

**CAPRICORN NORTH DISTRICT
GEOGRAPHY ACTIVITY BOOKLET
PAPER 1
CLIMATE AND WEATHER
AND
GEOMORPHOLOGY
SOLUTIONS
2024/5**

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SOLUTIONS

1. SHORT OBJECTIVES

1.1. Global air circulation

1.1.1. D ✓

1.1.2. B ✓

1.1.3. A ✓

1.1.4. B ✓

1.1.5. C ✓

1.1.6. B ✓

1.1.7. B ✓

(7x1) (7)

1.2. (Low pressure and high pressure cells)

1.2.1 Low pressure cell ✓

1.2.2 High pressure cell ✓

1.2.3 Low pressure cell ✓

1.2.4 Low pressure cell ✓

1.2.5 High pressure cell ✓

1.2.6 Low pressure cell ✓

1.2.7 High pressure cell ✓

1.2.8 High pressure cell ✓

(8x1) (8)

1.3.

1.3.1. Low pressure cell ✓

1.3.2. Low pressure cell ✓

1.3.3. Low pressure cell ✓

1.3.4. High pressure cell ✓

1.3.5. High pressure cell ✓

1.3.6. Low pressure cell ✓

1.3.7. High pressure cell ✓

(7x1) (7)

1.4

1.4.1. Y/Summer ✓

1.4.2. Y/ridge ✓

1.4.3. Y/1012 ✓

1.4.4. Y/D ✓

1.4.5. Y/ anticlockwise ✓

1.4.6. Z/ moisture ✓

1.4.7. Z/ ✓

(7x1) (7)

1.5. Mid-latitude Cyclones

1.5.1. Polar front ✓

1.5.2. Wave/Formative stage ✓

1.5.3. 1 000 hPa/mb ✓

1.5.4. Z ✓

1.5.5. Occlusion/Occluded stage ✓

Clockwise rotation of air ✓ Subcontinent of southern Africa is visible on the map

1.5.6. Warm sector facing northwards ✓ Cold sector facing southwards ✓ 60°S

line of latitude shown ✓ [ANY ONE]

1.5.7. Family of cyclones/Cyclone families/Family of depressions ✓

(7 x 1) (7)

1.6.

1.6.1. C ✓

1.6.2. C ✓

1.6.3. A ✓

1.6.4. C ✓

1.6.5. A ✓

1.6.6. B ✓

1.6.7. B ✓

1.6.8. B ✓

(8x1) (8)

1.7.

1.7.1. B ✓

1.7.2. D ✓

1.7.3. B ✓

1.7.4. C ✓

1.7.5. C ✓

1.7.6. A ✓

1.7.7. D ✓

1.7.8. A ✓

(8 x 1)(8)

1.8.

1.8.1. Low. ✓

1.8.2. East to west. ✓

1.8.3. 5°- 30° ✓

1.8.4. Converges ✓

1.8.5. Southern ✓

1.8.6. 300-600km ✓

1.8.7. Mature ✓

(7 x 1) (7)

1.9.

1.9.1. X/6 ✓

1.9.2. Y/clockwise ✓

1.9.3. Y/eye ✓

1.9.4. Y/cumulonimbus ✓

1.9.5. X/heavy ✓

1.9.6. Y/calm ✓

1.9.7 X/latent heat ✓

1.9.8 Y/decrease ✓ (8 x 1) (8)

1.10.

1.10.1. .E ✓

1.10.1. G ✓

1.10.2. H ✓

1.10.3. F ✓

1.10.4. B ✓

1.10.5. A ✓

1.10.6. C ✓ (7 x 1) (7)

1.11

1.11.1. North ✓

1.11.2. South Indian ✓

1.11.3. Ridge ✓

1.11.4 1016 hPa ✓

1.11.5 10 knots ✓

111.6 North west ✓

1.11.7 Subtropical High ✓ (7 x 1) (7)

1.12

1.12.1. Z ✓

1.12.2. Y ✓

1.12.3. Y ✓

1.12.4. Z ✓

1.12.5. Z ✓

1.12.6. Y ✓

1.12.7. Z ✓

(7 x 1) (7)

1.13.

1.13.1. Tropical cyclone ✓

1.13.2. Low ✓

1.13.3. Summer ✓

1.13.4. Easterlies ✓

1.13.5. Hadley ✓

1.13.6. Reunion ✓

1.13.7. 5th ✓

1.13.8. Cumulonimbus ✓

(8x1) (8)

1.14

1.14.1. North ✓

1.14.2 South Indian ✓

1.14.3 Ridge ✓

1.14.4 1016 ✓

1.14.5 10 knots ✓

1.14.6 North-west ✓

1.14.7 Sub-tropical high ✓

(7 x 1) (7)

1.15

1.15.1 winter ✓

1.15.2 Kalahari ✓

1.15.3 coastal ✓

1.15.4 Eastwards ✓

1.15.5 Offshore ✓

1.15.6 Clear ✓

1.15.7 Onshore ✓

1.15.8 Increases ✓

(8 x 1) (8)

1.16

1.16.1 Clockwise ✓

1.16.2. Converges ✓

1.16.3. Lower ✓

1.16.4. Fog ✓

1.16.5. Lower ✓

1.16.6. A ✓

1.16.7. Q ✓

(7 x 1) (7)

1.17

1.17.1 A (1)

1.17.2 B (1)

1.17.3 A (1)

1.17.4 B (1)

1.17.5 B (1)

1.17.6 A (1)

1.17.7 A (1)

(7 x 1) (7)

1.18

1.18.1 14h00 (1)

1.18.2 Summer (1)

1.18.3 Trough (1)

1.18.4 Unstable (1)

1.18.5 NNE (1)

1.18.6 20 (1)

1.18.7 Higher (1)

(7 x 1) (7)

1.19

1.19.1 D (1)

1.19.2 B (1)

1.19.3 A (1)

1.19.4 C (1)

1.19.5 B (1)

1.19.6 A (1)

1.19.7 B (1)

1.19.8 B (1)

(8 x 1) (8)

1.20.

1.20.1. Winter (1)

1.20.2. X (1)

1.20.3. Y (1)

1.20.4. X (1)

1.20.5. Y (1)

1.20.6. B (1)

1.20.7. Less (1)

1.20.8. Y (1)

(8 x 1) (8)

1.21.

1.21.1. Z (1)

1.21.2 Y (1)

1.21.3 Y (1)

1.21.4 Z (1)

1.21.5 Z (1)

1.21.6 Y (1)

1.21.7 Z (1)

(7 x 1) (7)

1.22.1.B (1)

1.22.2.C (1)

1.22.3.B (1)

1.22.4.B (1)

1.22.5.C (1)

1.22.6.A (1)

1.22.7.D (1)

1.22.8.C (1)

(8 x 1) (8)

1.23.

1.23.1. A (1)

1.23.2. B (1)

1.23.3. A (1)

1.23.4. A (1)

1.23.5. B (1)

1.23.6. B (1)

1.23.7. B (1)

(7 x 1) (7)

1.24.1.terrestrial √

1.24.2.night √

1.24.3.katabatic ✓

1.24.4.B ✓

1.24.5.frost ✓

1.24.6.thermal belt (accept inversion layer) ✓

1.24.7.night ✓

(7 x 1) (7)

1.25.

1.25.1. B ✓

1.25.2.C ✓

1.25.3.A ✓

1.25.4.C ✓

1.25.5.B ✓

1.25.6.C ✓

1.25.7.B ✓

1.25.8.A ✓

(8 x 1) (8)

1.26.

1.26.1. Z ✓

1.26.2. Y ✓

1.26.3. Y ✓

1.26.4. Z ✓

1.26.5. Z ✓

1.26.6. Y ✓

1.26.7. Z ✓

(8x1) (8)'

1.27.

1.27.1. Day ✓ (1)

1.27.2. lower ✓ (1)

127.3. increases ✓ (1)

1.27.4. multiple reflections of heat ✓ (1)

1.27.5. increases ✓ (1)

1.27.6. decreases ✓ (1)

1.27.7. less ✓ (1)

1.27.8. more ✓ (1)

(8 x 1) (8)

1.28.

1.28.1. Day ✓ (1)

1.28.2. Day ✓ (1)

1.28.3. Night ✓ (1)

1.28.4. Day ✓ (1)

1.28.5. Day ✓ (1)

1.28.6. Night ✓ (1)

1.28.7. Night ✓ (1)

(7 x 1) (7)

1.29..

1.29.1. B ✓ (1)

1.29.2. C ✓ (1)

1.29.3. B ✓ (1)

1.29.4. D ✓ (1)

1.29.5. B ✓ (1)

1.29.6. C ✓ (1)

1.29.7. A ✓ (1)

1.29.8. D ✓ (1)

(8 X1) 8

1.30.

1.30.1. Isotherms ✓ (1)

1.30.2. A ✓ (1)

1.30.3. A to B $\sqrt{(1)}$

1.30.4. B to A $\sqrt{(1)}$

1.30.5. B $\sqrt{(1)}$

1.30.6. A $\sqrt{(1)}$

1.30.7. B $\sqrt{(1)}$

1.30.8. A $\sqrt{(1)}$

(8 x 1) (8)

1.31.

1.31.1.B $\sqrt{(1)}$

1.31.2.C $\sqrt{(1)}$

1.31.3.B $\sqrt{(1)}$

1.31.4.A $\sqrt{(1)}$

1.31.5.A $\sqrt{(1)}$

1.31.6.D $\sqrt{(1)}$

1.31.7.B $\sqrt{(1)}$

(8 x 1) (8)

1.32.

1.32.1.E $\sqrt{}$

1.32.2.G $\sqrt{}$

1.32.3.H $\sqrt{}$

1.32.4.F $\sqrt{}$

1.32.5.B $\sqrt{}$

1.32.6.A $\sqrt{}$

1.32.7.C $\sqrt{}$

(7x1) (7)

2. DATA RESPONSE

2. 1.

2.1.1. Winter ✓

2.1.2. During winter air becomes cold, dense and it starts to sink/subside/descend which increases the pressure. ✓✓ (2)

2.1.3. Summer ✓

2.1.4. In summer the air is heated, becomes less dense and starts to rise and decrease the pressure. ✓✓ (2)

2.1.5. Clear skies. ✓ (1)

2.1.6. During winter air becomes cold, dense and it starts to sink/subside/descend. ✓✓
Sinking air warms up adiabatically and becomes dry ✓✓.

There is no moisture to condense. ✓✓ (4) (2x2) (4)

2.1.7. Overcast/cloudy. ✓ (1) (1x1) (1)

2.1.8. In summer warm, moist air is less dense and starts to rise. ✓✓

Rising air cools down, condense to form clouds. ✓✓ (2x2) (4)

2.2

2.2.1. Mid-latitude cyclone/Frontal Depression (1)

ACCEPT: mid-latitude depression/extra tropical cyclone/temperate cyclone (1 x 1)(1)

2.2.2. Position: found between 30°S and 50°S (2)

Situated W/WSW of South Africa (2)

Presence of the cold front (2)

The shape of the cloud formation (2) [ANY ONE] (1 x 2) (2)

2.2.3. Summer ✓

2.2.4. Mid-latitude cyclone/ cold front moves further south in summer ✓✓

2.2.5. Southern hemisphere

2.2.6. Air movement is clockwise ✓✓

Found at the edge of south Africa/ presence of south Africa ✓✓

Found between 30° and 60 ° south ✓✓

[ANY ONE] (1x2) (2)

2.2.7. Driven by the westerlies (westerly wind belt) therefore moves from west to east /eastwards ✓✓ (1 x 2) (2)

2.2.8. Northward migration of pressure belts during South African winter ✓✓

Northward migration of westerly wind belt during South African winter ✓✓

Mid-latitude cyclone drawn northwards during South African winter and passes over country/inland/close to the land ✓✓

Mid-latitude cyclone moves northwards due to the apparent northward movement of the sun and passes over the country/inland/close to the land ✓✓

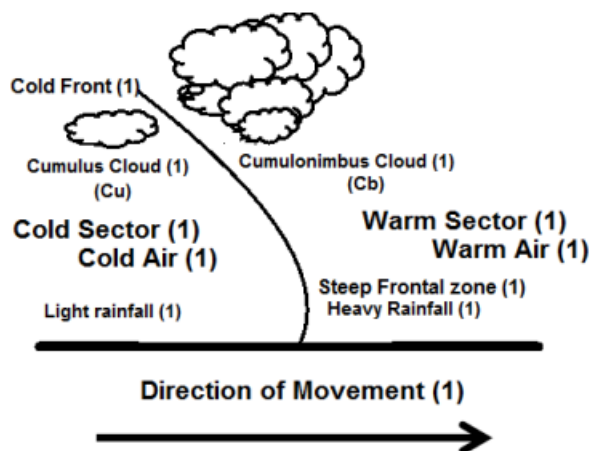
[ANY ONE] (1 x 2) (2)

2.2.9. Cold air undercuts/pushes warm air ✓✓

Warm air rise rapidly along cold front ✓✓

Warm rising air cools down and condenses to form clouds known as cumulonimbus cloud ✓✓ (3x2) (6)

2.2.10.



