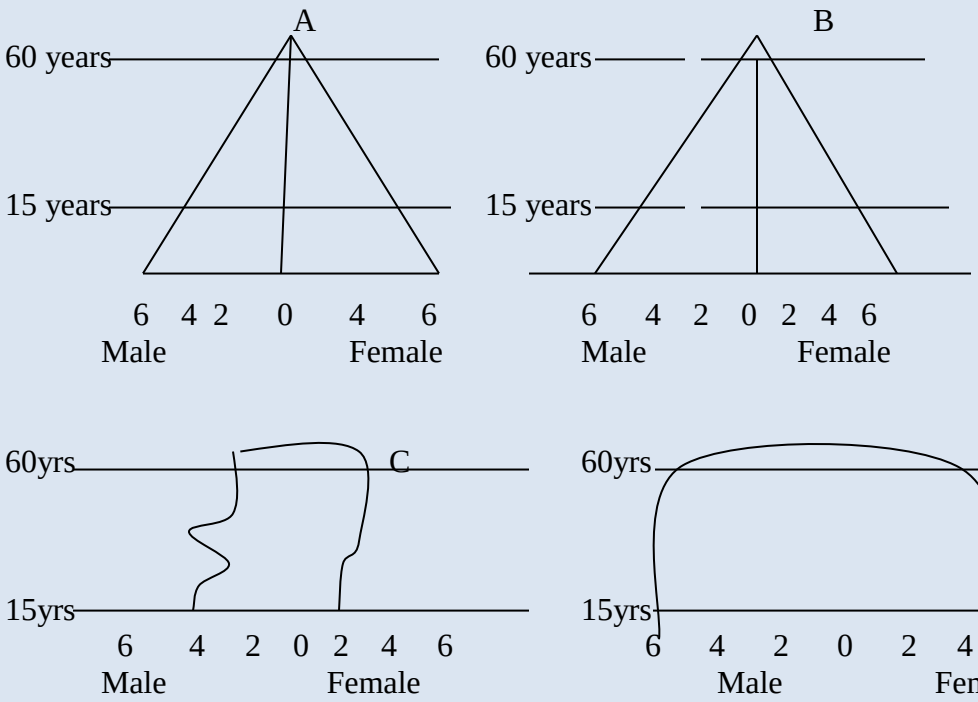
A. Gweru
B. Masvingo
C. Mvuma
D. Zvishavane

3. The graph below shows the rate at which urbanization has been taking place in a region.



Which of stages A, B, C or D is characterised by a high rate of unemployment, old buildings and increasing out migration?

4. Study graphs below



Which of countries A, B, C, D, best represents a population with an effective immunisation programme, improved health care system, high life expectancy and inefficient family planning programmes?

5. Study the table below:

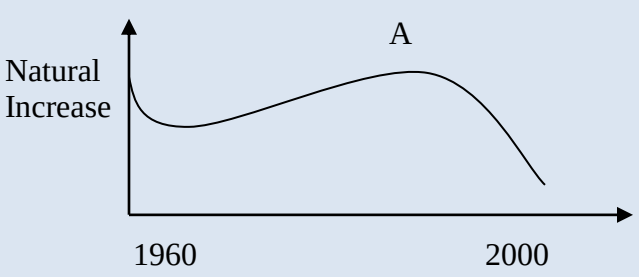
Country	**Birth rate per 1000 per year**	**Death rate per 1000 per year**
A	**13**	**12**
B	47	15
C	50	16
D	54	12

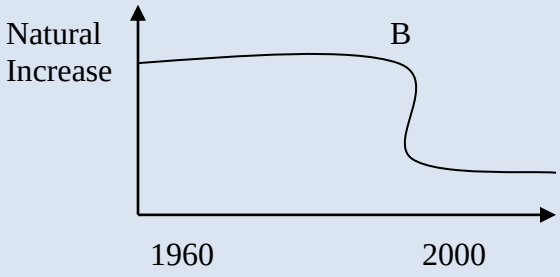
<u>Which of the countries has a highest natural increase in population?</u>

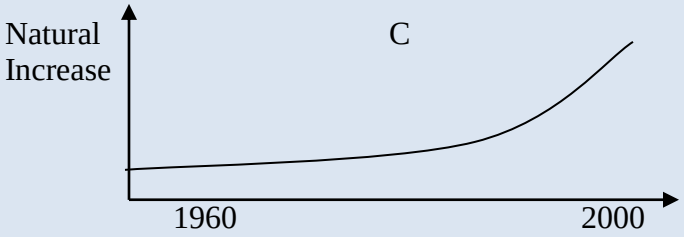
Year	**Birth rate**	**Death rate**
1960	4.0	4.0

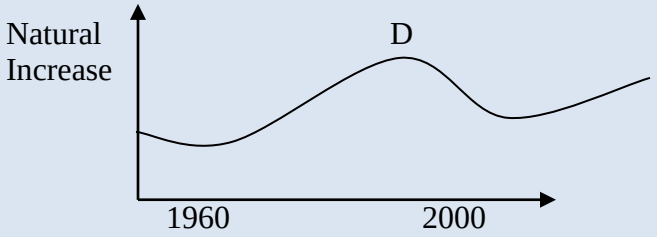
1970	4.0	4.0
1980	3.5	2.5
1990	3.0	1.5
2000	2.5	1.0

Which graph best represents the information shown in the table?









7. The introduction of a supplementary feeding scheme to children less than 5 years in communal areas recued prevalence of:

A. Bilharziasis
B. Cholera
C. Kwashiorkor
D. Tetanus

8) Population data is best collected through

A. Census
B. Interviews
C. Hospital records
D. None of the above

<u>Essay type questions</u>

Population characteristics for region x

Region x

	Male	Female
0-5	300 000	350 000
6-10	280 000	320 000
11-15	200 000	220 00
16-20	180 000	180 000
21-25	165 000	170 000
26-30	160 000	160 000
31-35	140 000	155 000
36-40	135 000	150 000
41-45	125 000	145 000
46-50	115 000	140 000
51-55	104 000	135 000
56-60	55 000	110 000
61-65	35 000	90.00
65+	30 000	60 000

1a) Define population structure. [2]
b) Describe and explain the population characteristics shown. [7]
2a) Outline the population characteristics of a region affected by out migration. [4]
b) What problems are likely to be experienced? [4]

3a) What environment problems may be faced by people living in low lying areas? [3]
b) What measures can be put in place to minimize the problems you have identified in (b) above? [4]
4) What is meant by Demographic Transition? [2]
b) What factors may cause a region to undergo population change? [3]
c) Explain reasons for and against relying on the Demographic Transition Model to explain world population? [4]

Reference

5) Carr. M. Human and Economic Geography
6) Nhandara. Geography Today-Physical
7) Waugh. D, Geography: An integrated Approach
8) Weiss P Focus on Geography Book 3.

