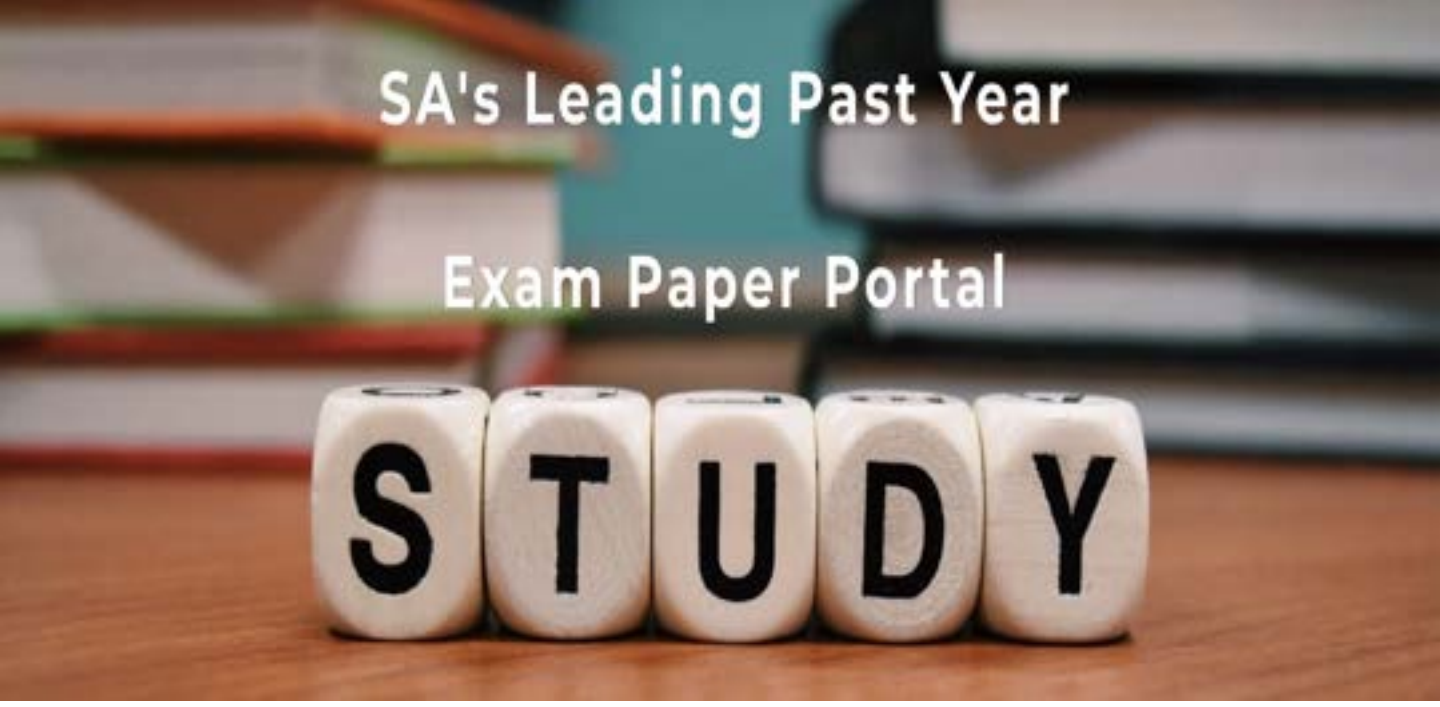

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TABLE OF CONTENTS

1. INTRODUCTION

The declaration of COVID-19 as a global pandemic by the World Health Organisation led to the disruption of effective teaching and learning in many schools in South Africa. The majority of learners in various grades spent less time in class due to the phased-in approach and rotational/ alternate attendance system that was implemented by various provinces. Consequently, the majority of schools were not able to complete all the relevant content designed for specific grades in accordance with the Curriculum and Assessment Policy Statements in most subjects.

As part of mitigating against the impact of COVID-19 on the current Grade 12, the Department of Basic Education (DBE) worked in collaboration with subject specialists from various Provincial Education Departments (PEDs) developed this Self-Study Guide. The Study Guide covers those topics, skills and concepts that are located in Grade 12, that are critical to lay the foundation for Grade 12. The main aim is to close the pre-existing content gaps in order to strengthen the mastery of subject knowledge in Grade 12. More importantly, the Study Guide will engender the attitudes in the learners to learning independently while mastering the core cross-cutting concepts.

2. HOW TO USE THIS SELF STUDY GUIDE?

This Self-Study Guide only covers the section on Geomorphology. The booklet is designed to explain concepts that seem to be challenging to learners in the Grade 12 exams. The first part focuses on the Exam structure for Paper 1 or Paper 2, followed by explanation of the most common action verbs used in the question paper and how learners should manage their time. The second part focuses on the selected key concepts with their explanatory notes, followed by assessment activities designed from previous examination question papers. The guide also provides relevant answers and guide learners on how to use a mark allocation (on a question) in order to determine the extent of your response. Mapwork has been integrated in all the relevant sections to follow the new exam structure.

The guide should be used in conjunction with other resources such as DBE approved textbooks, 2021 Exam Guidelines and Geography CAPS document.

3. EXAMINATION STRUCTURE

PAPER 1

3.1.1 This is a 3-hour question paper which is written on a SEPARATE DAY from Paper 2.

3.1.2 The mark allocation for this paper is 150.

3.1.3 The question paper consists of two sections, namely SECTION A and SECTION B:

SECTION A: Climate and Weather and Geomorphology (Theory)
SECTION B: Geographical Skills, Techniques, Application and Interpretation and GIS (Mapwork)

3.1.4 SECTION A consists of TWO questions of 60 marks each. SECTION B consists of ONE question of 30 marks.

3.1.5 All the THREE questions are compulsory.

PAPER 2

3.2.1 This is a 3-hour question paper which is written on a separate day from Paper

3.2.2 The mark allocation for this paper is 150.

3.2.3 The question paper consists of two sections, namely SECTION A and SECTION B: SECTION A: Settlement and Economic Geography of South Africa (Theory) SECTION B: Mapwork- Geographical Skills and Techniques (Map work)

3.2.4 SECTION A consists of two questions of 60 marks each and SECTION B consists of one question of 30 marks.

3.2.5 All the three questions are compulsory.

4. EXAMINATION TIPS

4.1 TYPES OF QUESTIONS

The types of questions in both Paper 1 and Paper 2 are as follows:

4.1.1 Short objective questions:

- Multiple-choice:
  - Know what each multiple-choice question is asking.
  - Read the entire question.
  - Evaluate each answer to the multiple-choice question.
  - Eliminate each answer that is clearly wrong.
  - Select the best answer.
  - Do not leave any question unanswered.
- Matching:
  - Know the definitions/explanations of concepts for each section as you will be required to pair each item with the correct terminology provided.
  - These questions assess recognition and recall of knowledge acquired.

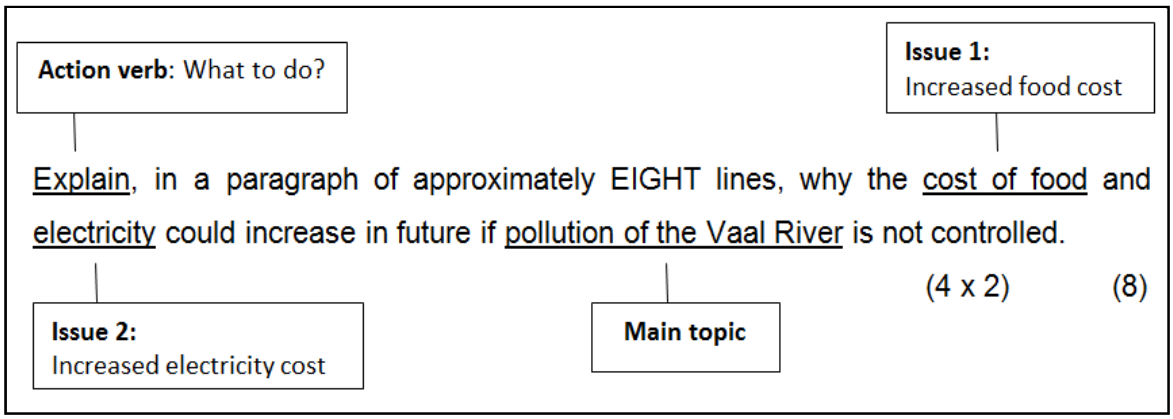
4.1.2 Data response questions

- With a data response question, you are required to interpret diagrams, maps, photos, tables, statistics, cartoons, graphs, etc.
- Data response questions require knowledge, application, analysis, critical thinking and evaluation.
- Marks for data response questions range from 2-8 marks.

4.1.3 Paragraph-type questions

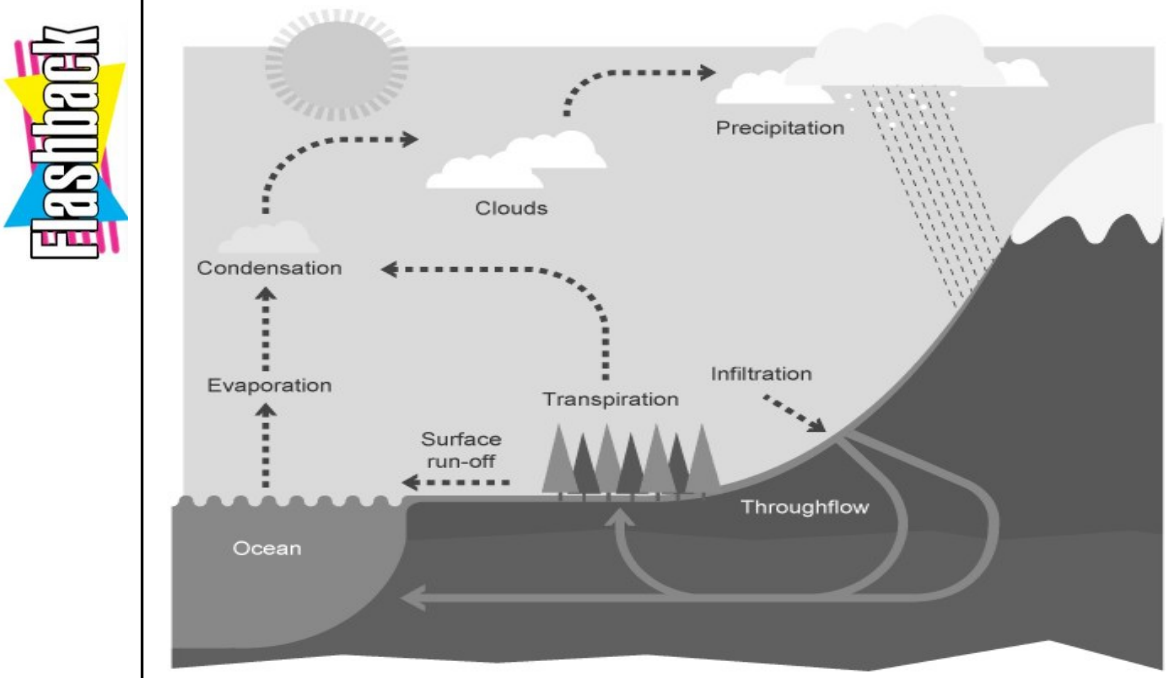
- Paragraphs assess communication skills, knowledge, and insight. These questions require critical and analytical thinking. In order to master these questions, learners should:
  - underline the main topic of the question,
  - underline the action words or question verbs,
  - underline the focus areas of the question (note that most paragraph questions might require two aspects or issues that must be discussed/ explained in two equal parts),
  - write in full sentences to explain answers, and
  - avoid repetition of facts.

An illustration of how to analyse a paragraph question statement:



The cost of food will increase because the polluted water will be expensive to purify so that it could be used in agriculture. Farmers will have to buy more chemicals to purify the water. If not, they will have to buy purified water from other service providers at a costly price. This will have a negative impact on production costs in agriculture, leading to increased food prices. Furthermore, polluted water reduces soil fertility which could lead to crop failure. This could lead to food being imported from other countries at very expensive prices in order to prevent food insecurity in the country. Polluted water will be expensive to purify so as to generate hydro-electricity, thereby causing Eskom to inflate electricity prices. Increased production costs will increase electricity costs. Less production of electricity due to river pollution will increase demand and supply, making electricity costs expensive. (4 x 2) (8)

4.2 FLASHBACK ON THE WATER CYCLE



Water cycles refers to the process whereby water evaporates from the ocean and is transported by wind, in the form of water vapour and clouds to the atmosphere where it falls back to the surface as precipitation.

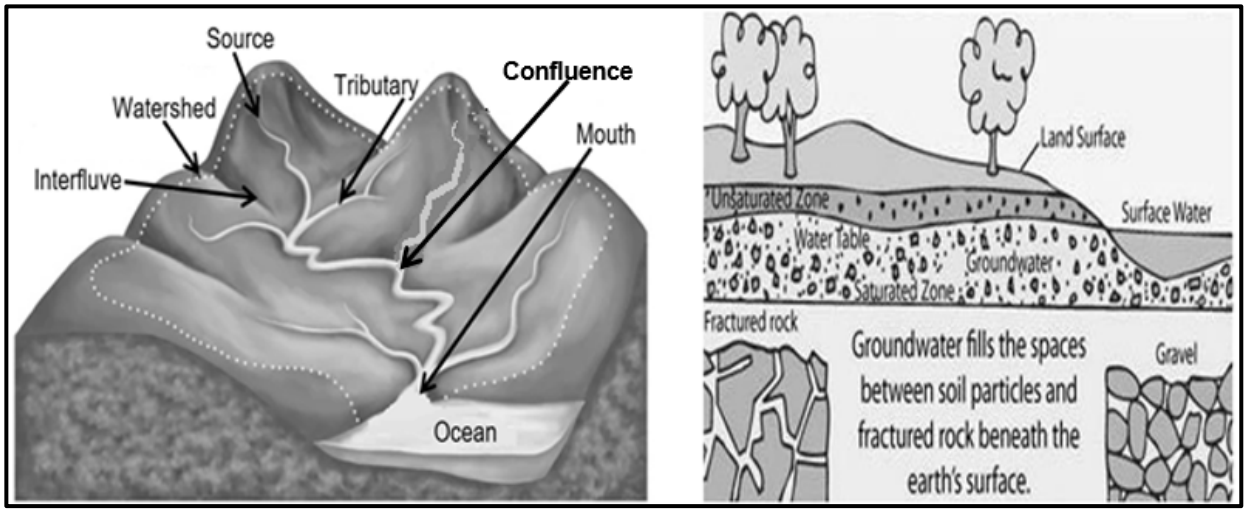
The precipitation flows on the surface as *sheet flow and *channel flow and become part of the drainage basin.

*** Sheet flow** The even flow of water on the surface	*** Channel flow** The flow of water mainly in rivers

5. CONCEPTS OF DRAINAGE BASINS

A. KEY CONCEPTS AND NOTES

CONCEPT	DESCRIPTION
Drainage Basin	This is the area through which a river system flow
Catchment Area	The collection area of rainwater in lakes, rivers, and reservoirs
River System	The mainstream and its tributaries
Tributary	A river or stream flowing into a larger river
Confluence	The junction of two rivers/streams
Watershed	High laying area that separates drainage basins
Interfluve	High laying area that separates tributaries in a drainage basin
Source	The place where the river begins
River mouth	It is the part of the river, where the river flow into another river, a lake, a reservoir, a sea, or an ocean
Ground water	Water underneath the earth surface
Through flow	It is the lateral flow of water in the soil zone
Water table	Upper level of ground water
Infiltration	When water soaks or filters into the soil



B. FACTORS INFLUENCING INFILTRATION OF WATER

1. **Amount of water already in the ground**
   - Saturated soil can hold more water increasing surface flow.
   - Dry soil absorbs more water increasing infiltration.

2. **Evaporation rate**
   - High evaporation means that there is less water for infiltration.
   - Dry, hot, and windy

3. **Gradient of slope**
   - Gentle gradient slopes allow more to infiltrate and be retained by the soil.
   - Steep slopes enable water to run-off more easily

4. **Nature and Amount of precipitation**
   - Heavy showers cause greater run-off and less infiltration.
   - Softer rains allow more infiltration.

5. **Density and type of plant cover**
   - Sparse (Little) vegetation encourages run-off and allows rapid evaporation.
   - Thick plant cover allows more infiltration.

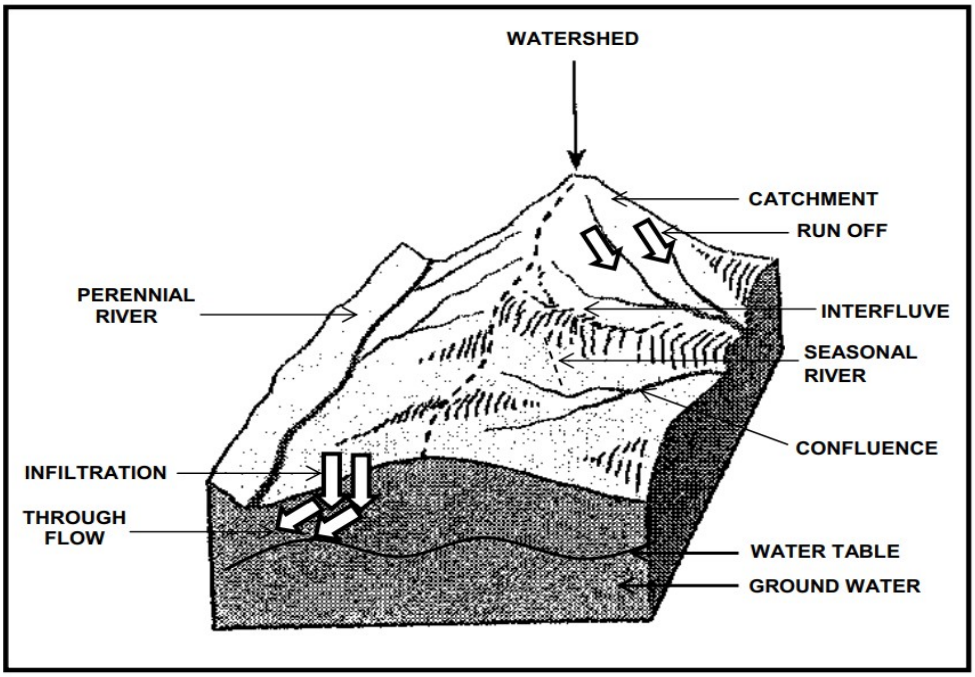
6. **Porosity**
   - High porosity results in high permeability, therefore more infiltration.
   - High porosity in soil increases infiltration.
   - A rock or soil is porous when it is able to store water.

7. **Permeability**
   - Rocks or soil is permeable when it allows water to pass through it.
   - Rock with high permeability and high porosity are known as aquifers.
   - Rock with low permeability and low porosity are known as aquicludes.

8. **Soil Moisture**
   - Dry soil absorbs more water and reduce stream runoff. This leads to lower drainage density.
   - Infiltration is low in soil that has high moisture content.

C. DRAINAGE BASINS ACTIVITIES

5.1 Refer to FIGURE 5.1 which shows fluvial features and give ONE term for each of the statements below.



Adapted: Geomorphological Landforms

5.1.1 Water that flows on the surface after it rains

5.1.2 High-lying area that separates two rivers in the same drainage basin

5.1.3 Water found below the earth's surface

5.1.4 River that flows throughout the year

5.1.5 Upper level of ground water

5.1.6 Meeting place of two rivers

5.1.7 Soaking of water into the ground

5.1.8 Movement of water through the soil to rivers (8 x 1) (8)

5.2 FIGURE 5.2 illustrates the main features of a drainage basin. Study the diagram to answer the following questions.

5.2.1 Define the term drainage basin. (1 x 2) (2)

5.2.2 Explain the difference between a watershed and an interfluve. (2 x 1) (2)

5.2.3 What major factor influences the type of river that exists? (1 x 2) (2)

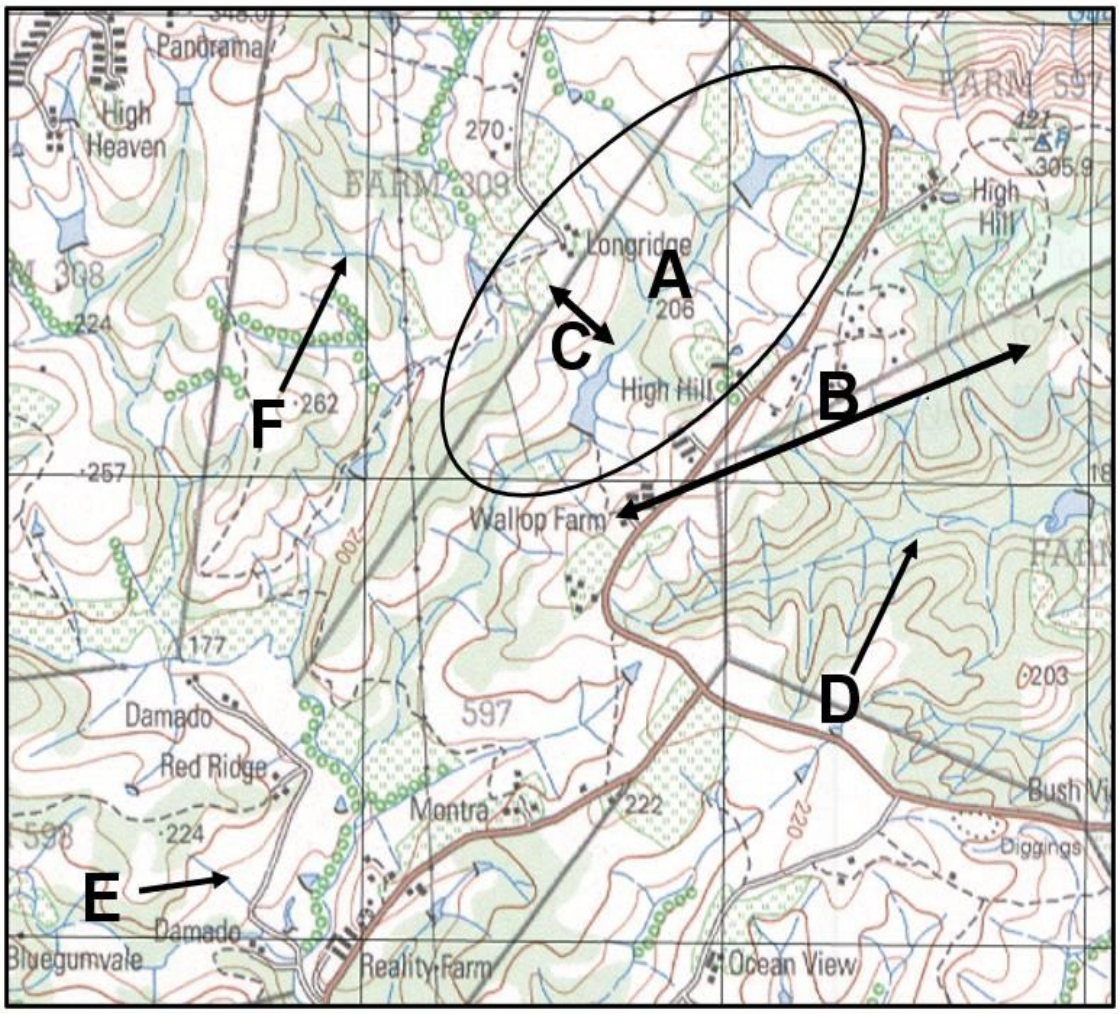
5.2.4 How will the urban environment affect the rate at which run off occurs? (1 x 2) (2)

5.2.5 Give TWO reasons for your answer in QUESTION 5.2.4. (2 x 2) (4)

5.2.6 "Due to human activities, the natural balance that exists within a river system has been disturbed and the natural catchment areas have been degraded." Write a paragraph of approximately EIGHT lines on the negative impact that human activities have on drainage basins. (4 x 2) (8)

MAP WORK APPLICATION

5.3 Refer to the extract from a topographic map and answer the questions that follow.



5.3.1 The area at A represents the (river system/drainage basin). (1 x 1) (1)

5.3.2 Differentiate between high lying areas B and C. (2 x 1) (2)

5.3.3 Refer to D

(a) In which direction does the mainstream at D flow? (1 x 1) (1)

(b) Provide TWO reasons for your answer to QUESTION 5.3.3(a). (2 x 2) (4)

5.3.4 At which point E or F are the chances of flooding higher? Motivate your choice. (1 + 2) (3)

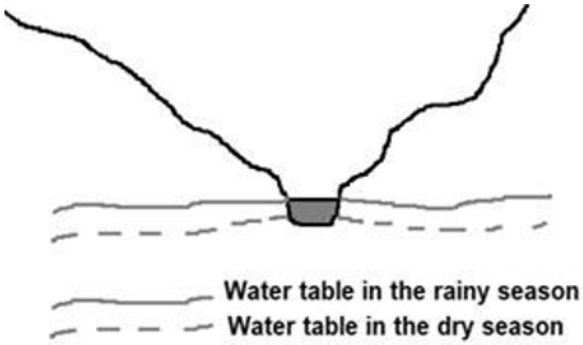
6. TYPES OF RIVERS

A. KEY CONCEPTS

Concept	Explanation
Permanent Rivers	Flows throughout the year
Periodic Rivers	Flows every year only in the rainy season
Episodic Rivers	The rivers only flow for a short period of time after heavy rainfall
Exotic Rivers	This is a permanent river that originates in a rainy/wet area but later flows through a desert

B. NOTES AND EXPLANATION

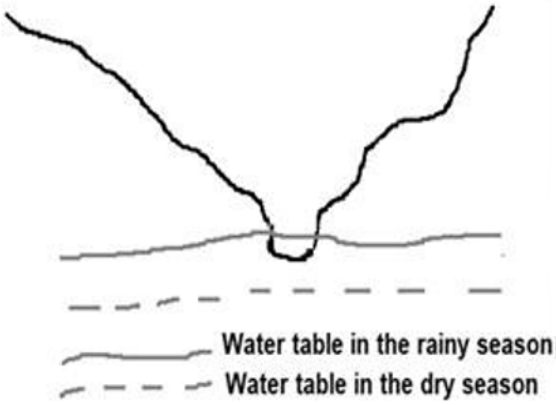
PERMANENT RIVERS / PERENNIAL RIVERS



[Source: https://www.google.com/search?q=types+of+rivers]

- Flows throughout the year.
- The water table intersects the riverbed throughout the year.
- Usually occur in areas of high rainfall

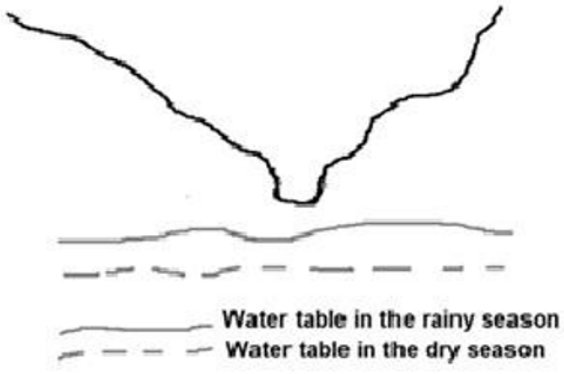
PERIODIC RIVERS / NON-PERENNIAL RIVERS



[Source: https://www.google.com/search?q=types+of+rivers]

- Flows every year only in the rainy season.
- The water table intersects the riverbed only in the rainy season.