[1 mark for diagram showing steep cold front and any 3 labels] ✓✓✓✓ (4 x 1) (4)

2.2.11. Increased rainfall improves crop yields ✓✓

Increasing the growth of trading produce for both large-scale and small-scale

Farmers in winter ✓✓

Increased rainfall improves dam water levels allowing for more water to be made

Available to the agriculture/farming in South-Western Cape ✓✓

Greater variety of crops ✓✓

Water provided for irrigation can decrease production costs ✓✓

Snow-capped mountains attracts tourists ✓✓

Water can be stored to be used during the drier summer months to keep the economy going ✓✓

More water is available for industrial purposes ✓✓

More water is available for the of Hydro-electric power and reduces costs of electricity generation ✓✓

Lower temperatures reduce production costs ✓✓

Increases the level of food security ✓✓

[ANY TWO MUST BE A LINK BETWEEN THE LOW PRESSURE SYSTEM

AND THE ECONOMY]

(2 x 2) (4)

2.3..

2.3.1. West to east/eastwards ✓

(1 x 1) (1)

2.3.2. Driven by the westerlies ✓✓

(1 x 2) (2)

2.3.3. 'series of cold fronts' ✓✓

'widespread rain' ✓✓

'20-30 mm of rain' ✓✓

'more than 50 mm' ✓✓

'waterlogged' ✓✓

'heavy rainfall' ✓✓

[ANY ONE]

(1 x 2) (2)

2.3.4. Shifting of the ITCZ to the north ✓✓

South Atlantic High has migrated northwards ✓✓

Mid-latitude cyclones migrate further north ✓✓

Pressure belts follow the perpendicular sunrays northwards ✓✓

[ANY ONE]

(1 x 2) (2)

2.3.5. Increases ✓✓

(1 x 2) (2)

2.3.6. The cold air undercuts the warm air ✓✓

Rapid upliftment of warm air occurs ✓✓

Rising warm air cools and condenses ✓✓

Condensation results in cumulonimbus clouds ✓✓

[ANY THREE]

(3 x 2) (6)

2.4.

2.4.1. Southern ✓

(1x1) (1)

2.4.2. Air movement is clockwise indicated by the arrows ✓

Symbol in this diagram implies clockwise circulation ✓

Warm front located east of the cold front (in the Southern Hemisphere) ✓

The warm sector lies to the north of the cold sector (in the Southern Hemisphere) ✓

The V of the warm sector points southwards (in the Southern Hemisphere) ✓

[ANY ONE]

(1x1) (1)

2.4.3. Polar front ✓

(1x1) (1)

2.4.4. **Cold sector**

Dry air ✓✓ Dense, heavy air ✓✓ Low temperature✓✓ High pressure✓✓ South-westerly/ south-easterly wind ✓✓ Behind the cold front✓✓ In the cold sector ✓✓ the air is drier✓✓ In the cold sector✓✓ the air is denser and heavier ✓✓ In the cold sector✓✓ the temperature is lower ✓✓ In the cold sector ✓✓ the pressure is higher ✓✓ In the cold sector ✓✓ south-easterly/south-westerly winds occur✓✓ The cold sector ✓✓ is behind the cold front ✓✓

Warm sector

Humid air ✓✓ Light, less dense ✓✓ High temperature ✓✓ Low pressure ✓✓ North-westerly wind ✓✓ Behind the warm front ✓✓ In the warm sector ✓✓ the air is more moist✓✓ In the warm sector ✓✓ the air is lighter and less dense✓✓ In the warm sector✓✓ the temperature is higher✓✓ In the warm sector ✓✓ the pressure is lower ✓✓ In the warm sector ✓✓ north-westerly winds occur✓✓ The warm sector✓✓ is behind the warm front✓✓

[ANY ONE DIFFERENCE]

(2X2) (4)

2.4.5. Temperature drops ✓✓

Air pressure increases ✓✓

Wind changes from NW to SW ✓✓

Cloud cover increases. ✓✓

Heavy rainfall ✓✓

(ANY TWO)

(2x2) (4)

2.4.6. The leading edge of the cold front catches up with warm front at the apex ✓✓

Cold air undercuts the warm air and it is displaced and uplifted ✓✓

Cold and warm front merges/joins ✓✓

[ANY TWO]

(2x2) (4)

2.5.

2.5.1. Family of cyclones/depressions ✓

(1 x 1) (1)

2.5.2. It is further east/south/south-east ✓✓ Movement is eastwards, therefore A is ahead of B and C ✓✓ [ANY ONE] (1 x 2) (2)

2.5.3. Less moisture causes less/no rainfall ✓✓ Warm air from the warm sector is uplifted slowly and more gently (gentle gradient) (creating stratus/altostratus/cirrus and cirrostratus clouds, and causes no rain) ✓✓ Softer rainfall from nimbostratus clouds ✓✓

[ANY ONE] (1 x 2) (2)

2.5.4. The cold front catches up to the warm front/two fronts merge ✓✓ Warm air is displaced off the earth's surface (occluded)/Occlusion has taken place ✓✓ Warm and cold air masses move horizontally past one another again ✓✓

[ANY ONE] (1 x 2) (2)

2.5.5. South Atlantic anticyclone causes mid-latitude to move in a north easterly direction ✓✓ It causes the weather along the cold front to intensify ✓✓ South Indian anticyclone blocks the path of mid latitude cyclone ✓✓ It causes mid-latitude to move in a southerly direction ✓✓ (4x2) (8)

2.6.

2.6.1. Westerlies ✓ (1 x 1) (1)

2.6.2. Cold front ✓ (1 x 1) (1)

2.6.3. A ✓ (1 x 1) (1)

2.6.4. The wind speed behind the cold front is faster (30 knots) ✓✓

The wind speed behind the warm front is slower (10 knots) ✓✓

Ahead of the cold front the air is warmer/less dense/lighter ✓✓

Ahead of the warm front the air is colder/denser/heavier ✓✓

Warm front use energy to move forward and rise ✓✓

The pressure gradient associated with the cold front is steeper ✓✓

[ANY ONE] (1 x 2) (2)

2.6.5. Clockwise circulation of air ✓✓

Position of the low pressure is south of the system ✓✓

Warm sector / Cold front is to the north ✓✓

Cold sector / Warm front is to the south ✓✓

Backing of the wind occurs (2)

Apex is to the south (2).

[ANY ONE] (1 x 2) (2)

2.6.6.

(a) Z ✓✓ (1 x 2) (2)

(b) The air behind the cold front is colder (10°C) than the cool air in front of the warm front (14°C) ✓✓

The cold front symbol is at the apex of the mid-latitude cyclone ✓✓

Cold front touches the surface (2)

Cold front has uplifted the warm front (2)

Cumulonimbus clouds evident (2)

[ANY ONE] (1 x 2) (2)

(c) The cold front which is moving faster undercuts/overtakes (✓✓) the warm front (2)

The warm air is forced to rise (✓✓), resulting in the narrowing of the warm sector ✓✓

The cool air (in front of the warm front) (✓✓) is completely uplifted (2)

[ANY TWO] (2 x 2) (4)

Reduced income of tourism sector due to poor weather conditions (cancellation of bookings) (2)

2.7. .

2.7.1. Shape of front/convex (1)

Steep gradient of front (1)

Cloud – cumulonimbus (1)

Cold air behind the cold front (1) [ANY ONE] (1 x 1) (1)

2.7.2. Cold air undercuts the warm air (2)

Warm air is forced to rise very high (2)

Large scale condensation takes place (2)

Steep gradient causes rapid/strong upliftment of air (2)

[ANY ONE] (1 x 2) (2)

2.7.3. Cold air/drop in temperature behind the cold front (2)

Cold air heavy and dense thus increasing air pressure (2) (2 x 2) (4)

2.7.4. Air behind the cold front is colder than the air in front (2)

Cold air moves faster than warm air (2)

Cold front catches up with the warm front (2)

Catches up at the apex, because it is the shortest distance between the fronts (2)

Cold front undercuts the warm front (2)

Warm sector is lifted off the surface (2) [ANY FOUR] (4 x 2) (8)

2.8.

2.8.1. Winter (1) (1 x 1) (1)

2.8.2. (10/12/13) June /Date (1)

Cold fronts in the interior of Western/Eastern Cape (1)

High amounts of rainfall (1)

Significant drop in temperature (1)

[ANY ONE] (1 x 1) (1)

2.8.3. Northward movement of the high pressure belts (anticyclones)/l

TCZ (2) (1 x 2) (2)

2.8.4. Backing (1) (1 x 1) (1)

2.8.5. (The wind direction associated with the cold front will) change from north-west to south-west as the front moves over the Western Cape (2) (1 x 2) (2)

2.8.6. SUGGEST POSITIVE AND NEGATIVE IMPACTS OF HEAVY RAINFALL ON PHYSICAL (NATURAL) ENVIRONMENT

Positive:

Brings much needed moisture to the soil (2)

Revival of biodiversity/ecosystem/habitat (2)

Water available for wildlife (2)

Water available for growth of natural vegetation (2)

Water allows for more grazing land/veld (2)

Fill up (by infiltration) natural aquifers/springs/groundwater (2)

Fill up (via surface runoff) rivers (2)

Negative:

(Low-lying) areas are flooded (2)

Soil erosion will increase (2)

Destruction of biodiversity/ecosystem/habitat (2)

Damage to natural vegetation (2)

Loss of wildlife (2)

Increase salination of rivers (2)

Saturation of soil (waterlogged conditions) (2)

Rock falls/mass movements on steeper slopes (2)

2.9.

2.9.1. Mediterranean (1) (1 x 1) (1)

2.9.2. Cool wet (winters) (1) (1 x 1) (1)

2.9.3. The shifting of the ITCZ (2)

Sun is now overhead of the Tropic of Cancer/follow the shifting of rays
sun/apparent movement of the sun (2)

2.9.4. Decrease in temperature (2)

Pressure decreases (but increases with cold sector) (2)

Cloud cover increases/cumulonimbus clouds form (2)

More precipitation/heavy rain/snow/hail/thunderstorms (2)

Humidity decreases (2)

Wind direction changes (backs northwest to southwest) (2)

Increase in wind speed/sudden gusty winds (2)

[ANY TWO] (2 x 2) (4)

2.9.5. Heavy rainfall will make tourist destinations inaccessible (2)

Rock falls and landslides decrease accessibility (2)

Strong winds decrease accessibility (2)

Rough seas and high waves decrease accessibility (2)

Rough seas decrease business for tour operators (2)

Snow on the mountains makes hiking trails inaccessible (2)

Outdoor activities will be affected by the poor weather/dangerous conditions
(can give examples rain, wind, cold and hail) (2)

Travel arrangements of tourists will be affected by poor weather conditions
(examples flights, tour buses, sea travel) (2)

The aesthetical appeal of the tourist attraction may be diminished by poor
weather conditions (example debris on the beaches) (2)

Reduced income of tourism sector due to poor weather conditions
(cancellation of bookings) (2)

[ANY FOUR] (4 x 2) (8)

2.10.

2.10.1. Severe storm that is characterised by torrential rainfall accompanied by
strong winds

2.10.2. Driven/steered/powered by tropical easterlies

2.10.3. Well-developed eye

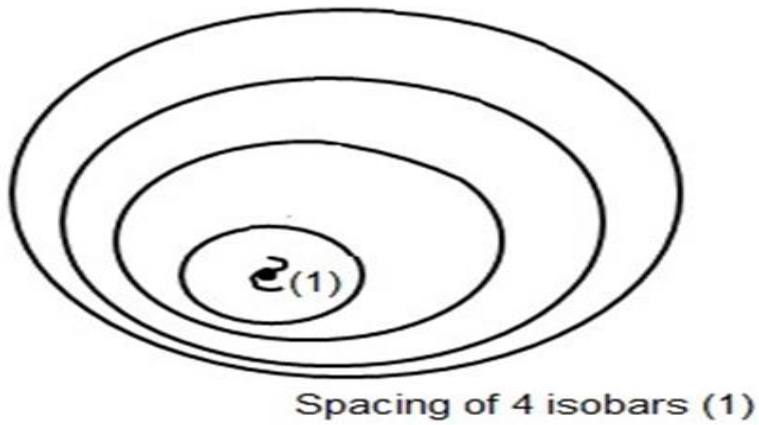
2.10.4. Tropical cyclones are named alphabetically

2.10.5. More friction over the land reduces wind speed

Latent heat is reduced

Moisture is reduced

2.10.6.



INSTRUCTIONS FOR MARKING

- (i) Pressure reading at centre of eye must not be more than 996
(range 950-996) (1)
- (ii) 4 isobars indicating the correct spacing (1)
- (iii) correct symbol showing the southern hemisphere (1)

(3 x1) (3)

2.11.

