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SUBJECT: GEOGRAPHY

GRADE 12

AUTUMN CLASSES

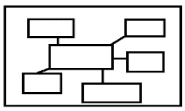
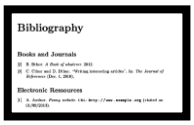
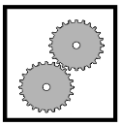
TEACHER AND LEARNER CONTENT MANUAL

Topics

1. Climatology
2. Geomorphology

CONTENTS **PAGE**

ICON DESCRIPTION

 MIND MAP	 EXAMINATION GUIDELINE	 CONTENTS	 ACTIVITIES
 BIBLIOGRAPHY	 TERMINOLOGY	 WORKED EXAMPLES	 STEPS

GEORAPHY PAPER ONE TIPS

Paper, one comprises of **Climatology**; **Geomorphology** and **Mapwork**.

Learners are encouraged to read instructions carefully before answering the question paper.

Instructions provide important information with regards to the length of responses and to indicate the unit in final answer.

Highlighting the instructional verbs and important aspects of the question will assist learners in interpreting the question correctly.

Geographical issues are often assessed, and thorough preparation is crucial.
Learners should focus on the causes and effects, both negative and positive impacts, as well as possible solutions or sustainable strategies/measures to be implemented to overcome these issues.

Paragraph writing

Knowledge of paragraph writing skills is essential. Learners need to write in full sentences and **NOT** use bullets or point form.

Four points (if required) must be explained; answers in most instances require qualification. (4x2) (8).

Learners should underline or highlight the main topic of the question, the instructional verb, and the focus areas of the question.

Make at least four points and then elaborate on each point.

Learners know all the geographical concepts and definitions required.
Learners must know all the geographical concepts and definitions required.
Learners should compile a glossary of terms/concepts and an explanation of each in their notebooks for easy reference.

CLIMATE AND WEATHER: EXAMINATION GUIDELINES

1.1 Mid-latitude cyclones (frontal depressions, extra-tropical cyclones)

- General characteristics
- Areas of formation
- Conditions necessary for formation

- Stages of development
- Cross-section through a mid-latitude cyclone

- Associated weather patterns
  Cold front conditions
  Warm front conditions
  Occluded front conditions

- Impact on human activities (social and economic) and the (physical) environment.

- Possible pre-cautionary and management strategies

- Identification on synoptic weather maps and satellite images:
  Identification of stages of development on synoptic weather maps
  Impact of South Indian High and South Atlantic High on movement of the cyclone
  Reading and interpretation of weather symbols, predicted weather impact

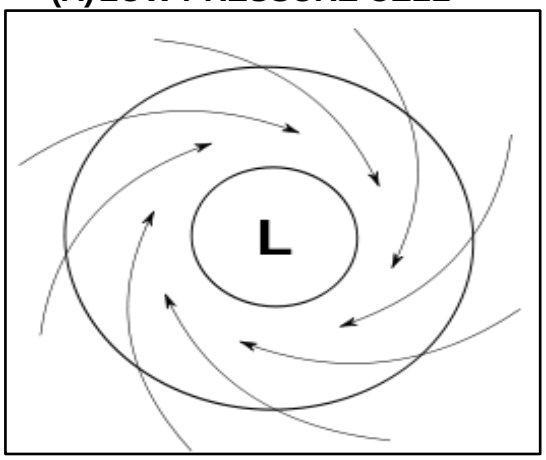
IMPORTANT TERMS AND DEFINITIONS

Cyclogenesis	development and strengthening of **extratropical(midlatitude)** cyclones.
Midlatitude cyclones	low pressure systems that have **cyclonic (clockwise)** flow in the southern hemisphere found in the **middle latitudes (mid latitude)** 30 ° and 60° South.
Front	a **zone of separation** between two air masses of different density and temperature.
Cold front	A cold front is the **boundary line** or the **leading edge** of a cooler mass of air that replaces a warmer mass of air at ground level. The air **behind** a cold front is **cool** and the air **ahead** of a cold front is **warm**.
Warm front	A warm front is the boundary line between a mass of warm air and a retreating mass of cold air. The air **behind** a warm front is **warm** and the air **ahead** of a warm front is **cold**.
Occluded front	a front formed when a cold front overtakes a warm front and forces it to rise.
Polar front	the transition region **separating warmer tropical air** from **colder polar air** in the mid-latitudes.
Wind shear	change in wind speed or direction.
Backing	Change of wind direction to the **left.** (anticlockwise) A backing wind would change from a **northerly wind** to a **north westerly** wind.
Veering	Changes of wind direction to the **right** (clockwise) A veering wind would change from a **northerly wind** to a **north easterly** wind.
Physical Environment	the part of the human environment that includes purely physical factors (as **soil, climate, water supply**).

CONTRAST BETWEEN **HIGH-** AND **LOW-**PRESSURE CELLS IN THE SH.

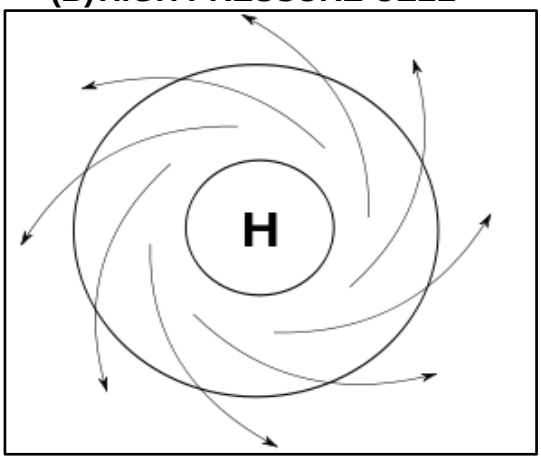
Figure 1

(A) LOW PRESSURE CELL



- Pressure lower than 1000hpa.
- Pressure is lowest at the center and increases as one moves away from the center.
- Winds blow towards the center in a clockwise direction.
- Characterised by warm moist rising air.
- May lead to cloud formation and rainfall.