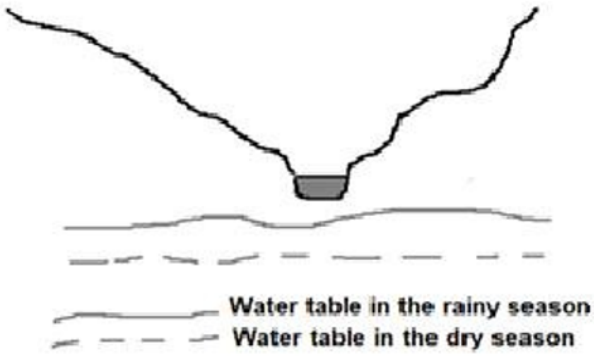
EPISODIC RIVERS



[Source: https://www.google.com/search?q=types+of+rivers]

- The rivers only flow for a short period of time after heavy rainfall
- The water table never intersects the river bed.
- Very important water source in dry areas
- These rivers do not necessarily flow every year.

EXOTIC RIVERS

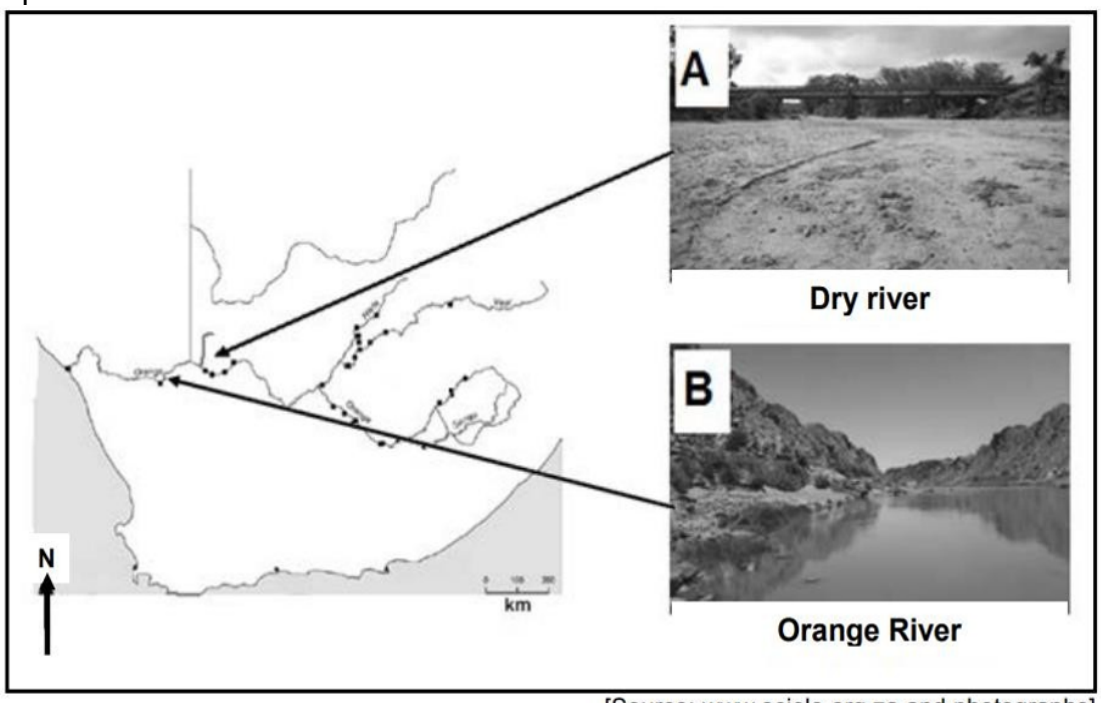


[Source: https://www.google.com/search?q=types+of+rivers]

- This is a permanent river that originates in a rainy/wet area but later flows through a desert.
- The river does not show the climatic characteristics of its surroundings.

C. TYPES OF RIVERS ACTIVITY:

6.1 Refer to FIGURE 6.1 and answer the questions that follow. Photograph A shows an episodic river in the north-western part of South Africa. Photograph B shows a permanent river in the same area.



[Source: www.scielo.org.za and photographs]

6.1.1 (a) What is an episodic river? (1 x 2) (2)

(b) Give evidence from the QUESTION 6.1.1(a) photograph to support your answer. (1 x 1) (1)

(c) State TWO physical factors that will influence the discharge (stream flow) of this river. (2 x 2) (4)

6.1.2 (a) What do you call a permanent river that flows through dry areas? (1 x 2) (2)

(b) Explain why the river in QUESTION 6.1.2(a) flows throughout the year. (2 x 2) (4)

(c) State TWO advantage of this river for farmers in the north-western part of South Africa. (2 x 2) (4)

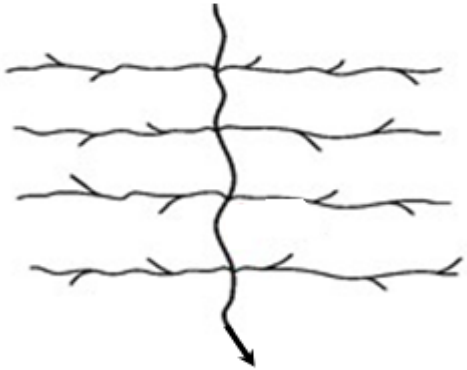
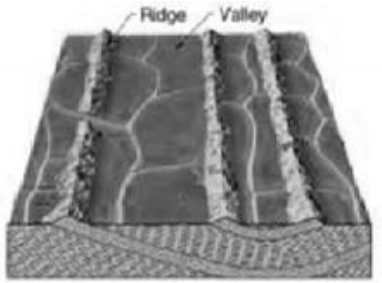
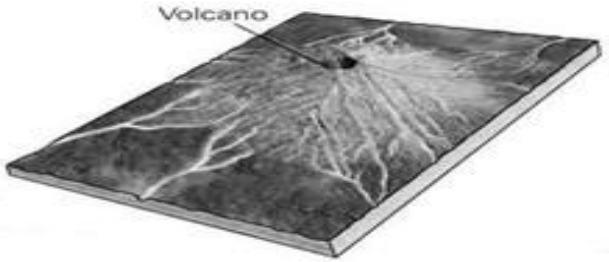
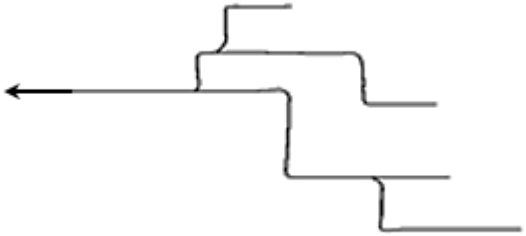
7. DRAINAGE PATTERNS

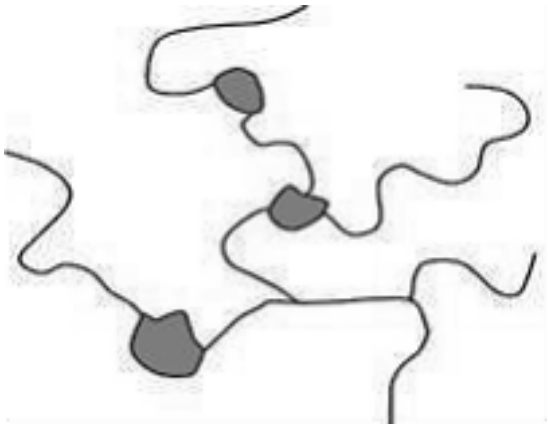
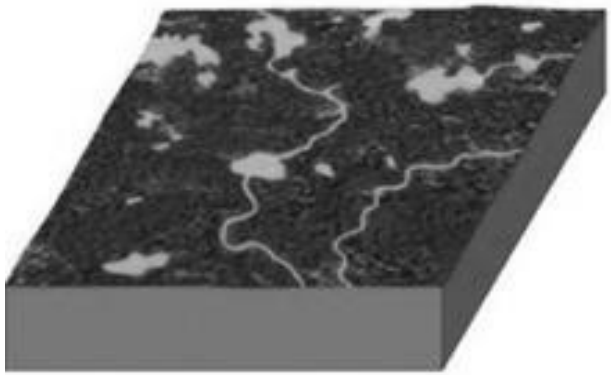
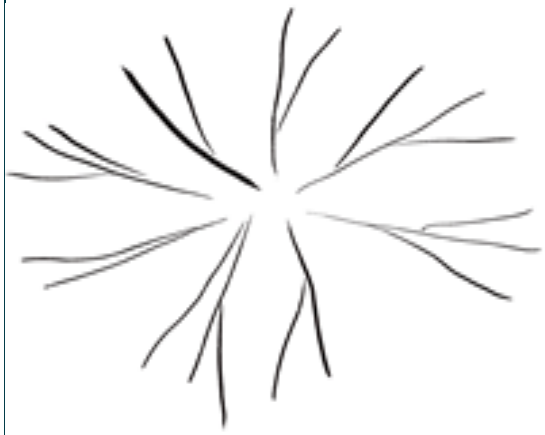
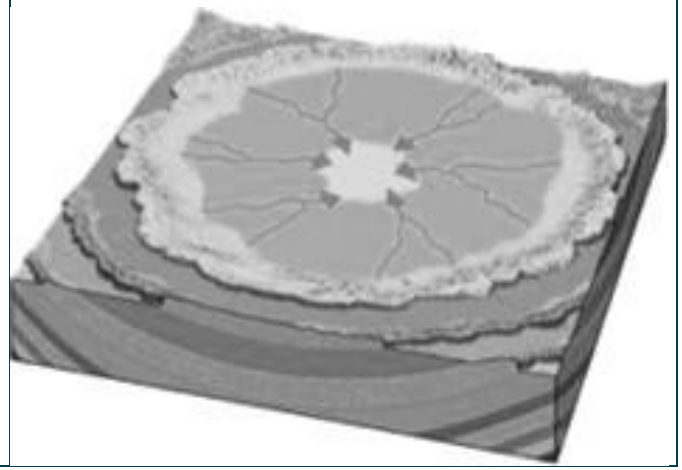
A. KEY CONCEPTS

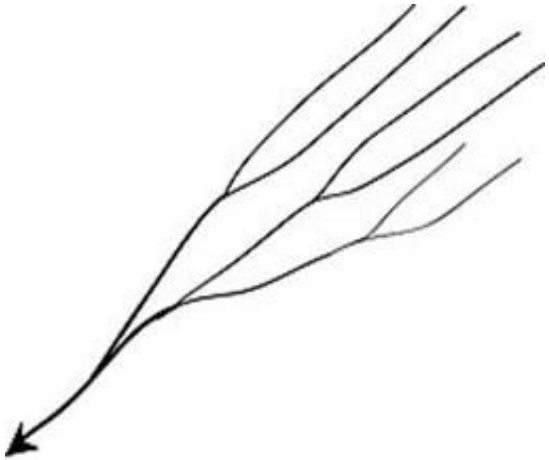
Concept	Explanation
Pattern	Arrangement of stream in a drainage basin
Resistant to erosion	Hard rock that does not erode easily
Underlying rock structure	Type of rock on which the river system flow
Alternate layer	Layers of hard and soft rock next to one another

B. NOTES AND EXPLANATIONS

PATTERN	UNDERLYING ROCK STRUCTURE	SKETCH /DIAGRAM	EXAMPLE
Dendritic pattern Tributaries join the main stream at acute angles. Resembles the branches of a tree.	Found in areas with rocks of equal resistance to erosion		

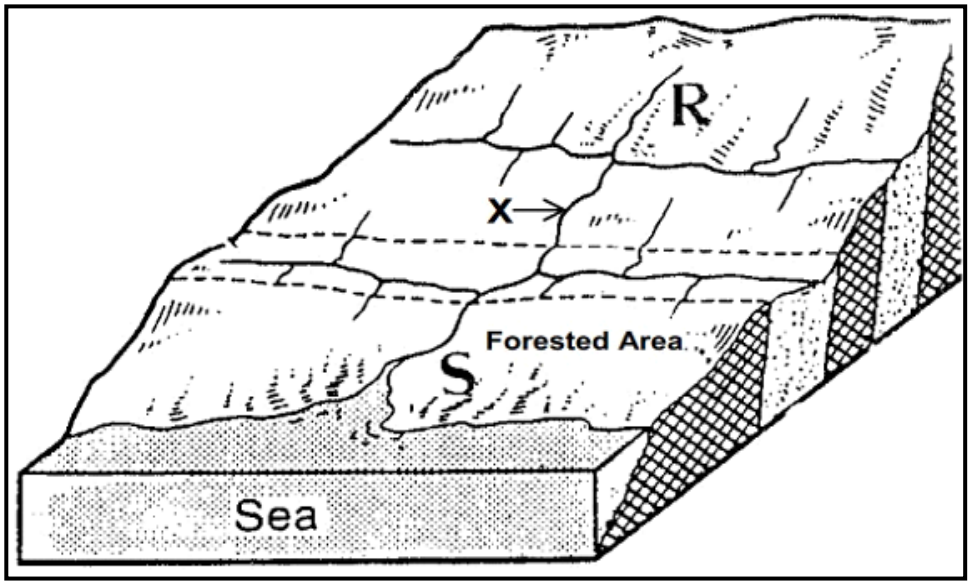
Trellis pattern Tributaries join the main stream at right angles. Main streams are parallel to each other	Occurs in areas of folded sedimentary rocks. Occurs in areas where hard rocks and soft rocks alternate.		
Radial Pattern Streams radiate from a central point.	Found in areas with dome like structures		
Rectangular Pattern The mainstream displays right-angle bends.	Found in areas with igneous rocks with joints and cracks.		

Deranged Pattern Streams have irregular patterns. Tributaries do not link up with the main stream	Occur in regions subjected to glaciation		
Centripetal Pattern Streams converge into a low-lying area. rivers discharge their waters from all directions in a lake or depression	Basin like structure		

Parallel Pattern Pattern of rivers caused by steep slopes with some relief. Because of the steep slopes, the streams are swift and straight, with very few tributaries, and all flow in the same direction.	Parallel drainage patterns form where there is a pronounced slope to the surface. A parallel pattern also develops in regions of parallel, elongate landforms like outcropping resistant rock bands		

C. DRAINAGE PATTERNS ACTIVITIES

7.1 FIGURE 7.1 illustrates a drainage basin.



[Source: Adapted from Hydrology and landforms]

7.1.1 Define the term drainage basin. (1 x 1) (1)

7.1.2 Identify the drainage pattern assumed by the river system in this drainage basin. (1 x 1) (1)

7.1.3 Give ONE reason, visible in FIGURE 7.1, for your answer to QUESTION 7.1.2. (1 x 1) (1)

7.1.4 The drainage density of the river system seems to be denser (finer) at R than at S. Explain why this is the case. (1 x 1) (1)

7.1.5 Determine the stream order of the river system where it flows at X. (1 x 1) (1)

7.1.6 (a) At which point, R or S, would there be a greater risk of flooding? (1 x 1) (1)

(b) Explain your answer to QUESTION 7.1.6(a). (1 x 1) (1)

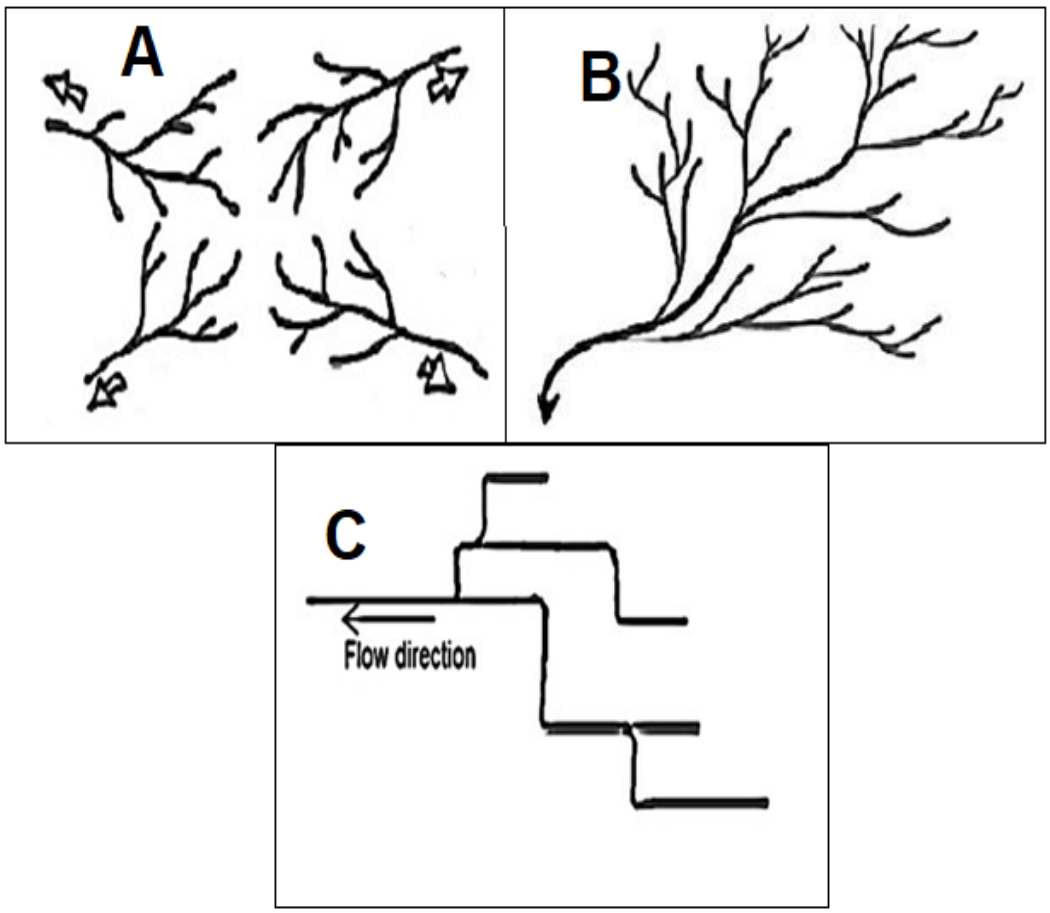
(c) Write a short paragraph (approximately 8 lines) outlining flood prevention methods that can be implemented to reduce the risk of flooding in this drainage basin. (4 x 2) (8)

7.2 Choose the term in COLUMN B that matches the statement in COLUMN B. You can choose one term for more than one response.