CHAPTER 15

TOURISM

Chapter Objectives

By the end of the chapter one should be able to:

a) Outline the main factors affecting the growth of tourism.
b) Describe current trends in world tourism arrivals.
c) Discuss the effect of cumulative causation with regards to tourist earnings.
d) Outline the contribution of domestic tourism in the growth of the local tourism industry.
e) Outline the positive and negative impacts of tourism on a given region.

Tourism is a service industry, that provides services to people on holiday. This has evolved over the past 30 years into a very large money spinning business. At one time it was Zimbabwe's second largest foreign currency earner after tobacco, and Kenya's 2nd after tea and coffee. Various regions all over the world have made a lot of efforts to have their attractions known in order to raise revenue from tourist earnings.

The major regions that account for tourist arrivals are, Spain, the Swiss Alps, tropical Island of Asia and South America and a number of Areas in Africa. All these areas offer some attraction that will pull tourists from all over the world, especially the wealthy nations of Europe, North America and Asia. The main factor contributing to the growth of the industry on a global scale are outlined below.

Factors promoting the expansion of the tourism industry Additional factors promoting tourism in Zimbabwe

1. The formation of tourist boards such as our Zimbabwe Tourism Authority. Its role is to promote the tourist industry both internally and externally.
2. The setting up of "package tours" to various resort areas. These help to reduce costs.
3. An intensive tourist advertising programme through a variety of mass media, television, magazines, brochures, and newspapers. Tourist publicity centres have also been set up over seas, e.g. in the USA and countries in Europe.
4. Expansion of air services mainly on an international level.

Current trends in tourism arrivals in Zimbabwe.

Period	Nature of Change	Reasons for Change
1970 – 1979	Steady decline	- War of liberation intensified

1980 – 1986	90% rise – higher than world average	- Independence brought about the international community in Zimbabwe
1986 – 1987	Steady decline	- Disturbances in the Midlands and Matabeleland provinces - Dissident activities - Showing political instability and insecurity.
1987 – 1999	Steady rise in tourist arrivals	- The unity accord and ESAP i.e. Economic Structural Adjustment Programme.
2000 – 2008	Rapid decline in tourist arrivals	- The land re-distribution programme - Tourist travel warning against Zimbabwe - Bad international relations - Economic sanctions etc.
2009	Steady increase in tourist arrivals	- The global political agreement - Lifting of travel warnings - Improving international relations

Exercise
What other factors than those outlined above have led to an increase in tourist arrivals in Zimbabwe? [3]

Main tourist attractions in Zimbabwe

Distribution of Game Parks and Resorts: -

Places of Attraction	The Attraction
Zimbabwe	- The Devil's Cataract - Main falls - Rainbow galls - Crocodile farm - Fishing on the Zambezi river - The rainforest - Livingstone's statue

Victoria Falls	- The casino - Bungi jumping
The Kariba Dam	- Fishing on Kariba - Cruising - Watch sunsetting - The hydro-electric power station - The dam wall - Boating - Game viewing - Crocodile farm
Hwange National Park	- Wildlife viewing, especially the big 5 i.e. elephant, lion, leopard, buffalo, rhino. - Vegetation
Matopo National Park	- Game viewing - Bird viewing - Fishing - Mountain/ hill viewing - Painting on the rocks (rock paintings)
Great Zimbabwe	- Viewing the ruins - The Zimbabwe bird - The paintings on the walls
Chinhoyi Caves	- viewing the caves. - the blue waters. - seeing the stalagmites, stalactites - bird viewing. - Fishing.
Inyanga Mountains	- mountain climbing
<u>Kenya</u>	- four marine or sea parks along the coast - about 40 mammal species and about 200 of

National Parks and Reserves:	birds to be viewed - elephant, to tiny duiker, wild beast, zebra, antelope, lion, leopard etc. - beaches and reefs for goggling, several water sports, hotels, night clubs
The Rift Valley and lakes	- archeological findings, bird watching e.g. long-legged pink flamingoes
Mountains and forests	- mountain climbing - game viewing and bird watching.

Game parks and resorts are generally located in natural areas. They are natural in the sense that they were not affected by human activities. This is mainly because they are the least attractive or useful for human settlement.

The tourist attraction outlined in the above table need to be marketed in order to attract tourists. It is the day of responsible ministries to provide support services to make these natural attractions viable. These services may include.

- Good well maintained roads.
- Attractions. These will enable easy movement for tourists from big centers.
- State of the art Airports and Hotels. These will give tourists a task of what to expect in the country. Harare international Airport Victoria Falls as well Joshua Mqabuko Airport are being upgraded to world standards.
- Well-trained staff- this is being done by the ministry of higher education and Hotel groups who have trained competent staff.
- The other important aspect is the provision of security to transit telecommunication as well as a vibrant agricultural economy to supply food to tourists.

The Multiplied effect and tourist earnings

The multiplier effect refers to how tourist earnings are gradually spiraled to different sectors of the economy. Read the following story and answer the questions that follow.

The government identified a piece of land for a hotel project. However, it cannot build the hotel due to lack of funds. It finds a partner to build and operate the hotel for a period of 10 years. The initial project requires 2 million bricks and 20 000 bags of cement, among others. This caused the company to mould bricks, to hire more workers and to increase production. The cement and

other supplies do the same. The company that is hired to build the hotel hires builders, painters etc as well as locals as casual laborers.

When the hotel is completed some workers would be put on a permanent basis to run the hotels' various divisions. Local farmers and food suppliers as well as other services provided benefit from supplying services to the hotel.

A peasant farmer, sends her son to a boarding school as a result of a hotel bursary offered to children in the community. Also he has been able to build a brick house and purchase 4 herd to cattle from the produce he supplied to the hotel. During the dry season he works as a part time to guide. The ministry of roads has upgraded the strip into a state of the art road, telephone services are now available as well as clean water and electricity. All this has happened as a result of the hotel construction in the area.

1. Identify the direct benefits resulting from the construction of the hotel.
2. What are the long-term benefits of the stabilization of the hotel after the construction is completed to the community and the country?