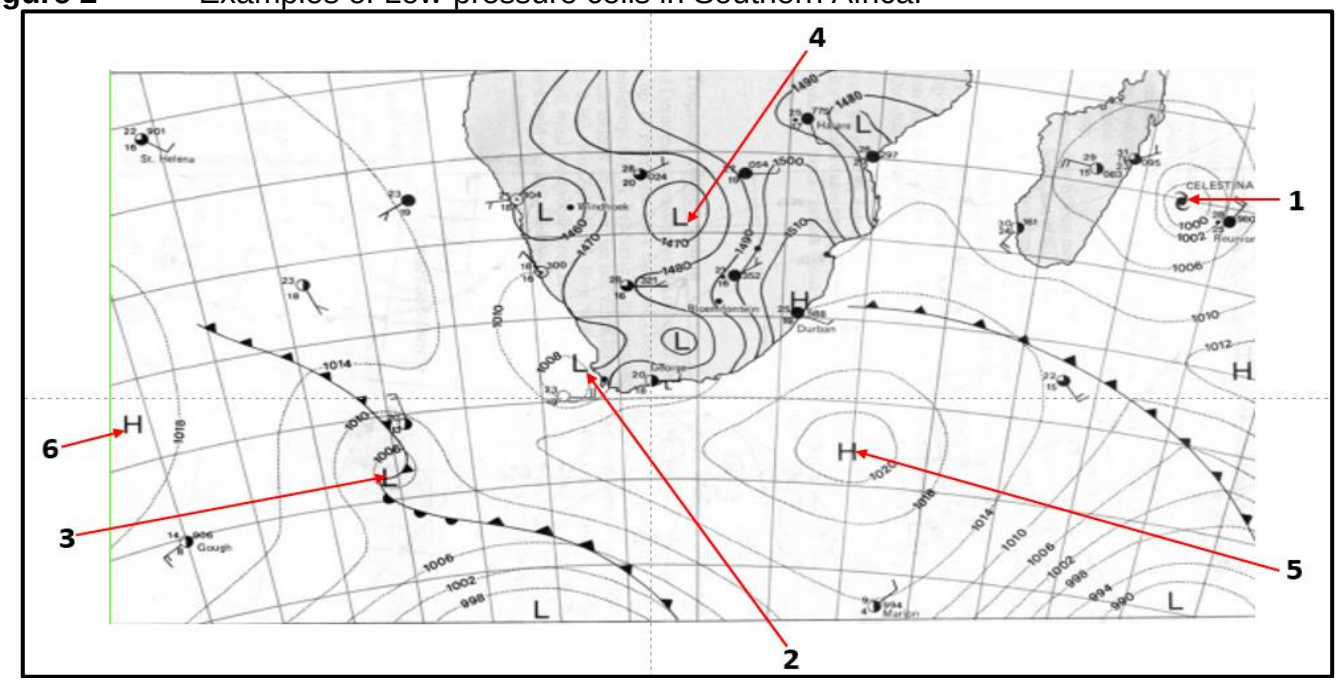
(B) HIGH PRESSURE CELL



https://steemit.com

- Highest pressure at the center and decreases as one moves away from the center.
- Pressure is higher than1000hpa.
- Winds blow outward from the center in an anticlockwise direction.
- Characterised by dry cool descending air.
- Seldom leads to cloud formation, associated with clear skies.

Figure 2 Examples of Low-pressure cells in Southern Africa.

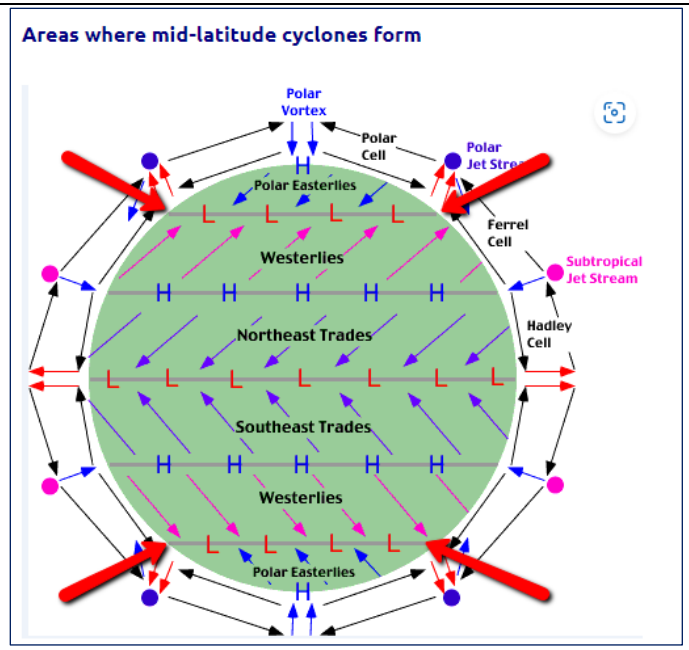


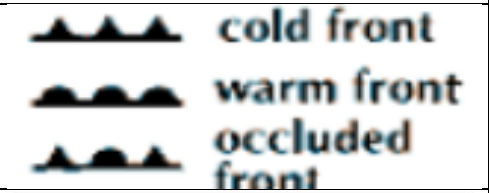
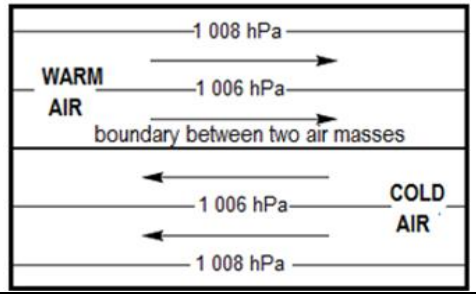
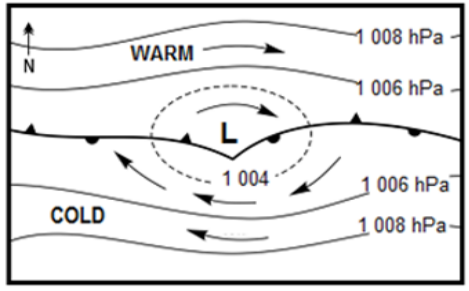
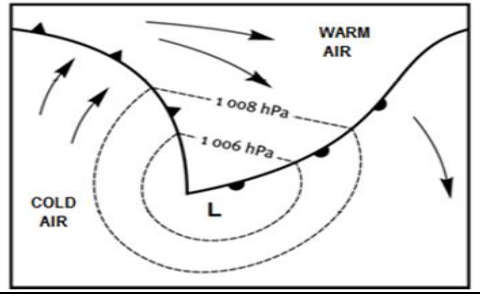
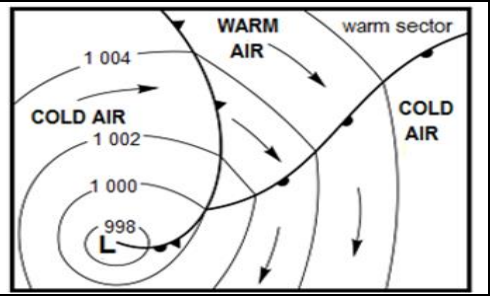
1.1. Identify the cells 1 to 6. (6x1) (6)