	COLUMN A		COLUMN B
7.2.1	A pattern found in areas that experienced glaciation.	A	Dendritic pattern
7.2.2	The underlying rock is a dome like structure.	B	Centripetal pattern
7.2.3	Occurs in areas of folded sedimentary rocks.	C	Rectangular pattern
7.2.4	Main stream and tributaries all flow in the same direction on a steep slope.	D	Radial pattern
7.2.5	Pattern found on a basin like structure	E	Trellis pattern
7.2.6	Tributaries join the main stream at acute angles.	F	Deranged pattern
7.2.7	Underlying rock structure has cracks and joints.	G	Grid pattern
7.2.8	Streams converge into a low-lying area.	H	Parallel pattern
		I	Linear pattern

(8 x 1) (8)

7.3 Study the FIGURE 7.3 below and answer the questions that follow.



7.3.1 What is a drainage pattern? (1 x 2) (2)

7.3.2 Identify drainage patterns A and C. (2 x 1) (2)

7.3.3 Compare the underlying rock structures of drainage patterns B and C. (2 x 2) (4)

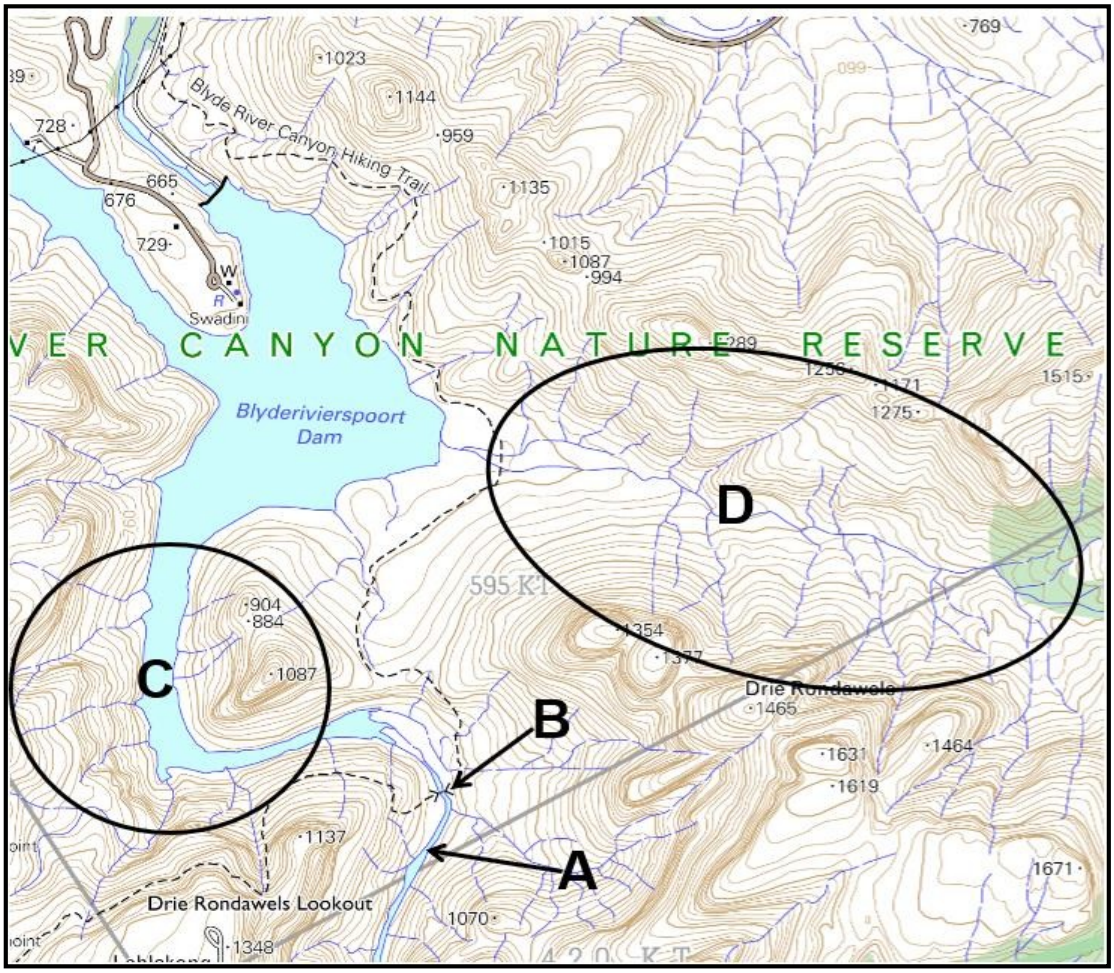
7.3.4 Account for the direction of the stream flow in patter A. (2 x 2) (4)

7.3.5 Explain why drainage pattern B is suitable for farming? (2 x 2) (4)

7.3.6 Draw a simple, labelled plan view sketch of a drainage pattern that will develop in a folded landscape. (2 x 2) (4)

MAP WORK APPLICATION

7.4 Refer to the Topographic Map extract and answer the questions that follow.



7.4.1 Name the type of river at A. (1 x 1) (1)

7.4.2 Explain the purpose of the human-made feature at B. (1 x 1) (1)

7.4.3 Name drainage patterns C and D. (2 x 1) (2)

7.4.4 Discuss the reasons for the development of the respective drainage patterns C and D. (2 x 2) (4)

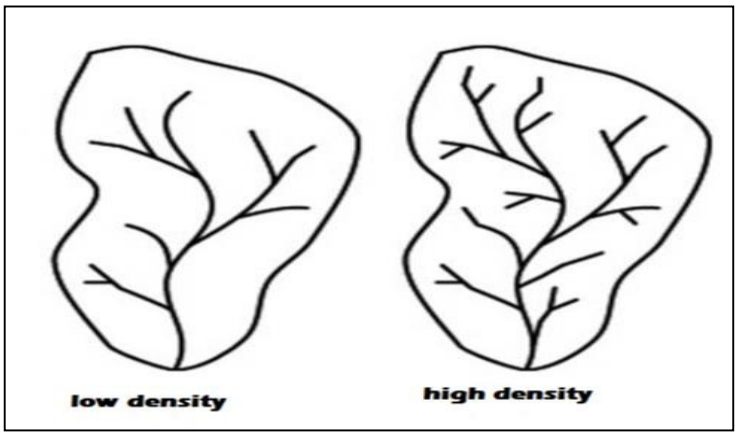
7.4.5 Explain why the location of the Blyderivierpoort Dam is ideal. (2 x 2) (4)

8. DRAINAGE DENSITY

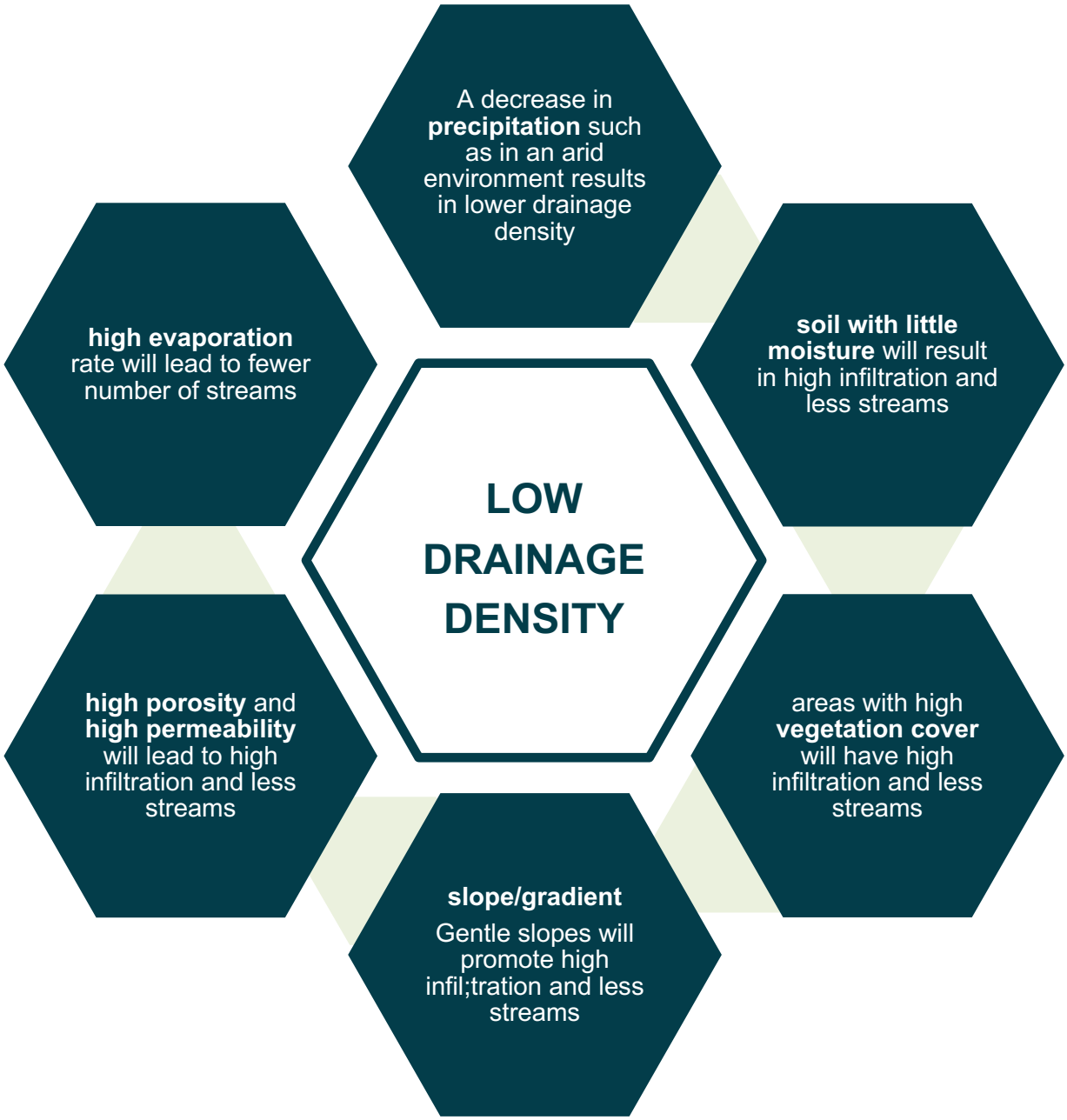
- The drainage density is the measure of the length of stream channel per unit area of drainage basin.
- It describes how many streams there are in a drainage basin. Drainage
- Density is affected by infiltration and surface runoff.

A. KEY CONCEPTS

Infiltration: Water soaks or filters into the soil
Surface runoff: Water moves across the surface of the earth becoming a stream, tributary or river.



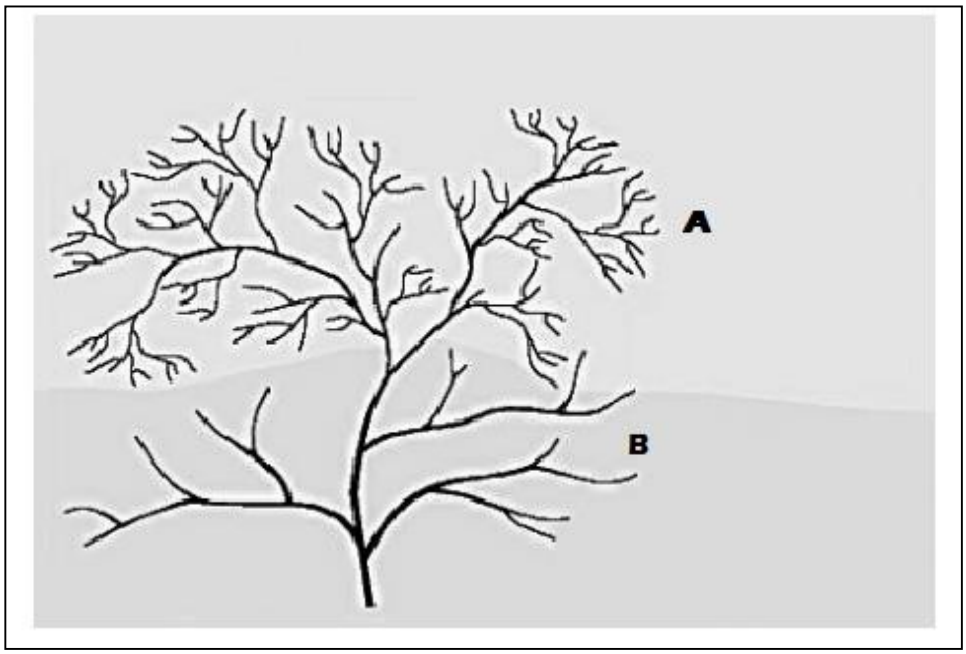
B. FACTORS INFLUENCING DRAINAGE DENSITY




Increase in **precipitation** results in high run-off
Soil with high moisture will result in low infiltration and high run-off
Areas with little **vegetation cover** will have little infiltration and high run-off
Slope/Gradient Steep slopes will promote high run-off and less infiltration
Low porosity and low permeability will lead to high run-off
Low evaporation rate will lead to high number of streams
HIGH DRAINAGE DENSITY

C. DRAINAGE DENSITY ACTIVITIES

8.1 Refer to FIGURE 8.1 which shows drainage basins.



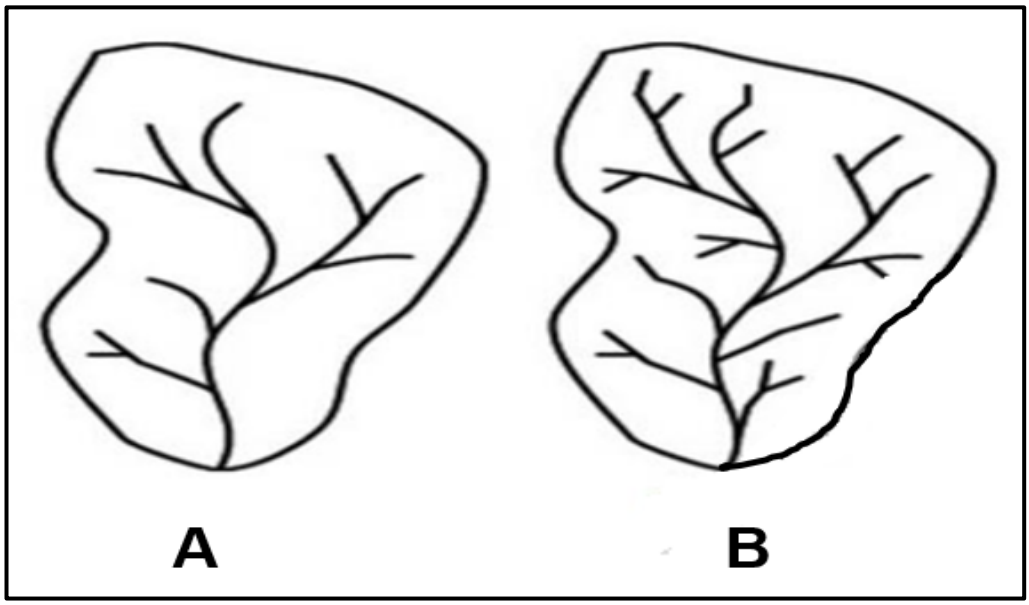
8.1.1 Explain the concept drainage density. (1 x 2) (2)

8.1.2 Compare the drainage density at A and at B. (2 x 2) (4)

8.1.3 Describe two factors that may have resulted to the drainage density at B. (2 x 2) (4)

8.1.4 Write a paragraph of approximately EIGHT lines discussing how human activities could have impacted on the drainage density at A. (4 x 2) (8)

8.2 The diagram below represents drainage densities, study it and answer the questions that follow.



[Adapted from: https://gis4geomorphology/com/wp-ontent/uploaded/201403threshold.jpg]

8.2.1 Define the term drainage density (1 x 2) (2)

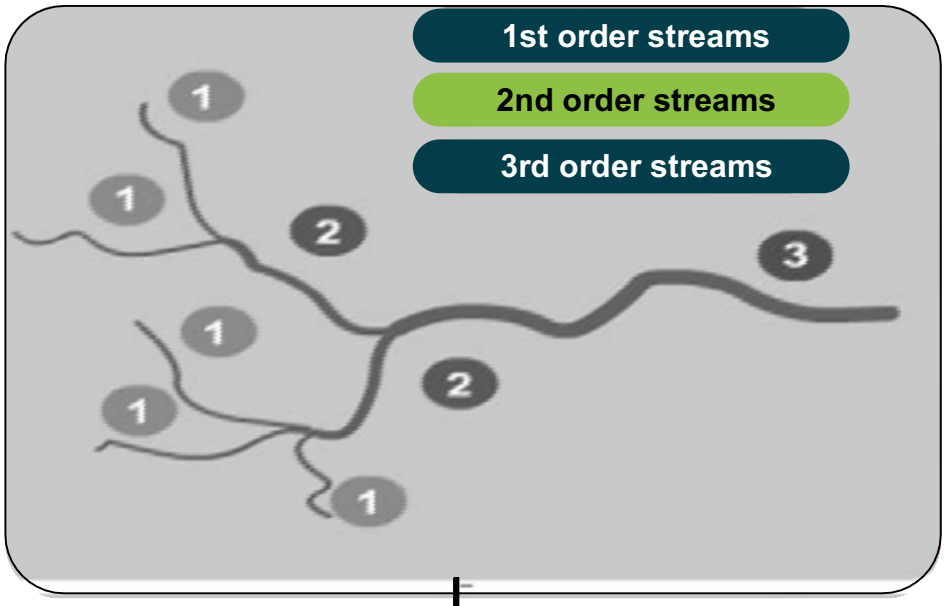
8.2.2 Which ONE of the drainage basins, **A** or **B**, shows the drainage density during the dry season and rainy season respectively? (1 x 2) (2)

8.2.3 Explain why the drainage density of the drainage basins changes during the course of the year. (2 x 2) (4)

8.2.4 The change in drainage density changes the stream order of the drainage basin over the course of a year. In a paragraph of approximately EIGHT lines, explain why this is the case. (4 x 2) (8)

9. STREAM ORDERS

A. KEY CONCEPTS AND NOTES



The smallest stream in the river is classified as first order stream, first order streams have no tributaries

When two first order streams join 1 + 1 they become second order stream (2) below their joining place

below the junction of the second order streams the stream become a third order stream

NOTE

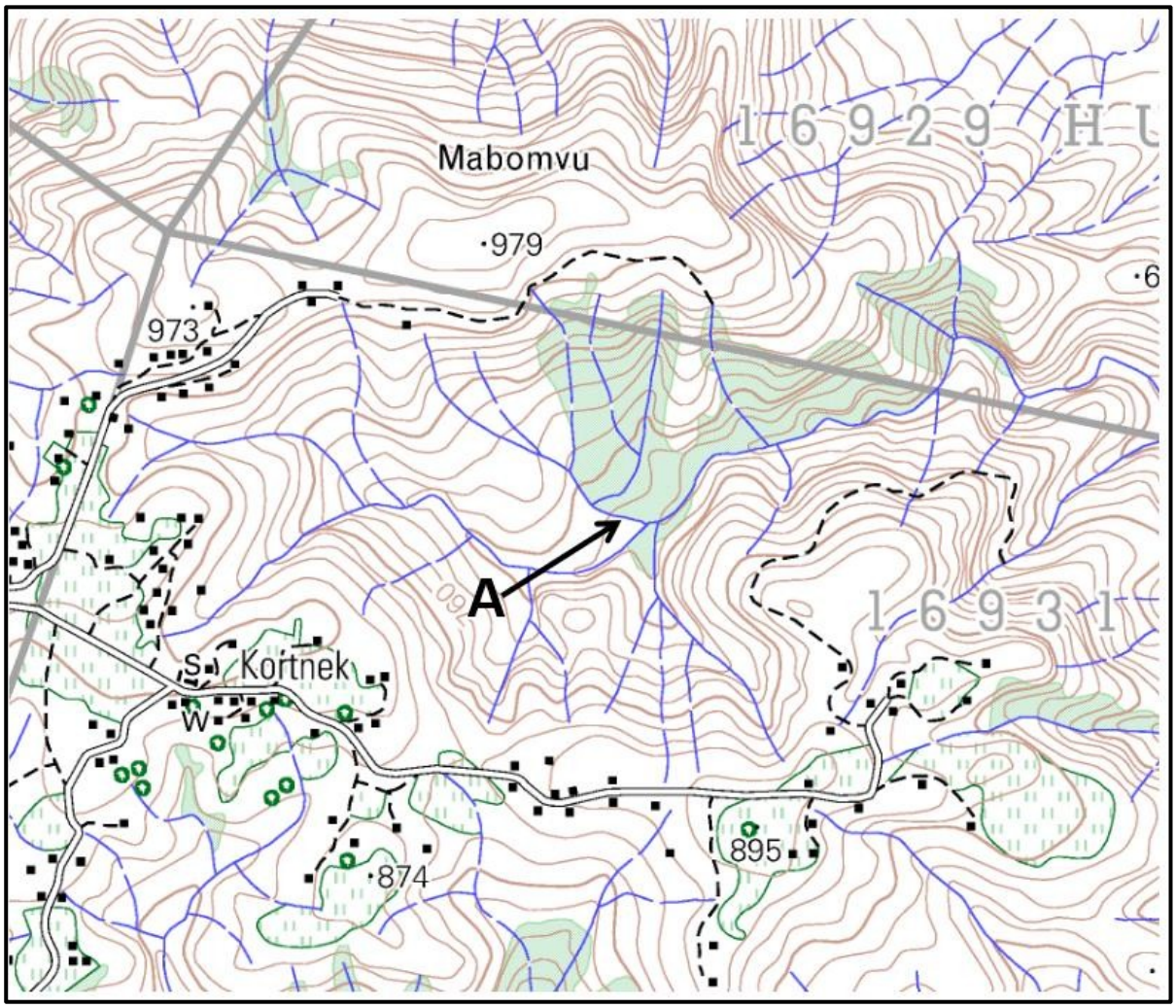
If a second order stream joins the third order stream the stream below the junction remains a third order stream

B. LAWS OF STREAM ORDERS

- The steeper the slope the lower the stream order
- The bigger the drainage basin the higher the stream order
- The longer the stream the higher the stream order
- There are more lower order streams than higher order stream

C. ACTIVITY ON MAP WORK APPLICATION OF STREAM ORDERS

9.1 Refer to the Topographic Map extract and answer the questions that follow:



9.1.1 Is the drainage density in the mapped area high or low? (1 x 1) (1)

9.1.2 Discuss how the topography in the mapped area influenced the drainage density you mentioned in QUESTION 9.1.1. (2 x 2) (4)

9.1.3 Determine the stream order at A. (1 x 2) (2)

9.1.4 Predict the likely stream order at A, in the dry season. Give a reason for your answer. (1 + 2) (3)

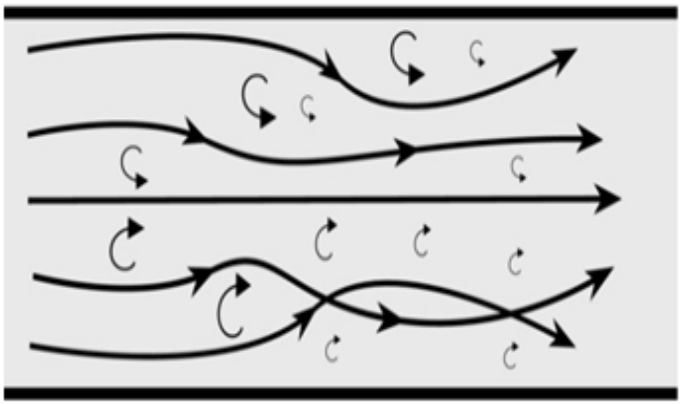
10. RIVER DISCHARGE

A. KEY CONCEPTS AND NOTES

TURBULENT FLOW

Turbulent flow is water motion characterised by chaotic changes in pressure and velocity

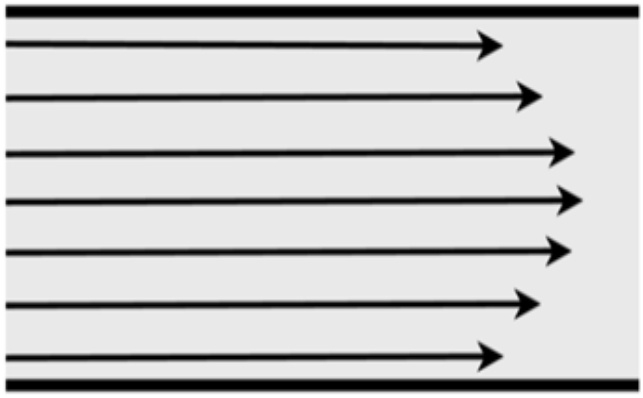
- Water flows bubbly
- Riverbed is uneven
- More erosion



LAMINAR FLOW

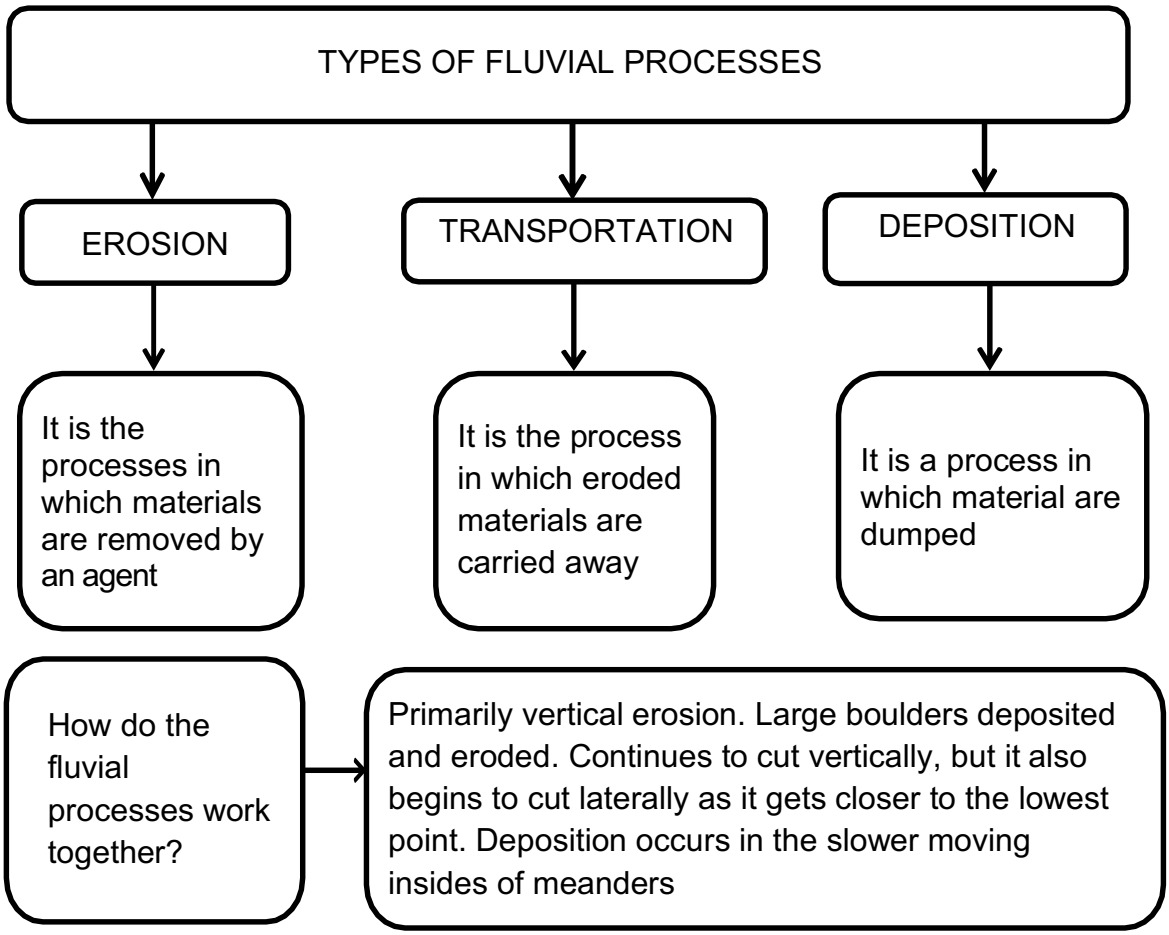
Laminar flow is water motion characterised by smooth layers of water