It should be noted that tourism investments spread to all parts of the economy and to sectors not directly linked to the industry. This is known as the multiplier effect or cumulative causation. Let us look at the following example:

The hotel group which operates many hotels in the regions needs to purchase new sheets. This will lead to the textile industry having to produce more sheets. This will mean that the demand for cotton will improve leading to better prices. Thus the money paid to the textile company will pay the worker who will pay fees, rates, and other sources, thereby creating employment. The worker will also be taxed, bringing revenue to the government. Also the peasant farmer in Gokwe will receive better payment for his crop, improving the standard of living for rural communities not directly linked to the initial investment.

Exercise:
Identify some other sectors in the economy that may benefit from tourism investment.

Domestic tourism
Domestic tourism refers to local people visiting areas of interest within their country. It is quite unfortunate to note that most people rarely find time or cannot afford to visit areas of interest. Local tour operates have come up with packages that cater for locals. These include offer of special rates and special promotions. Such programmes have enabled a lot of people who have had a chance to visit areas of interest. A typical example is shown by such tours as, Africa Sun and Rainbow Tourism promotions and packages, among others.

Factors promoting tourism in Zimbabwe
Additional Factors promoting tourism in Zimbabwe
5. The formation of tourist boards such as our Zimbabwe Tourism Authority. Its role is to promote the tourist industry both internally and externally.
6. The setting up of "package tours" to various resort areas. These help to reduce costs.

7. An intensive tourist advertising programme through a variety of mass media, television, magazines, brochures, and newspapers. Tourist publicity, centres have also been set up overseas, e.g. in the USA and countries in Europe.
8. Expansion of air services mainly on an international level.

Factors promoting the expansion of tourism industry:

- Development infrastructure eg roads to places of interest and railway lines which are cheaper means of transport.
- Expansion of air lines.
- Climate of an area.
- Tourist attractions found in a country.

Tourist Attraction include the following:

- Physical features, such as mountains, lakes, rivers and coastal areas with beaches.
- Wildlife – wide variety of wild animals of different sizes eg. The African elephant.
- Buildings and monuments – all should be of historical importance eg. The Great Zimbabwe runs the Egyptian Pyramids. etc.
- The Heroes Acre in Harare, the Red Square in Moscow – Russia.
- Sports and other recreational facilities
- Culture – eg. Cultural dance groups
- Good accommodation for visitors
- Good promotion or advertising of the countries attractions and facilities.
- Political stability as reputation of a country will attract tourist into a country.

The role of the government

- Provide the infrastructure and transport.
- It also owns part of the tourist facilities such as hotels e.g. in Zimbabwe the Rainbow Tourism Group (TRG), national monuments, national parks or game parks, museums etc.

The Zimbabwean government established a good infrastructure and many of the transport systems like the National Railways of Zimbabwe, Air Zimbabwe, and ZUPCO are all state owned companies.

The government also provides cheap accommodation and camping caravan sites in national parks and reserves. As a result, the tourist industry relies on national resources and can be bringing a lot of benefits to the country.

Advantages of Tourism

(1) It brings foreign currency and encourages investments.
(2) It creates employment to meet the needs of tourists. Some are employed in hotels, planes, as tour guides, at places of interest etc.
(3) It encourages development of infrastructure in remote areas e.g. construction of roads, hotels, restaurants etc.
(4) It promotes local arts and crafts e.g. carving, pottery, music and dancing.
(5) It creates wealth from natural resources which may not be used otherwise.

(6) It promotes the conservation of our national resources.
(7) It introduces new ideas and cultures and promotes international understanding.

Disadvantages of Tourism

(1) A lot of foreign currency is spent on imports to provide goods and facilities for tourists.
(2) Competition for tourism is costly. A country has to spend a lot of money on advertising for it to promote its tourist destinations or attractions to Europeans and North Americans who are the main travelers.
(3) Too many tourists may pollute and spoil our natural wild places or habitats.
(4) Too many tourists with different cultures may disturb our own local values and way of life.
(5) Tourism may promote crime such as theft and prostitution.
(6) Many of the jobs are poorly paid and are menial. Employment here is unreliable since tourist numbers tend to fluctuate.

Examination type questions

Multiple choice

1. Domestic tourism involves:
a) Locals travelling to tourism resort
b) Locals accompanying foreigners to tourist resorts
c) Locals working in tourist resorts
d) Foreigners visiting tourism resorts

2. Tourism is a service industry because:
A) It employs a lot of people
b) It earns the country a lot of foreign currency
c) It leads to the improvement in communication
d) It provides a service to people wishing to visit places.

3. The main tourist attraction found in the south eastern part of Zimbabwe is:

a) Mountains
b) Waterfalls
c) Wildlife
d) Balancing rocks

4) One advantage of tourism is:
a) It leads to the development of infrastructure
b) It leads to cultural alienation
c) It makes people visit a lot of places
d) All of the above.

5) C.I.T.E.S is an abbreviation for:
a) Cities in tourism entertainment
b) Convection in Trade in Endangered Species

c) Convention in Tourism and Entertainment
d) Celebrate in Tourism education services

6) The following is not a down stream benefit of tourism
a) Hotel construction
b) Road Construction
c) Improved demand for Agriculture produce
d) Payment of school fees.

7) Why do we have more tourists from western countries?
a) They have well developed economies
b) They love travelling
c) They don't like their countries
d) Most of their countries are always cold

8) Game farming is a tourism attraction because:
a) Wild animals are protected from poachers
b) Tourists can view wild animals in large numbers
c) Tourists can pouch animals on game farms
d) All of the above.

Essay type Questions

1) Outline the main characteristics of service industries?[3]
b) Why are service industries important in the economy of a country? [3]
2) With reference to a named tourist destination:
a) Outline the initial factors that led to its development.[4]
b) Describe the economic impact of the destination on local communities.[3]

3) Describe and explain the negative effects of tourism in an area you have studied.[7]
b) How can the effects you have outlined above be overcome? [4]

4) Differentiate domestic tourism from international tourism. [3]
b) What has been done to promote both domestic and international tourism in Zimbabwe? [4]
5) With reference to examples, describe and explain how tourist earnings may improve other sectors of the economy? [7]

Reference

1) Carr. M. Human and Economic Geography
2) Nhandara. Geography Today-Physical
3) Waugh. D, Geography: An integrated Approach
4) Weiss P Focus on Geography Book 3.