1.2 Contrast pressure cells 4 and 5. (2x2) (4)

1.3 Describe the similarities and differences of pressure systems 1 and 3? (3x2) (6)

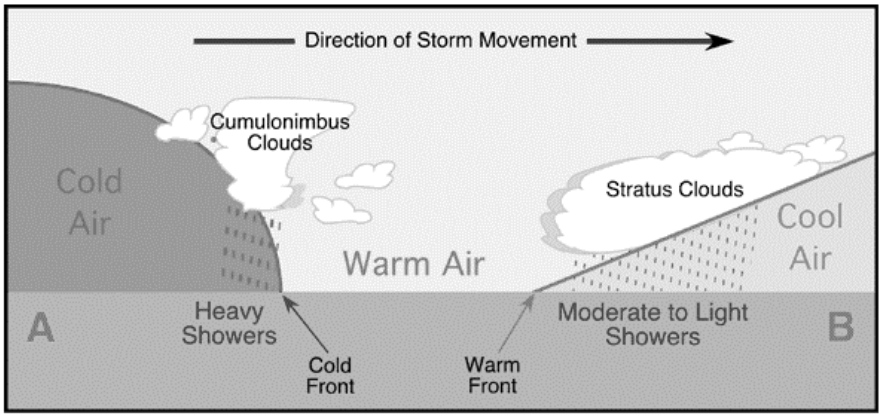
1.1.1

Conditions necessary for formation	Areas of formation	General characteristics.
• Frictional drag caused by difference in temperature and speed of the two air masses.	• Occur in the middle latitudes of the earth, usually between 30° and 60° latitude north and south of the equator.	• They are sometimes called temperate cyclones, extra-tropical cyclones, midlatitude cyclones, frontal depressions or wave cyclones.
• Air masses must move opposite to each other and parallel.	• Cold polar easterlies meet warm westerlies and move parallel but do not mix.	• They occur as a pair of fronts: a **warm front** and a **cold front** linked to a central area of low pressure.
• Warm subtropical air must meet cold polar air at the polar front.	 sageography.co.za	• The cold fronts reach South Africa mostly in winter. • The pressure belts and wind systems move slightly north in winter.
• There needs to be a large temperature difference between polar easterlies and subtropical westerlies for fronts to develop.		• They move from **west to east.** • They are steered by the **westerlies.** • Midlatitude cyclones move in an **easterly** direction. (**They move eastwards**)
• There must be a disturbance at the jet stream that will cause cold air to push into warmer air.		• The air rotates clockwise around a center of low pressure in the southern hermisphere.
• The warmer air will push up above the cold air mass creating a low-pressure cell into which the wind spirals.		• They have a large diameter, can stretch to about 2000km across. • They occur in families

1.1.2	**Stages of development**			
	7 to 8 DAYS			
	Initial stage	**Mature stage**	**Occluded stage**	**Degeneration stage**
	Cold polar air and warm tropical air move parallel to each other but in opposite directions at the polar front.	Wave deepens and pressure gradient increases.	Cold front catches up to the warm front at the **apex**. **apex** is the shortest distance between the fronts.	All warm air is lifted off the ground and the cyclone weakens.
	Frictional drag takes place. Warm air becomes uplifted.	Cold and warm sectors fully developed. Both fronts fully developed.	Cold sector wedges below warm sector and warm sector narrows.	Air is cold and gusty as the sky clears.
	Fronts begin to form as air converges to the center low pressure	Warm air moves up steep pressure gradient of cold front to form towering cumulonimbus clouds. (Heavy rain and strong winds)	Two fronts combine to form an occluded front.	**Cold front occlusion:** warm air moves up the cold front. (cold front on the ground)
		Warm air moves up gentle pressure gradient of warm front to form a broad band of stratus clouds. (light rain over a large area)	Nimbostratus and rain.	**Warm front occlusion**: cold air moves up the warm front. (warm front on the ground)
				