- Water flows in parallel sheets
- Riverbed is even
- Less erosion



B. FLUVIAL PROCESSES

What are Fluvial Processes? → The physical interaction of flowing water and the natural channels of rivers and streams

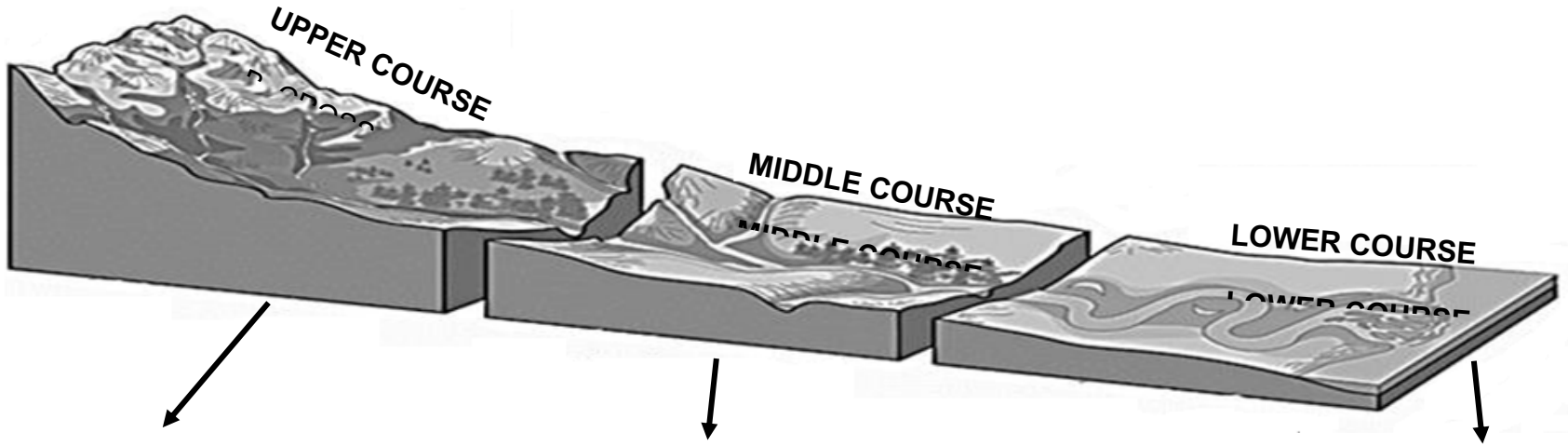


How do the fluvial processes work together? → Primarily vertical erosion. Large boulders deposited and eroded. Continues to cut vertically, but it also begins to cut laterally as it gets closer to the lowest point. Deposition occurs in the slower moving insides of meanders

11. RIVER PROFILES AND THE STAGES OF A RIVER

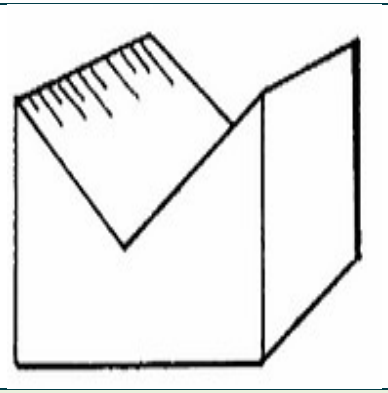
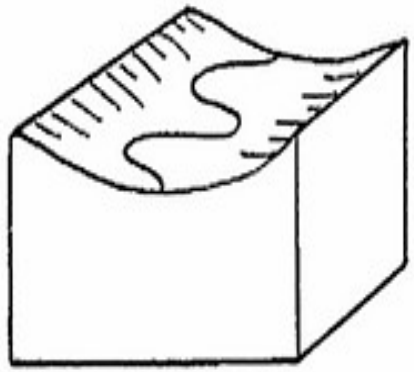
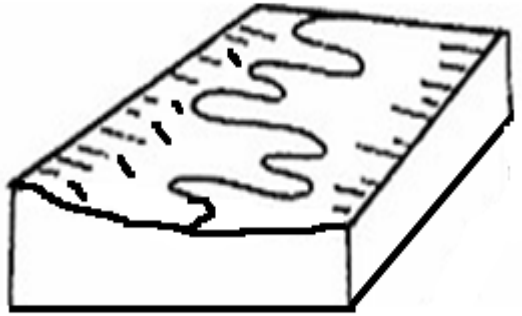
A. LONGITUDINAL PROFILE AND STAGES OF A RIVER

(Longitudinal profile - Side view of a river from source to mouth)



• Vertical erosion deepens the valley • Straight stream channel with short non-perennial streams • Turbulent flow due to uneven riverbed and valley slopes • Waterfall and rapids are being eroded through headward erosion • Large stream load with big boulders • Traction load	• Vertical erosion decreases and lateral erosion dominates • The channel becomes wider • The river starts to meander due to lateral erosion • Tributaries join the mainstream, increasing the volume and erosive power • Both laminar and turbulent flow occurs depending on the roughness of the riverbed and the sides • Saltation load occurs • Load becomes smaller due to attrition and abrasion	• Deposition dominates with very little erosion • The channel is at its widest • Extensive meandering of the river due to the flat surface and lateral movement of the river • Laminar flow dominates due to the smooth riverbed and sides • Suspension and solution load dominates • Very large load but smaller particles

B. CROSS /TRANSVERSE PROFILE: FRONT VIEW OF A RIVER

		
Upper course V-shaped valleys Waterfalls Rapids	**Middle course** U-shaped valleys River starts to meander	**Lower course** Wide open valley Floodplain Deltas

12. RIVER GRADING

A. KEY CONCEPTS AND NOTES

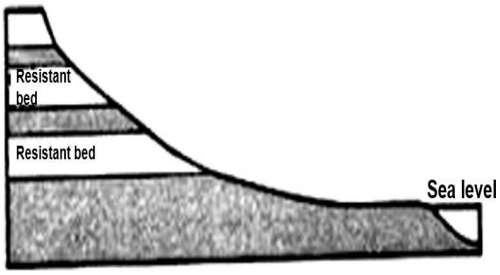
River grading: This is the balance/equilibrium between rate of erosion and rate of deposition.

<table>
<tr><th colspan="2">GRADING</th></tr>
<tr><td>Graded Rivers

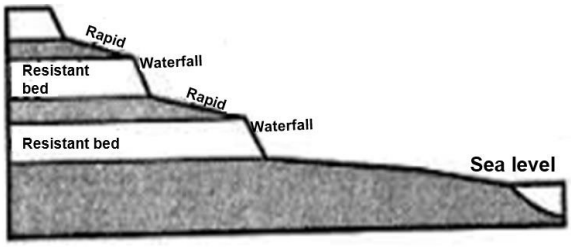
When there is a balance between erosion and deposition</td><td>Ungraded Rivers

When either erosion or deposition dominates</td></tr>
<tr><th colspan="2">LONGITUDINAL PROFILES OF GRADING</th></tr>
<tr><td>Graded Profile

• The longitudinal profile is SMOOTH CONCAVE
• Steep in the upper course and gentle in the lower course

 
</td><td>Ungraded Profile

• The longitudinal profile indicates knick points like waterfalls and rapids.
• The profile is therefore not smooth concave.

 
</td></tr>
</table>

Permanent / Ultimate base level of erosion

- The lowest level to which a river can erode.
- It is usually sea level

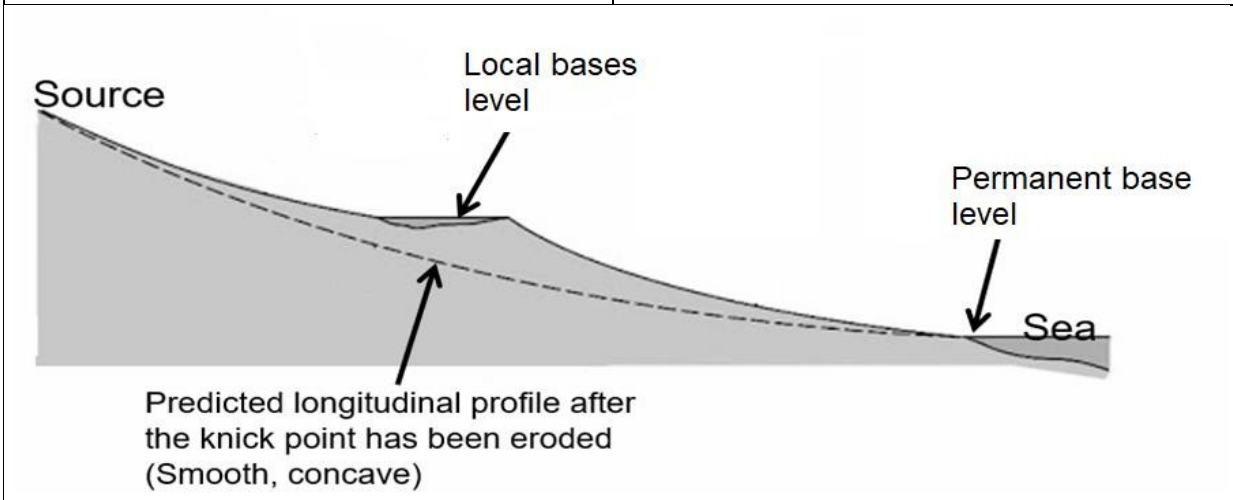
Temporary / Local base level

- When features/ structures delay further erosion
- This local base level causes a knick point in the profile, making it ungraded.

Types of local base levels

Human-made e.g., dams

Natural e.g., lakes, waterfalls, rapids

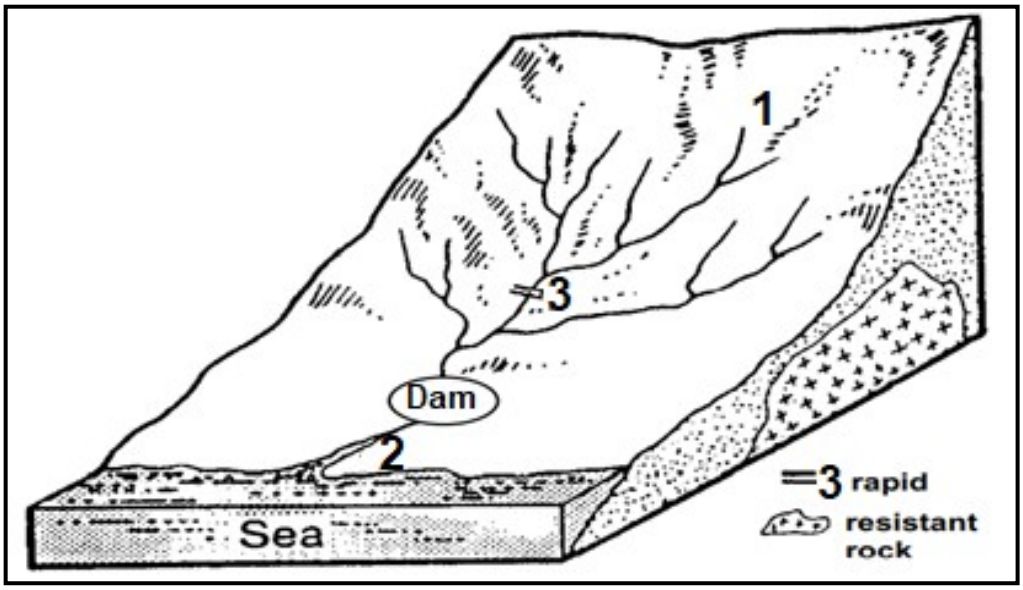


Processes involved in a river becoming graded from ungraded.

- Downward/Vertical erosion dominates in the upper course causing a steep valley slope.
- Headward erosion removes temporary base levels of erosion in the upper course.
- Downward/Vertical erosion removes temporary base levels (waterfall) in the upper course.
- This material is then transported downstream.
- Discharge of the river increases in middle course causing lateral erosion.
- Gradient in the middle course becomes less steep.
- Deposition dominates in the lower course because the gradient is gentle.
- Deposited materials fill up lakes and dams.
- The river profile will now develop a concave shape from upper to lower course.
- Equilibrium between erosion and deposition will maintain (result in) a graded profile.

C. RIVER GRADING ACTIVITIES

12.1 FIGURE 12.1 illustrates the stream profiles of a typical South African river from its source to its river mouth.



[Adapted: Hydrology and Landforms]

12.1.1 Define the term base level of erosion. (1 x 2) (2)

12.1.2 Identify ONE temporary base level of erosion in FIGURE 12.1 (1 x 1) (1)

12.1.3 Draw a labelled longitudinal profile of the river illustrated in FIGURE 12.1, clearly showing how the temporary base levels of erosion could have influenced the shape of the profile.(3 x 1) (3)

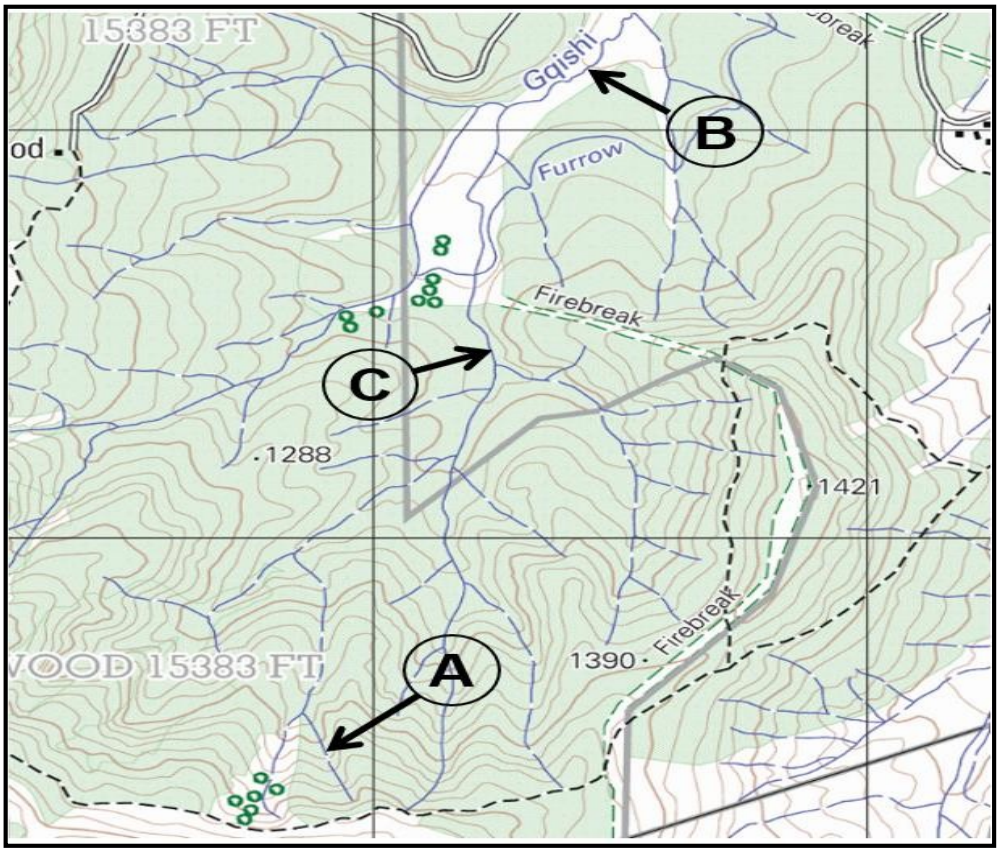
12.1.4 How would you describe the longitudinal profile that you have drawn in QUESTION 12.1.3? (1 x 2) (2)

12.1.5 Give a reason for your description in QUESTION 12.1.4. (1 x 2) (2)

12.1.5 Suggest THREE reasons why the cross-section profiles of the river change, from its source (**1**) to its river mouth (**2**). (3 x 2) (6)

MAP WORK APPLICATION

12.2 The map is an extract of 2930CA MERRIVALE.



12.2.1 In which stage is the Gqishi river at A and B on the topographic map. (2 x 1) (2)

12.2.2 Provide map evidence as reasons for your answers to QUESTION 12.2.1. (2 x 1) (2)

12.2.3 Explain the characteristics of the erosion in stages A and B . (2 x 2) (4)

12.2.4 Determine the stream order at C. (1 x 2) (2)

13. FLUVIAL LANDFORMS IN THE DIFFERENT STAGES OF THE RIVER

A. KEY CONCEPTS AND NOTES

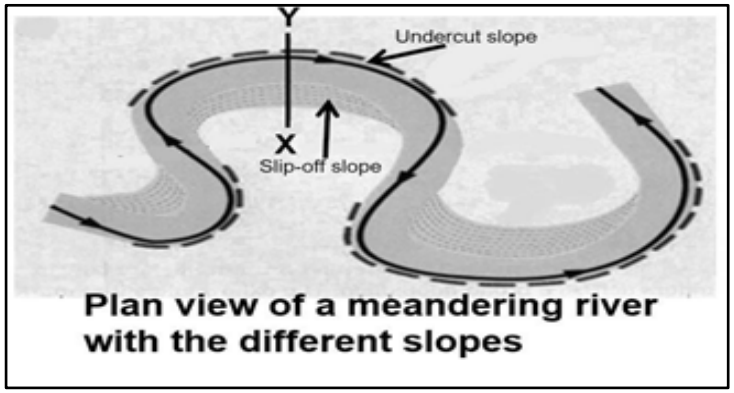
Fluvial landforms are those landforms generated by running water, mainly rivers. Some features are a result of river erosion and some a result of river deposition.

1. MEANDERS

A meander is defined as a distinct curve or loop in the course of a river channel.

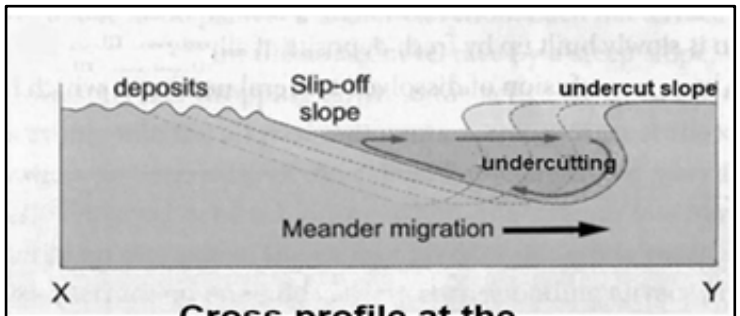
Formation

- In the middle course the river has more energy and a high volume of water as a result of tributaries joining
- Lateral (sideways) erosion starts to widen the river channel.
- As the river erodes laterally (to the right side then the left side) it forms large bends, and then horseshoe-like loops called meanders.
- The formation of meanders is due to both deposition and erosion and meanders gradually migrate downstream



Plan view of a meandering river with the different slopes

Two slopes with different characteristics develop at the meander loop.	
Undercut slope This slope develops at the outer bank. **Characteristics:** • The slope is concave. • The river flows fast at this side. • Erosion, especially undercutting occur • The area is deep.	**Slip-off slope** This slope develops at the inner bank. **Characteristics:** • This slope is convex. • The river flows slow at this side. • Deposition occurs. • The slope is shallow.



Cross profile at the meander loop/river bend

2. OXBOW LAKE

- The cut-off meander loop filled with water is called an oxbow lake.
- Continuous undercutting at the outer bank and deposition at inner bank
- Causes the horseshoe to become tighter over time, until the ends become very close together.
- During heavy rainfall and flooding the river breaks through the ends
- The loop is cut-off from the main channel.

Significance of OXBOW LAKES

- Oxbow lakes can be rich wildlife habitats,
- Can be utilised for agricultural purposes especially crop farming.
- Tourist attractions

How is the water in the oxbow lake maintained?

- During rainfall periods
- Flooding of the mainstream
- Underground water

Development of MEANDER SCARS
(Dry oxbow lake)

- Decrease in average rainfall over the years.
- Silt deposits from flooding

3. BRAIDED STREAM:

- A stream consisting of multiple small, shallow channels (distributaries)
- They divide and recombine numerous times forming a pattern resembling the strands of a braid.

Formation

- Braided streams form where the sediment load is deposited as shifting islands or bars between the channels
- When the river's carrying capacity is exceeded the river deposits its load into the channel.

Significance of BRAIDED STREAMS

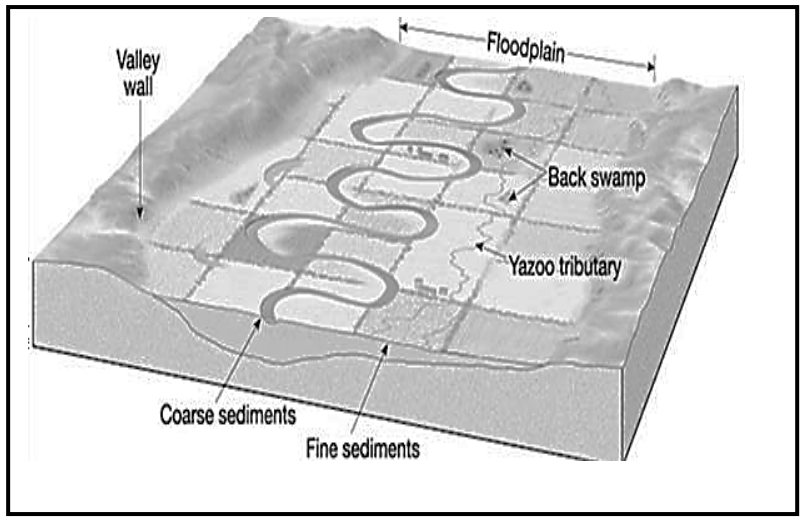
- Source of water for crop farming
- Silt deposits form fertile soil.
- Area preserves bird life.
- The area hampers the construction of infrastructure.
- It is therefore expensive to build roads and railway lines.

4. FLOOD PLAIN

A wide, flat area of land surrounding a river that continuously flood.

Formation

- Floodplains form due to mainly deposition.
- Because of the gentle gradient, there is more deposition occurring.
- The heavier load (rocks and pebbles) is deposited closer to the banks of the river.
- Lighter and smaller load is dropped further away from the river banks.



Significance of FLOOD PLAINS

- Floodplains provide fertile land for agriculture.
- Easy to construct infrastructure.
- Flat area is heavily populated.
- Settlements develop.
- Tourist attraction
- Source of water for economic and domestic purposes
- They are beneficial for wildlife by creating a variety of habitats for fish and other animals.
- It preserves water quality by continuous refreshing due to flooding.
- It provided numerous recreational opportunities.