2.11.1. Presence of Coriolis force (1)

Ocean surface temperature of at least 26,5 °C (1)

Calm (surface) conditions for several days/less friction (1)

Presence of low (air) pressure (1)

Unstable atmospheric conditions (1)

Evaporation from the sea surface / rising of warm moist air (1)

Upper air divergence (1)

Latent heat (1) [ANY ONE (1)

2.11.2 Southern (1) hemisphere (1 x 1)

Air circulation around the low- pressure cell is clockwise (2)

Forward (leading) left-hand quadrant/dangerous semi-circle is located on the south-west of the tropical cyclone (2) [ANY ONE] (1 x 2) (2)

2.11.3 A- has clear skies (1)

B- dense (cumulonimbus) cloud cover (1) (2 x 1) (2)

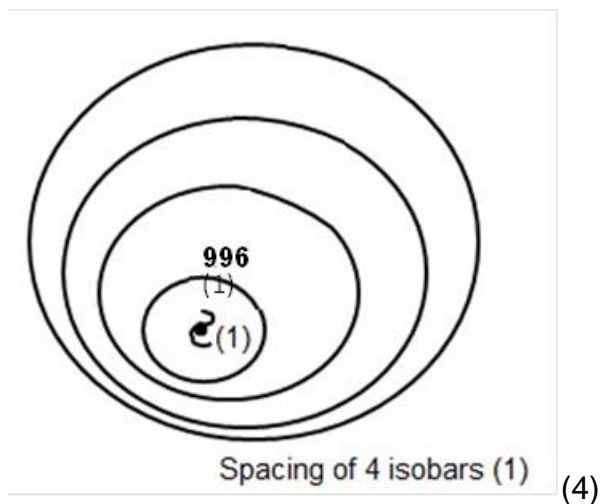
2.11.4 At A (eye) - air is descending (heating) results in no condensation (no formation of clouds) (2)

At B (eye wall) - air is rising (cooling) and results in condensation (the formation of clouds) (2) (2 x 2) (4)

2.11.5 INSTRUCTION FOR PART MARKING- MAXIMUM OF TWO

At A (eye) - air is descending (1)

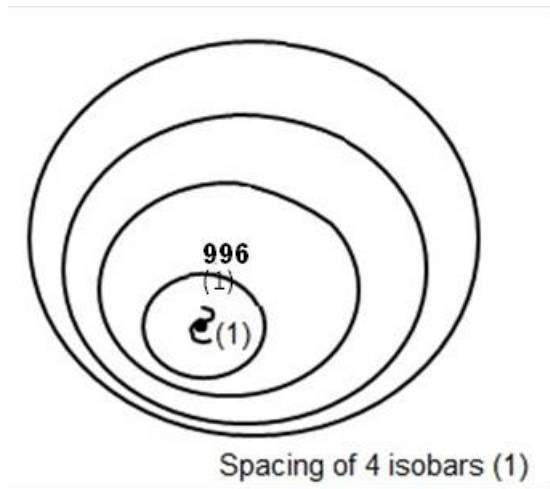
At B (eye wall) - air is rising (1)



2.11.6 Combination of the forward movement and rotation of the system (2)

It has a steep pressure gradient (2) [ANY ONE] (1 x 2) (2)

2.11.7.



Pressure reading at center of eye must not be more than 996 (range 950-996) ✓

4 isobars indicating the correct spacing ✓

correct symbol showing the southern hemisphere ✓ (3x1) (3)

2.12

2.12.1. Six (1x1) (1)

2.12.2. Madagascar is present on the map.

The cyclone is moving from east to west, away from the equator, which is south westerly. (2x2) (4)

2.12.3. It is steered by the tropical easterlies. (1x2) (2)

2.12.4. Indian ocean has warm surface temperature of at least 26,5 °C (1)

Evaporation from the sea surface / rising of warm moist air (1)

2.12.5. Putting evacuation plans in place for getting people out of danger areas (2)

There must be rescue teams to rescue people from flooded areas (2)

A good forecasting system is essential to track and predict the path of a tropical cyclone and to issue warnings (2)

Organization of a first aid kit and batteries for radios, lamps and torches (2) Stock up on canned food and water supplies (2)

Place sand bags along rivers and coastal areas to reduce the impact of flooding (2)

Erect wooden shutters on windows and educate people to stay away from windows and doors during the storm (2) (4x2) (8)

2.13.

2.13.1 A category 3 hurricane

2.13.2. Sea surface temperature of 26,5°C and above (1)

Unstable atmospheric conditions (1)

Originates between 5° and 25° north and south (1)

Coriolis force (1)

Calm conditions (light variable winds) over the ocean surface (1)

Little surface friction (1)

Surface air convergence (1)

Extensive upper air divergence of winds aloft (1)

Rapid large scale evaporation of moisture over ocean/High humidity (1)

Release of latent heat (1)

[ANY ONE] (1 x 1) (1)

2.13.3. 120 (km/h) (1)

(Accept 120km/h to 149km/h) (1 x 1) (1)

2.13.4. Pressure gradient decreases when you move away from the eye (2)

Isobars are further apart as you move away from the eye (2)

Pull of the vortex becomes weaker (2)

[ANY ONE] (1 x 2) (2)

2.13.5. Circulation and forward movement in the same direction (2)

Intense winds in the cyclone combines with the force of the entire cyclone

moving forward/westwards into the left-hand quadrant (2)

Wind shear (a sudden change in wind direction) at lower altitudes intensifies this quadrant (2)

[ANY ONE] (1 x 2) (2)

2.13.6. Storm surges due to strong winds will cause floods (2)

Damage to property because of flooding/strong winds (2)

Loss of life (2)

It causes injury to people/animals (2)

It will cause coastal erosion (2)

Destruction of infrastructure (accept examples) (2)

Ecosystems are disrupted (2)

Loss of biodiversity (2)

Negative impact on tourism/Outdoor activities (2)

Negative impact on the fishing industry (2)

Loss of agricultural production/Food insecurity (2)

Costly to repair damages/medical and insurance claims (2)

Contamination of water/Water borne diseases (2)

Aesthetic beauty of coastal area destroyed (2)

[ANY FOUR]

(4 x 2) (8)

2.14.

2.14.1 Date /January indicates summer (1)

Mozambique (1)

Madagascar (1)

Beira (in Mozambique) (1)

South-westerly movement (1)

Clockwise circulation symbol (1)

Located over the South Indian Ocean (1)

Mozambique channel (1)

Tropical Cyclone (Eloise) (1)

Map of Southern Africa (1)

[ANY ONE]

(1 x 1) (1)

2.14.2. Heavy rainfall / Rainfall of 250mm in 24 hours (1)

Wind speeds up to 140-160 km/hr (1) (2 x 1) (2)

Increased frictional drag (2)

System moves over land (2)

Decrease in latent heat (2)

Decrease in moisture levels (2)

[ANY ONE]

(1 x 2) (2)

2.14.3. .Movement over the warm Mozambique channel (2)

Less friction over Warm Mozambique channel/ ocean (2)

High temperatures/warm ocean results in increased evaporation (2)

Increased condensation results in the release of latent heat (2)

Latent heat drives the system and increases the wind speed (2)

[ANY TWO] (2 x 2) (4)

2.14.4 PRECAUTIONARY MEASURES AND MANAGEMENT STRATEGIES

Early warning systems put in place (2)

Sandbags to reduce flooding (2)

Reinforcing existing infrastructure (2)

Awareness and education programmes (2)

Evacuation protocols and drills (2)

Stocking up of emergency supplies and necessities (2)

Identify high lying areas to evacuate people (2)

Build above flood lines/ coastal zoning (2)

Tracking the movement of the tropical cyclone

Good forecasting/ Use of media to update regularly (2)

Improve accessibility to evacuate people (2)

Move people to higher ground (2)

Development of good rescue and emergency services (2)

Storage/ provision of clean water and food supplies (2)

Rescue personnel, police, medical personnel on standby (2)

Maintain coastal vegetation to act as a buffer against storm surges (2)

Request National and international aid if necessary (2)

[ANY THREE- ACCEPT EXAMPLES]

(3 x 2) (6)

2.15.

2.15.1. Coastal Low (1) (1 x 1) (1)

2.15.2 It is a moving system (2) (1 x 2) (2)

2.15.3 Moist air is carried over the land at B (2)

Onshore winds at B (2)

Dry air is moving from land to sea at C (2)

Offshore winds at C (2)

[ANY TWO] (2 x 2) (4)

2.15.4. 23.01.2022 (Date) (2)

The high pressure cells are in a Southerly position (2)

Cold fronts/mid-latitude cyclones are further south (2)

A tropical depression is evident (2)

[ANY TWO] (2 x 2) (4)

2.15.5.

(a) E (2) (1 x 2) (2)

(b) E has a higher pressure (1032hPa) reading than D (1024hPa) (2)

D has a lower pressure (1024hPa) reading than E (1032hPa) (2)

[ANY ONE] (1 x 2) (2)

2.16

2.16.1.A zone between the warm moist air from the Indian Ocean and the cold dry air from the Atlantic Ocean/A zone between two air masses with different moisture content (1) [CONCEPT] [ANY ONE] (1 x 1) (1)

2.16.2.A – Warm, moist air – onshore flow from Indian (warmer) Ocean where levels of evaporation are higher (1)

B – Cold, less moist air – onshore flow from the Atlantic (colder) Ocean where level of evaporation are lower (1) (2 x 1) (2)

2.16.3.Line Thunderstorm/ Squall (2) (1 x 2) (2)

2.16.4.Eastern side (2) (1 x 2) (2)

2.16.5.Warm, less dense and moist air comes from the northeast (A) (2)

Collides with cold, dry air mass from the southwest (B) (2)

Warm, moist air east of the moisture front rises (2)

Condensation of warm, moist air east of the moisture front (2)

[ANY TWO] (2 x 2) (4)

2.16.6.Hail (damage to crops) (2)

Lightning (start fires) (2)

Heavy rainfall (2)

Flooding (2)

Soil oversaturated (2)

[ANY TWO] (2 x 2) (4)

2.17.

2.17.1. Winter ✓

2.17.2. Kalahari HP is dominant ✓

Approaching cold front ✓

2.17.3. High temperatures ✓

High pressure

2.17.4. The sinking air warms up adiabatically. (2)

2.17.5. Descending air compresses and warms up adiabatically (2)

No condensation due to lack of moisture. (2)

2.17.6. It will be affected by Berg winds which dries up vegetation which increases the risk of veld fires. (2)

Berg winds increases temperature and promotes ignition of veld fires. (2)

[ACCEPT ANY OTHER RELEVANT ANSWER]

2.18.

2.18.1. Thermal low (1) heat low (1)

High temperatures (1)

Overcast conditions (1)

South Indian- and South Atlantic high are in a southerly position (1)

Dominant low (1) [ANY ONE] (1 x 1) (1)

2.18.2.4 hPa/mb (1) (1 x 1) (1)

2.18.3. South Indian (1)

Mauritius Anticyclone (1) [ANY ONE] (1 x 1) (1)

2.18.4. South east South easterly (1) [ANY ONE]

5 knots (1)

2.18.5. The isobars are far apart/gentle pressure gradient indicating low wind speeds (2) (1 x 2) (2)

2.18.6. The South Indian high pressure is further south and away from the land in summer (2)

On-shore winds from the South Indian high have a larger fetch as they are located further south in summer (2)

More water is evaporated over the warm Indian Ocean (2)

Moisture laden air from the South Indian high rises (adverts) towards the low pressure in the interior (2)

Intense heating over the land in summer causes thermal/heat low pressures to develop (2)

Unstable air causes convectional rainfall/thunderstorms (2)

[ANY FOUR] (4 x 2) (8)

2.19.

2.19.1. A South Atlantic (1)

B South Indian (1) (2 x 1) (2)

2.19.2. Summer (1) (1 x 1) (1)

2.19.3. Line thunderstorms (heavy rainfall) occur in the interior (2)

Cumulonimbus clouds/lightning/hail (2)

Moisture front developed (2)

Air from the east/west reaches the interior (2)

[ANY ONE] (1 x 2) (2)

2.19.4. The boundary (dry line) between two air masses of different moisture content (2)

The boundary (dry line) between two air masses (2)

2.19.5. (Heavy) Rainfall (1)

Hail (1)

Thunderstorms (1) [ANY TWO] (2 x 1) (2)

2.19.6. Convergence of warm moist air and cold dry air (2)

Moisture front develops (2)

Cold dry air undercuts warm moist air (2)

Warm moist air rises (2)

Condensation occurs in the eastern side of the moisture front (2)

Cumulonimbus clouds develops (2)

[ANY THREE](3 x 2) (6)

2.20

2.20.1 Summer (1)

(1 x 1) (1)

2.20.2 Weak descending air (2)

The inversion layer is above the escarpment/plateau (2)

Moist (onshore) winds will reach the interior (2)

Wet conditions over the interior (2)

[ANY ONE] (1 x 2) (2)

2.20.3 Plateau (1)

Height above sea level (1)

Ocean currents (1)

Inversion layer (1)

Descending air/Kalahari HP (Anticyclonic movement) (1)

Distance from the ocean (1)

[ANY TWO] (2 x 1) (2)

2.20.4 As air subsides it compresses and heats up (2)

Adiabatic heating due to subsiding air (2)

[ANY ONE] (1 x 2) (2)

2.20.5 Sketch (A)

Inversion layer is above the level of the plateau/escarpment (2)

Moist air flows into the interior (2)

Unstable conditions cause air to rise (2)

Condensation occurs and clouds form (2)

Results in more rainfall (2)

Sketch (B)

Inversion layer below the level of the plateau/escarpment (2)

Moist air cannot reach the interior (2)

Stable conditions cause clear skies (2)

Less/No condensation occurs (2)

Results in less/no rainfall (2)

[ANY FOUR – MUST INCLUDE CONDITIONS OF SKETCH A AND
SKETCH B] (4 x 2) (8)

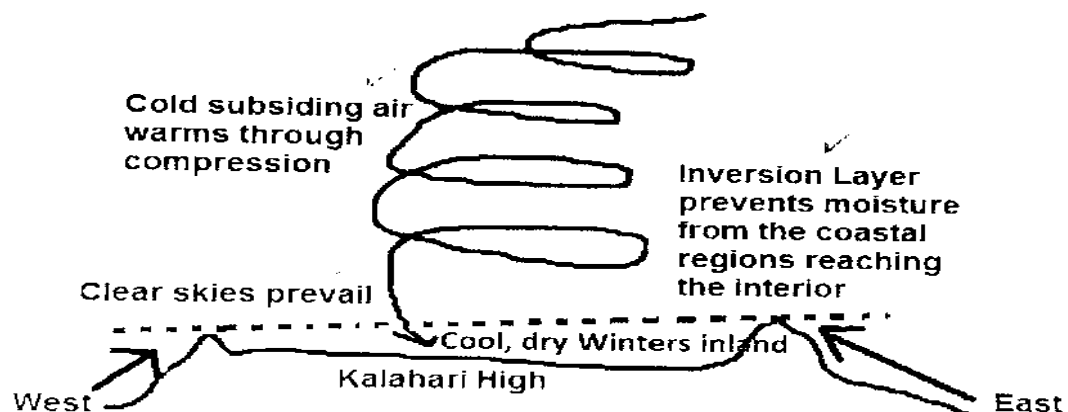
2.21

2.21.1.A: South Atlantic Anticyclone (1) or St Helena High (1)

B: Kalahari Anticyclone (1) or Continental High (1)

C: South Indian Anticyclone (1) or Mauritius High (1) (3 x 1) (3)

2.21.2.