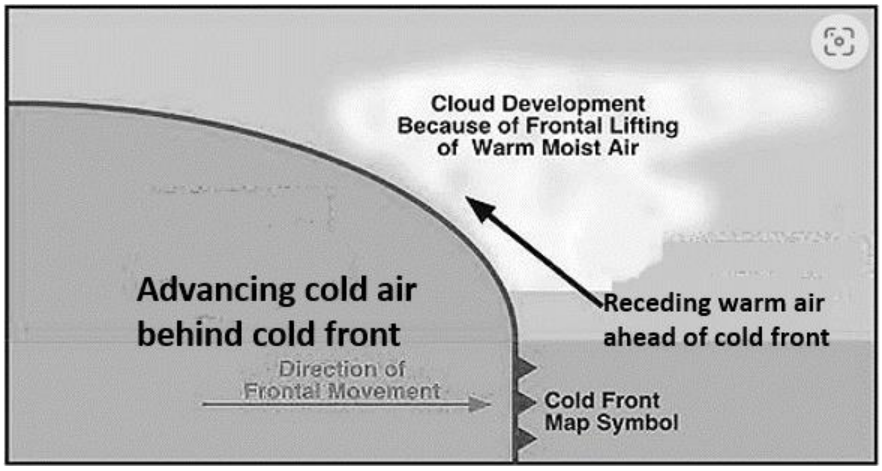
CROSS SECTIONS THROUGH A MIDLATITUDE CYCLONE

MATURE STAGE



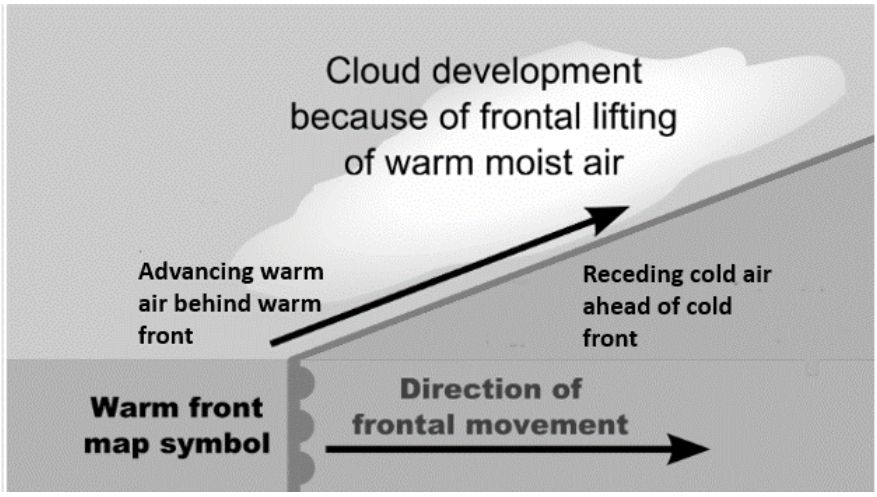
http://www.physicalgeography.net/

COLD FRONT



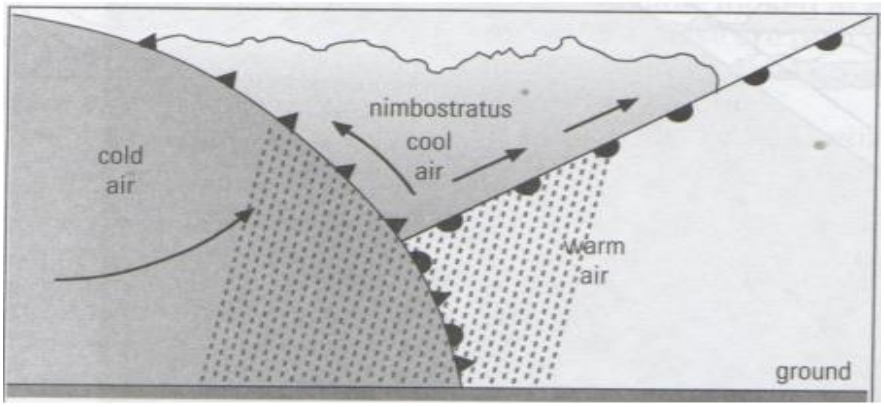
Cold Front Conditions
Temperature decreases
Pressure decrease but increase with cold sector.
Humidity decreases
Cloud cover increases- Cumulonimbus clouds
Chances of precipitation increase.
Heavy rain/ snow
Wind direction changes
Strong winds

WARM FRONT



Warm front conditions
Temperature increases
Pressure increases
Humidity increases
Cloud cover- Nimbostratus
Precipitation: soft soaking rainfalls

COLD FRONT OCCLUSION

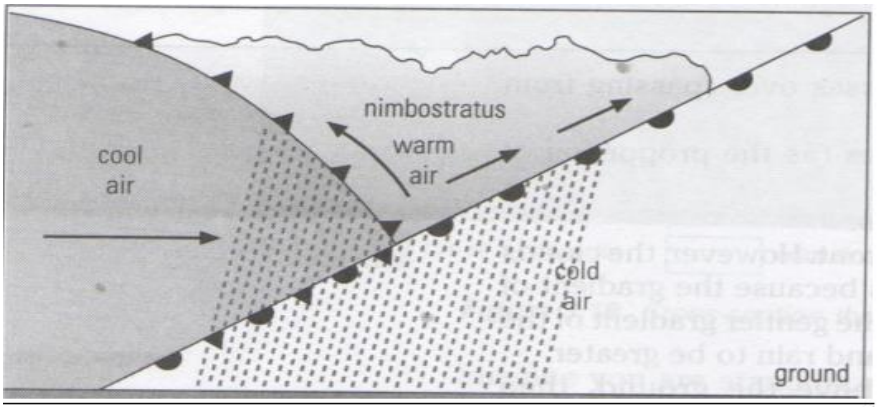


Conditions

Temperature in front of system is higher than behind system

Cold front cuts into warm front

WARM FRONT OCCLUSION

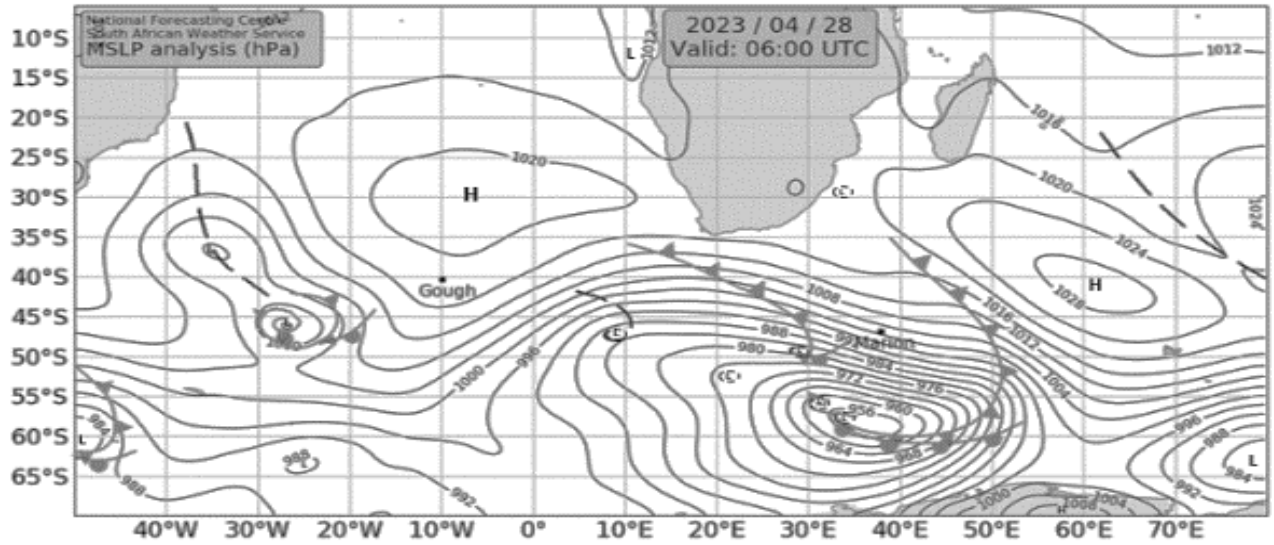


Conditions

Temperature in front of system is lower than behind system

Warm front cuts into cold front

MIDLTIDUDE CYCLONES ON A SYNOPTIC MAP



1.1.4 Impact of midlatitude cyclones human activities (social and economic) and the (physical) environment.

Human activities

- Cyclones can trigger disasters, including the lives of people and property.
- Cyclone-induced storms can cause inland flooding.
- The torrential rainfall resulting from the Cyclone can cause extensive flooding and cover the whole range of human habitats
- Can wash away all the pesticides and fertilizers used by the farmers in their fields.
- Such activity can lose agricultural production and may result in food scarcity
- It affects the human settlements near the coastal areas causing significant property damage and human lives.