5. NATURAL LEVEE

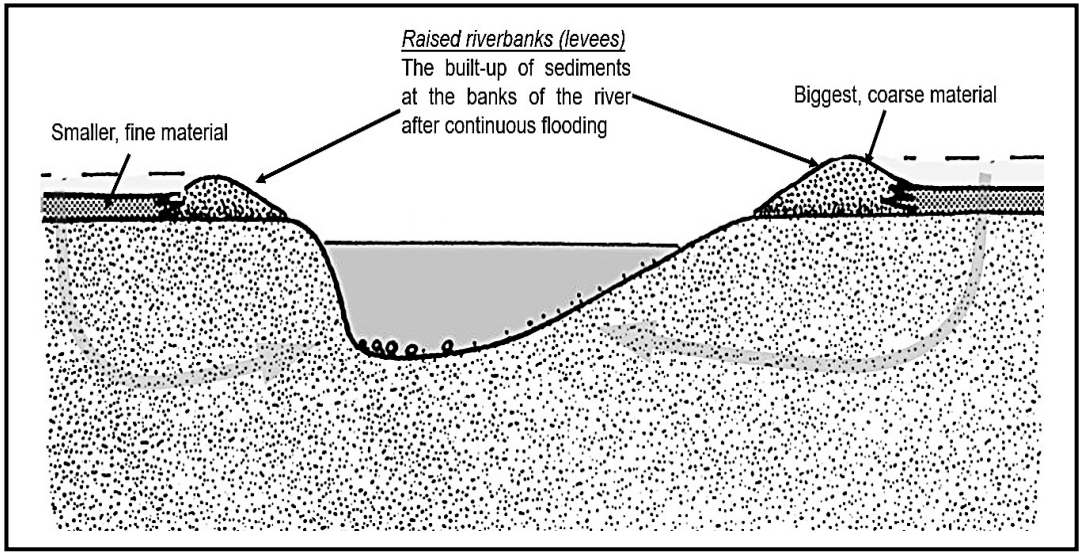
Levees are natural embankments (raised river banks) which are formed when a river flood.

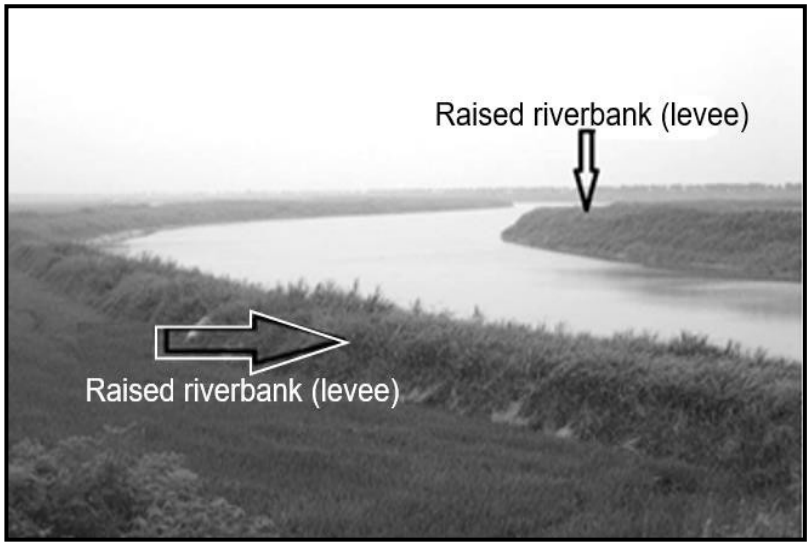
Formation

- Levees are formed by the repeated flooding of the river.
- When the river floods, the biggest, most coarse material will be deposited.
- This will be close to the river banks.
- Continuous flooding causes repeated deposition on the river banks.
- The banks form levees made of sediment, silt, and other materials.

Significance of NATURAL LEVEES

- They prevent rivers from flooding.
- Levees are usually parallel to the way the river flows, so levees can help direct the flow of the river.
- Levees can also provide a measure of protection from invaders.
- Fertile soil near levees is suitable for farming.
- Levees may be used to increase available land for habitation.





6. DELTAS

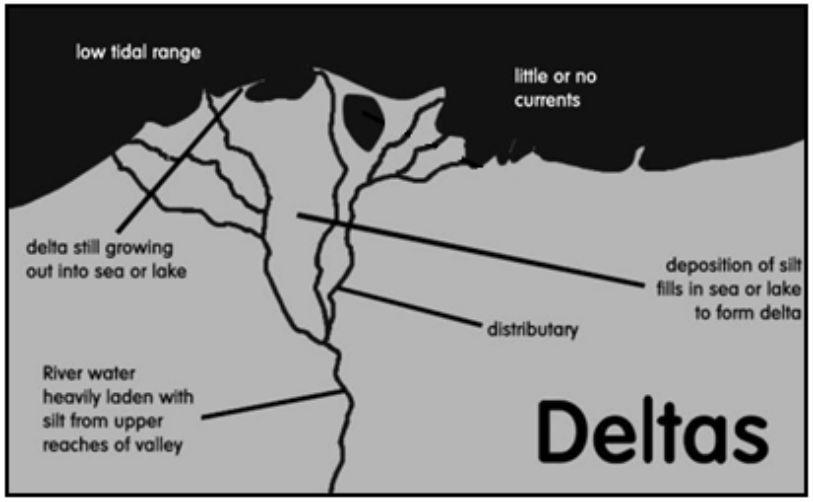
It is landform at the mouth of a river, where different channels (distributaries) of the same river flow into an ocean or sea.

Formation

- The river slows down at the mouth due silt deposits and gentle gradient.
- The channel splits into several smaller channels (distributaries) and it loses velocity.
- As the river loses velocity it deposits its load on the river bed.
- Both the bed load and suspended load are deposited producing fertile alluvial land.

Significance of DELTAS

- Deltas are usually highly fertile areas and support extensive crop cultivation.
- Sand and gravel are also quarried from deltas and are utilized for a variety of purposes e.g., road and building construction.
- They are important industrial hubs.
- Large settlements often grow up in the delta regions.
- Deltas are a source of water.
- Deltas sustain all ecosystems.
- Deltas ensures biodiversity.
- Tourism(leisure activities) opportunities are created by deltas and contributes to the economy.
- Can be part of water transport system.
- Deltas are a source of protein (fish)

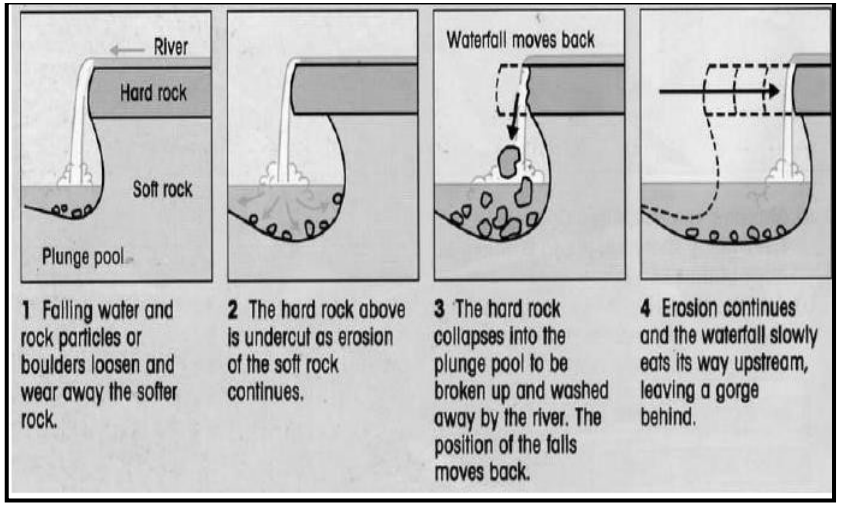


7. WATERFALLS

A waterfall is an area where water flows over a vertical drop or a series of steep drops in the course of a stream or river.

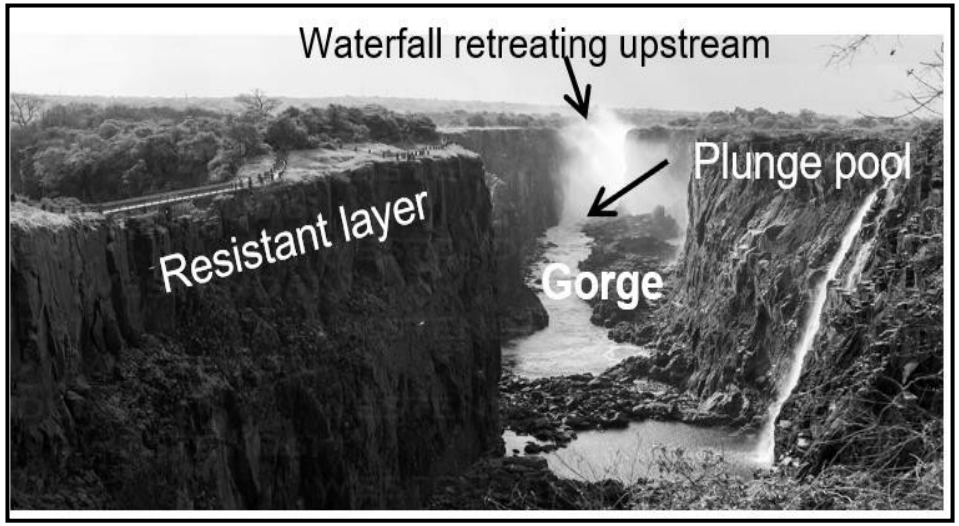
Formation

- Waterfalls often form in the upper stages of a river where it flows over different layers of rock.
- The soft rock erodes more quickly, undercutting the hard rock.
- The hard rock is left overhanging and because it is not supported, it eventually collapses.
- The fallen rocks crash into the plunge pool. They swirl around, causing more erosion.
- Over time, this process is repeated, and the waterfall moves upstream.
- A steep-sided gorge is formed as the waterfall retreats.



Significance of WATERFALLS

- The strong currents near falls are often used to generate hydro- electricity.
- Waterfalls are sometimes a disadvantage since they form a barrier to infrastructure development.
- Waterfalls attract tourists.
- Fishing can be carried out on waterfalls.
- Waterfalls is aesthetically pleasing.
- Waterfalls also provide opportunities for a wide range of, sometimes incompatible, outdoor leisure activities.

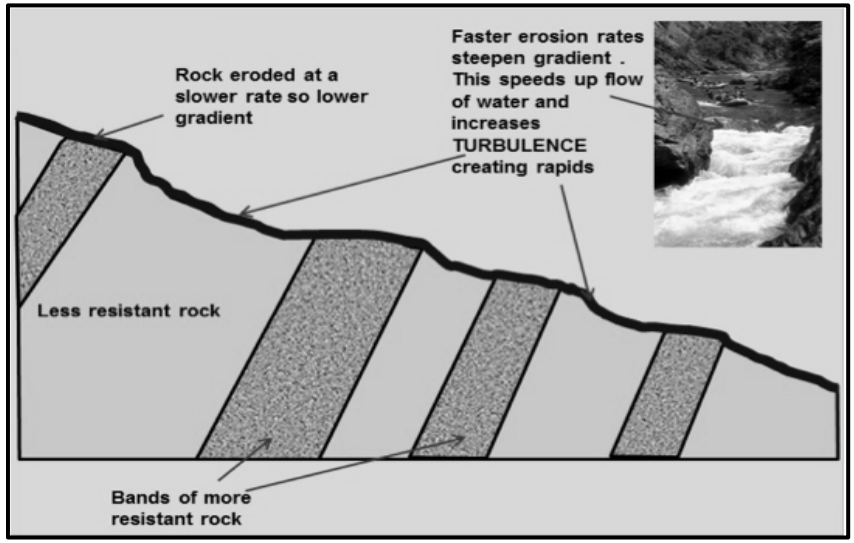


8. RAPIDS

Rapids are areas of shallow, fast-flowing water in a stream.
Rapids are stretches of fast-flowing water tumbling over a rocky-shallow riverbed.

Formation

- Water goes from one hard rock to softer rock
- Rock layers below the water is exposed
- Flowing water splashes over and around the rocks, forming what is called “white water”.



Significance of RAPIDS

- Attract tourists who want to raft down the stream.
- Water splashing over rocks is called white-water and it dissolve oxygen.
- The oxygen is useful to the ecosystem around the stream e.g., fish, insect and bacteria in the water.

B. FLUVIAL LANDFORMS AND FEATURES ACTIVITIES

13.1 Study FIGURES 13.1 A and 13.1 B showing fluvial landforms.

FIGURE 13.1A

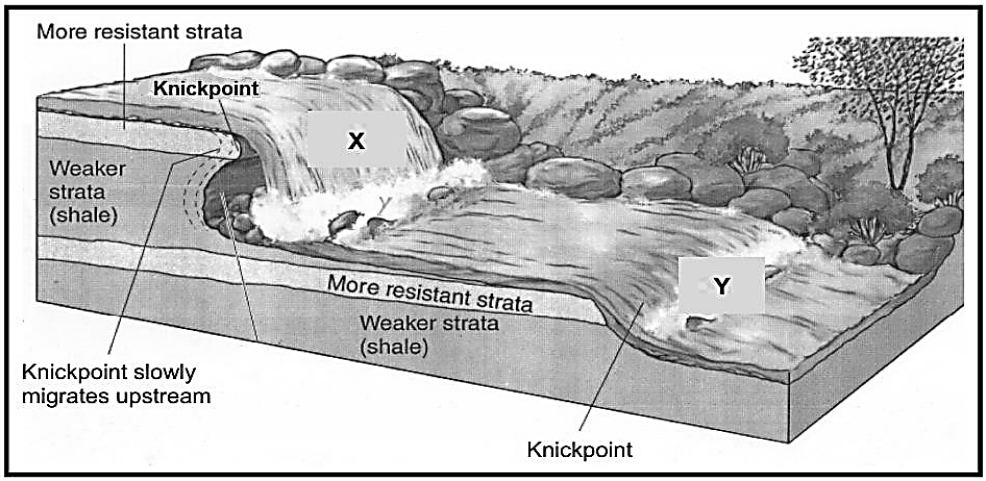
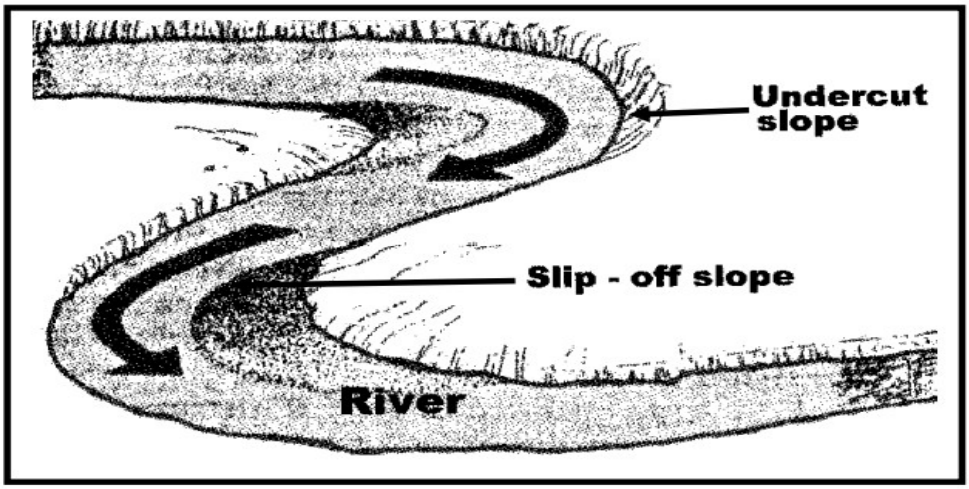


FIGURE 13.1B



13.1.1 Refer to FIGURE 13.1 A

(a) Define the term river discharge. (1 x 2) (2)

(b) Identify feature X. (1 x 1) (1)

(c) Along which course of the river does this feature commonly occur? (1 x 1) (1)

(d) Give a reason for your answer in QUESTION 13.1.1 (c). (1 x 1) (1)

(e) Account for the formation of feature X. (2 x 1) (2)

(f) Explain how feature X contributes to the economy of a country. (1 x 1) (1)

13.1.2 (a) Identify feature labelled Y. (1 x 1) (1)

(b) Name ONE popular sport that takes place at Y. (1 x 1) (1)

13.1.3 Refer to FIGURE 13.1 B showing a meandering river channel.

"Distinctive landforms (features) develop along the course of a river as a result of erosion or deposition."

(a) Define the term meander. (1 x 2) (2)

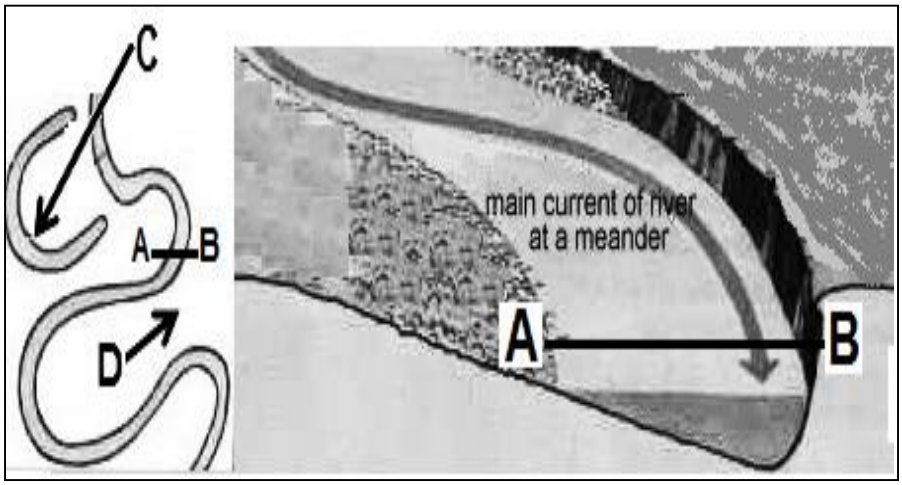
(b) Explain how a meander develops. (2 x 1) (2)

(c) Describe ONE characteristic of the "undercut slope" in a meander. (1 x 1) (1)

(d) Name the feature that will result from the narrowing of the meander neck. (1 x 1) (1)

(e) Suggest ONE reason why the feature identified In QUESTION 13.1.3(d) is classified as a "temporary feature". (1 x 1) (1)

13.2 Study the FIGURE 13.2 below and answer the questions that follow.



[Adapted from easymapwork.blogspot.com]

13.2.1	Identify fluvial landform C on the sketch.	(1 x 1)	(1)
13.2.2	In which course of the river is this landform found?	(1 x 1)	(1)
13.2.3	Identify slopes A and B.	(2 x 1)	(2)
13.2.4	Account for the differences in the gradient of slopes A and B.	(2 x 2)	(4)
13.2.5	Explain what will happen to feature C over time.	(2 x 2)	(4)
13.2.6	Mention one significance of the landform C.	(1 x 2)	(2)

13.3 Refer to the cartoon which illustrates activities at a river bend.

[Source: Ucdenver.org]

13.3.1 What is the term used to describe a river that winds and bends? (1 x 1) (1)

13.3.2 Name the TWO dimensions of a river that are visible in the cross profile. (2 x 1) (2)

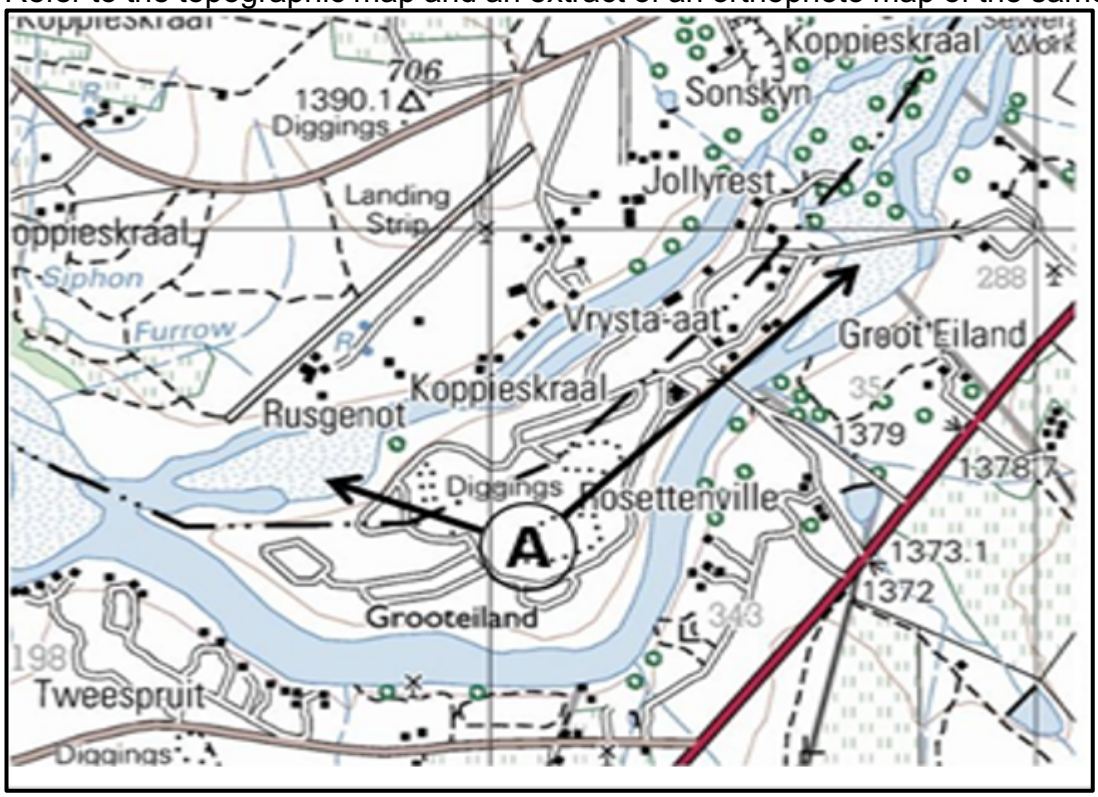
13.3.3 Name the slope of the river at B. (1 x 1) (1)

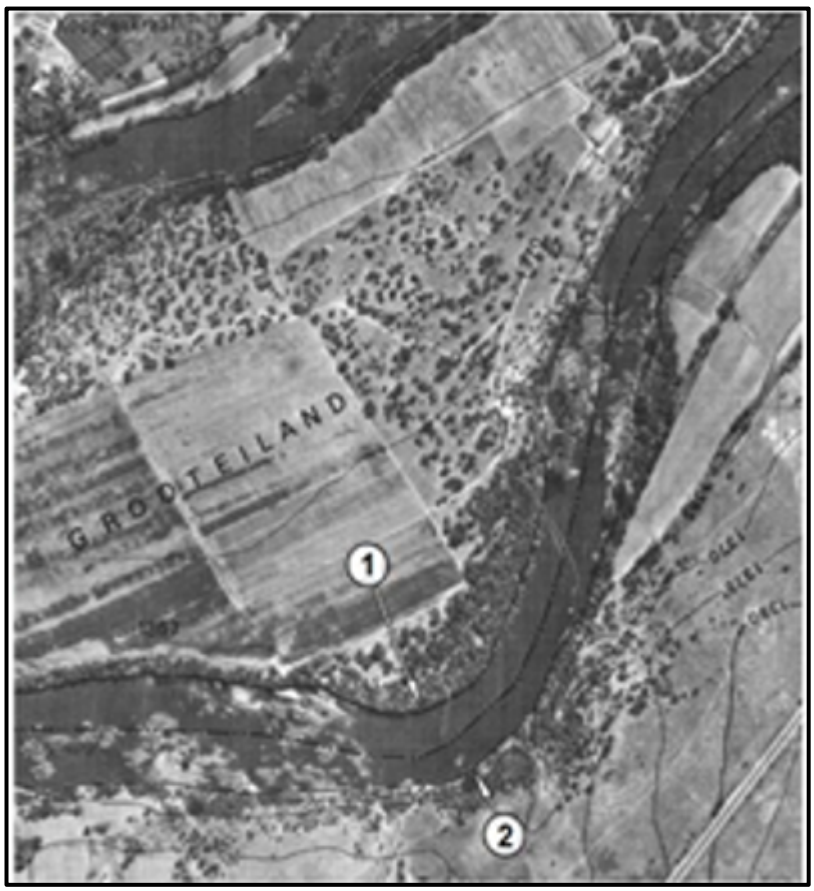
13.3.4 Why does the fish think both boys are idiots? (2 x 2) (4)