(4 x1) (4)

2.21.3.THE IMPACT OF ITCZ ON ANTICYCLONES

The Earth is tilted $23\frac{1}{2}^{\circ}$ to the vertical, as it faces the sun. (2)

This causes the ITCZ to shift north and south of the equator from season to season. (2)

Pressure belts follow the apparent migration of the sun. (2)

In summer the 3 anticyclones are located further south. (2)

In winter the 3 anticyclones are located further north. (2)

[ANY FOUR] (4 x 2) (8)

[15]

2.22.

2.22.1.Moisture front (1) (1 x 1) (1)

2.22.2.Band of cloud stretching from the NW to the SE of the country (2)

(Cumulonimbus) clouds arranged in a line from the NW to the SE (2)

Converging air masses over the interior of the country (2)

Presence of the moisture front (2)[ANY ONE] (1 x 2) (2)

2.22.3.Low pressures over the land during summer, draw in moisture off the oceans onto the land (2)

Inversion layer above escarpment in summer allows inflow of moist air (2)

Increased convergence of air masses from well-developed high-pressure cells along the coast (2)

Weakened Kalahari High Pressure Cell facilitates greater vertical rising of air above the interior (2)

Presence of trough over the interior during summer (2)[ANY ONE] (1 x 2) (2)

2.22.4. Warm moist air from above the Indian Ocean/Warm Mozambique/Warm Agulhas Current (2)

Warm moist tropical air diverging from the South Indian High Pressure Cell (2)

Warm moist air from the North-easterly winds (2) [ANY ONE] (1 x 2) (2)

2.22.5. Warm moist air from the east (more moisture) reaches the interior (2)

Cold dry dense air from the west forces warm moist less dense air to rise (2)

Air on the eastern side is more unstable (2)

Large scale condensation results in dense cloud formation (2)

[ANY TWO](2 x 2) (4)

2.22.6. Has a longer duration (2)

They cover a greater/widespread area (2)

Damage is more widespread (2)

Continuous feeding of moisture from the ocean (2)

Constant formation of cumulonimbus clouds along the moisture front (2)

Stronger upliftment/rapid rising and condensation along the moisture front (2)

Torrential or heavy rainfall and/or hail (2)

Occurs any time of day (2)

OR

Has a much shorter duration (2)

Isolated thunderstorms are over a small area (2)

Isolated thunderstorms will result in damage that is not widespread (2)

Isolated thunderstorms do not have a continuous source of moisture (2)

Only occurs during late afternoon (2)

[ANY TWO. CANNOT REFER TO THE SAME FACTOR ON BOTH SIDES]

(2 x 2) (4)

[15]

2.23.

2.23.1. Winter (1) (1 x 1) (1)

2.23.2. The presence of the Kalahari High Pressure Cell (in the interior) (1)

The presence of berg winds (1)

Kalahari High is close to the surface (1)[ANY ONE] (1 x 1) (1)

2.23.3. Blows from the Kalahari High Pressure to coastal low (1)

Blows down the escarpment to coastal low (1)

Blows down the mountain to the ocean (1)[ANY ONE] (1 x 1) (1)

2.23.4. (a). A. Offshore (1)

B - Onshore (1) (2 x 1) (2)

(b) Lack of moisture because air blows from the land to the sea (2)

Air subsides therefore no condensation (2) [ANY ONE] (1 x 2) (2)

(c) NEGATIVE

Warm, dry wind increases surface water evaporation (2)

Warm winds dry out the vegetation (2)

Dry vegetation could result/facilitate veld fires (2)

The gusty winds could fan and spread the fire (2)

Veld fires destroy ecosystems/habitats (2)

Biodiversity is reduced (2)

Food chains are disrupted (2)

Destruction of vegetation can result in bare soil and soil erosion (2)

Soil erosion will decrease soil fertility (2)

POSITIVE

Raises the temperature of coastal areas in winter (2)

Veld fires encourage regrowth and regeneration of natural vegetation (2)

[ANY FOUR] (4 x 2) (8)

2.24

2.24.1. The Kalahari High Pressure can be seen over South Africa (1) and the coastal low along the east coast (1)

2.24.2. Veld fires (1) (1 x 1) (1)

2.24.3. The Kalahari High is more dominant over South Africa in winter (1)

The coastal low moves easier along the coast during winter (1)

A steep pressure gradient exists between the interior and the coast (1)

[ANY TWO] (2 x 1) (2)

2.24.4. The air has heated by 1°C/100m of descent – according to the dry adiabatic lapse rate – and increased the air temperature (2)

Any moisture is evaporated as the air heats up through descent lowering the

humidity (2) (2 x 2) (4)

2.24.5. Winter in South Africa is generally dry (as a result of little or no rain), so this

warm, dry wind can cause veld fires (2)

People are susceptible to the risk of runaway fires – putting people's lives in danger (2)

Farmers lose crops and suffer financially as a result of this environmental

hazard (2)

Urban settlements on mountain slopes are threatened (2)

People suffer from the hot conditions (2)

During berg winds people suffer from discomfort and skin irritations (2)

[ANY THREE ACCEPT ANY OTHER REASONABLE ANSWERS] (3 x 2) (6)

2.25

2.25.1 A weak low pressure system that develops along the west coast. (1)(1 x 1) (1)

2.25.2. It moves southwards along the west coast (1) and eastwards along the south coast. (1) (2 x 1)

(2)

Ahead of the low, offshore winds occur blowing dry air off the land. (2)

Behind the low, onshore winds feed moisture onto the land. (2) (2 x 2) (4)

2.25.3. West coast: cold air is fed onto the land which causes (advection) fog. (2)

East coast: warm/moist air is fed onto the land causing drizzle. (2)

(2 x 2) (4)

2.25.4 Air descends from the Kalahari High towards the coast and it warms adiabatically (2)

The formation of warm/berg winds increases temperature along the coast. (2)

Clockwise air circulation brings warm, dry conditions towards the coast. (2)

[ANY TWO] (2 x 2) (4)

[15]

ACTIVITY 5 VALLEY CLIMATES

2.26

2.26.1 Katabatic/Downslope wind (2)

1x2 (2)

2.26.2. C is formed during the night when the land surface cools rapidly due to terrestrial radiation (2)

Air in contact with land also cools down (2)

Cold air becomes heavy and dense (2)

The cold wind will sink down the sides of the valley (2) [ANY THREE] 3x2 (6)

2.26.3. The wind is warm because it is in contact with the valley that is warm (2)

Warm air is light and less dense (2)

Warm wind will move upslope (2)

[Any TWO] 2x2 (4)

2.26.4. LOCATION OF SETTLEMENT

Wind C causes temperature inversion (2)

Thus temperatures at the bottom of the valley are much colder in winter (2)

This will result in the formation of frost on the valley floor (2)

Houses will also be built away from the valley floor to avoid lower temperatures during the night in winter (2)

Houses will then be built on the thermal belt (2)

Formation of fog will prevent houses being built on valley floor (2)

Damp condition not good for human health (2)

Industries will also be built away from this area (2)

Industries can cause serious pollution in the valley because air cannot rise when the valley is cold (2)

FARMING ACTIVITIES

Frost will limit farmers from planting crops in the valley (2)

Frost damages crops, therefore only frost resistant crops will be planted (2)

Farming activities will take place on middle slopes (2)

[ANY FOUR must refer to both aspects] (4x2) (8)

2.27

2.27.1. The direction in which a slope faces/The angle at which the sun's rays strike a Slope (1)[CONCEPT] (1 x 1) (1)

2.27.2. The north-facing facing slope is receiving the direct rays of sunlight, in the Southern Hemisphere (1) (1 x 1) (1)

2.27.3. The area at A does not receive direct sunlight (2)

Area A is facing away from the sun's rays (2)

High lying area casts a shadow over slope A (2)

[ANY ONE] (1 x 2) (2)

2.27.4. Air in contact with slopes heated (2)

Air becomes light/less dense (2)

Air rises along the slope (2)

[ANY TWO] (2 x 2) (4)

2.27.5. North-facing slopes in the southern hemisphere receive more sunlight throughout the year(2)

Crops that require direct sunlight would be more well suited at area D (2)

Descending cold air forms frost pockets on the valley floor (2)

Crops that are sensitive to frost should not be planted in the frost pocket (C) (2)

Frost resistant crops to be planted at C (2)

Soils on the north-facing slope is also drier as a result of higher levels of evaporation (2)

Farmers will have to irrigate the north-facing slope, to successfully plant crops here (2)

The farmstead can be located on a higher slope as it is warmer/in the thermal belt

[ANY FOUR] (4 x 2) (8)

2.28

2.28.1. Katabatic/downslope/gravity (1) (1 x 1) (1)

2.28.2. Mountain slopes cool at night (2)

Winds in contact with the slopes cool down (2)

Lower temperatures increase the density of the air and it is forced to sink to the valley floor (2)

[ANY TWO] (2 x 2) (4)

As cold air sinks into the valley during night time it displaces the warm air upwards (2) (1 x 2) (2)

2.28.3. WARM THERMAL BELT

Suitable for human habitation (2)

Creates stable warm weather conditions (2)

Reduces costs of heating households during cold winter night (2)

Suitable for the cultivation of crops that do not withstand frost (2)

VALLEY FLOOR

Plant frost resistant crops only (2)

Traps the cold air, fog and smoke (2)

Causes pollution problems in the valley (2)

[ANY FOUR - ACCEPT OTHER REASONABLE ANSWERS] (4 x 2) (8)

2.29

2.29.1. Industry/factory (1)

Smoke (1)

Carbon dioxide (1)

Sulphur dioxide (1)

Nitrogen oxide (1)

Soot (1)

[ANY ONE] (1 x 1) (1)

2.29.2. Thermal belt (1)

Inversion layer (1)

[ANY ONE] (1 x 1) (1)

2.29.3. Temperature decreases with altitude, except in the thermal belt where it increases with altitude, thereafter it continues to decrease (2) (1 x 2) (2)

2.29.4. Katabatic/downslope winds push smoke particles downward (2)

The inversion layer is lower down the valley slopes which traps smoke (2)

Mountain breeze blowing in the valley at night (2)

Low cloud cover to trap the pollutants (2)

Strong subsidence prevents pollution from rising/pushes pollutants further down (2)

Weak convection currents prevents the rising of pollutants (2) (2 x 2) (4)

2.29.5. Settlements locate along middle slopes because it is warmer in winter (2)

Generally settlements do not occur on the valley floor because of frost and low temperatures (2)

Most settlements in the Southern Hemisphere prefer the north-facing slopes where they receive direct sunlight (2)

Most settlements in the Northern Hemisphere prefer the south-facing slopes where they receive direct sunlight (2)

Settlements that locate in a warmer zone save on electricity, therefore they prefer this location (2)

High lying slopes are avoided as they are colder (2) [ANY THREE]

(3 x 2) (6)

2.30

2.30.1. night (1) (1 x 1) (1)

(a) frost (1) (1 x 1) (1)

(b) radiation fog (1) (1 x 1) (1)

2.30.2. Wind B is cold air that is heavy and drains onto the valley floor (2)

This cold air converges on the valley floor and displaces the warm air in the valley and forces it to rise (2)

This warm air causes an increase in temperature with height which is an inversion (2) [ANY TWO] (2 x 2) (4)

2.30.3. RADIATION FOG

Affects visibility for motorists and other activities (2)

Slows traffic and people are late for work/higher fuel costs (2)

Risk of accidents increase (2)

Constant dampness makes/creates uncomfortable conditions for people (2)

Combines with pollutants to form smog which causes health issues (2)

AND/OR

FROST

Farmers are only able to plant frost resistant crops on the valley floor (2)

Difficult to live on the valley floor because the temperature is low (2)

It is more expensive because it will require artificial heating (2)

People can fall ill due to cold conditions (2)

Reduction in income as farming activities are reduced (2)

[ANY FOUR] (4x2)(8)

2.31

2.31.1. Direction in which slopes face in relation to sun's rays (1)/

Angle at which the sun's rays strike the slope (1) [CONCEPT] (1 x 1) (1)

2.31.2. B (1) (1 x 1) (1)

2.31.3. In the southern hemisphere (B) the north facing slopes receive direct rays of the sun (2)

In the northern hemisphere (A) the south facing slopes receive direct rays of the sun (2)

In the southern hemisphere (B) south facing slopes receive oblique rays of the sun (2)