Environment

- The high onshore winds can drive sea-level rise to large meters, reaching unusual heights
- A cyclone extends damage on the waves basically on the beach, eroding.
- It may cause coastal flooding

Possible pre-cautionary and management strategies

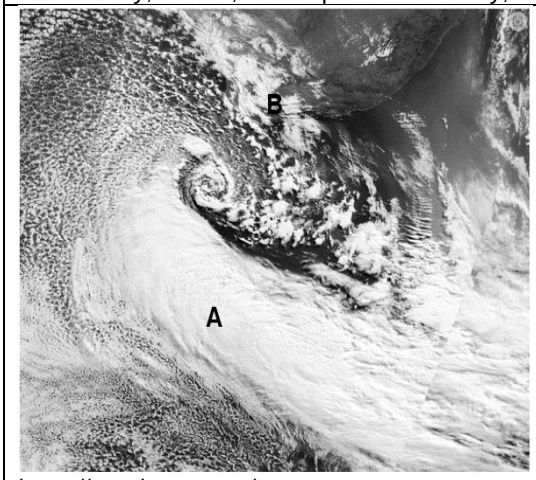
- Monitoring the development of Mid-Latitude cyclones.
- Early warning systems for people to be prepared.

- Evacuate low lying areas to protect it against floods
- Keep livestock in barns to protect them against the cold.
- Plant winter crops that can resist cold
- People should stay indoors for protection against the cold, wind, and rain

ACTIVITY 1 **30 minutes**

1.1 Refer to the infographic below.

Worst winter storm in 30 years hits Cape Town, causing at least 8 deaths.
Wednesday, June 7, 2017 Updated on Friday, March 4, 2022 18:26 UTC



https://watchers.news/


Knysna Fire continues to burn. http://coast.Pic: Koos Britz

A major winter storm hit South Africa's province of Western Cape and the Cape Town metropolitan area around 23:00 SAST (21:00 UTC) on Tuesday, June 6, 2017, and intensified on Wednesday morning. It brought powerful winds, huge waves and coastal flooding, frequent lightning, heavy rain and snow at higher elevations. By 16:00 UTC, it claimed the lives of at least 8 people.

Wind gusts in excess of 80 km/h (50 mph) brought destruction throughout the region, leaving thousands of people homeless. According to the City of Cape Town Disaster Management, around 700 structures in the city have been affected by flooding.

Schools across the Western Cape are closed today, and are expected to re-open tomorrow, June 8, provincial authorities said

1.1.1 Which weather system is responsible for the weather mentioned in the infographic? (1x2) (2)

1.1.2 Refer to the satellite image in the infographic.
a. Identify the front at **A** and **B** respectively. (2x1) (2)

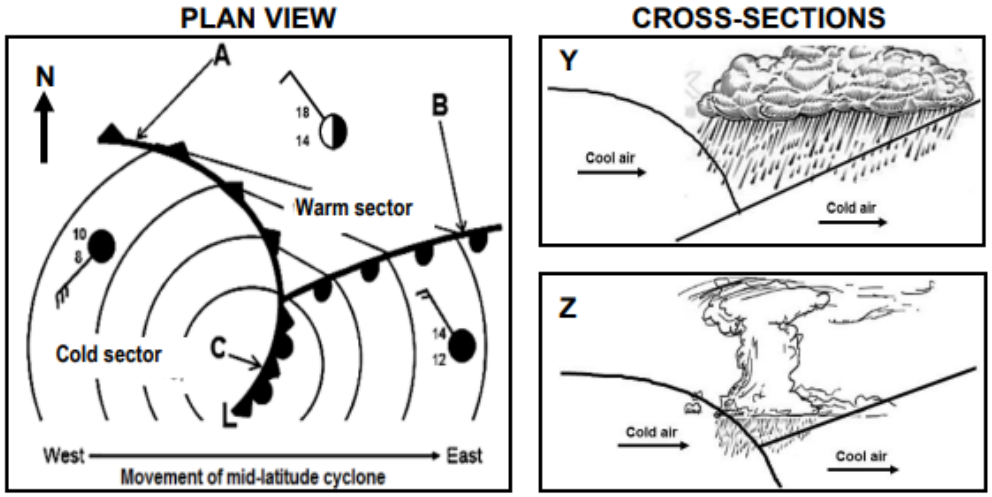
b. Explain any **three** weather conditions experienced at **A** on the synoptic map. (3x2) (6)

1.1.3 Give an account for the fires burning at Knysna. (2x2) (4)

1.1.4 To what extent did the weather system discussed in the infographic cause damage in Cape Town? (3x2) (6)
(20)

ACTIVITY 2

2.1 Refer to the sketches below on a mid-latitude cyclone.



[Source: Examiner's own sketch]

dbe.nov 2022

2.1.1 Name the wind belt that causes the easterly movement of the mid-latitude cyclone (1x1) (1)

Refer to the plan view.