13.3.5 In a paragraph of approximately EIGHT lines, give a detailed explanation to account for the difference in the formation of slope A and slope B. (4 x 2) (8)

MAP WORK APPLICATION

13.4 Refer to the topographic map and an extract of an orthophoto map of the same area.





13.4.1 Name the dominant fluvial landform evident on the topographic map. (1)
(1 x 1)

13.4.2 Refer to fluvial feature A

(a) Name fluvial feature A. (1 x 1) (1)

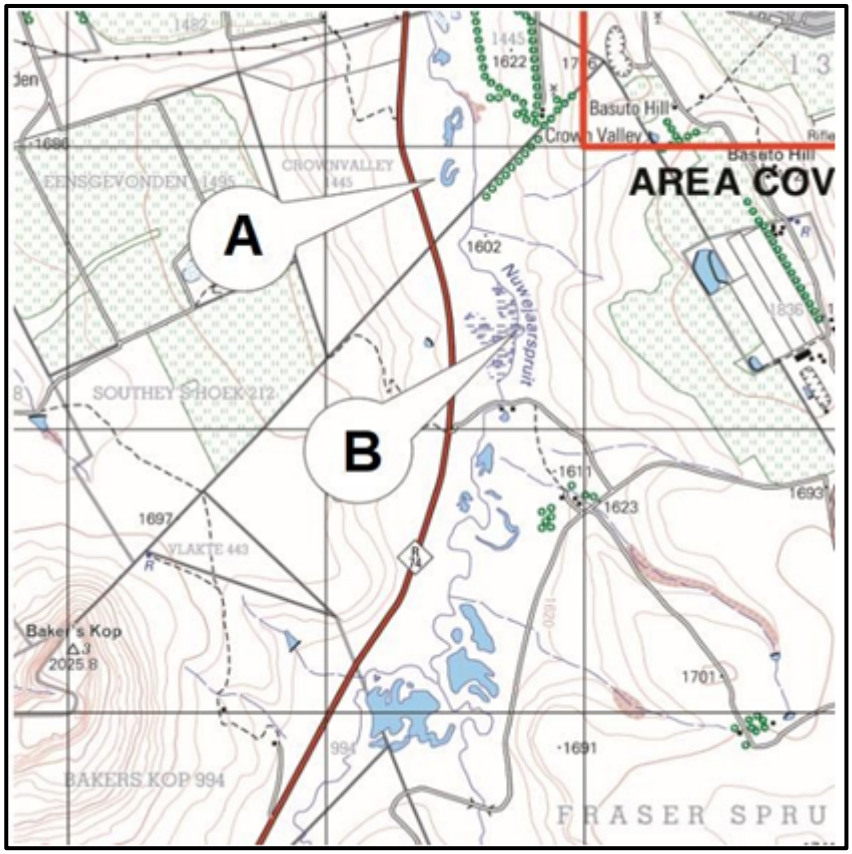
(b) How did the fluvial feature mention in QUESTION 13.4.2 (a) influenced the construction of roads in the area? (1 x 2) (2)

13.4.3 Refer to the orthophoto map, which is a part of the topographic map.

(a) Draw a labelled cross section from 1 to 2 on the orthophoto map. (4 x 1) (4)

(b) Explain how the dominant geomorphological process at 1 influenced agricultural activities. (1 x 2) (2)

13.5 The topographic map is part of the 2829AC HARRISMITH.



13.5.1 The Nuwejaarspruit (river) is in its lower course. Provide TWO evidences from the topographic map to support this statement. (2 x 1) (2)

13.5.2 Explain the impact of the Nuwejaarspruit (river) on human activities in the area. (2 x 2) (4)

13.5.3 Identify fluvial features A and B. (2 x 1) (2)

13.5.4 Discuss why the existence of landform feature A help to reduce flooding. (2 x 2) (4)

14. RIVER REJUVENATION

A. KEY CONCEPTS AND NOTES

Definition

When a river regains its erosive power

Explanation

It is made young (gaining erosive power) again and starts eroding

Characteristics

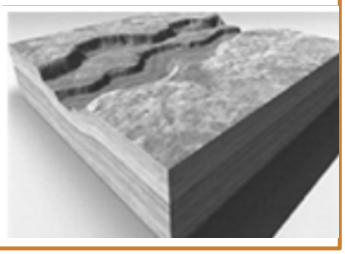
River flows faster and vertical erosion increases

CAUSES OF REJUVENATION

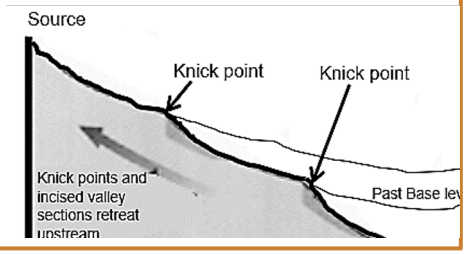
- DROP IN SEA LEVEL
- INCREASE IN RAINFALL
- STREAM PIRACY/RIVER CAPTURE
- ISOSTATIC UPLIFT
- DECREASE IN STREAM LOAD

B. RESULTANT LANDFORMS

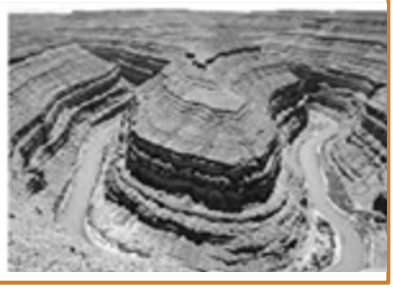
River terraces:
Bench or step that extends along the side of the valley and represents former level of the valley floor



Knick point:
Part of a river channel where there is sharp change in channel slope such as a waterfall or lake. A point where the new profile meets the old profile



Incised meanders:
The curve of a winding river with steep slopes on both sides rising to the former floodplain

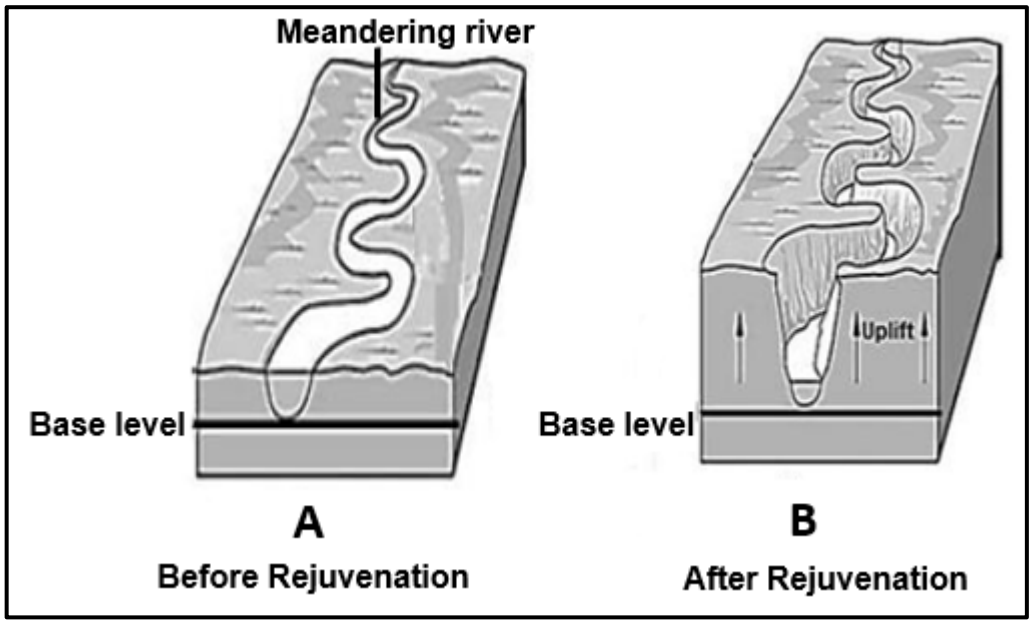


IMPORTANCE OF REJUVENATED LANDSCAPES

- Landforms are good for tourist attractions.
- People can visit areas with terraces for recreation.
- Old flood plain suitable for crop farming
- People can visit areas with terraces for recreation.
- Water at the knick point waterfalls can be used for power generation.

C. RIVER REJUVENATION ACTIVITIES

14.1 The FIGURES below illustrated the process of rejuvenation.



[Adapted from https://www.google.com/search?q=rejuvenation+of+rivers]

14.1.1 What type of erosion is associated with river rejuvenation? (1 x 1) (1)

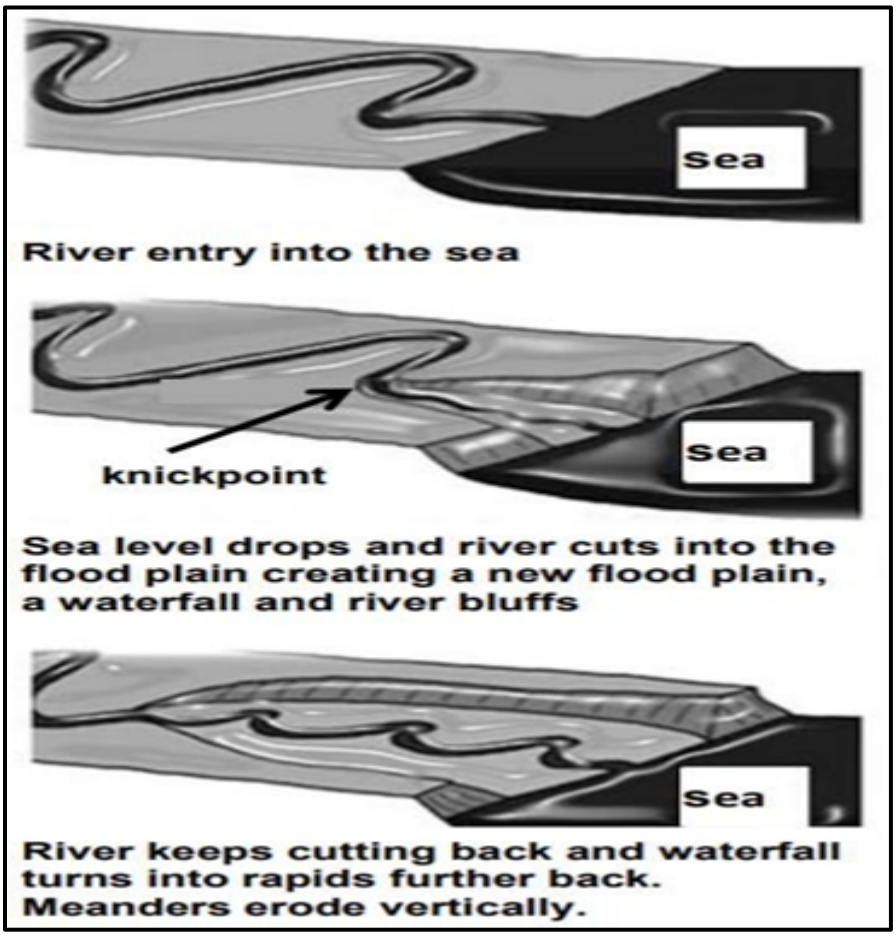
14.1.2 What evidence indicates that river rejuvenation has taken place? (1 x 2) (2)

14.1.3 Identify the force of upliftment associated with rejuvenation. (1 x 2) (2)

14.1.4 Why is rejuvenated land not suitable for human activity? (2 x 2) (4)

14.1.5 In a paragraph of approximately EIGHT lines, explain how rejuvenation could change the fluvial features downstream of the point of rejuvenation. (4 x 2) (8)

14.2 FIGURE 14.2. represents river rejuvenation.



[Source: https://alevelrivers.weebly.com/rejuvenation.html]

14.2.1 Define the term river rejuvenation. (1 x 2) (2)

14.2.2 Identify the condition that resulted in river rejuvenation. (1 x 1) (1)

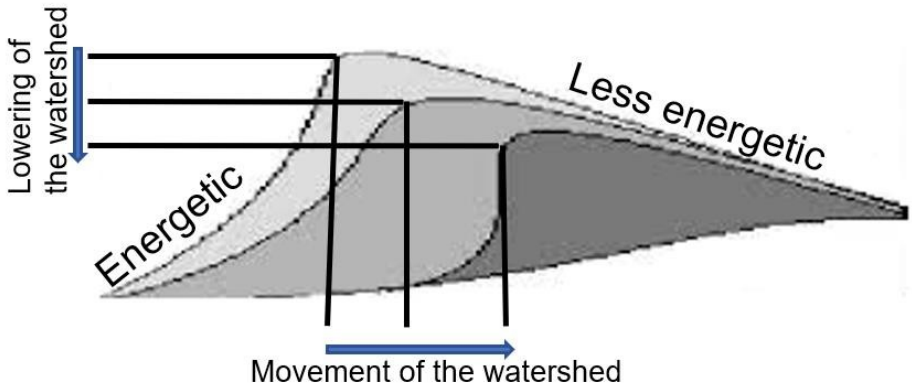
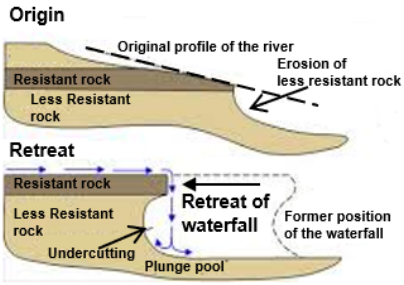
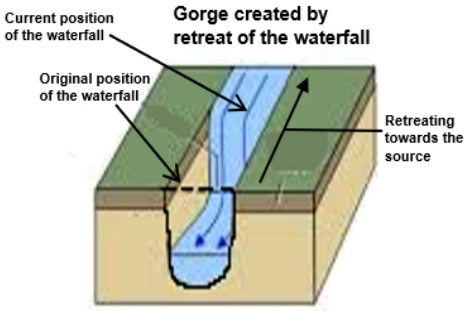
14.2.3 Name ONE fluvial feature that can form at the knick point along the river profile. (1 x 2) (2)

14.2.4 Explain the impact of river rejuvenation on the grading of a river. (2 x 2) (4)

14.2.5 Write a paragraph of approximately EIGHT lines elaborating on the changes that will occur in the fluvial features found in the illustrated course of the river as a result of river rejuvenation. (4 x 2) (8)

15. RIVER CAPTURE/STREAM PIRACY

A. KEY CONCEPTS AND NOTES

Concepts	Definition
River capture/stream piracy	When the more energetic (active) river, captures some of the water of a less energetic river.
Abstraction	The process whereby the watershed becomes lower and its position shifts. 
Headward erosion • Erosion takes place towards the source of a river. • Headwaters of a river are moving upstream. • Upper stream is moved backward. • Undercutting of upper reaches of river • Less resistant rocks promote the erosion process.	The stream erodes away at the rock and soil at its headwaters (source) in the opposite direction that it flows. This lengthens the stream channel and enlarge the drainage basin  

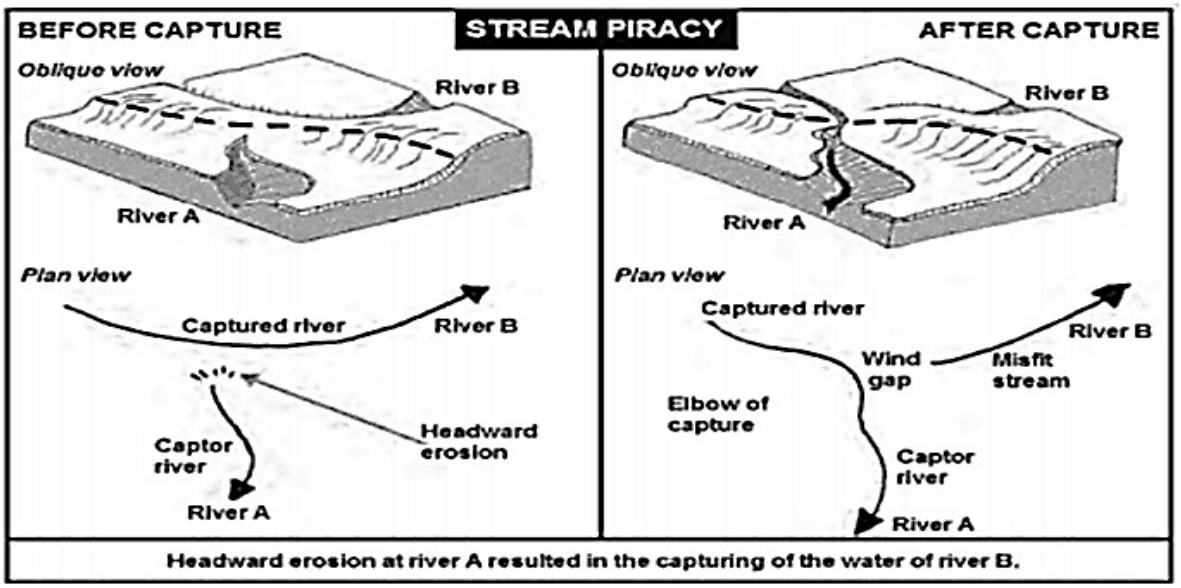
B. CAUSES AND CHARACTERISTICS

1. Causes of stream piracy.

- Steeper gradient on the side of the energetic stream of the watershed.
- The low-lying stream has more energy.
- Higher precipitation, giving greater runoff and more erosion to the energetic stream.
- Softer rocks on the side of the energetic stream cause faster erosion.
- Presence of faults or joints in rocks to assist the erosion process.

How does stream piracy occur.

- The more energetic stream erodes backward at its source.
- The energetic stream captures the waters of the less energetic stream.



FEATURE	EXPLANATION
Captor Stream	The energetic stream that intercepts (takes) the water of the less energetic stream
Captured Stream	The river from which water was intercepted (taken) by the captor stream)
Misfit Stream	The stream that has lost his water. Also called beheaded stream. The river is too small for then valley it flows in
Elbow of capture	The place at which stream piracy (river capture) takes place. Usually, a knickpoint waterfall develops.
Wind gap	The dry river valley between the misfit stream and the elbow of capture.

Characteristics of Captor stream after piracy

- Volume of water increases in the stream.
- Downward erosion increases.
- Carrying capacity of the river increases.
- River rejuvenates.

Characteristics of misfit stream after stream piracy

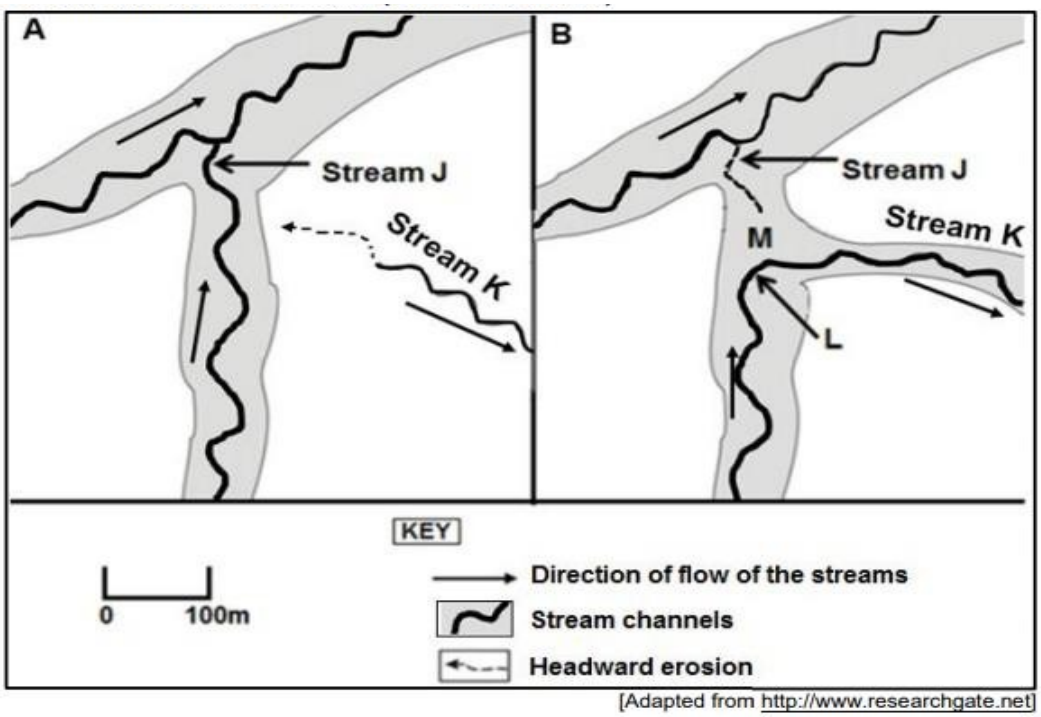
- Volume of water decreases
- Stream too small for its channel/valley
- Deposition of stream load occurs.
- Water erosion is reduced, but wind erosion will increase.
- Carrying capacity is reduced.

<table>
<tr><th colspan="2">2. IMPLICATIONS OF RIVER CAPTURE</th></tr>
<tr><th colspan="2">1. Human activities</th></tr>
<tr><td>At the Captor Stream
More agricultural production
Less irrigation
Increase in production might lead to manufacturing.
Increase in water might cause flooding and people must relocate.
More water might have damaged the recreational facilities on the banks of the river.</td><td>At the Misfit Stream
People will relocate due to job losses in agriculture.
Decrease in agricultural production.
Financial implication due to irrigation
Less of recreational facilities due to less income
Factories close due to lack of water
Decrease in fishing for source of food</td></tr>
<tr><th colspan="2">2. Settlements</th></tr>
<tr><td>Captor Stream
Due to increase of water along the banks people must relocate.</td><td>Misfit Stream
Due to the decrease in agricultural production people relocate.
Rural- urban migration
The settlement might become a ghost town</td></tr>
<tr><th colspan="2">3. Recreation</th></tr>
<tr><td>Captor Stream
Recreational facilities along the banks of the river might be damaged.
Increase in water sports</td><td>Misfit Stream
Decrease in water sports.
Because of less people, there is financial instability in the area</td></tr>
<tr><th colspan="2">4. Agriculture</th></tr>
<tr><td>Captor Stream
Increase in crop production.
More exports
Less irrigation</td><td>Misfit Stream
More water expenses.
Decrease in crop production</td></tr>
</table>

2. IMPLICATIONS OF RIVER CAPTURE	
5. Ecosystem	
Captor Stream • Habitat will be disturbed. • Increase in water will cause an increase in fish. • Diversity of ecosystems will develop because of the increase in vegetation.	**Misfit Stream** • Marine/water ecosystem disturbed. • Less fish • Land degradation due to soil erosion • Decrease in biodiversity
IMPLICATIONS OF RIVER CAPTURE	
Elbow of capture • Tourist attraction due to the waterfall • Job creation in the tourism sector • There can be hydroelectricity being generated. • Area of research	**Wind gap** • Biodiversity is destroyed. • Decrease in crop production and farming activities. • Soil erosion will increase.