In the northern hemisphere (A) north facing slopes receive oblique rays of the sun (2) [ANY ONE] (1 x 2) (2)

a. Difference in temperature on the different slopes in the valley (2)

The slope that faces the sun will have a higher temperature (2)

The slope that faces away from the sun will have a lower temperature (2)

(Accept responses to specific slopes)

[ANY ONE] (1 x 2) (2)

(b) Evaporation rates differ on each slope (2)

The slope that faces the sun will have a higher evaporation/will be drier (2)

The slope that faces away from the sun will have a lower evaporation/will

have a higher moisture content (2) [ANY ONE] (1 x 2) (2)

b. Different types of crops have to be grown on the north and south facing slopes (accept examples - deciduous fruit) (2)

North facing slopes favour the growth of crops that require more

sunlight/less moisture (accept examples - citrus fruit/thick skinned fruit) (2)

South facing slope encourage the growth of products that require cooler

conditions with more moisture (accept examples) (2) [ANY ONE]

(1 x 2) (2)

(b) People prefer to settle on the warmer north facing slopes (2)

Save on energy costs on north facing slopes (2)

South facing slopes require more and expensive heating methods of settlements (2)

Cooler south facing slopes are not favourable for human settlements (2)

South facing slopes will be colder and not ideal for settlement (2)

South facing slopes receive more precipitation and fog and not favourable for settlement (2)

[ANY TWO-MUST REFER TO SPECIFIC SLOPE] (2 x 2) (4)

2.32.1. Anabatic/upslope wind (1) (1 x 1) (1)

2.32.2. occurs during the day while 2 occurs at night (2)

At 1 there is upslope movement of air while there is down slope movement of air at 2 (2)

At 1 wind originates when slopes are heated and at 2 there is cooling of slopes (2)

Density of air at 1 is low while density of air at 2 is high (2)

[ANY ONE DIFFERENCE] (1 x 2) (2)

2.32.3. Wind 2 (2)

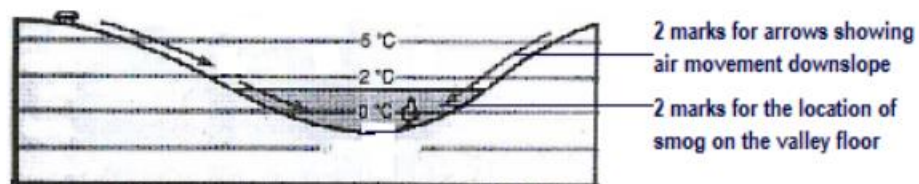
Air moves down slope from high pressure to low pressure (2) (2 x 2) (4)

Cold air rolls into the valley and forms an inversion (trap pollutants) (2)

This forms smog (2)

Radiation fog/mist/haze also forms(2)

In winter more artificial heating also results in higher pollution levels (2)



2.33

2.33.1. The direction which the slope faces in relation to the sun rays (1)

The orientation of the slope with regard to the sun rays (1)

[CONCEPT] (1 x 1) (1)

2.33.2. North-facing slope/southern slope (1) (1 x 1) (1)

2.33.3. (a) Being in the shadow zone it experiences lower temperatures (2)

It is subjected to lower evaporation rates (2)

It does not receive direct sunlight (2)

[ANY ONE] (1 x 2) (2)

(b) The slope does not receive any sun's rays as it is a south-facing slope and would have lower average temperatures/cooler temperatures (2)

The slope has a relatively steeper gradient (2)

The dampness of the slope (2)

[ANY ONE] (1 x 2) (2)

2.33.4. The slope is gentle and therefore easier to build on flat land (2)

Close to fertile soil (2)

Close to water/dam (2)

Farmer wants to be closer to the crops (2)

Close to roads for easier access (2)

Farm house is close to the golf course (2)

[ANY ONE] (1 x 2) (2)

2.33.5. Katabatic winds form at night/cooler air sinks to the bottom at night (2)

Cold air collects on the valley floor (2)

The temperature of the cold air on the valley bottom can result in frost /frost pockets form (2)

Crops that are not frost resistant could die (2)

Might experience radiation fog (2)

Reduces visibility (2)

Cold conditions and fog impact negatively on health (2)

No advantage of thermal belt (2) [ANY FOUR]

(4 x 2) (8)

2.34.

2.34.1. 25,9 °C (1) (1 x 1) (1)

2.34.2. The materials used (concrete, glass, steel) to construct buildings in the CBD retain more heat (2)

Artificial conditioning (climatic controls) of air creates a microclimate within each building (2)

Use of non-reflective paints (2)

Tall buildings create a larger surface area that is heated (2)

Tall buildings reflect greater heat between buildings due to a larger surface area being heated (2)

Early morning and late afternoon sun's rays hit sides of tall buildings at right angles concentrating heat on tall buildings (2)

The high building density retains more heat from multiple reflection of heat (2)

The flat closed roofing traps heat within taller buildings (2)

[ANY ONE] (1 x 2) (2)

2.34.3. The air temperatures between the buildings are slightly cooler due to the channelling of air/wind between buildings (2)

More shadows between buildings (2)

Vegetation between buildings promotes transpiration and therefore evaporation and cooling of air (2)

Air between the buildings is cooled by upliftment (2)

At night time, the atmosphere cools down quicker while the buildings retain heat (2) [ANY TWO] (2 x 2) (4)

2.34.4. CBD Redevelopment

Create more green belts around the CBD in open spaces e.g. parks/gardens (2)

Taller building should be encouraged to have roof top gardens (2)

Large pot plants/trees at intersections between taller buildings (2)

Use of paved surfaces (paving blocks) rather than tarred surfaces (2)

Reduction of transport routes within the core of the CBD (2)

Rapid Transport Systems (alternate transport systems) to decrease vehicular traffic (2)

The development of ring roads to reduce vehicular traffic in the CBD (2)

Water features to increase evaporation cooling (2)

Reduction/Removal of trading with open fire cooking in the core of the CBD (2)

Encourage buildings with underground parking (2)

Rezoning of the CBD to encourage industries to locate outside the city limits
(industrial decentralisation) (2)

Commercial decentralisation (2) (4X2) (8)

2.35

2.35.1. An area of high temperature over the city that decreases towards the rural area/phenomenon that makes urban areas hotter than their surroundings (1)

[CONCEPT] (1 x 1) (1)

2.35.2. the global focus of city infrastructure planning has been on cars' (1)

'getting as many people as possible into tall buildings' (1)

'Heat comes from decades of poor planning' (1)

'office blocks overcrowding their occupants' (1)

'tarred roads criss-crossing' (1)

'big cement slabs' (1) [ANY TWO] (2 x 1) (2)

- 2.35.3. Subsiding air at night pushes the warm air closer to buildings in the city which results in more heat being concentrated (in a smaller area) (2)

Weaker convection currents at night concentrates the heat island effect (2)

Subsiding air traps the heat between buildings (2)

[ANY TWO] (2 x 2) (4)

- 2.35.4. Plant more trees to absorb more carbon dioxide (2)

Establish roof gardens/vertical gardens on high rise buildings (2)

Create parks/greenbelts in the urban area (2)

Reduce carbon emissions in urban areas by making use of solar energy (2)

Reduce carbon emissions in urban areas by making use of wind energy (2)

Replace concrete/tar surfaces with cobble stones which allow infiltration of water and cooling through evaporation (2)

Promote urban farming that will result in more evapotranspiration and cooling of temperatures (2)

Use of public transport/cycling to reduce the number of vehicles on the roads (2)

Reduce the number of vehicles on the road (accept examples) (2)

Use of reflective paint on buildings and roofs (2)

Reducing our carbon footprint through recycling and re-using of products (2)

Modernisation of buildings with greener materials (accept examples) (2)

Implementing energy saving strategies (accept examples) (2)

Encourage the use of hybrid cars which produce no pollution (2)

Use of catalytic converters in motor vehicles (2)

Creation of water features (accept examples) (2)

Green policy to be included in all legislation (2)

Awareness/education campaigns on green policies (2)

Incentives for going green/eco-friendly products (accept examples) (2)

(4 x 2) (8)

6.13

2.36.1. A (1) (1 x 1) (1)

2.36.2. Rising warm air (convection currents) has a greater vertical dimension in A (2)

No evidence of subsiding air (2)

Inversion layer not visible in A (2) Cold air is high above city (2)

A low lying inversion layer is evident at B (2)

Warm air is blocked from rising at B (2)

[ANY ONE] (1 x 2) (2)

2.36.3. Higher concentration of pollution trapped close to the earth's surface (2)

Pollution trapped close to the ground mixes with fog/ground based cloud (2)
(1 x 2) (2)

2.36.4. Convection/rising air disperses pollution to upper levels of the atmosphere No
inversion layer close to surface to trap pollution (2)[ANY ONE] (1 x 2) (2)

2.36.5. SUSTAINABLE SOLUTIONS TO LIMIT SMOG FORMATION IN CITY

Roof top gardens/green lungs (2)

More natural environments e.g. green belts within the city limits (2)

Taller chimneys to release pollution higher in the atmosphere (2)

Regulate industrial activity at night to reduce the concentration of emissions
within the CDB (2)

Bylaws/restrictions to carbon emissions by various pollution producing industries in the city (2)

Penalties/Fines for exceeding smog restrictions by industries located closer to the city (2)

More decentralised industrial growth points away from the CBD (2)

Filters on chimneys to reduce toxicity of emissions (2)

Use of green/clean source of energy (2)

Car-pooling/lift clubs (2)

Filters/catalytic converters on motor vehicle exhaust pipes (2)

Hybrid/solar powered/electric/battery-operated vehicles (2)

Improved public transport/dedicated bus lanes will result in less private vehicles within the limits of the CBD (2) Park-and-ride facilities (2)

Promote use of bicycles in city centre (2)

Pedestrians the city centre (2)

Increased public awareness/education (2) [ANY FOUR](4 x 2) (8)

2.37

2.37.1. An accumulation of dust, soot and smoke (pollution) particles over the city (1)

2.37.2. Urban areas produce more pollution/combustion released by cars, industries and other activities/More human activities (2) (1 x 2) (2)

2.37.3. During the night subsidence is stronger/trapped closer to the ground/

inversion layer is closer to the surface at night (2)

Less activity resulting in heat generation to lift pollution dome (2)

Pollution covers a smaller area (2)

Less convection/thermal currents to distribute pollution at night (2)

2.37.4. Soot accumulation on buildings results in more cleaning services needed (2)
Results in acid rain which results in peeling of paint of buildings (2) Buildings must be painted more often (2)

Concrete surfaces become pitted (holes) and must be maintained/renovate more frequently (2)

Metal structures such as metal window frames/air conditioners become corroded because of the acid rain/renovated more often (2)

Replacing damaged material with good quality/durable material is costly (2)

Regular replacement/purchase of air conditioner filters (2)

More regular painting of road markings as acid rain makes it peel easier (2)

High pollution results in higher rainfall and can cause flood damage (2)

Damaged plants in gardens to be replaced (2)

Water reservoirs/dams become polluted and money spent to purify water (2)

3. MAPWORK

3.1. Map Skills and Calculations

3.1.1. B (1)

3.1.2. C (1)

3.1.3. B (1)

3.1.4. Area = Length x Breadth

$$\text{Breadth} = 3.7\sqrt{\text{cm}} \times 0.5\text{km}$$

$$= 1.85\text{km}\sqrt{}$$

$$= 2.1\text{km} \times 1.85\text{km}$$

$$= 3.9\text{km}^2\sqrt{} \quad (3)$$

3.1.5. Total change = 7' x 10

$$= 70'\text{W} \quad (1^\circ 10'\text{W})\sqrt{}$$

MD for 2024 = 28°25' West of True North

$$+\sqrt{} \quad 1^\circ 10'\text{W}$$

$$= 29^\circ 35' \text{ West of True North}\sqrt{} \quad (3)$$

3.1.6. Convex slope (1)

3.2 Map interpretation

3.2.1. Katabatic wind (1) (1 x 1) (1)

3.2.2. Katabatic wind reduces the temperature in area G. (1 x 2) (2)

3.2.3. Reduced/lower temperatures promote the formation of frost which destroys/damages crops.

(1 x 2) (2)

3.2.4. Plant crops in greenhouses (2)

Plant frost resistant crops (2)

Use mulch to retain heat in the soil. (2)

Plant rows of trees to block sinking cold air at night. (2)	(1 x 2) (2)
3.2.5. River valley (1)	(1 x 1) (1)
3.2.6. Contours point upstream. (2)	(1 x 2) (2)
3.2.7. Anabatic wind blows upslope. (2)	(1 x 2) (2)
3.3 Geographical Information Systems (GIS)	
3.3.1. Putting one data layer on top of another to show the relationship/enable comparison between features. (2)	
	(1 x 2) (2)
3.3.2. Topography (1)	
Drainage (1)	
Soil type (1)	(1 x 1) (1)
3.3.3. Poor farming methods (2)	
Deforestation/ removal of vegetation around the river (2)	
Over-cultivation (2)	(1 x 2) (2)
3.3.4. Raster data (1)	(1 x 1) (1)
3.3.5. Features are displayed in the form of pixels. (2)	(1 x 2) (1)
3.3.6. Non-perennial river. (1)	(1 x 1) (1)
	(8)

GEOMORPHOLOGY SOLUTIONS

1.1. DRAINAGE BASIN

1.1.1. D✓

1.1.2. B ✓

1.1.3. C✓

1.1.4. E✓

1.1.5. G ✓

1.1.6. A✓

1.1.7. F ✓

(7x1) (7)