CHAPTER 16

Mining, Fuel and Power:

Chapter Objectives

By the end of this chapter one should be able to:

a) Assess the role of geological structure in influencing type of mining
b) Describe the environmental impact of mining
c) Outline the contributions of small scale mining to the economy of a country
d) Describe the various types of funds in use around the world
e) Explain the effect of resource exploitation on local committees.

Mining

The extraction of minerals is a very important activity in many countries and has greatly led to great economic developments. Even in Ancient times mining formed the basis of economic activities from the onset of the Stone Age.

Factors affecting nature and type of mining.

The factors that are discussed below affect mining.

1. **Capital:** This plays a central role in any mining operations. Capital provides for requirements necessary to start mining activities.

   Technology: An area may have the mineral ore, but without the relevant technology it may prove difficult to exploit the mineral e.g. it will be impossible to mine ore underground without technology that supplies oxygen to miners. It is also necessary to have the technology to transport the ore from underground.

   Accessibility: This refers to 2 issues, first, the area where the mine is located should have be a good transport network. Secondly, the mineral ore should be positioned in a place that makes it easy for it to be exploited.

   Market: There should be a ready market for the mined product, for, example international demand for copper has dropped over the years. This has led to the international buying price of copper also falling. Therefore as a result world copper exploitation has fallen drastically. On the other hand platinum is fetching very high prices on the global market as a result countries with platinum reserves are seriously increasing exploitation and mining activities so as to benefit from this resource.

Government Policy: The government may promote or discourage the mining of a particular resource, for example, the buying price of gold in Zimbabwe is determined by the reserve Bank of Zimbabwe. If it puts a low buying rate, then very few investors would put their money in mining of gold. At the

present moment government is supervising the exploitation of diamonds in Manicaland and coal as in Sengwa coalfields in Gokwe.

Environmental impact of mining

Generally mining is associated with a lot of negative effects on the environment. Some of the negative effects of mining are outlined below.

1. Scaring of the Landscape
   Mining pits and escavated sites are left unclosed, in most cases making the land unsuitable for any other economic activity.

2. Hazard to Humans and Wildlife:
   Mining pits left unclosed fill up with water, hence they pose a serious health hazard to both wild animals and human beings. A typical example is the quarrying pits that are found in Entumbane suburb in Bulawayo and in Epworth near Harare. Most people have lost their lives by drawing while some livestock may also stray into the pits.

   Mining causes a lot of air pollution that causes low vision and also chest infections. A typical example is the mining and manufacturing of cement, a lot of dust is released into the atmosphere during the crushing process e.g at Coleen Bawn east of Gwanda town, and Cement Site east of Bulawayo city.

Destruction of Agricultural land

Mining activities, may lead to destruction of productive agricultural and pastoral land.

Mine dams if not properly constructed, break during times of heavy rainfall leading to siltation of rivers and release of harmful substances into rivers, leading to loss of aquatic life and poisoning of drinking water.

Siltation of rivers: The economic impact of mining

1. Job creation
2. Development of infrastructure such as roads, schools, clinics which in turn benefits local communities
3. Helps the country gained much needed foreign currency selling minerals
4. Support of development initiatives by mining companies through payment of school fees, drilling of boreholes, donations in communities they operate.
5. Development of housing projects. These houses are handed over to the community when the mining project is accomplished.

Negative Aspects

- Exploitation of workers.
- Repatriation of profits by transnational companies.
- Antisocial behavior: in mining compound such as commercial sex (prostitution) and drug abuse.

Attempts to minimize the negative impact of mining activities.

A number of communities have carried out a number of measures to reduce the impact of mining on the environment. Some of these measures include:

- Reclamation or reprocessing of mine dumps.
- Filling in of smaller open cast pits.
- Replanting of trees.
- Opening up of mining activities in old mining schemes.
- Transformation of mining compound into useful projects e.g. Kamative vocational training centre which is located on the premises of old Kamative tin mine.

Introducing fish and water based sports in discussed quarry sites that would have filled up with water. Camping sites may be opened.

Small Scale Mining

This involves the operation of mining concerns on a small scale. In Zimbabwe this is mainly done by black people with limited resources. The government has provided considerable support to the small scale mines in the country. Some advantages of small scale mining are:

- Less damage to the environment
- A lot of disadvantaged communities have benefited from the mining activities
- Less machinery is needed to carry out operation.
- Labour costs are minimized.
- Profits benefit communities directly.

Disadvantages

- Lack of capital to import necessary equipment.
- Difficulty in marketing the minerals.
- Lack of skills to effectively exploit the minerals.
- Unfair competition from big mining companies.

FUEL AND POWER

The global use of fuel is determined by the resources that can be exploited by a particular region. It also depends on the knowledge or capacity by a particular area to exploit the resources.

Fossil Fuels:

Fossil fuels are fuels that are found from dead organic matter millions of years ago, and they are non-renewable. This includes:

Oil

-Natural gas

-Coal

The above fuel forms drive most industries on a global scale. These have a very high energy conservation ratio. They live out a lot of by products when they are refined, and are still found in abundance. Their man disadvantage is that they will run out some day and the fact that they are very high in carbon means that when they burn they release a lot of carbon monoxide causing air pollution.

Exercise

- Identify the by -products that are obtained from the processing of natural fuel.
- What problems are caused by the burning of fossil fuels? How can this be overcome.

Other sources of Power

- Wood.
- Bio gas.
- Hydroelectric Power.
- Geo-thermal.
- Nuclear.
- Tidal waves.
- Solar Power.

We shall briefly evaluate the positive and negative effects of the sources of energy outlined above.

Wood

Wood fuel is mainly used in developing countries. This is because these countries do not have the necessary technology and skill to shift to other sources of power. Communities have come up with lots of measures to protect and manage forests, so as to ensure a steady supply of wood fuel.

Exercise

1) What are the advantages and disadvantages of using wood fuels in the communal areas of Zimbabwe and other developing countries?
2) With reference to a named area, outline methods that have been put in place to conserve natural forests?.

Biogas:

Biogas is gas that is produced from fermenting Bio-degradable material, especially waste matter. A special chamber is constructed called a biogas converter). The gas that is produced can be used for cooking and lighting.

Biogas is a good alternative to wood fuels but it has some disadvantages as follows:

It cannot be implemented on a large scale due to the cost involved. A biogas converter can be used only by one household. Only a few rural households can afford to construct biogas converter.

Solar Energy

This is energy from the sun. it is the best alternative to non-renewable sources of energy. It is safe, infinite and user friendly.