C. STREAM PIRACY ACTIVITIES

15.1 Refer to sketches A and B of FIGURE 15.1



[Adapted from http://www.researchgate.net]

15.1.1 Define the term river capture. (1 x 2) (2)

15.1.2 Describe the erosion associated with the process of river capture in sketch A. (1 x 1) (1)

15.1.3 Identify features L and M that result from river capture. (2 x 1) (2)

15.1.4 Match the terms captor stream and misfit stream to streams J and K in diagram B. (2 x 1) (2)

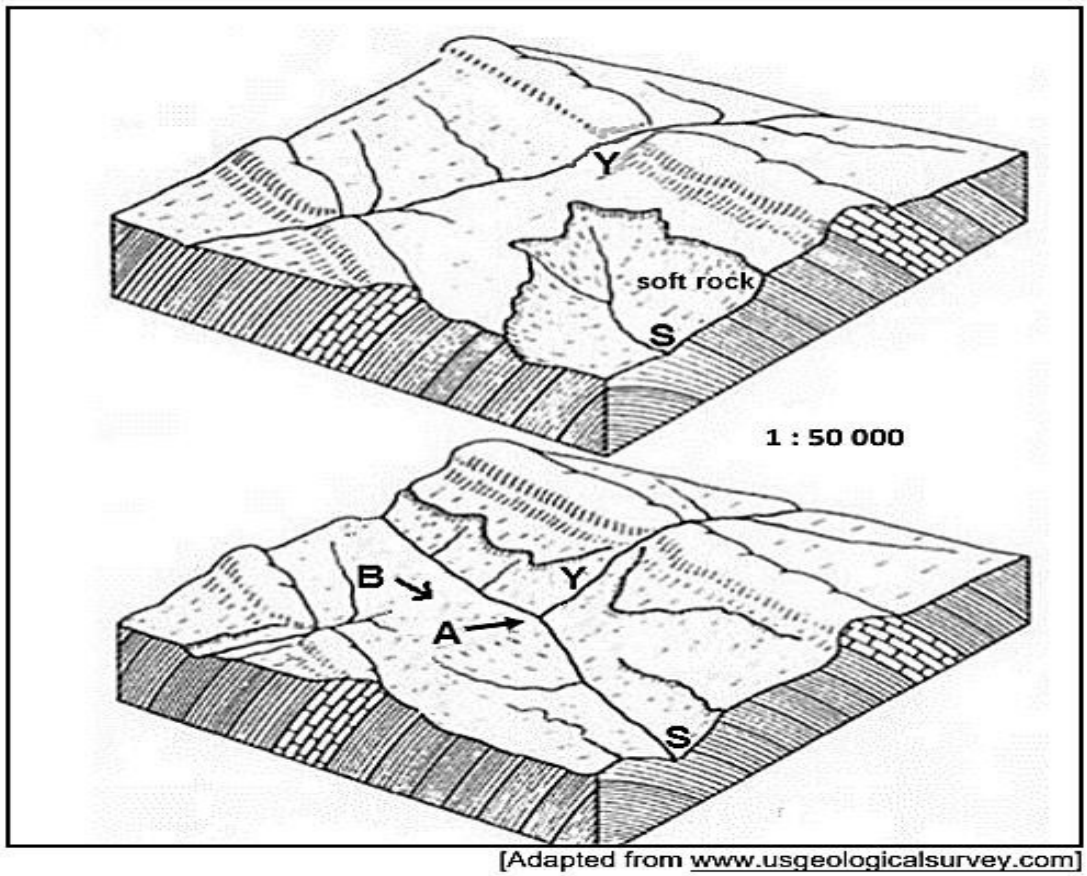
15.1.5 (a) What is a watershed? (1 x 2) (2)

(b) How can the process of river capture cause the watershed to change its position? (1 x 2) (2)

15.1.6 What effect will river capture have on the volume of water in stream K? (1 x 2) (2)

15.1.7 What can the local farming community around stream J do to continue with their daily activities after river capture have taken place? (2 x 2) (4)

15.2 Refer to the sketches that indicate the river capture process.



[Adapted from www.usgeologicalsurvey.com]

15.2.1 Identify streams S and Y. (2 x 1) (2)

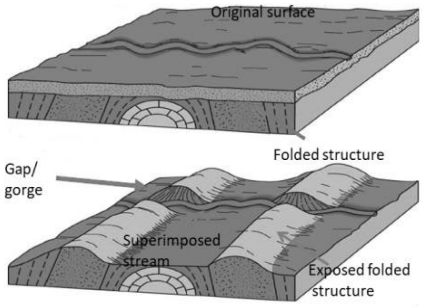
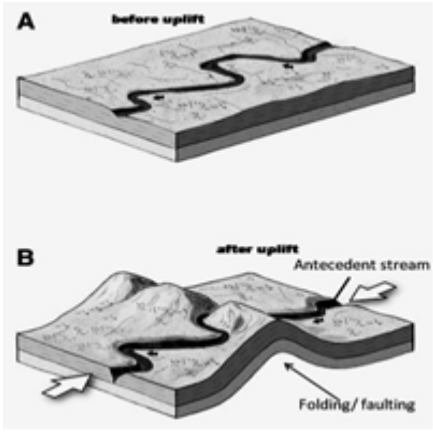
15.2.2 Name the features of river capture at A and B respectively. (1 x 1) (1)

15.2.3 Give TWO reasons for the river S eroding at a faster rate. (2 x 1) (2)

15.2.4 In a paragraph of approximately EIGHT lines, explain the impact of river capture on the volume of water and the erosive ability of rivers B and S respectively. (4 x 2) (8)

16. SUPERIMPOSED AND ANTECEDENT DRAINAGE PATTERNS

A. KEY CONCEPTS AND NOTES

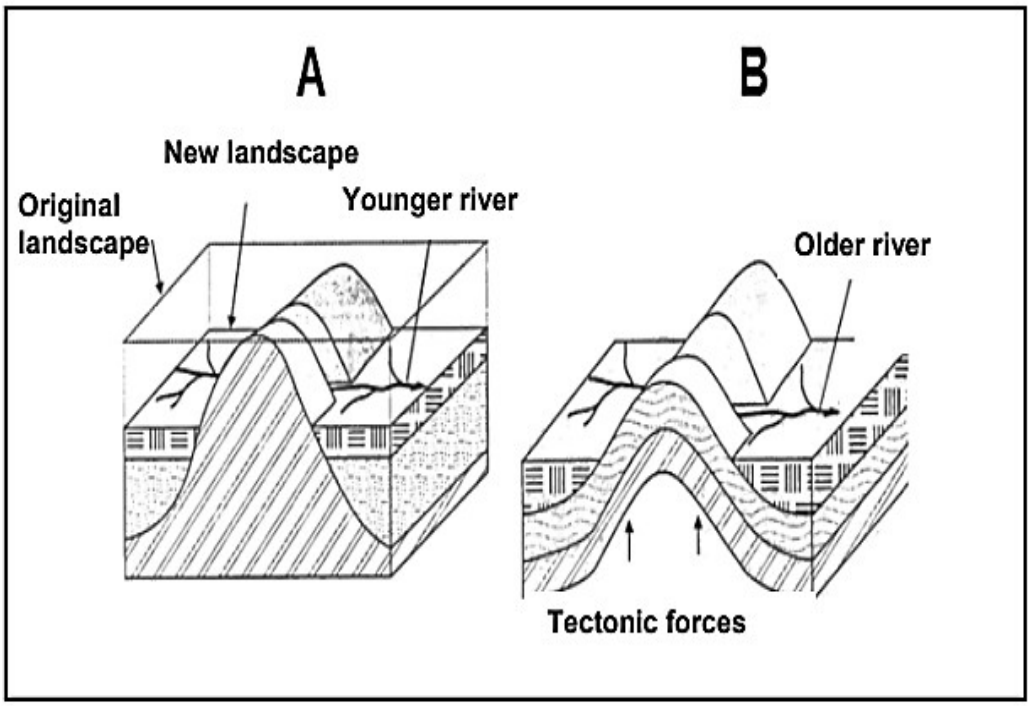
Concepts	Definition	Description	
Superimposed	A drainage pattern/stream that has been established on an earlier surface	• Rivers are younger than the structures across which they cut. • May cut narrow gab/gorges if forced across bands of hard rock	
Antecedent	Occurs where a river developed its course before the high- lying area was formed.	• Rivers is older than the landform across which they cut. • Warping, folding or faulting occurred. • May cut narrow gab/gorges if forced across bands of hard rock	

B. Why the streams maintained their course

- Softer rock over which they flow.
- Volume of water increase through rejuvenation and increased rainfall.
- There are crack and joints where the river flows

C. SUPERIMPOSED AND ANTECENDENT DRAINAGE ACTIVTIES

16.1 Study FIGURE 16.1 which shows superimposed drainage (A) and antecedent drainage (B).



[Adapted from *Exam Fever Series*]

16.1.1 Distinguish between superimposed drainage and antecedent drainage. (2 x 2) (4)

16.1.2 Give ONE reason why superimposed drainage does not change its course. (1 x 2) (2)

16.1.3 Name ONE unique feature associated with the flow patterns of superimposed and antecedent drainage. (1 x 2) (2)

16.1.4 Identify the tectonic force associated with the uplift of the surface evident in diagram B. (1 x 2) (2)

16.1.5 Give the relationship between the rate of down cutting and tectonic uplift in antecedent drainage. (2 x 2) (4)

16.1.6 Explain why the illustrated landscapes are not suitable for human habitation. (2 x 2) (4)

17. CATCHMENT AND RIVER MANAGEMENT

A. KEY CONCEPTS AND NOTES

Concepts	Definition
River management	River Management is defined as the management of water resources of a basin in relation to their socio-economic setting.
Catchment area	The area from which rainfall flows into a river, lake, or reservoir.
Overgrazing	Excessive grazing which causes damage to vegetation.
Afforestation	Planting more trees to reduce stream discharge and surface runoff
Deforestation	Deforestation, clearing or thinning of forests by humans to make the land available for other uses
Environmental injustice	It is the poor treatment/use of the natural resources/environment by humans

B. CAUSES, IMPORTANCE AND IMPACT OF RIVER MANAGEMENT

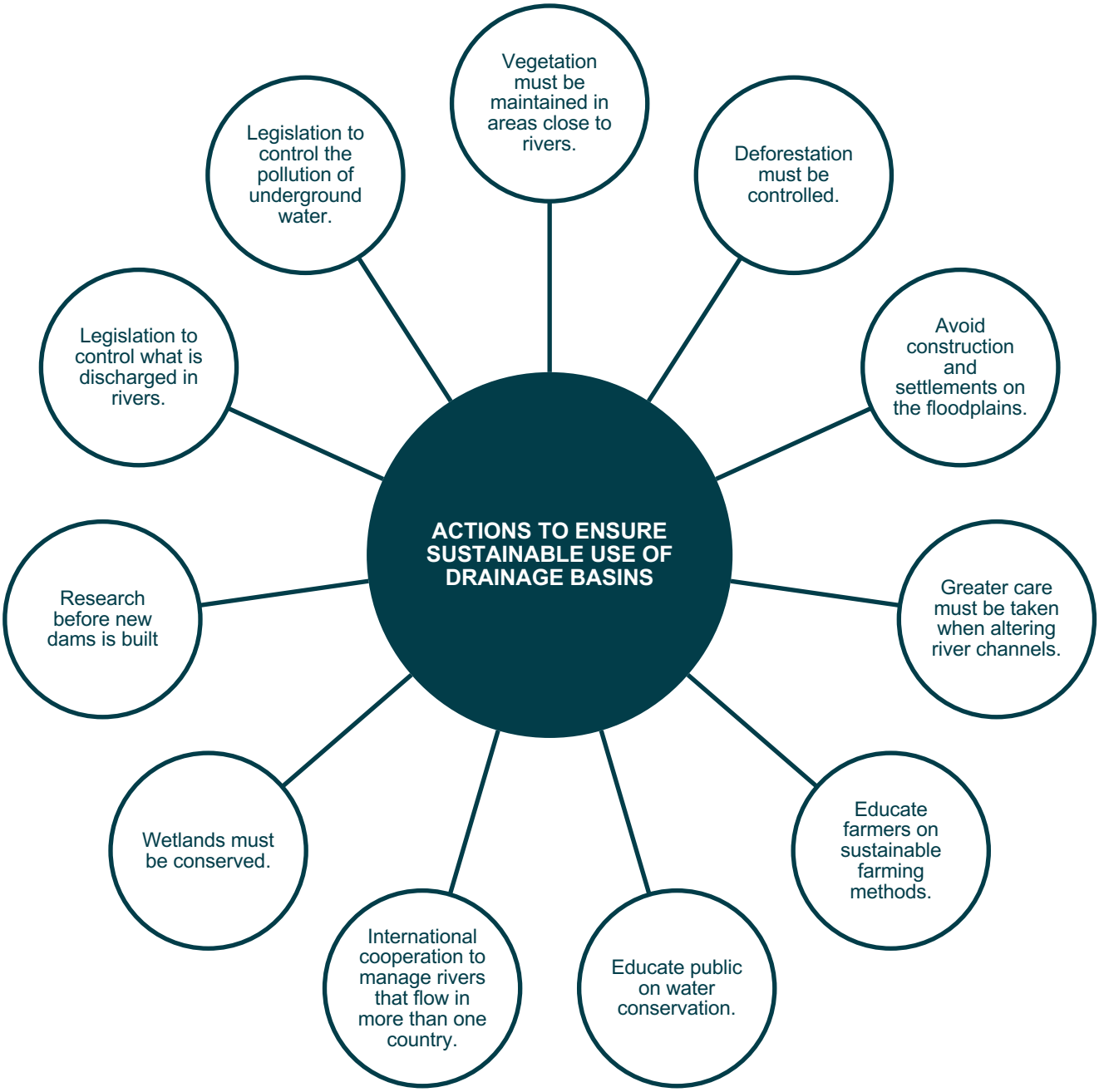
CAUSES OF POOR RIVER MANAGEMENT

- Inadequate sewage collection and treatment are sources of water pollution.
- Cutting down trees and concreting over large areas generates an acceleration of flows which does not give enough time for water to infiltrate and be purified by the ground.
- Agriculture has an impact on water pollution due to the use of chemicals such as fertilizers, pesticides or insecticides running off in the water, as well as livestock excrement, manure and methane (greenhouse effect).
- Industries produce a lot of waste containing toxic chemicals and pollutants. A huge
- amount of the industrial waste is drained in the fresh water which then flows into canals, rivers and eventually in the sea.
- Garbage such as plastic, paper, aluminum, food, glass, or rubber are deposited into the sea.

IMPORTANCE OF MANAGING DRAINAGE BASINS

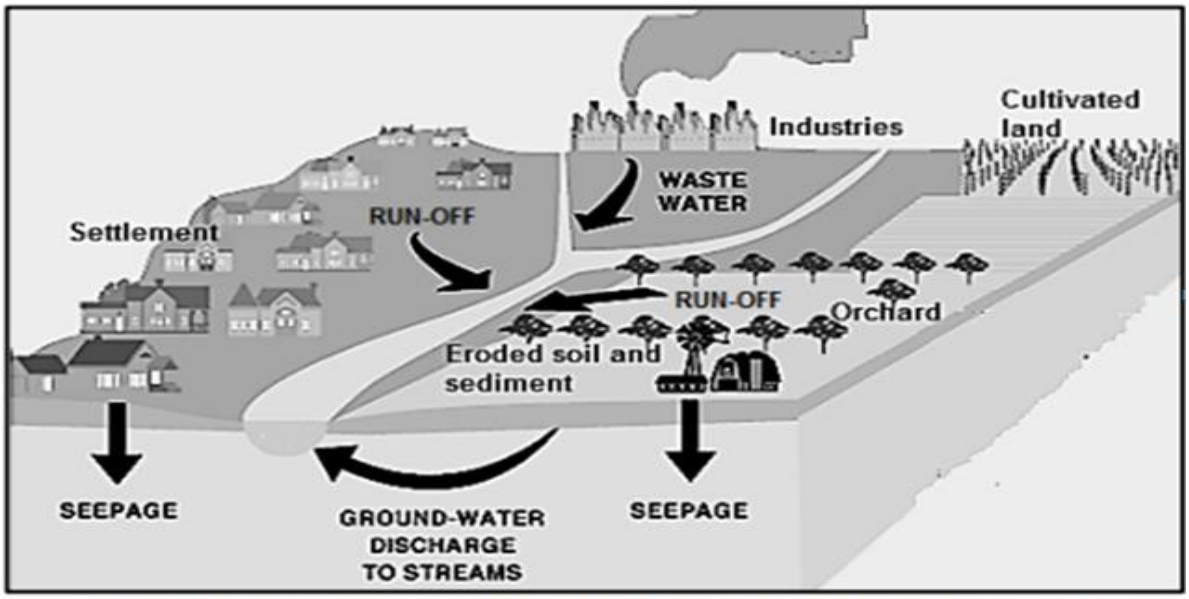
- Store water and protecting for future use.
- Reduce discharge and recycle harmful agricultural run-off.
- Agricultural purposes e.g., crop farming
- Industrial purposes e.g., to cool the machines in factories and is also a vital part of production.
- Control the flow of water to reduce the chances of flooding.
- Domestic purposes
- Recreation e.g., water sports
- Generation of Hydroelectricity
- Preserve natural vegetation.
- Preserve biodiversity.


River Pollution
- Industrial waste
- Sewage and waste water
- Marine dumping
- Accidental oil leakage
- Burning of fossil fuels
Causing acid rain
- Chemical fertilizers and pesticides
- Leakage from sewer lines
Industrial Waste
- Untreated wastewater pollute ground- and surface water
- Drinking water sources and irrigation water may be negatively affected
- Aquatic biodiversity and habitats may be destroyed
- Dumped chemicals increases eutrophication
Untreated Sewage
- If untreated sewage gets into rivers, microorganisms decompose it.
- They use oxygen from the water
- There is less oxygen in water
- Aquatic organisms such as fish is unable to survive.
IMPACT OF PEOPLE ON DRAINAGE BASINS
Human Settlements
- Increases waste dumping in the river
- Water quality decreases and leads to increased waterborne diseases
- Marine ecosystems and biodiversity destroyed
- Eutrophication destroys water habitats
Deforestation
Increases run-off causing silting in the rivers
Impact of silting
- Hydroelectric projects affected
- Irrigation infrastructure lose productivity
- Riverbed are raised increasing flood risk
- Biodiversity is disturbed
Overgrazing
- Overgrazing increases soil erosion
- This increases run-off that causes silting of the river
- Salinity increases and nutrients are loss


ACTIONS TO ENSURE SUSTAINABLE USE OF DRAINAGE BASINS
Vegetation must be maintained in areas close to rivers.
Deforestation must be controlled.
Avoid construction and settlements on the floodplains.
Greater care must be taken when altering river channels.
Educate farmers on sustainable farming methods.
Educate public on water conservation.
International cooperation to manage rivers that flow in more than one country.
Wetlands must be conserved.
Research before new dams is built
Legislation to control what is discharged in rivers.
Legislation to control the pollution of underground water.

C. CATCHMENT AND RIVER MANAGEMENT ACTIVITIES

17.1 The FUGURE below show catchment and river management.



[Source: https://openoregon.pressbooks.pub/envirobiology/chapter/7-3-water-pollution]

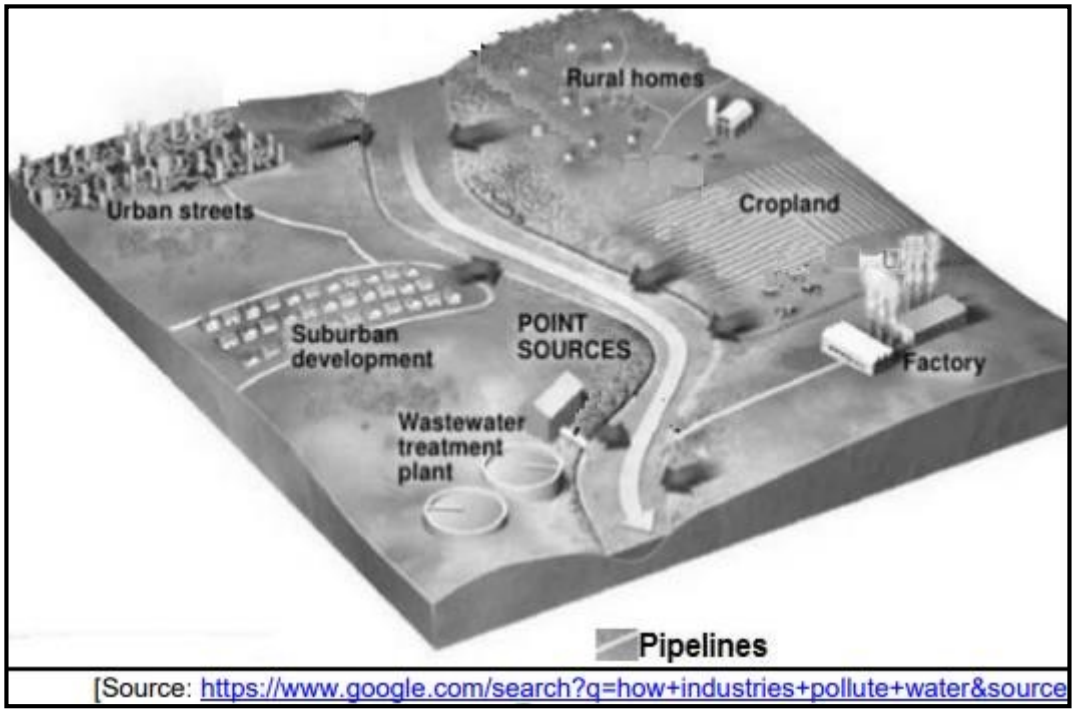
17.1.1 What is the main source of wastewater? (1 x 1) (1)

17.1.2 Discuss how the removal of the natural vegetation for human activities increased the eroded soil and sediments in the river. (1 x 2) (2)

17.1.3 Explain how run-off from both settlements and cultivated land decreases the quality of water of a river. (2 x 2) (4)

17.1.4 In a paragraph of approximately EIGHT lines, discuss why sustainable river management is important for all sectors of the economy. (4 x 2) (8)

17.2 Refer to FIGURE 17.2 showing catchment and river management.



[Source: https://www.google.com/search?q=how+industries+pollute+water&source

17.2.1 What is river management? (1 x 2) (2)

17.2.2 Name ONE way in which the factory pollutes the river. (1 x 2) (2)

17.2.3 Explain the importance of the wastewater treatment plant in river management. (2 x 2) (4)

17.2.4 State TWO ways in which fertilizers from the crop land can impact on the ecology of the river. (2 x 2) (4)

17.2.5 Outline the negative impact of water pollution on the economy of a country. (2 x 2) (4)

MAP IMPLICATIONS

17.3 2930CA MERRIVALE / 2930CA 5 MERRIVALE

17.3.1 Name features **1** and **2** on the orthophoto map. (2 x 1) (2)

17.3.2 Identify the slope represented by line **3**-**2**. (1 x 1) (1)

17.3.3 Draw a rough cross profile from **3** to **2** to support your answer to QUESTION 13.3.2. (3 x 1) (3)

17.3.4 Discuss how human activities, evident on the topographic map, might influence the quality of water of the Midmar Dam. (2 x 2) (4)

18. POSSIBLE ANSWERS

5. DRAINAGE BASINS CONCEPTS

5.1	5.1.1	Surface runoff	
	5.1.2	Watershed	
	5.1.3	Ground water	
	5.1.4	Permanent	
	5.1.5	Water table	
	5.1.6	Confluence	
	5.1.7	Infiltration	
	5.1.8	Base flow	(8 x 1) (8)
5.2	5.2.1	Total area drained by a river and its tributaries	(1 x 2) (2)
	5.2.2	Watershed: separates two drainage basins Interfluve: separates two streams	(2 x 1) (2)
	5.2.3	Precipitation	(1 x 2) (2)
	5.2.4	Built up area will promote high runoff.	(1 x 2) (2)
	5.2.5	There are artificial surfaces. No vegetation cover to increase infiltration.	(2 x 2) (4)
	5.2.6	Inadequate sewage collection and treatment are sources of water pollution. Cutting down trees does not give enough time for water to infiltrate and be purified by the ground. Use of chemicals such as fertilizers, pesticides or insecticides running off in the water, as well as livestock excrement, manure and methane (greenhouse effect). A huge amount of the industrial waste is drained in the fresh water which then flows into canals, rivers and eventually in the sea. Garbage such as plastic, paper, aluminium, food, glass, or rubber are deposited into the sea.	(4 x 2) (8)
5.3	5.3.1	drainage basin	(1 x 1) (1)
	5.3.2	B: watershed C: interfluve	(2 x 1) (2)
	5.3.3	Refer to D c) Easterly d) Tributaries join the main stream in an easterly direction. Contour lines point towards the opposite direction of flow.	(1 x1) (1) (2 x 2) (4)
	5.3.4	F- confluence has more water joining the streams	(1 + 2) (3)

6. TYPES OF RIVERS

6.1 6.1.1 a) A river that only flows after heavy rainfall, short duration (2) (1 x 2) (2)
b) Many rocks and boulders visible in the river course (1)
Dry river bed (1) (1 x 1) (1)
c) Regularity of rainfall/droughts (2)
Amount of rainfall (2)
Soil type over which the streams flow (2)
Underlying rock structure (2)
Rate of evaporation (2)
Vegetation density in catchment area (2)
The speed/velocity at which the water flows (2)
The volume of flowing water/floods (2)
The manner in which the water flows (2)
Infiltration rate (2)
Soil water content (2)
Gradient (2)
[ANY TWO] (2 x 2) (4)