1.2. COLUMN A & COLUMN B

1.2.1. X ✓

1.2.2. Y ✓

1.2.3. X ✓

1.2.4 Y ✓

1.2.5. X✓

1.2.6. Y✓

1.2.7. X ✓

1.2.8. X ✓

(7x1) (7)

1.3. TYPES OF RIVERS

1.3.1. C

1.3.2. B

1.3.3. C

1.3.4. A

1.3.5. C

1.3.6. B

1.3.7. C

1.3.8. A

(8x1) (8)

1.4. TYPES OF RIVERS

1.4.1. Permanent River✓

1.4.2. Exotic River✓

1.4.3. Episodic River✓

1.4.4. Period River✓

1.4.5. Permanent River✓

1.4.6. Permanent River✓

1.4.7. Episodic River ✓

(7x1) (7)

1.5. DRAINAGE PATTERN

1.5.1. Rectangular ✓

1.5.2. Dendritic ✓

1.5.3. Trellis ✓

1.5.4. Rectangular✓

1.5.5. Trellis ✓

1.5.6. Dendritic ✓

1.5.7. Trellis ✓

(7x1) (7)

1.6. DRAINAGE PATTERN

1.6.1. C ✓

1.6.2. F ✓

1.6.3. A ✓

1.6.4. D ✓

1.6.5. E ✓

1.6.6. A ✓

1.6.7. F ✓

1.6.8. B ✓

(8x1) (8)

1.7. COLUMN A & COLUMN B

1.7.1. Y ✓

1.7.2. X ✓

1.7.3. Y ✓

1.7.4. Y ✓

1.7.5. X ✓

1.7.6. X ✓

1.7.7. Y ✓

(7x1) (7)

1.8. DRAINAGE DENSITY COLUMN A & COLUMN B

1.8.1. B ✓

1.8.2. A ✓

1.8.3. A ✓

1.8.4. B ✓

1.8.5. A ✓

1.8.6. B ✓

1.8.7. B ✓

(7X1) (7)

1.9. DRAINAGE DENSITY COLUMN A & COLUMN B

1.9.1. X√

1.9.2. Y√

1.9.3. Y√

1.9.4. Y√

1.9.5. X√

1.9.6. Y√

1.9.7. X√

1.9.8. Y √

(8 x1) (8)

1.10. Stream order.

1.10.1. C

1.10.2. A-1

B-2

C-3

D-4

1.10.3. B

1.11. TURBULENT & LAMINAR FLOW OF RIVER

1.11.1. B - Turbulent√

1.11.2. A -Laminar√

1.11.3. B-Turbulent √

1.11.4. B - Turbulent √

1.11.5. A - Laminar√

1.11.6. A - Laminar√

1.11.7. B- Turbulent √

(7x1) (7)

1.12. TURBULENT & LAMINAR FLOW OF RIVER

1.12.1. Laminar✓

1.12.2. turbulent ✓

1.12.3. laminar ✓

1.12.4. turbulent✓

1.12.5. turbulent ✓

1.12.6. laminar✓

1.12.7. turbulent ✓

1.12.8. turbulent ✓

(8x1) (8)

1.13. LONGITUDINAL PROFILE OF A GRADED RIVER

1.13.1. C-D✓

1.13.2. Sea ✓

1.13.3. H✓

1.13.4. G✓

1.13.5. F✓

1.13.6. A-B✓

1.13.7. Deltas✓

(7x1) (7)

1.14. MULTIPLE CHOICE

1.14.1. C✓

1.14.2. C✓

1.14.3. A✓

1.14.4. B✓

1.14.5. C✓

1.14.6. A✓

1.14.7. C✓

1.14.8. A ✓

(8x1) (8)

1.15 COLUMN A & B

1.15.1. G – Oxbow Lake✓

1.15.2. E – Levee ✓

1.15.3. A – Braided Stream ✓

1.15.4. H – Rapids ✓

1.15.5. B – Delta ✓

1.15.6. F – Waterfall✓

1.15.7. C – Undercut ✓

1.15.8. D – Meander ✓

(8x1) (8)

1.16 COLUMN A&B

1.16.1. Z✓

1.16.2. Y✓

1.16.3. Z✓

1.16.4. Y✓

1.16.5. Z✓

1.16.6. Z✓

1.16.7. Y✓

(7X1) (7)

1.17 COLUMN A & B

1.17.1. Z✓

1.17.2. Z✓

1.17.3. Y ✓

1.17.4. Z ✓

1.17.5. Z✓

1.17.6. Y✓

1.17.7. Y✓

(7x1) (7)

1.18._MULTIPLE CHOICE

1.18.1. B✓

1.18.2. B✓

1.18.3. A✓

1.18.4. D✓

1.18.5. C✓

1.18.6. A✓

1.18.7. A✓

1.18.8. C ✓

(8X1) (8)

2. DATA RESPONSE QUESTIONS

2.1 DRAINAGE BASIN

2.1.1. The area of land drained by a river and its tributaries ✓✓ (1x2) (2)

2.1.2. Watershed ✓ (1x1) (1)

2.1.3. (a) 2nd order ✓✓ (1x2) (2)

(b) it has more tributaries ✓✓ (1x2) (2)

2.1.4. Low density

- Density is usually lower in places that experience a dry climate ✓✓ (2)
- Gentle slope increases the amount of infiltration into the ground ✓✓ (2)

High density

- Density is usually higher in places that experience heavier rainfall ✓✓ (2)
 - Steeper slope increases the amount of run-off into streams causing higher density ✓✓ (2)
- ANY TWO (2x2) (4)

2.2. DRAINAGE BASIN

2.2.1. The total area drained by a river and its tributaries ✓✓ (2) (1x2) (2)

2.2.2. X ✓ (1) (1x1) (1)

2.2.3. Many streams to cover the greater part of the drainage basin ✓✓ (1x2) (2)

2.2.4. An increase in precipitation will increase the number of streams ✓✓ (2)

Saturated soil increases run-off, forming more streams ✓✓ (2)

Low permeability results in run-off and more streams form ✓✓ (2)

Sparse vegetation increases run-off and more streams form ✓✓ (2)

Steep gradients increase run-off and more streams develop ✓✓ (2)

ANY TWO (2x2) (4)

2.2.5. Drainage density will increase ✓✓ (2)

More artificial surface and storm water drainage increase run-off outside urban

development ✓✓ (2)

Many small stream develops ✓✓ (2) (3x2) (6)

2.3 RIVER PROFILE

2.3.1. Longitudinal profile✓ (1x1) (1)

2.3.2. Meander ✓ (1)

Floodplains ✓ (1)

Oxbow lake ✓ (1)

Braided stream✓ (1)

Levee/natural dykes✓ (1) ANY ONE (2x1) (2)

2.3.3. A is V-shaped because of vertical erosion✓✓ (2)

C is wide with a gentle slope due to lateral (sideward) erosion

dominating. ✓✓ (2) (2x2) (2)

2.3.4. Gradient is gentle✓✓ (2)

Deposition is dominant✓✓ (2)

More water has accumulated in the river✓✓ (2) ANY TWO (2x2) (4)

Flooding may drown people ✓✓ (2)

House closer to the river might be destroyed✓✓ (2)

Vegetation may be destroyed ✓✓ (2)

Flood deposits fertile soil for cultivation ✓✓ (2) (2x2) (4)

2.4. RIVER PROFILE

2.4.1. Side view of a river from source to mouth ✓✓ (2)

(1x2) (2)

2.4.2. It has concave shape ✓✓ (2)

2.4.3. It is steep in the upper course, less steep in the middle course and gradual in the lower course. ✓✓ (2)

(1x2) (2)

2.4.4. Ultimate (permanent) – sea ✓ (1)

(1x1) (1)

2.4.5. It will decrease the capacity/reduce the volume of water. ✓✓ (2)

(1x2) (2)

2.4.6. Original longitudinal profile is graded/concave shaped with no temporary based level. ✓✓ (2)

New longitudinal profile is ungraded/multi-concave has temporary based levels of erosion ✓✓ (2)

(2x2) (4)

4.5.6. **Erosion**

More erosion upstream of dam due to greater water volumes. ✓✓ (2)

Erosion temporarily stops at the dam. ✓✓ (2)

Rate of erosion decreases downstream of the dam due to less water ✓✓ (2)

Deposition

Deposition of silt in the dam results in less deposition downstream ✓✓

The rate of deposition increases as the velocity of the water is reduced downstream. ✓✓

[must refer to both erosion and deposition]

ANY TWO

(2x2) (2)

2.5 DEVELOPMENT OF FLUVIAL FEATURE

2.5.1. Meander ✓✓ (2)

(1x2) (2)

2.5.2. Erosion ✓✓ (2)

(1x2) (2)

2.5.3. water moves slower ✓✓ (2)

River loses energy ✓✓ (2)

River load thus deposited ✓✓ (2)

ANY TWO

(2x2) (4)

2.5.4. deposition occurs in the meander neck ✓ ✓ (2)

It is cut out of the main stream ✓ ✓ (2)

It does not have supply of water from the river any more ✓ ✓ (2)

ANY TWO (2x2)(4)

2.5.5. The lower course of the river has a horizontal or flat gradient ✓ ✓ (2)

Velocity of the river decreases ✓ ✓ (2)

River has a large volume of water ✓ ✓ (2)

To overcome gentle gradient, the river starts to meander ✓ ✓ (2)

Deposition takes place as the gradient is minimal ✓ ✓ (2)

River erode the outer bank and deposition takes place along the inner
bank ✓ ✓ (2)

River erode through the neck ✓ ✓ (2)

Oxbow lake remains behind and can dry to form meander scar ✓ ✓ (2)

ANY TWO (2x2)(4)

2.6 FORMATION OF LEVEE

2.6.1. (a) A raised bank of the river due to deposition ✓ ✓ (2) (1x2)(2)

(b) At C the sediments are heavier particles that are deposited first next to the
river and are coarser and larger in size ✓ ✓ (2)

At D has finer particles/smaller materials are lighter and easily pushed away
from water ✓ ✓ (2) (2x2)(4)

(c) Advantages

Protects farmland from flooding ✓ ✓ (2)

Traps fertile soil and prevents soil from re-entering the river ✓ ✓ (2)

Increases the carrying capacity of the river and allows for more water for irrigation. ✓ ✓ (2)

Disadvantages

Raised banks that restrict the deposition of silt in future ✓ ✓ (2)

It hampers irrigation as a raised bank would increase the costs of implementing irrigation ✓ ✓ (2)

Levee may trap flood water on the floodplain ✓ ✓ (2)

During the time of repeated flooding, the levee may break and damage the crops ✓ ✓

[any 2, must refer to both advantages and disadvantages] (2x2) (4)

2.6.2.

a. at the mouth/river mouth ✓ ✓ (2)

Along an inland lake ✓ ✓ (2)

In the lower course of the river ✓ ✓ (2)

At a temporary base level ✓ ✓ (2) (1x2) (2)

(b) river slows down as it reaches the sea and deposition occurs ✓ ✓ (2)

A gentle gradient when the river is entering into the sea ✓ ✓ (2)

(c) most rivers have steep gradients when entering the sea ✓ ✓ (2)

Reduce deposition (✓ ✓ 2)

Rough seas at the mouth of the rivers do not allow the accumulation of sediments ✓ ✓ (2)

Strong ocean current along south African coastline ✓ ✓ (2)

[ANY ONE] (1x2) (2)

2.7 RIVER REJUVENATION

2.7.1. When a river erodes (downwards) again because it is re-energised ✓ (1x 1) (1)

2.7.2. Lower course ✓ (1) (1x 1) (1)

2.7.3. Wide floodplain (almost flat) ✓ (1)

Wide river valley ✓ (1)

Meanders are visible ✓ (1)

River enters the sea/river mouth ✓ (1)

Presence of terraces ✓ (1)

Evidence of lateral erosion (1)

At the sea/ocean (label) ✓ (1)

Entrenched meanders ✓ (1)

Shading shows a deepening of the river channel ✓ (1)

[ANY ONE] (1 x 2) (2)

2.7.4. Gradient is steeper (river flows down a slope) ✓ ✓ (2)

Turbulent flow (fast flowing river has more energy) after rejuvenation ✓ ✓ (2)

Increase in volume of water ✓ ✓ (2)

Results in a higher velocity after rejuvenation ✓ ✓ (2)

[ANY TWO] (2 x 2) (4)

a. River channel has become deeper ✓ ✓ (2)

River channel has become wider ✓ ✓ (2)

River channel has become straighter (fewer meanders/curves/bends) ✓ ✓ (2)

River channel has steeper sides ✓ ✓ (2)

[ANY ONE] (1 x 2) (2)

(b) Meander loop has moved further downstream ✓ ✓ (2)

Meander downstream has disappeared ✓ ✓ (2)

Meander neck has become narrower (length and width of meander decreased) ✓ ✓ (2)

Meander is entrenched/incised/deepens ✓ ✓ (2)

[ANY ONE]

(1x2) (2)

2.7.5. Increases the amount of silt in the dam ✓ ✓ (2)

Increased silt may damage the dam wall and cause it to collapse ✓ ✓ (2)

Silting negatively impacts on the biodiversity of dams ✓ ✓ (2)

Water holding capacity of dam reduced ✓ ✓ (2)

Less effective in controlling flood waters ✓ ✓ (2)

The increased volume and velocity of water may break the dam walls ✓ ✓ (2)