Most parts of the developing countries receive vast amounts of sunshine throughout the year and this energy can be harnessed and be used in the home. Solar water heaters have directly reduced

the electricity bills for most consumers and solar panels have an average lifespan of about 20 years which is a good investment.

Hydro-electric Power:
This is use of the kinetic energy produced by running water to turn turbines that produce electrical currents. This power is mostly used in areas that have got a lot of water with a lot of kinetic energy e.g. mountainous regions of Western Europe. Very few countries in Africa have got Hydro-Electric power generators. This is due to the cost involved in setting them up. In places where there is a mountain to provide considerable headfall, of water artificial resources are constructed. This holds back water and then creates sufficient storage for power generation. Typical examples of such schemes are the Lake Kariba lake Kabora Bassa in Mozambique and the Upper and Lower Volta project in Ghana.

Exercise
1. Describe with the aid of a labeled diagram the flow of water in a Hydro electricity generation plant.
2. Discuss the advantages and disadvantages of establishing a hydro electricity plant. (you may refer to the examples)

Geo-thermal Energy
This is energy that is generated through the use of the heat produced by the earth as a result of volcanic activities. Water is passed down into the earth's crust and it will be heated to produce steam. The steam is used to drive turbines that produce electricity.

Geothermal power stations are very expensive to construct and operate. Only a few developed countries can afford to operate such plants e.g. New Zealand and Japan.

Nuclear Power!
Nuclear power is the generation of electricity by using heat generated through nuclear fusion, that is the breaking down of radio-active elements such as uranium. Nuclear power plants are expensive to construct and fairly dangerous. As a results, very few stations have been established especially after a Russian power station exploded in 1986 the (Chernobyl disaster). Nuclear waste is difficult to dispose of safely because it is harmful to the environment. As such, most environmental activists are lobbying for a ban on the use of nuclear energy.

Exercise
Discuss the advantages and disadvantages of using nuclear energy.

Thermal Power:
This is energy produced by burning wood, or mainly coal which will be used to convert water into steam, to turn turbines that generate electricity. The most common example is the Hwange thermal power station which produces about 40% of the countries electricity needs.

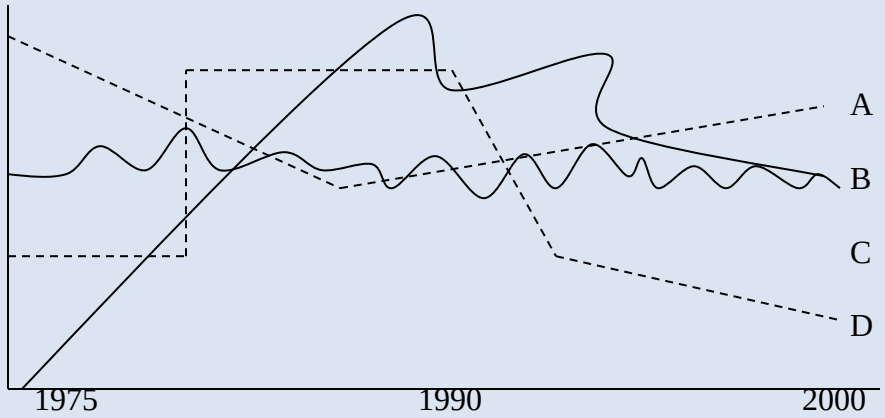
Coal is in abundant supply in Hwange and this promotes the location of the power station there.

Exercise

i) Describe the production disadvantages of using thermal power in an area you have studied.

Multiple choice questions

1. The graph shows changes in prices for 4 minerals marketed by a country.



Which of the minerals A, B, C and D, provided the most reliable source of revenue for the country?

2) An example of a non renewable resource is:
a) Oil
b) Wood
c) Biogas
d) Cow dung

3) One disadvantage of non renewable fuels is:
a) They produce too much pollution
b) They are expensive to import
c) They are found in few countries
d) They can be replaced

4) **One disadvantage of solar energy is:**
a) It is definite
b) Solar panels are expensive
c) Panels can be stolen
d) People

5) A dragline is associated with:
a) Audit mining
b) Open Cast mining

c) Shaft Mining
d) Gold Panning

6) One environmental impact of mining is:
a) Siltation of rivers
b) Exploitation of works
c) Construction of bad roads
d) Anti social behaviour

7) Strip mining is suitable for:
a) Ore buried deep underground
b) Ore buried just below the surface
c) Ore inclined from the surface
d) All types of ore.

8) Load shedding is caused by:
a) Corruption at ZESA
b) Insufficient power produced to meet demand
c) Too much power produced to meet demand
d) Lack of foreign currency to pay workers.

Essay type questions

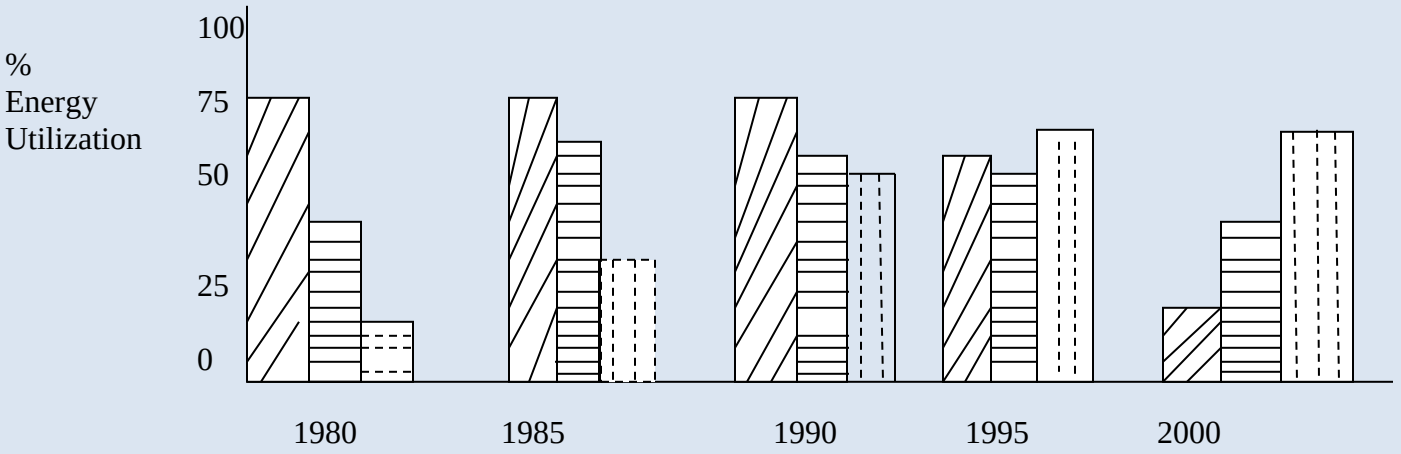
1a) Discuss the impact of uncontrolled diamond mining in Zimbabwe. [4]
b) Describe and explain measures put in place to minimise the impact noted in (a) above. [7]
c) What are the benefits of controlled diamond mining on the social and economic well being of Zimbabwean? [4]