6.1.2 a) Exotic river (2) (1 x 2) (2)
b) Gains water in much wetter areas – Drakensberg Mountains (2)
Stream flow volume exceeds infiltration rate (2)
Fed by tributaries in high rainfall areas (2)
Reliable ground water close to the source (2)
Construction of dams to regulate the flow of water (2)
[ANY TWO] (2 x 2) (4)
e) Regular water supply (2)
Irrigation (2)
Stock farming (2)
[ANY ONE – ACCEPT OTHER] (2 x 2) (4)

7. DRAINAGE PATTERNS

7.1 7.1.1 Total area drained by a river and its tributaries. (1 x 1) (1)

7.1.2 Trellis Pattern (1 x 1) (1)

7.1.3 Tributaries join the main stream at right angles (1 x 1) (1)

7.1.4 Steep slopes at R more erosion. (1 x 1) (1)

7.1.5 3rd order (1 x 1) (1)

7.1.6 a) At S (1 x 1) (1)
b) More water in the river Gentle gradient (1 x 1) (1)
c) More load and the river is entering the sea
Plant more vegetation along the river banks
Building artificial levees
Divert the channel flow of rivers (4 x 2) (8)

7.2 7.2.1 F

7.2.2 D

7.2.3 E

7.2.4 H

7.2.5 B

7.2.6 A

7.2.7 C

7.2.8 B (8 x 1) (8)

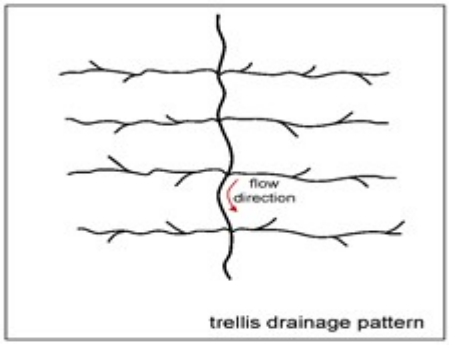
7.3 7.3.1 The way in which streams are arranged within a drainage basin/
The surface pattern formed by a river and its tributaries. (1 x 2) (2)

7.3.2 A. Radial pattern
C. Rectangular pattern (2 x 1) (2)

7.3.3 Pattern B: found on a rock with a uniformed resistance to erosion.
Pattern C: found on an igneous rock with cracks and joints. (2 x 2) (4)

7.3.4 High lying area at the center.
Streams are flowing outwards from a central elevated point.
Dome like structure at the center will cause water to flow in all directions.
(Any ONE) (1 x 2) (2)

7.3.5 In the dendritic pattern water is widely distributed in the drainage basin and water is accessible
Longer tributaries therefore water is more accessible
Occurs over flat/gentle land (middle/lower course) thus more suitable for farming
Larger floodplains with access to fertile soils (2 x 2) (4)

7.3.6 

(2 x 2) (4)

7.4 7.4.1 Permanent (1 x 1) (1)

7.4.2 Because of the bridge to cross the river. (1 x 2) (2)

7.4.3 C – Parallel D – Trellis (1 x 2) (2)

7.4.4 C – steep slope all streams flowing down in one direction.
D – tributaries join main stream at right angles 90°. (2 x 2) (2)

7.4.5 The Dam is located in the basin.
Lots of tributaries flowing towards the center. (2 x 2) (4)

8. ACTIVITY DRAINAGE DENSITY

8.1 8.1.1 Total number of streams found in an area. (1 x 2) (2)

8.1.2 A. density is high
B. density is low (2 x 2) (4)

8.1.3 High vegetation cover results in high infiltration rate and less streams on the surface.
Little rainfall will lead to few streams on the surface
High porosity and permeability will result in high infiltration and less streams. Gentle slopes will lead to high rate of infiltration and less runoff.
Soil with little moisture will lead to high amount of infiltration and low density. (2 x 2) (4)

8.1.4 Clearing of natural vegetation/deforestation will increase run-off (2)
Overgrazing by animals removes natural vegetation which increases run-off (2)
Incorrect ploughing methods can result in more water flowing down the furrows (2)
Over-cultivation of farmland destroys vegetation and top soil (2)
The loss of topsoil due to human activities can result in the formation of gullies (dongas) (2)
Building of settlements increases artificial surfaces therefore more run-off (2)
Building of canals to divert run-off create more river channels (2)
Building of roads reduces natural vegetation which increases run-off (2)
Open cast mining causes removal of natural vegetation increasing run-off (2)
Trampling of soil by livestock decreases infiltration (2)
[ANY FOUR] (4 x 2) (8)

8.2 8.2.1 The ratio between the total length of all the streams in a river system and the area of the drainage basin that it drains (1 x 2) (2)

8.2.2 A: Dry season
B: Rainy season (1 x 2) (2)

8.2.3 In the wet season drainage density will be high due to high rainfall (often soil is saturated) and a high rate of run-off occurs (2)
In the dry season the drainage density will be low due to low rainfall and high rate of infiltration occurring (2). (2 x 2) (4)

8.2.4 IMPACT OF DRAINAGE DENSITY ON DRAINAGE BASIN ORDER
In the wet season there will be higher rainfall, which leads to higher volumes of water (2)
leading to more 1st and 2nd order streams/rivers (2)
The area will have high rates of run-off (2),
as soils will be saturated (2)
This increases the drainage basin order (2)
In the dry season there will be less run-off due to less rainfall (2)
Less 1st and 2nd order streams will be found (2)
The area will have higher levels of infiltration creating lower drainage densities (2)
This decreases drainage basin order (2)
[ACCEPT OTHER REASONABLE ANSWERS] (4 x 2) (8)

9. STREAM ORDERS

9.1 9.1.1 High (1 x 1) (1)

9.1.2 Steep slopes will promote high runoff and less infiltration Areas with little vegetation cover will have little infiltration and high runoff (2 x 2) (4)

9.1.3 3rd order (1 x 2) (2)

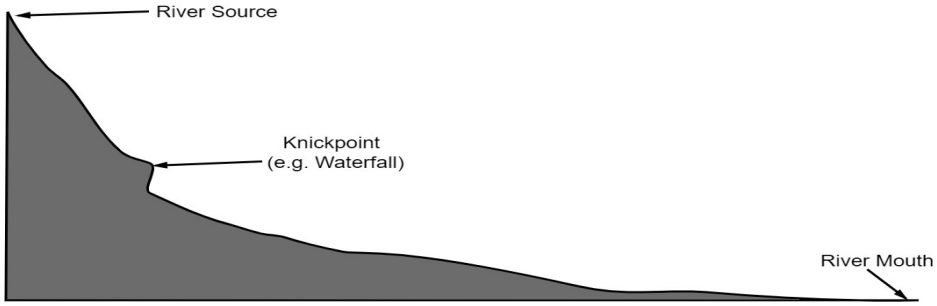
9.1.4 2nd order
Non perennial streams will dry up in dry seasons. (1 + 2) (3)

12. RIVER GRADING

12.1 12.1.1 Lowest level to which a river can erode (1 x 2) (2)

12.1.2 Dam / Waterfall temporary base level (1 x 1) (1)

12.1.3



(3 x 1) (3)

12.1.4 Ungraded (1 x 2) (2)

12.1.5 It has a knickpoint

12.1.6 Gradient is steep at the source and gentle at the mouth.
Backward erosion changes the gradient from source to mouth
More erosion in the upper course and deposition at the lower course (3 x 2) (6)

12.2	12.2.1	A: upper course and B: middle course	(2 x 1) (2)
	12.2.2	A: V shaped valleys in the upper course/straight stream/steep slope/first order streams B**:** open valley/ starting to meander	(2 x 1) (2)
	12.2.3	A: vertical erosion steep gradient. B: lateral erosion/ more water volume.	(2 x 2) (4)
	12.2.4	3rd order	(1 x 2) (2)

13. FLUVIAL LANDFORMS AND FEATURESM ACTIVITIES

13.1 13.1.1 a) The down-slope flow of water in a river under the influence of gravity that is either smooth or turbulent. (1 x 2) (2)
b) Waterfall (1 x 1) (1)
c) Upper course (1 x 1) (1)
d) The area is steep (1 x 1) (1)
e) More resistant rock is found at X. (1 x 1) (1)
Water falls from the upper layers of the river (2 x 1) (2)
f) It serves as a tourist attraction Electricity can be generated (1 x 1) (1)

13.1.2 a) Knickpoint (1 x 1) (1)
b) Rafting (1 x 1) (1)

13.1.3 a) A meander is defined as a distinct curve or loop in the course of a river channel. (1 x 2) (2)
b) In the middle course the river has more energy and a high volume of water as a result of tributaries joining
Lateral (sideways) erosion starts to widen the river channel.
As the river erodes laterally (to the right side then the left side) it forms large bends, and then horseshoe-like loops called meanders.
The formation of meanders is due to both deposition and erosion and meanders gradually migrate downstream (2 x 1) (2)
c) The slope is concave.
The river flows fast at this side.
Erosion, especially undercutting occur
The area is deep. (1 x 1) (1)
d) Oxbow lake (1 x 1) (1)
e) The valley will dry up over time. (1 x 1) (1)

13.2 13.2.1 Oxbow lake (1 x 1) (1)

13.2.2 In the lower course (1 x 1) (1)

13.2.3 A: slip off slope
B: undercut slope (2 x 1) (1)

13.2.4 A: There is deposition
B: There is erosion (2 x 2) (4)

13.2.5 The area will be dried up over time.
It will remain as a scar (2 x 2) (4)

13.2.6 Provides water and fertile soil for farming (1 x 2) (2)

13.3 13.3.1 Meandering stream (1 x 1) (1 x 1) (1)

13.3.2 Width and depth of the valley (2 x 1) (2 x 1) (2)

13.3.3 Slip off slope (1 x 1) (1 x 1) (1)

13.3.4 The boys do not understand the difference between the slopes on the river bend/Where the slip off slope is, it is shallow and where the undercut slope is, it is deeper (2 x 2) (2 x 2) (4)

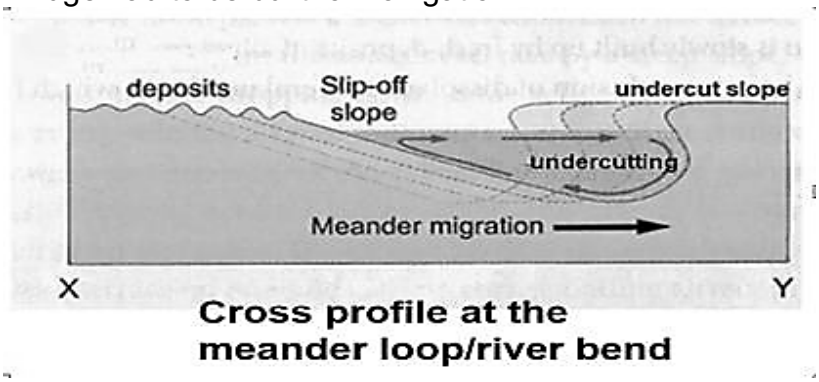
13.3.5 **Slope A – Undercut slope**
It is the undercut cut slope that is associated with fast flowing water Lots of energy resulting in the process of lateral erosion
It occurs on the outer bank of the meander
The slope is steep and concave

Slope B - Slip-off slope
It is the slope that is associated with a slower flowing water More friction and slower flowing resulting in deposition
It occurs on the inner bank of the meander
The slope is gentle and convex
[Any FOUR] (4 x 2) (8)

13.4 13.4.1 Braided stream (1 x 1) (1)

13.4.2 a) Sand banks (1 x 1) (1)
b) Bridge had to be built for navigation (1 x 1) (1)

13.4.3



Cross profile at the meander loop/river bend

a) (4 x 1) (4)

b) There is deposition of fertile soil at 1, good area for farming (1 x 1) (1)

13.5 13.5.1 There are meandering streams and oxbow lakes (2 x 1) (2)

13.5.2 Deposition of fertile soil promotes crop farming
Flat area is possible for construction of main road along the river (2 x 2) (2)

13.5.3 A: oxbow lake
B: marshes and vlei (2 x 1) (2)

13.5.4 Meander loop reduced the speed of water in the river and increases chances of flooding.
When the loop is cut, the channel straightens and water moves faster (2 x 2) (4)

14. RIVER REJUVENATION

14.1 14.1.1 Vertical erosion (1 x 1) (1)

14.1.2 Uplift of the surface (1 x 2) (2)

14.1.3 Isostacy /tectonic forces (1 x 2) (2)

14.1.4 Steeper slopes make it unsuitable for human living Deeper gorges makes farming activity impossible Building infrastructure will be more expensive
More specialized farming machinery will be needed Water will not be easily accessible for human usage Narrow floodplains reduce fertile farming land
[ANY TWO] (2 x 2) (4)

14.1.5 A knick point will develop between the old and the new point of erosion (2) Waterfalls develop at the knick point where there is a sharp change in gradient (2)
Vertical (accept downward) erosion results in (paired) terraces (2)
Valleys within valleys develop as a result of a new valley floor (2)
Meanders deeply erode to form entrenched or incised meanders (2)
Floodplains are narrowed (2)
[ALSO ACCEPT THE FOLLOWING]
Higher velocity may remove some braided streams (2)
Higher velocity may break through the levees (2)
Higher velocity may wash the existing deltas away (2)
Higher velocity may result in more oxbow-lakes (2) (4 x 2) (8)
[ANY FOUR]

14.2 14.2.1 When a river is eroding the landscape downwards in response to a lowering/change of its base level (1)
River rejuvenation is a process where rivers (are re- energized to) actively erode downward again (1 x 2) (2)

14.2.2 A drop in the sea level. (1 x 1) (1)

14.2.3 Waterfall/rapids. (1 x 2) (2)

14.2.4 Rejuvenated rivers will be ungraded/obstructions along the course as a result of renewed downward erosion (2)
River will now show a multi-concave profile (2)
Temporary base levels of erosion will develop (examples: knickpoint, rapids, waterfall) (2)
Over graded river as renewed downward erosion now takes place (2)
Vertical erosion downstream of the knickpoint dominates (2)
The balance between erosion and deposition is disturbed (2)
[ANY TWO] (2 x 2) (4)

14.2.5 Knickpoints can form because of the old erosion level meeting the new erosion levels
The knickpoint retreats upstream
Waterfall can form at the knickpoint due to the break/lowering along the course of the river
Waterfalls can turn into rapids
Meanders will become more incised and entrenched (erode vertically) River cuts into the flood plain and a new flood plain

develops
A valley within a valley forms because of vertical erosion Valleys with multi-terraced slopes will form
River channel becomes narrower
New floodplain is narrower than the original flood plain More meanders develop
[ANY FOUR] (4 x 2) (8)

15. STREAM PIRACY

15.1 15.1.1 When one river captures/intercepts/robs/steals the headwaters of another
river/When a more energetic river captures a less energetic river
The stream flowing at a lower-level
captures/intercepts/robs/steals the water of a stream flowing at a higher level
[CONCEPT] (1 x 2) (2)

15.1.2 Headward/Backward erosion
Erodes upstream (from its source)
[Any ONE] (1 x 2) (2)

15.1.3 L – elbow of capture
M – wind gap (2 x 1) (2)

15.1.4 J – Misfit stream
K – Captor stream (2 x 1) (2)

15.1.5 a) It is a high lying area that separates two different drainage basins **[CONCEPT]** (1 x 2) (2)

b) Lowering (vertically) of the watershed
Headwards movement/retreats horizontally
[Any ONE – CONCEPT] (1 x 2) (2)

15.1.6 It will increase the volume of the water in this upstream (1 x 2) (2)

15.1.7 The transport of water from other areas
Make use of wind pumps/bore holes to access ground water
Build (farm/small) dams
Recycling/purification of water
Reduce the number of livestock on farms
They would have to reduce the variety of crops on farms
Decrease the production of crops on farms
Change to crops that require less water
The use of GM/drought resistant seeds
Increase the use of fertilizers
More intensive irrigation
Use of canals and furrows for irrigation (accept examples)
More effective method of irrigation (e.g., drip irrigation instead of sprinkler system) (2 x 2) (4)

15.2 15.2.1 S: Captor Stream
Y: Captured Stream (2 x 1) (2)

15.2.2 A: Elbow of capture
B: Wind gap (2 x 1) (2)

15.2.3 Higher rainfall causing increased headward erosion
Larger stream volume increase erosion

S is flowing through softer rock S has a steeper gradient.
[Any TWO] (2 x 2) (8)

15.2.4 THE IMPACT OF RIVER CAPTURE ON THE VOLUME OR WATER AND EROSIVE ABILITY

River B
The headwaters of B is captured
The volume of water in B will decrease
The abovementioned reduces the erosive ability
It will become a misfit stream

River S
River S captured the headwaters of river B
Water added to river S increases its volume
The abovementioned increases the erosive ability
The river becomes rejuvenated
[Any FOUR] (4 x 2) (8)

16. SUPERIMPOSED AND ANTECENDENT DRAINAGE ACTIVTIES

16.1 16.1.1 Superimposed: The river now flows on an older uncovered rocks that are uncovered by erosion
Antecedent: river flows on a young landscape altered by tectonic forces (2 x 2) (4)

16.1.2 The river erodes downwards into the original surface to each underlying rock layers (1 x 2) (2)

16.1.3 Knickpoint (1 x 2) (2)

16.1.4 Isostatic uplift (1 x 2) (2)

16.1.5 The rate of downcutting is faster than the rate at which the current rock layer is exposed. (2 x 2) (4)

16.1.6 Steep areas impossible to build at
Expensive to construct roads (2 x 2) (4)

17. CATCHMENT AND RIVER MANAGEMENT ACTIVITIES

17.1 17.1.1 Chemical waste/waste water could be released in the river
Industries (1 x 2) (2)

17.1.2 Removal of vegetation increases runoff thereby increasing the rate of erosion. (1 x 2) (2)

17.1.3 CULTIVATED LAND
Fertilizers used on farms is washed into the rivers causing eutrophication Pesticides used for crops is washed into the river polluting the water
Soil erosion makes the water murky (2 x 2)

17.1.4 SUSTAINABLE RIVER MANAGEMENT STRATEGIES
Access to clean fresh water for future generations (2)
South Africa is a water scarce country (low unreliable rainfall) (2)
Better quality crops will be produced with higher yields (2)
Most industries need a good water supply to function productively (2)
Water is necessary for the production of products e.g. soft drinks,

sweets, canned foods (2)
Higher exports with more profits from crops (2)
Healthier meat products with a better monetary value will be produced (2)
Rivers are a less expensive mode of bulk transport (2)
Good river management encourages eco-tourism/tourism/ recreation (2)
Good quality of water sustains farming/mining/fishing/forestry industry (2)
Maintaining rivers creates sustainable employment (2)
It allows for the generation of hydroelectricity which is an alternative source of power (2)
Decreases purification costs of drinking water (2)
Decreases water borne diseases therefore workforce is healthier (2)
Results in water being more affordable/cheaper (2)
[OR]
UNSUSTAINABLE RIVER MANAGEMENT
Increases purification costs of drinking water (2)
Increases water borne diseases therefore workforce is unhealthy (2)
Acidic water stunts plant growth (2)
Acidic water can hinder crop cultivation (2)
Contaminated water poses a health hazard (2)
Polluted rivers will affect the fishing industry (2)
Polluted rivers can contaminate oceans (2)
[Any FOUR] (4 x 2) (8)

17.2 17.2.1 Using river resources in a sustainable way so that it will still be available in the future (1 x 2) (2)

17.2.2 Chemical waste/waste water could be released in the river
Acid rain caused by air pollution by the factory could end up in the river
[Any ONE] (1 x 2) (2)

17.2.3 Waste water will be treated/purified at the wastewater treatment plant so that it could be re-used/recycled
More fresh water resources will be available
The purified water will prevent and eliminate diseases
Protect aquatic ecosystems
[Any TWO] (2 x 2) (4)

17.2.4 Aquatic life threatened
Imbalance of the ecosystem
Reduced biodiversity
Increased nitrate encourages growth of algae/eutrophication
Reduced oxygen levels
[Any TWO] (2 x 2) (4)

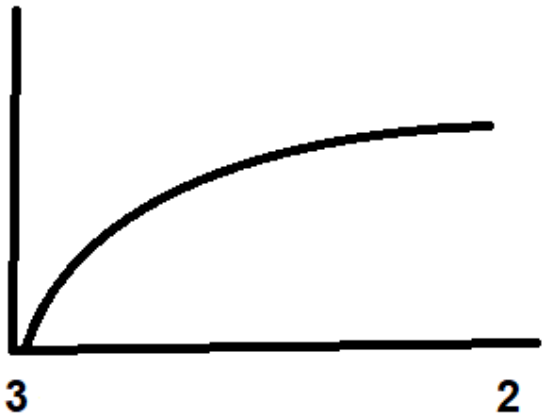
17.2.5 Less clean/pure water resources for primary and secondary economic activities (2)
Less clean water results in water restrictions (2)
Water treatment is expensive and increases the cost of water (2)
Finding alternative water sources will become costly (Accept examples) (2)

Less goods produced for home and export market (2)
Decreases the productivity of farming/manufacturing (2)
Negative influence on stock farming as the number of animals will be reduced (2)
Poor water quality will negatively influence tourism due to the fear of diseases by drinking poor quality water (2)
Fewer tourists will mean less income for the country (2)
[Any TWO] (2 x 2) (4)

17.3 17.3.1 1: Midmar Dam
2: Woodlands (2 x 1) (2)

17.3.2 Convex slope (1 x 1) (1)

17.3.3



(3 x 1) (3)

17.3.4 Chemicals and insecticides used for agriculture near the dam can be washed into the dam and pollute the water
People living near the dam may pollute the dam by dumping waste into the dam (2 x 2) (4)

19. EXAMINATION ACTION VERBS

ACTION WORDS (VERBS/COMMAND WORDS) FOR ASSESSMENT

VERB	MEANING	HOW TO ANSWER
Account	to answer for - explain the cause of - so as to explain why	Full sentences
Analyse	to separate, examination and interpret critically	Full sentences
Classify	to divide into groups or types so that things with similar characteristics are in the same group - to arrange according to type or sort	One-word answers /phrases
Comment	to write generally about	Full sentences
Compare	to point out or show both similarities and differences	Full sentences
Define	to give the concise and clear meaning	Full sentences
Describe	to list the main characteristics of something - give an account of	Full sentences
Differentiate	to show the difference between things	Full sentences
Discuss	to examine by means of argument, presenting both sides and reaching a conclusion	Full sentences
Determine		Full sentences
Distinguish	to recognise the difference between things	Full sentences
Draw/Sketch	to show by means of a sketch	A diagram is required
Evaluate	to make an appraisal or express an opinion concerning the value - to define, analyse and discuss	Full sentences

Explain	to make clear, interpret and spell out the material you present	Full sentences
Give	to state facts without discussions	One-word answers
Identify	to give the essential characteristics of - to name	One-word answers
Illustrate	to show what something is like - to show that something is true / to clearly demonstrate and supports a point through the use of evidence	Full sentences
Justify	to prove or give reasons for decisions or conclusions, using logical argument	Full sentences
List	to write an itemised series of concise statements	One-word answers
Locate	to find the exact place where something is	One-word answers
Mention	providing relevant facts	Full sentences
Name	to state something - give, identify or mention	One-word answers
Outline	give a summary, using main points and leaving out minor details	Full sentences
Predict	to say what you think will happen - to foretell - to say in advance	Full sentences
Propose	to suggest a plan - to make a formal suggestion	Full sentences
Provide	to state facts without discussions	Full sentences/one-word answers
Recommend	to advise that something should be done	Full sentences
Report	to produce an official statement or written document	Full sentences
Select/Choose	to choose something from a greater whole	One-word answers

Sketch	to illustrate with a simple drawing	A diagram is required
Solve	to find a solution to something that is causing difficulties	Full sentences
State	to present information plainly without discussion	One-word answers
Suggest	to propose an explanation or solution	Full sentences
Support	to show that an idea/statement is true	Full sentences
Tabulate	to group like terms or activities under specific headings	One-word answers/phrases
Verify	to check/prove that something is correct	Full sentences
Write	to create a formal document	Full sentences

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