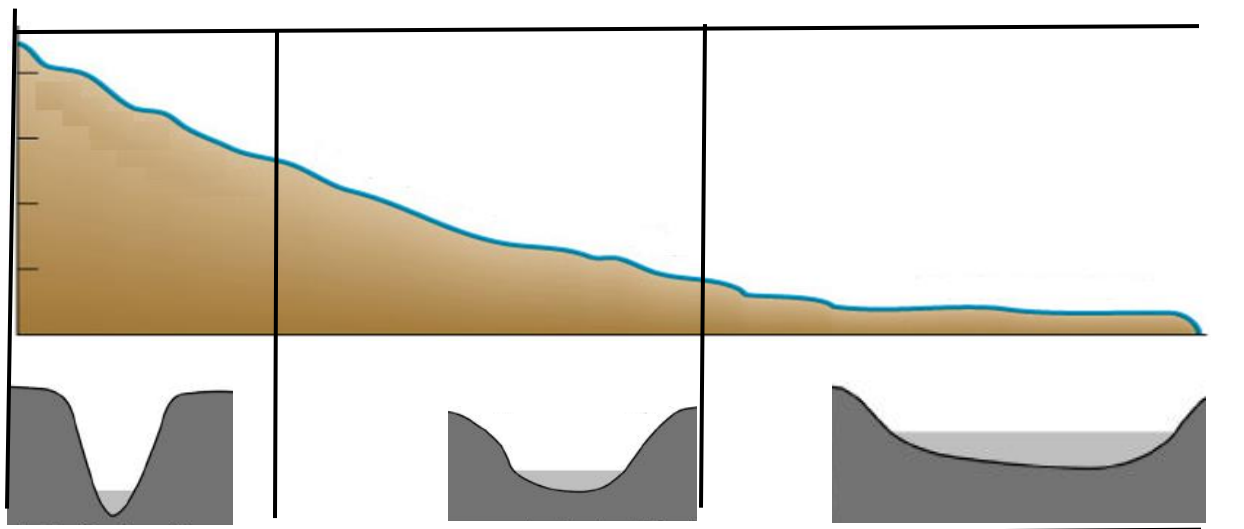
Increased in the cost of maintenance ✓ ✓ (2)

Water quality decreases when sediments are deposited ✓ ✓ (2)

[ANY TWO]

(2x2) (4)

2.8 RIVER PROFILE



2.8 Complete the table below using diagram figure 6.4

ELEMENT	UPPER COURSE	MIDDLE COURSE	LOWER COURSE
Slope	Steep slope✓	Gradual slope✓	Gentle slope✓
Processes	Downward/vertical erosion✓	Lateral erosion✓	deposition✓
Velocity	High velocity/speed✓	Gradually slow✓	Very slow✓

Channel	Narrow v shaped✓	U shaped✓	Wide open✓
Flow type	turbulent✓	laminar✓	laminar✓
Stream volume	Low ✓	high✓	high✓
Landforms	Waterfall, rapids, plunge pool✓	Rapids, levees✓	Floodplains, deltas alluvial fans, sand dunes✓

2.9 SUPERIMPOSED AND ANTECEDENT DRAINAGE

2.9.1. **Antecedent drainage** River flows on a younger landscape which is altered by tectonic forces✓ (1) River is older than the landscape over which it flows ✓ (1)

2.9.2. A Antecedent

B Superimposed

2.9.3. Both rivers maintain their original course ✓ ✓ (2)

2.9.4. Folding ✓ ✓ (2)

2.9.5. The rate of down cutting by the river is equal to the rate of upliftment/ there is a balance between the two processes✓ ✓ (2)

2.9.6. High lying ridge form infrastructure obstructions ✓ ✓ (2)

Building roads and railways would be more expensive✓ ✓ (2)

The landscape is hilly and it is difficult to use machinery✓ ✓ (2)

The building costs of houses will be higher ✓ ✓ (2)

[any TWO]

(2x2) (4)

2.10 CATCHMENT AND RIVER MANAGEMENT

2.10.1. Inadequate municipal sewage treatment (1)

2.10.2. Studies show the presence of harmful viruses in the river ✓ ✓ (2)

2.10.3. An outbreak of diarrhea in Durban ✓ ✓ (2)

Two children died ✓ ✓ (2)

People are hospitalized ✓ ✓ (2)

It could cause an outbreak of cholera ✓ ✓ (2)

People cannot go to work ✓ ✓ (2)

Loss of income ✓ ✓ (2)

People cannot afford high cost of health care ✓ ✓ (2)

[Any TWO]

(2x2)(4)

2.10.4. Stricter control and enforcement of legislation which monitors effluents from factories ✓ ✓ (2)

Heftier fines to punish polluters ✓ ✓ (2)

Improved waste treatment facilities ✓ ✓ (2)

Have a buffer so that people cannot live close the rivers ✓ ✓ (2)

Provide running water in or close to homes ✓ ✓ (2)

Regular testing of water quality ✓ ✓ (2)

Increased awareness of and education on the problem which people cause by living so close to river ✓ ✓ (2)

[ANY FOUR]

(4x2) (8)

3. MAP INTERPRETATION AND ANALYSIS

- 3.1.1. Perennial river✓ (1x1) (1)
- 3.1.2. Perennial rivers are visible with a blue solid line ✓ ✓ (1x2) (2)
- 3.1.3. North ✓✓ (1x2) (2)
- 3.1.4. The tributaries join the main stream in the north direction ✓ ✓ (2)
The position of the dam wall - water accumulates on the direction from
where the river comes✓✓ (2)
- 3.1.5. Vector – use of point, line and polygon to identify geographic features ✓✓ (2)
- 3.1.6. Lines – non perennial river, contour lines ✓ (1)
Polygon – cultivated land✓ (1) (2x1) (2)
- 3.1.7. It provides enough water for irrigation✓✓ (2)
Farmers will have sustainable water for their stock-farming✓✓ (2) (2x2) (2)

3.2 MAP INTEGRATION

- 3.2.1. Northwest turning north (1)
(1x1) (1)
- 3.2.2. Tributaries joining at acute angles from the northeast and southeast (1)
Waterfall retreats upstream (1)
The waterfall retreats in a north-westerly direction (1)
- [ANY TWO] (2 x 1) (2)**
- 3.2.3. Augrabies waterfall (1) (1 x 1) (1)
- 3.2.4. It causes the profile to ungraded or multi concave ✓ ✓ (2) (1 x 2) (2)
- 3.2.5. Incised meander is evident ✓ ✓ (2) (1 x 2) (2)
- 3.2.6. Water is deeper and make extraction difficult and more expensive for
agriculture ✓ ✓ (2)
The steep slopes make the construction of roads impossible✓ ✓ (2)

Bridges have to be built in order to have access over the river, which is expensive ✓ ✓ (2)

[ANY TWO - MARKS WILL BE AWARDED FOR AGRICULTURE AND ROAD DEVELOPMENT] (2 x 2) (4)

Worksheet

1.1. Define the following concepts

1.1.1. **Drainage basin** is an area drained by a river and its tributaries ✓ ✓

1.1.2. **Confluence** is a point where two rivers/streams meet ✓ ✓

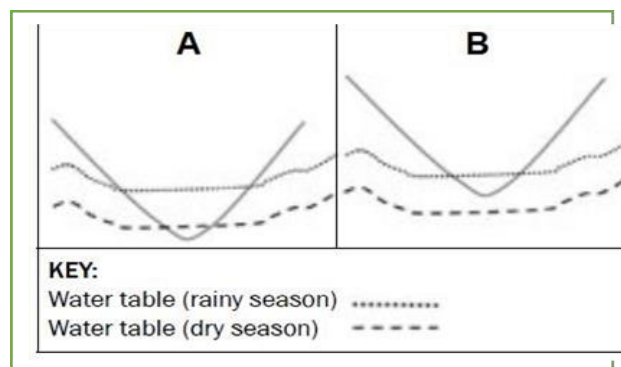
1.1.3 **Interfluvies** is a High lying areas which separate tributaries within the same drainage basin ✓ ✓

1.1.4. **Base flow** Refers to the movement of groundwater that seeps into streams. ✓ ✓

1.1.5. **Watershed** is high lying areas separating different drainage basins. ✓ ✓

[10]

1.2.1. Identify the types of rivers marked by A and B



A- Permanent river ✓

B- Periodic River ✓


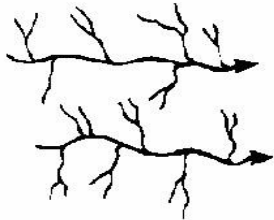


1.2.2 Explain both rivers in relation to water table.

A Permanent rivers flow all year round because the river water table always above the river bed throughout the year. ✓ ✓

Periodic Rivers only flow during the rainy season, because the water table is above the river bed only in the rainy season. ✓ ✓

[6]

1.3. Identify the following drainage patterns and for each give the underlying rock and TWO characteristics

A -Dendritic✓	B-Trellis ✓	C -Radial Centrifugal✓	D -Radial Centripetal ✓ (4)
			
Rock structure	Rock structure	Rock structure	Rock structure
3.2 -rocks of uniform resistance to erosion✓ ✓ - massive igneous rocks and horizontal sedimentary Rocks✓ ✓	3.3 Alternating layers of hard and soft rock. ✓ ✓	3.4 It forms in areas where domes and volcanoes occur. ✓ ✓ - Associated with massive igneous rocks. ✓ ✓	3.5 Associated with massive igneous rocks. ✓ ✓
Description			
A- Dendritic drainage patterns Looks like branches of a tree and Tributaries join the main river at acute angles or less than 90°✓ ✓			
B- The trellis Strong drainage patterns, main river is joined by short tributaries at right angles/90°and The main streams are parallel to each other. ✓ ✓			
C- Radial / Centrifugal Rivers flow away from a high central point such as a mountain or			

volcanic mountain ✓✓


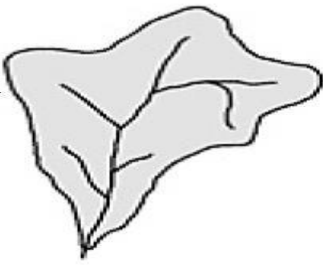
D Radial Centripetal- Streams flow towards a central basin such as a marsh or lake. ✓
✓

[20]

4.1 What is drainage density?

Drainage density is the ratio between the total length of all the stream channels in the drainage basin and the area of the drainage basin. ✓✓

4.2 Identify drainage density A with B.

<p style="text-align: center;">A</p> 	<p style="text-align: center;">B</p> 
<p>A-High drainage density✓</p>	<p>B- Low drainage density ✓</p>

4.3 Discuss how the difference in gradient and vegetation as influenced the drainage density of A and B respectively.

4.3.1 Gradient:

In drainage basin A the gradient is steep, which increases run-off and more streams are created which results in a high drainage density. ✓✓

In drainage basin B the gradient is gentle, which increases infiltration and fewer streams will be created which result in a low drainage density. ✓✓

4.3.2 Vegetation

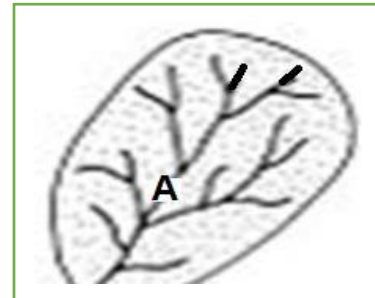
Drainage basin A has less vegetation cover, therefore run-off is not slowed down and more streams will have created resulting in a high drainage density✓✓

Drainage basin B has more vegetation cover therefore there is more infiltration and fewer streams will be created resulting in a low drainage density ✓✓

4.3.3 An urban area is set to be built near the drainage area B. Discuss how these new development is going to affect the drainage density around these areas.

- Removal of vegetation for urban development will increase the drainage density as will be less infiltration ✓✓
- There will be more surface run-off and thus more streams ✓✓
- Removal of vegetation will increase surface run-off. ✓✓
- Concrete surface will promote run-off

4.4 Identify the stream order at A: 3rd stream order✓

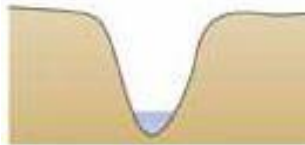




5.1 Identify the following stream flow/Discharge and give the course of the river where they are most likely to occur

A	B
Flow A: Turbulent flow ✓	Flow B: Laminar flow ✓
River course: Upper course ✓	River course: Lower course ✓

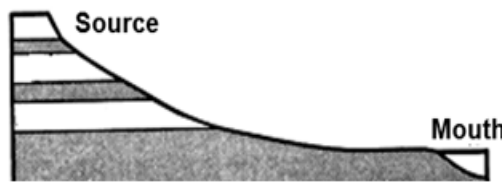
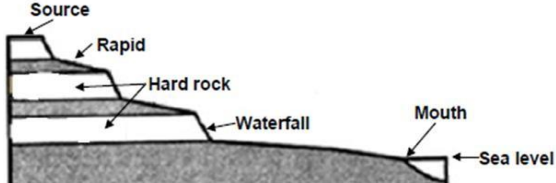
5.1.1. Define the term cross/transverse profile of the river. Side view of the river from bank to bank ✓ ✓

5.1.2. Identify the river course represented by the following cross sections and explain the processes responsible for their different shapes.