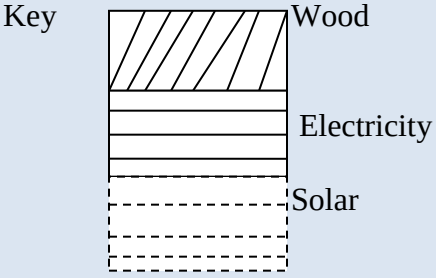
2) Define small Scale mining [2]
b) What are the advantages of small scale mining in Zimbabwe? [4]
c) Describe the environmental impact of mining activities? [4]

3) What are the causes of load shedding in Zimbabwe? [3]
b) Describe and explain ways by which Zimbabwe can reduce the occurrence of load shedding? [7]
c) What problems are likely to be faced by the country in its attempt to reduce load shedding? [3]

4) Explain the terms Bio-diesel [3]
b) What are the advantages and disadvantages of using Bio-diesel to a fuel importing country such as Zimbabwe? [7]
c) What other measures have the government put in place to ensure a constant supply of fuel in the country? [3]

5) Study the diagram below showing energy utilization trends of a developing country over a period of time.





a) List 3 advantages and 3 disadvantages of solar energy. [6]
b) Describe and explain the trends shown in the diagram below. [7]
c) What measures can be put in place to ensure that more people can access solar energy? [4]

Reference

1) Carr. M. Human and Economic Geography
2) Nhandara. Geography Today-Physical
3) Weiss P Focus on Geography Book 3.

CHAPTER 17

MAP WORK SKILLS

Chapter objectives

At the end of the chapter one should be able to:

a) Identify places on a map
b) Measure bearing and distance on a map
c) Draw relief sections and describe land use patterns

Grid Reference

This is a map reading technique or skill which can be applied in different careers linked to geography. It gives general and specific position or location of places, features, objects or targets in given regions or areas on a map.

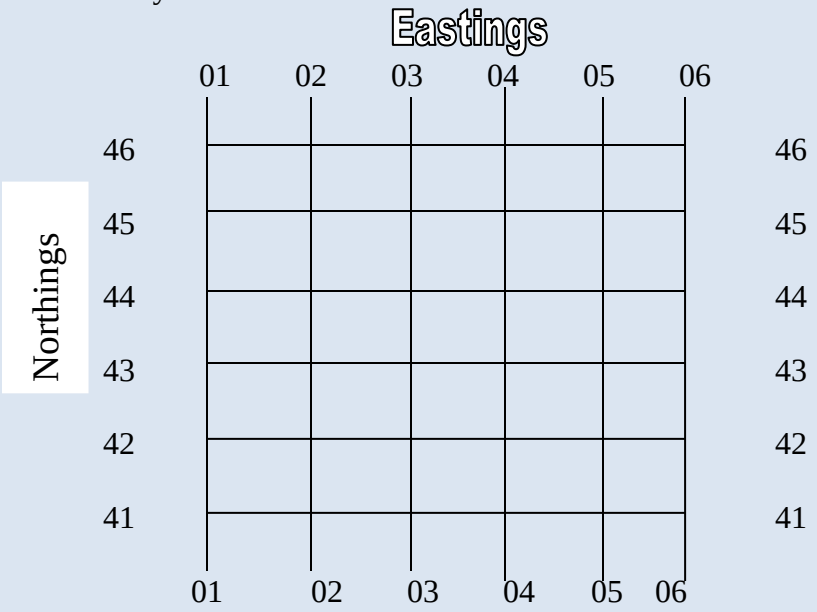
Careers relying on grid reference

1. Aviation/aircraft piloting
2. Survey and civil engineering
3. The army and police
4. Travel and tourist guides
5. Geographers etc

The grid system

Topographical or relief maps are made up of a combination of vertical and horizontal lines. The lines give reference to a grid system, hence the term **Grid reference**.

The vertical lines are called eastings. This is because they measure towards the east of the map. They increase in value from the west to the east. For example 01, 02, 03, 04, 05, 06 as below:



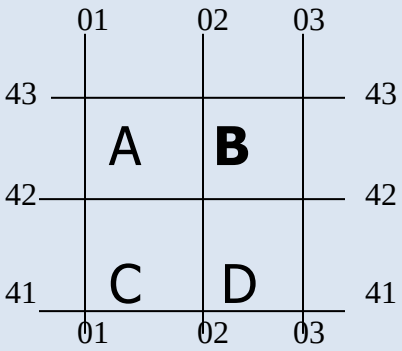
- When giving the grid reference of a point or feature on a map we start by vertical lines (eastings) followed by horizontal lines (Northing)
- There are two ways of giving the grid reference on maps which are:

a) Four figure grid reference
b) Six figure grid reference

Four figure grid reference.

- This gives a general location or position of features on maps

Example:



The four figure grid reference of:

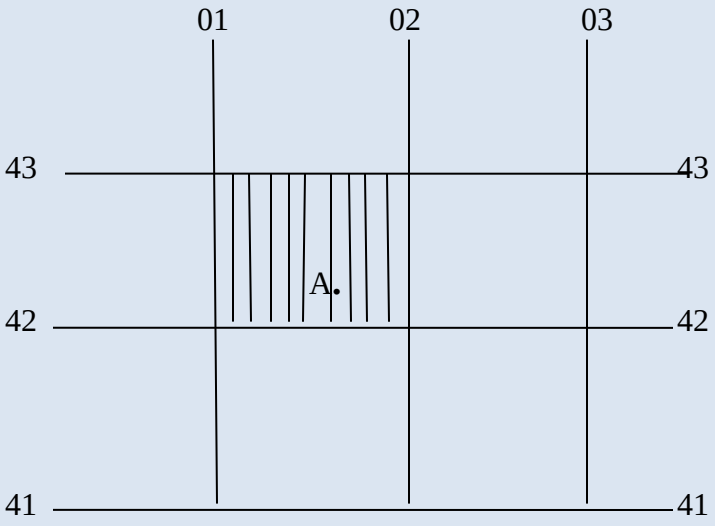
A= 0142
B= 0243
C= 0141
D= 0241

The six figure grid reference:

- It gives us the specific position or location of features on maps. It shows where exactly the feature is located.