2.1.2 Identify front **A.** (1x1) (1)

2.1.3 Which ONE of fronts **A** or **B** is moving faster? (1x1) (1)

2.1.4 Give a reason for your answer to QUESTION 2.1.3. (1x2) (2)

2.1.5 Give evidence from the sketch that the mid-latitude cyclone is found in the Southern Hemisphere. (1x2) (2)

Refer to the cold front occlusion **C** and the cross-sections

2.1.6 Which ONE of the cross-sections **Y** or **Z** represents the cold front occlusion at **C**? (1x2) (2)

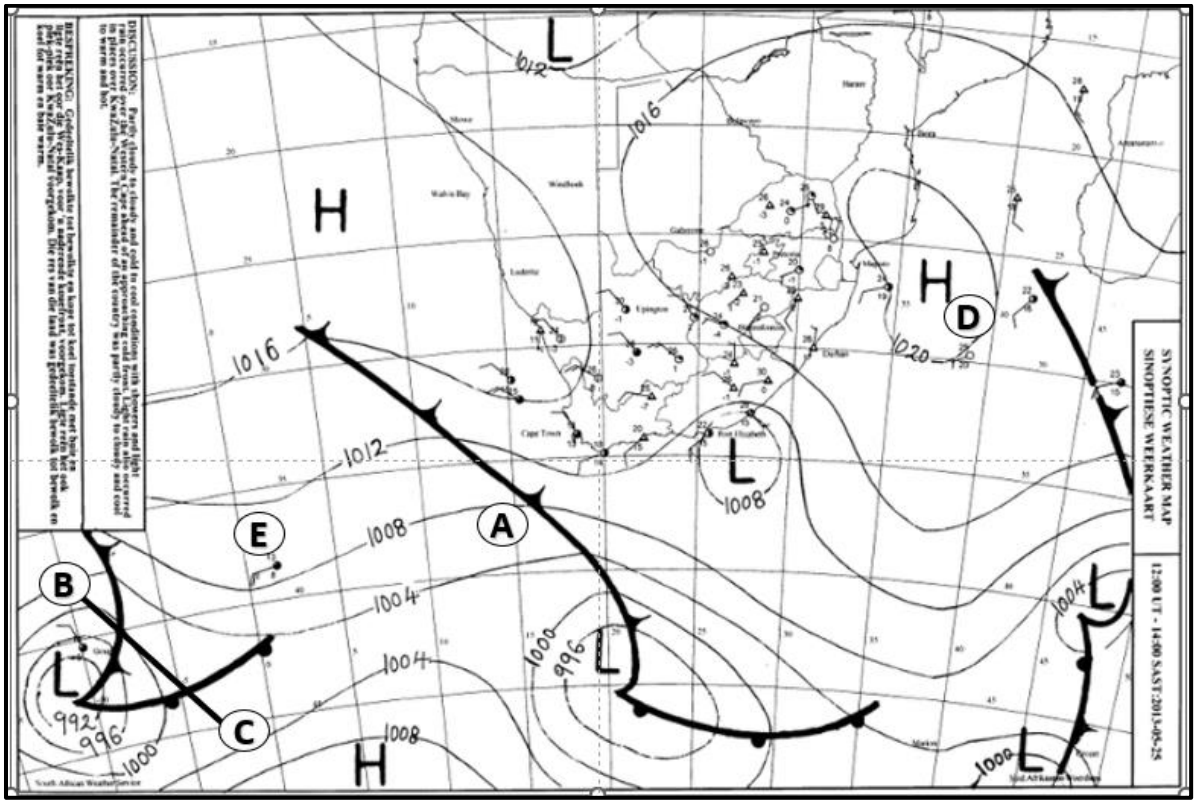
2.1.7 Give evidence that **C** is a cold front occlusion. (1x2) (2)

2.1.8 Explain how the cold front occlusion developed. (2x2) (4)

ACTIVITY 3 **30 minutes**

Refer to the synoptic map below

3.1



www.researchgate.net

3.1.1	Define the concept a family of cyclones.	(1x2)	(2)
3.1.2	Identify the area at **A**.	(1x1)	(1)
3.1.3	Draw a cross section of the midlatitude cyclone from **B** to **C**.	(2x2)	(4)
3.1.4	Explain the effect the high pressure at **D** has on midlatitude cyclones.	(1x2)	(2)
3.1.5	Predict the wind direction at the weather station E after a cold front has passed.	(1x2)	(2)
3.1.6	Discuss why heavy rainfall and cold weather has been predicted for Cape Town in the coming days.	(2x2)	(4)
			(15)