A- Upper course ✓	B- middle course ✓	C- Lower course ✓
		
Process responsible/Type of erosion	process responsible/Type of erosion	process responsible/Type of erosion
Vertical/Downwards erosion ✓	Lateral erosion ✓	Deposition (also lateral) ✓

5.1.3. Define the longitudinal profile- Side view of the river from the source to the mouth ✓ ✓

5.1.4 Identify and describe the longitudinal profile A and B

A 	B 
Identify: Graded profile ✓	Identify: Ungraded profile ✓
Description: It is a smooth concave profile from source to mouth ✓ ✓	Description: It is uneven and has many obstacles along the course of the river, e.g. waterfalls, rapids, lakes. ✓ ✓

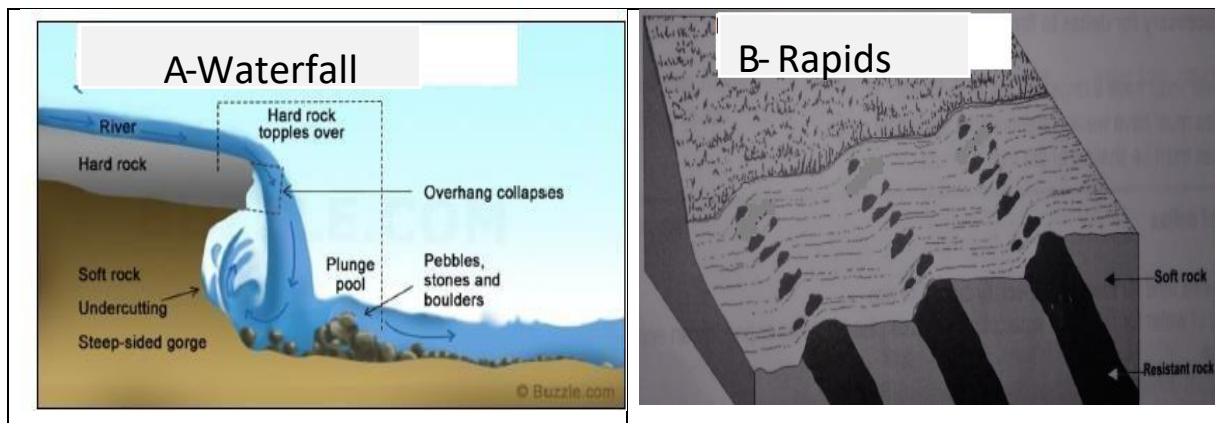
5.1.5 Differentiate under graded river and over graded rivers

Under graded If a river does not have enough energy to carry its load, deposition will take place. ✓ ✓	An over-graded river has more energy than is required to move its water and its load and thus it will be able to erode its channels. ✓ ✓
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FLUVIAL LANDFORMS

6.1. FLUVIAL LANDFORMS OF THE UPPER COURSE

6.1.1 Identify and describe the fluvial land forms A and B of the upper course



6.1.2 State ONE way in which feature A can be eliminated

Backward retreat ✓

6.1.3 What are the benefits of fluvial land form A?

They attract tourists to the area. ✓ ✓

Water can be used to generate electricity ✓ ✓

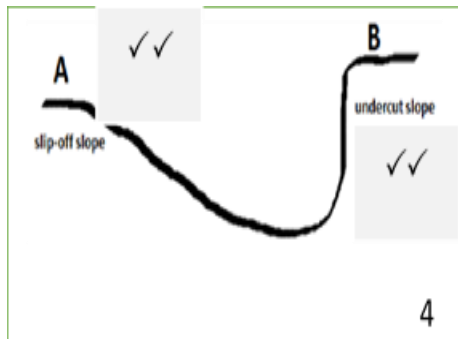
6.2 FLUVIAL LAND FORMS OF THE MIDDLE AND LOWER COURSE



6.2.1 Identify the stream channel pattern above: meander✓

6.2.2 In which course/s of the river is this channel pattern found. Middle and lower course✓

6.2.4 Draw a fully labelled cross section between A and B of the slip-off slope



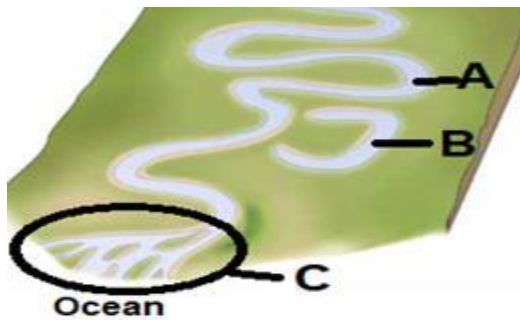
6.2.5. State ONE characteristic of the slip-off slope

Deposition takes place /it is a shallow slope/ convex slop ✓

6.2.6 State ONE characteristic of the undercut slope

Erosion takes place/ Deep slope/concave slope✓

6.3 FLUVIAL LAND FORMS OF THE LOWER COURSE



6.3.1 Identify the fluvial land form B in the diagram above. Oxbow lake ✓

6.3.2 In which course of the river is the fluvial land form above more likely to form? Lower course ✓

6.3.3 Briefly describe the formation of feature B

Ox-Bow lakes form from a meander that is cut off from the main stream. ✓ ✓

Erosion is takes place leading to the formation of the meander neck. ✓ ✓

As times goes on, the meander neck reduces in size or narrows and cut off. ✓ ✓

Water will flow straight, no longer following the meander. ✓ ✓

Where deposition was takes place therefore separating the meander loop from the main stream. ✓ ✓

6.3.4 Provide suitable terms to describe A when it dries up? Meander scare ✓

6.3.5 Identify the fluvial feature C. deltas ✓

6.3.6 What term is given to the river channels (branches)? Distributaries ✓

6.3.7 Explain TWO conditions necessary for the formation of deltas

The river must have a large amount of sediments. ✓ ✓

The sea must have weak currents and a small tidal range. ✓ ✓

The sea must be shallow at the river mouth. ✓ ✓ (2X2) (4)

6.4. River rejuvenation

6.4.1 **Define River rejuvenation:** It's a process where the river regains and renews its erosive power and begins to erode vertically. ✓✓

6.4.2. **Mention two causes of river rejuvenation.**

High rainfall increases the erosive potential of the river. ✓✓

Sea level drops and the river tries to erode to a lower level. ✓✓

Uplift of the land/ isostatic uplift (crustal movement). ✓✓

Increased volume of water as a result of river capture. ✓✓

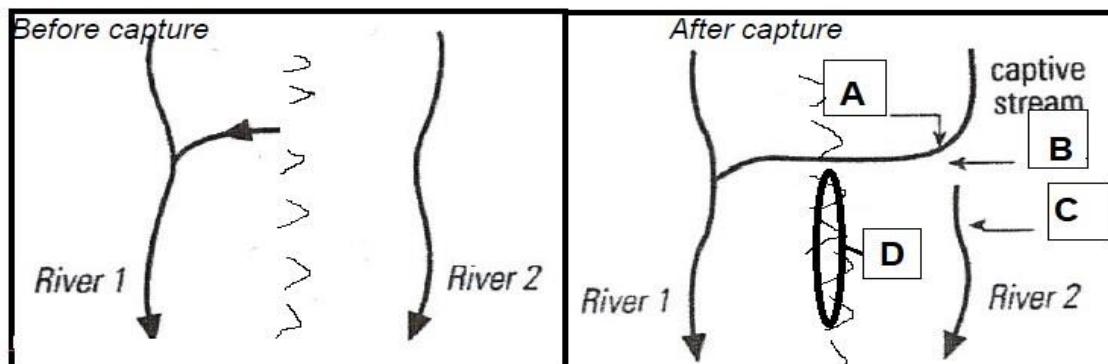
6.4.3. **Give TWO evidences/features of rejuvenation**

Knick point (waterfall) ✓

Terraces/ Valley in a valley ✓

Incised meanders ✓

6.5 RIVER CAPTURE



6.5.1 Explain river capture: One river capturing /stealing/robbing/water of another river ✓ ✓

6.5.2 Identify the features marked A, B, C and D

A; Elbow of capture □	B; Wind gap □	C; Misfit stream □	D; Water shared □
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6.5.3 Explain the changes that will happen in river 1 after capturing of the river

Increased volume of water in the river (wider river channel) ✓ ✓

Increased velocity of stream flow of water ✓ ✓

Increase in vertical erosion due to increased flow ✓ ✓

Results in rejuvenation of the river ✓ ✓

Increase in carrying capacity ✓ ✓

Incised meanders/Valley in a valley/Terraces develop because of increase in erosive power. ✓ ✓

Formation of Knick point waterfall at point of capture ✓ ✓

Increase in size of drainage basin ✓ ✓

6.5.4. Discuss measures that can be taken to protect our catchment areas

Reuse, recycle before disposing of waste ✓ ✓

Educate people on environmental awareness. ✓ ✓

Repair broken sewerage without delay. ✓ ✓

Introduce by-laws to curb water and land pollution. ✓ ✓

Cleaning campaigns to clear waste ✓ ✓

Awareness programmes using all forms of the media. ✓ ✓

Policing catchment areas to deal with by-law violators ✓ ✓

Spot checks on companies to ensure compliance with the law ✓ ✓

Improve general waste management. ✓ ✓

Implement buffer areas close to the rivers. ✓ ✓

Effective sewerage management ✓ ✓


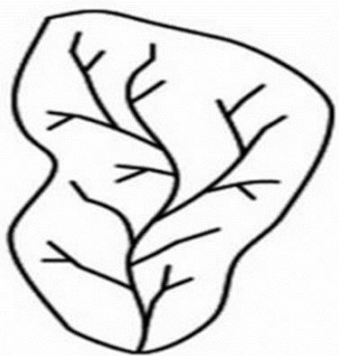
Plant trees near water sources. ✓ ✓

Incentives for community clean-up programmes ✓ ✓

1. Complete this worksheet that is based on factors influencing infiltration and drainage density.

CONCEPTS	
Drainage density	The drainage density is the measure of the total length of stream channels in a drainage basin per unit area of drainage basin.
Infiltration	Water soaks or filters into the soil
Surface run-off	Water moves across the surface of the earth becoming a stream, tributary or river

TYPES OF DRAINAGE DENSITY

How does it look like		
IDENTIFICATION	Low drainage density	High drainage density
DESCRIPTION (CHARACTERISTICS)	Few stream channel per unit area of drainage basin.	high stream channel per unit area of drainage basin

FACTORS INFLUENCING INFILTRATION AND RUN-OFF

FACTOR	EFFECT ON INFILTRATION	EFFECT ON RUN-OFF
1.Precipitation	Less rainfall can be easily absorbed by soil and result in high infiltration and low drainage basin.	High rainfall cause water to quickly flow on top of the surface as surface run-off which increase the drainage.
2. Evaporation	High evaporation rate will lead to reduced run-off resulting in fewer number of streams.	Low evaporation rate will lead to increased run-off resulting in a high number of streams.
3.Soil moisture	Dry can quickly absorbs water hence high infiltration rate can be experienced resulting in low drainage density.	Wet soil promotes more surface run-off leading to a high drainage density.
4.Vegetation	Thick forest reduce high runoff and promote high infiltration resulting in low drainage density.	Un-vegetated areas or bare land will experience high surface run-off and high drainage density.
5.Slope/Gradient	Gentler slopes promotes more infiltration and low drainage density.	Steep slope generally does not allow water to sink, hence they promote high surface run-off which and high drainage density.
6.Porosity	Porous rocks or soil allows	Clay soil do not allow water to

	water to easily infiltrate leading to low density.	pass through easily, resulting in high surface run-off which lead to high drainage density.
7.Permeability	Permeable rocks such as limestone absorbs water easily leading to more infiltration and low drainage density.	Impermeable rocks such as Granite and basaltic rocks promote run-off resulting in high drainage density.

FACTORS INFLUENCING DRAINAGE DENSITY

FACTOR	EFFECT – LOW DRAINAGE DENSITY	EFFECT – HIGH DRAINAGE DENSITY
1.Precipitation	A decrease in precipitation in arid areas lower drainage density	Increase in precipitation results in high run-off and a high density
2.Evaporation	High evaporation will lead to fewer number of streams	Low evaporation rate lead to high number of streams
3.Soil Moisture	Soil with little moisture will results in high infiltration and less streams	Soil with high moisture will results in low infiltration and high run-off
4.Vegetation	Areas with high vegetation cover will have high infiltration and less streams	Areas with little vegetation will promote high run-off and less infiltration
5.Slope/Gradient	Gentle slope will promote high infiltration and less streams	Steep slope will promote high run-off and less infiltration
6.Porosity/Permeability	High porosity and high permeability will lead to high infiltration and less streams	Low porosity and low permeability will lead to high run-off.

Worksheet

2. Complete the table below based on river rejuvenation.

	River rejuvenation	River capture
Definition	The process where a river regains its energy and start to erode vertically (2)	Where a river robs the headwaters of another river and increases the size of its drainage basin (2)
Reasons for formation or causes	Upliftment of the land Volume of water Higher rainfall Sea drops	Steeper gradient High volume of water High rainfall River rejuvenation Softer rock

	(3)	(3)
Three features associated	Knick point Paired Terrance's Valley within a valley Entrenched/incised meander (3)	Misfit Headed stream Wind gap Elbow of capture River gravel (3)
Human impacts (positive or negative) three each.	Its associated with steep slope and deep gorge that will not be suitable for human activities	People who are along the lower course of captured river will be disadvantaged. There will be less water available for agriculture, domestic use and industrial used. The captor stream will have enough water for hydro-electricity, irrigation, industrial and household use.

	(6)	<p>The captor stream may experience flooding during rainy seasons because it has more water.</p> <p>(6)</p>
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