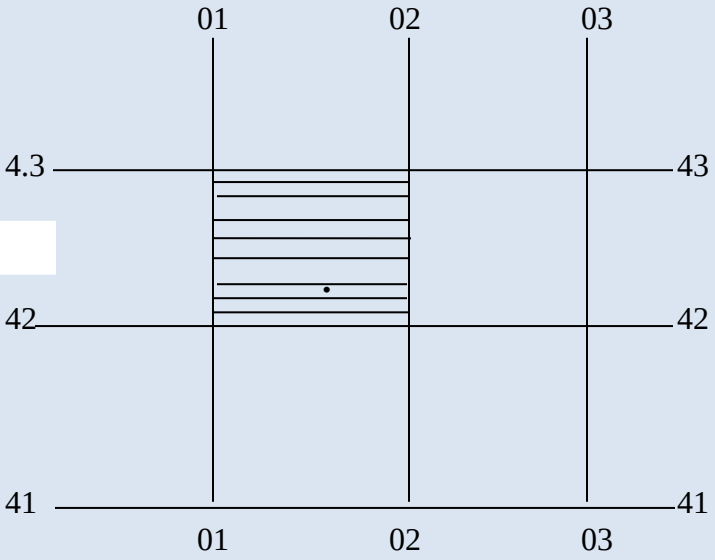
- When giving the six figure grid reference of a feature, we first of all find the eastings, then divide the square into ten equal parts, these divisions will help us to find the first three set of eastings.

Examples:

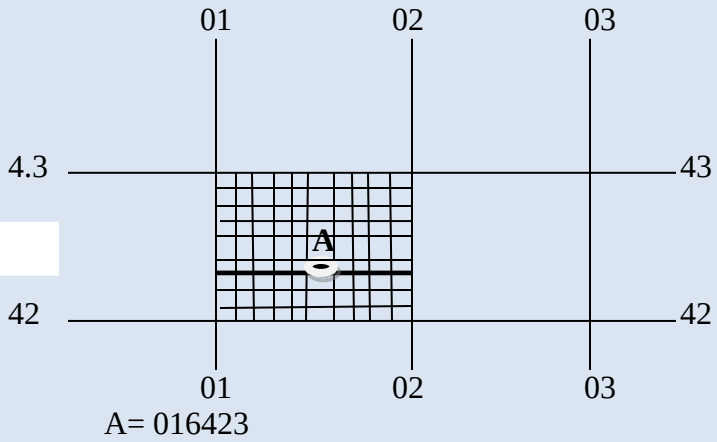


A= 016

After this we find the last three figures of the northings.



17.1.1 A



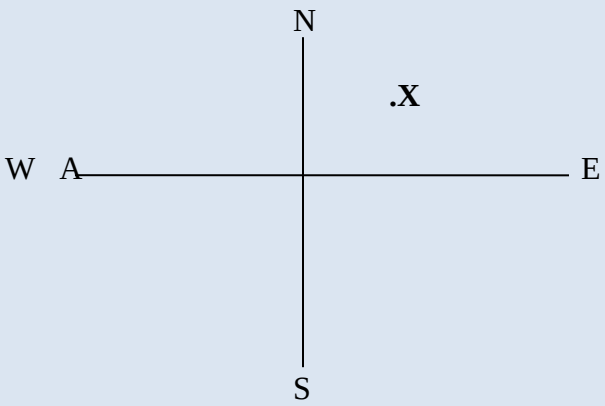
A= 016423

Direction

Direction is also another way of giving position of features on maps. Generally direction is given using compass points of which we have:

a) Four cardinal points
b) Other points

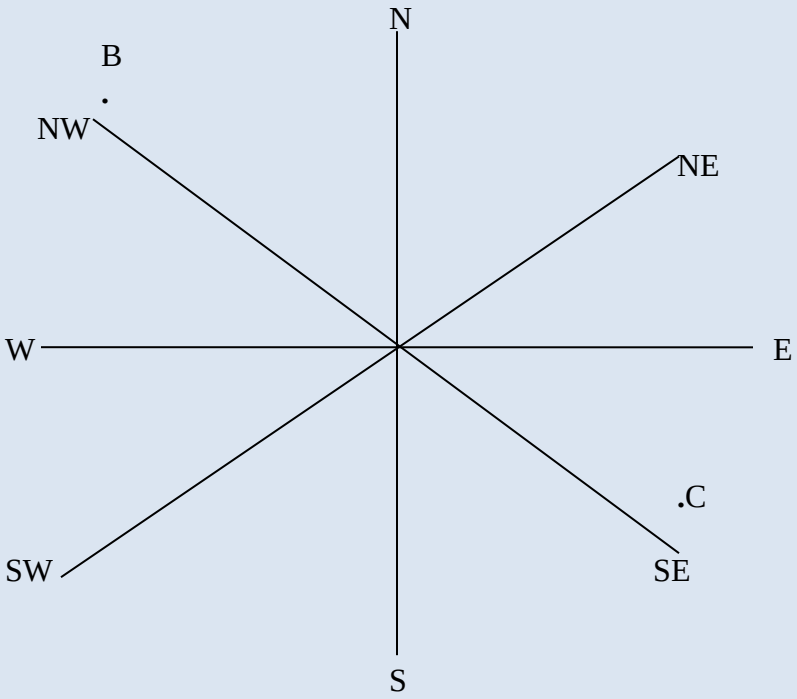
Four Cardinal points of a compass



Examples: What is the direction of point X from A?
Answer: North-East

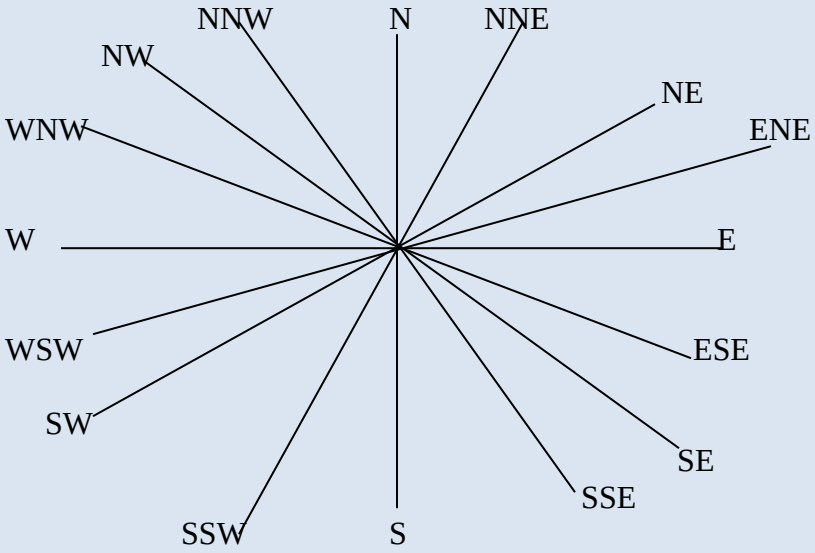
Ordinal points of a compass

-These lie mid way between the cardinal points of a compass

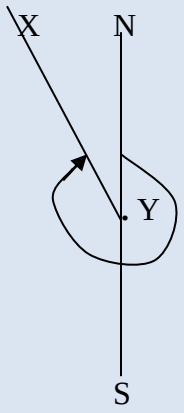


Example: What is the direction of point B from C?
Answer: North West

Other Compass points



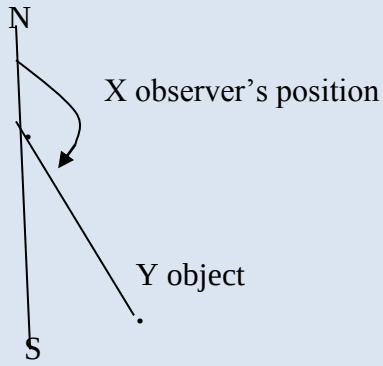
Bearing
Bearing is measured as an angle measured in a clockwise direction from north. It is taken to find the accurate direction of an object viewed from the observer's position in degrees.



Bearing of X from Y= 335^0

Example 2
Find the bearing of Y from X

Method:
1. Draw North- South line passing the observer's position- which is now X
2. Join X and Y by a straight line
3. Measure the angle in a clockwise direction from X to Y



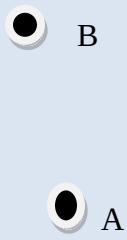
Bearing of Y form X= 165^0

Gradient

- It can simply be defined as the change of slope on a part of the earth's surface such as the side of a hill.
- It is stated as ratio, for example, 1:20m, which means that for every 20m of movement horizontally, the slope rises by 1m.
- On maps, gradient is calculated by subtracting the lowest altitude from the highest altitude and this will be the **vertical distance**.
- After this, measure the **horizontal distance** between the two points.
- Convert the vertical distance into the same units as the horizontal distance. After this, gradient can then be calculated.

Gradient = $\frac{\text{Vertical distance}}{\text{Horizontal distance}}$

Example: What is the gradient from the point A (1 500m) to point B (17 500).



Vertical distance = 17 500
- 1 500
= 16 000m.

Horizontal distance = 8cm

Gradient = $\frac{\text{Vertical distance}}{\text{Horizontal distance}}$

= $\frac{16000 \times 100}{8}$ (to changes to same units as horizontal distance

= $\frac{1600\ 000}{8}$

= 200 000
= **1:200 000**

Distance

Sometimes students may be required to calculate distance on maps. This distance may be along straight courses or along widening courses.

- To calculate distance along straight courses, we simply measure the distance between the two points by a ruler and convert this distance by the scale of the map.
- For example if the scale of the map 1:50 000 or 1 cm: ½ km, and the distance along a straight line between the two points is 13cm, the actual distance will be 7,5km, after converting, using the scale of the map.
- Along winding courses like roads or rivers, we should use a string. A string can be twisted and turned along the winding course of a road.
- After this the string can then be stretched and the distance measured by a ruler, after which the scale of the map can be used to convert the distance measured by a string.

Area

- Pupils may be required to find the area of regular and irregular land uses on maps
- The easiest method to use id the square method, where if the land use is regular, the pupils needs to count the number of squares. In this regular land use and this will give the answer for example if there are 10 squares the answer will be $10km^2$. This is because on the 1:50 000 maps, regular squares are 2cm x 2cm = $1km^2$ for one regular square. is Simply 1: 50 000 is 1:1/2 km or 2cm: 1km therefore 10 square is $10km^2$.
- On irregular land uses, trace the land use on graph paper, count the full squares, also count the remainder of the squares so that by your estimate they make full squares, then add up to find the area.

Land forms

Pupils need to familiarize themselves with the most common types of landforms on maps especially physical landforms. These landforms are identified on the basis of the arrangement of contour lines. The way that the contour lines are arranged tells us the type of physical landform. Pupils are therefore encouraged to familiarize themselves with the most common types of landforms.

Examination type questions

Multiple choice

1. A relief section shows

a) A generic outline of the whole area
b) The general relief of the area
c) A cross section of the map along an identified line
d) A line that cuts across the earth.

2. Which of the following is an example of a representative fraction scale?

a) 1cm to represent 2km.
b) 1:50 000.
c) 50. 000:1.
d) 2 term to represent 1 cm.

3) The 6 figure grid reference shows us:

a) The exact location of a given point on a map.
b) The area where we can locate features on a map.
c) The four figure reference of a place.
d) Six figures taken for northings and eastings.

4) One important use of maps is to:

a) Predict weather
b) Plan for new land development
c) Organize camping trips
d) Go fishing

5. Gradient is:

a) The ratio between vertical and horizontal distance

b) The distance between two points.
c) The measurement of distance.
d) All of the above.

6. Water on maps is represented by the colour:
a) Blue
b) Black
c) Red
d) Green.

7) A steep slope on maps is shown by:
a) Contour lines evenly spaced.
b) Contour lines being close together.
c) Contour lines being far apart.
d) Contour lines cutting across a river.

Essay questions
1a) Outline the main stages involved in map making. [3]
b) Discuss the role played by maps in different sectors of society. [b]

2) Describe in detail with the aid of sketch diagrams how you would locate places on given topological maps. [4]

3a) Define scale. [2]
b) Explain why scale is an important component in Map work. [3]

4) Explain your understanding of bearing.[4]
b) Describe how you would measure bearing of different points on a given topological map. [4]

5) Describe and explain how a skeletal/cross/relief section is constructed. [7]

b) What is the importance of using relief sections in map work? [3]

6a) Outline, with reference to examples, various ways by which physical and man- made features are presented in topological maps.[5]

b) What are the advantages and disadvantages of using the methods you have outline in (a) above. [4]

Reference

1) Prichard M.J Map reading.