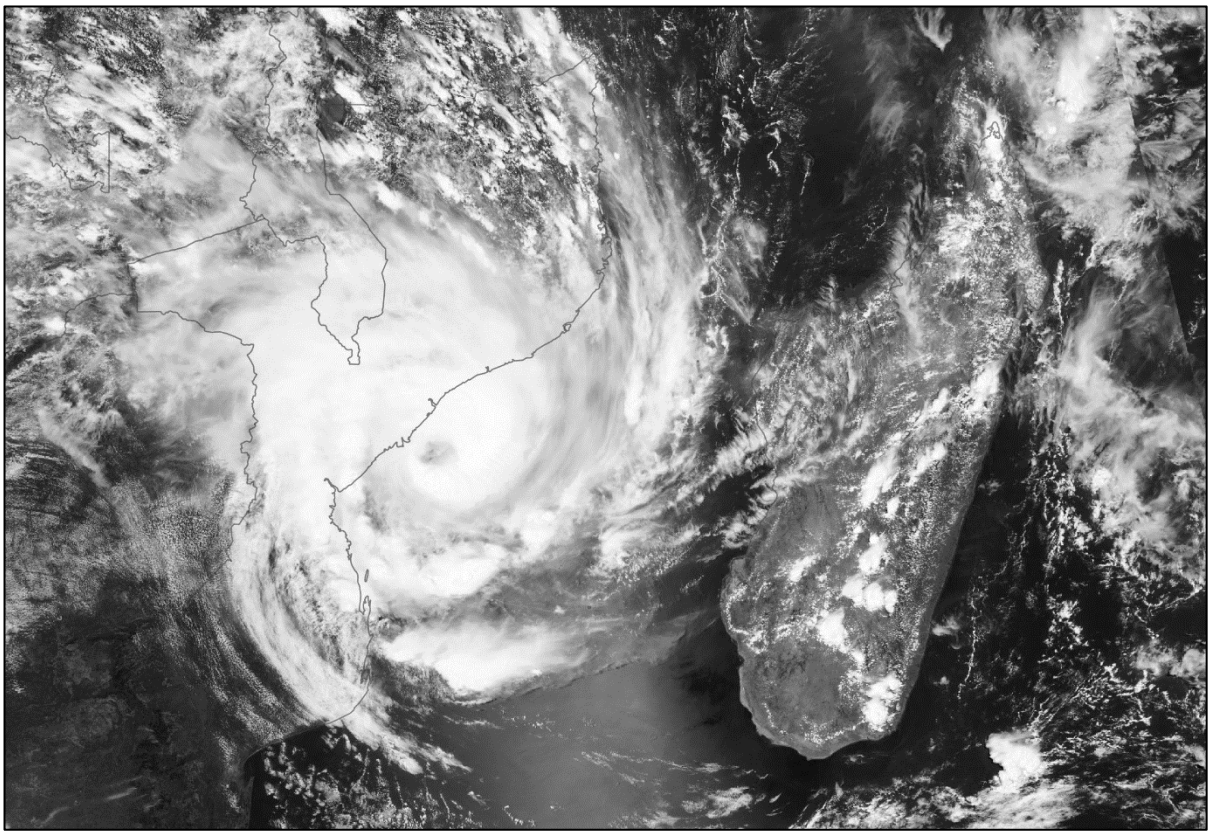
Tropical cyclones

- General characteristics
- Areas of formation and associated terms in different parts of the world
- Factors necessary for the formation

- Stages of development
- Associated weather patterns
- Cross-section through a tropical cyclone (interpretation)

- Impact on human activities (social and economic) and the environment (the impact of the weather associated with tropical cyclones)
- Pre-cautionary and management strategies to manage the effects of tropical cyclones.
- Identification on synoptic weather maps and satellite images:
- Identification of stages of development on synoptic weather maps Reading and interpretation of applicable weather symbols
- Case study of ONE recent tropical cyclone

Tropical cyclone Eloise January 22, 2021



IMPORTANT TERMS AND DEFINITIONS

Tropical Cyclone	A powerful, rotating storm system, around a low-pressure cell which develops over a warm ocean between the tropics.
Coriolis force	A force caused by the rotation of the earth which results in the deflection of the winds and ocean currents.
Eye	The calm area at the centre of a tropical cyclone
Eyewall	The walls of cumulonimbus cloud which surround the eye of a tropical cyclone.
Latent heat	The heat or energy that is released during condensation.
Stormsurge	Abnormal rise of water along the coast associated with a low-pressure system as a tropical cyclone.
Vortex	A mass of spinning air that attracts more air to its centre.
Waterspout	It is a weak tornado that forms at sea in association with the storm clouds of a tropical cyclone.

1.2.1

Factors necessary for the formation

The formation of tropical cyclones is strongly influenced by the temperature of the underlying ocean.

A sea temperature of 27° C.

Strong Coriolis Force.

Strong upper air divergence.

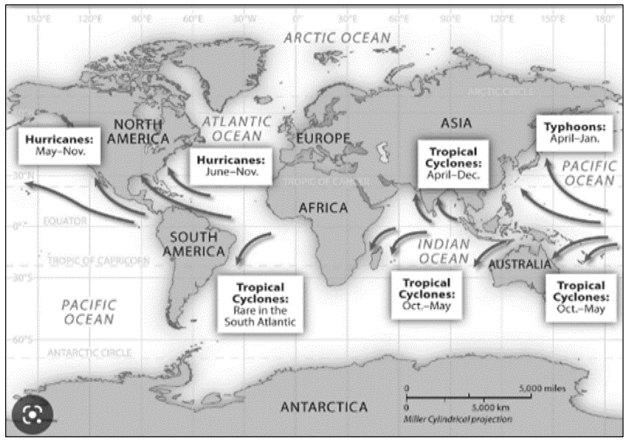
The hot air starts rising and forms an intense low pressure on the surface
The tropical jet stream in the upper air causes an upper air low pressure and this intensifies the low pressure on the surface.
Air is sucked into the low pressure.
Needs Coriolis forced to cause spiraling winds

Areas of formation and associated terms in different parts of the world

Tropical cyclones are also known as hurricanes in America; typhoons in China and Japan; and willy willies in Australia.

Over tropical oceans 5°–30° N and S

Do not occur between 0° to 5° N and S. because Coriolis force in weak.



General characteristics

They are given names alphabetically within the season in which they occurred. For example, ‘Alfred’ will denote that it is the first tropical cyclone to occur in that season.

Occur in Mid- to late summer, early autumn

Intense low-pressure system, below 1000 hPa.

Clockwise movement of air in Tropical Cyclone in the Southern Hemisphere.
Steep pressure gradient increases the wind speed.

Move from west to east within the tropical easterlies.

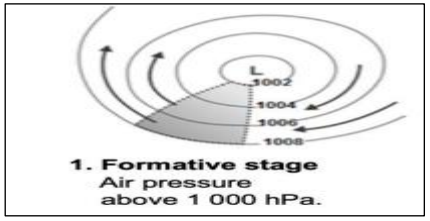
Winds up to 300km/h.

Eye develop in the centre of low pressure.
High Cumulonimbus clouds forms the eye wall.

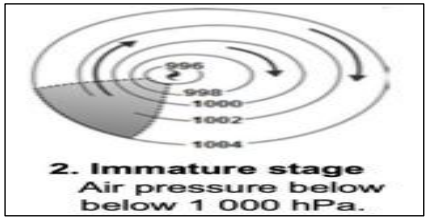
Heavy rainfall, hail, storm surges and hurricane winds
Affect the east coast of continents.

1.2.2 Stages of development

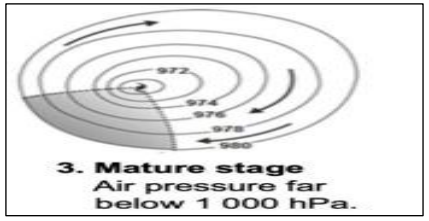
Formative	Immature	Mature	Dissipation
the cyclone has very strong up draughts and the low pressure intensifies.	Intensity of storm increases as air continue to coverge and rise in LP centre. Eye forms in centre of LP.	The pressure gradient is very strong and wind speeds reach hurricane strength. Fully developed eye.	When the tropical cyclone moves over land, the wind is slowed down by friction and there is less evaporation to cause unstable air conditions.
The cyclone is not very large yet and there is no clear eye yet.	Divergence takes place in upper atmosphere	The calm, clear eye is well developed, and the air pressure is less than 950hPa.	The cyclone also moves into cooler sub-tropical areas and the air pressure increases.
The winds start spiraling	Air pressure drops below 990hPa Wind speed increases to about 120 km/h.	The South Western quadrant is the most destructive as the winds and the Tropical Easterly winds are coinciding.	The weather clears up
	Huge cumulonumbus clouds forms the eyewall around the eye.	The cyclone can cover distances of up to 300km from the eye. The cyclone moves in a South Westerly direction from the equator and then turns South East at about 20º South.	



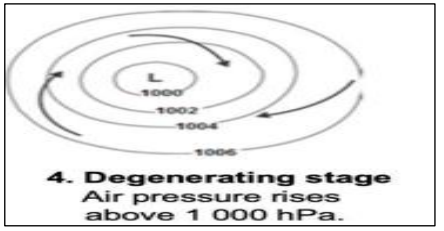
1. Formative stage
Air pressure above 1 000 hPa.



2. Immature stage
Air pressure below below 1 000 hPa.

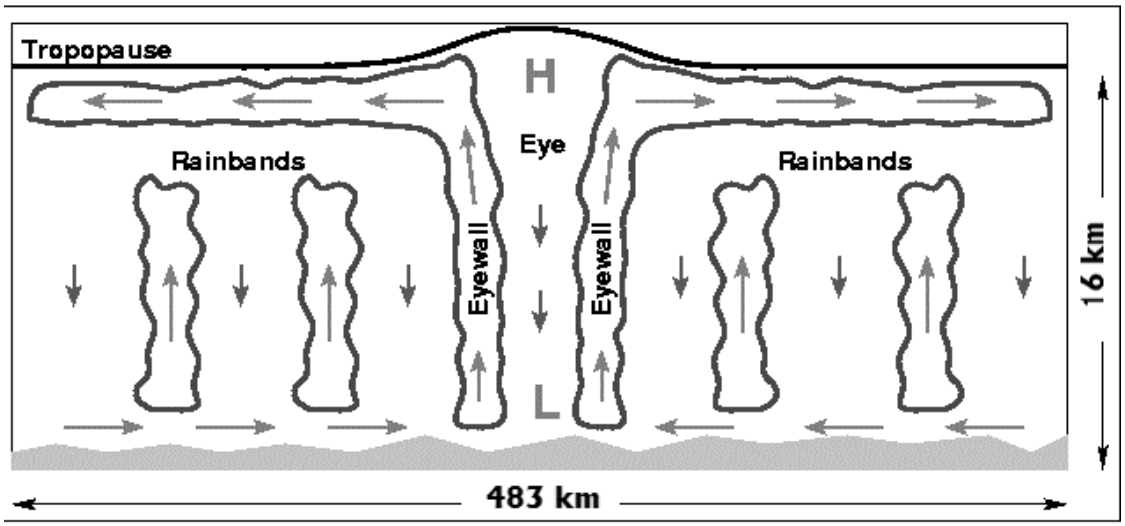


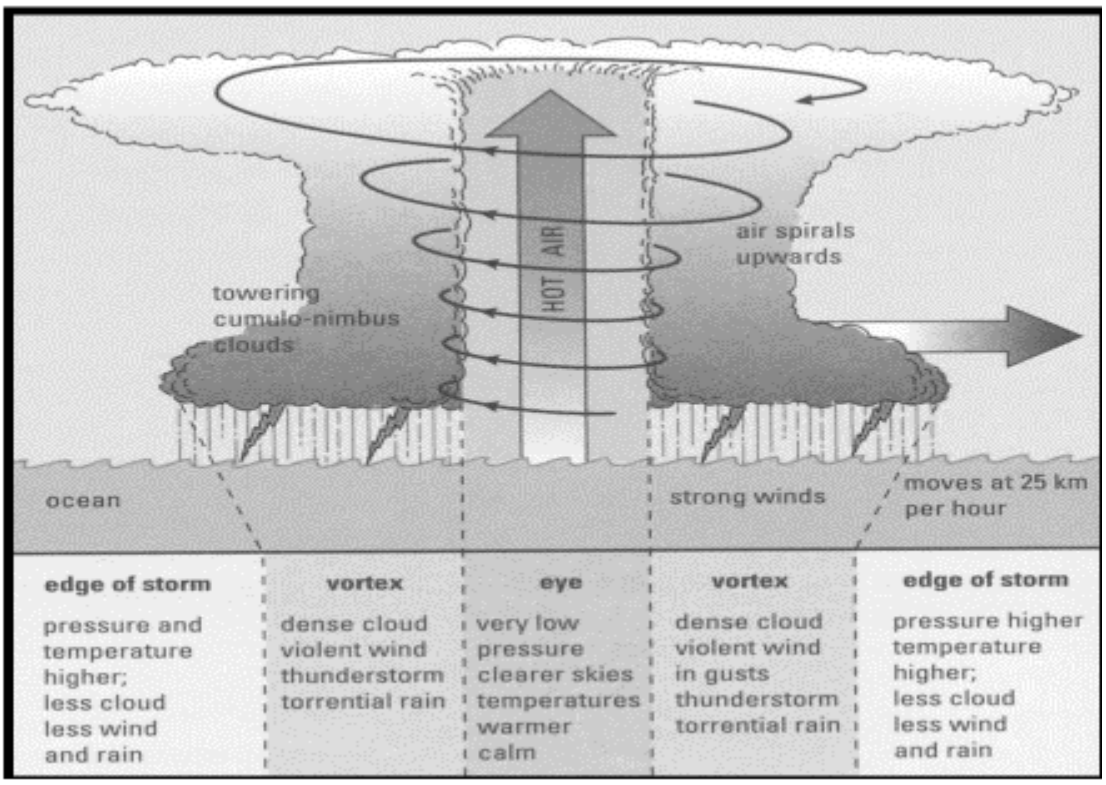
3. Mature stage
Air pressure far below 1 000 hPa.



4. Degenerating stage
Air pressure rises above 1 000 hPa.

1.2.3 Cross-section through a tropical cyclone





1.2.4 **Impact on human activities (social and economic) and the environment**

Humans

Torrential rain results in the risk of flooding.
Strong winds damage and shatter windows and rip off roofs.
Storm surges cause damage to the coastal areas.
Damage infrastructure. Roads and bridges washed away.
Loss and damage of homes.
Damaged water pipes result in lack of fresh water.
Wind and water damage power lines.
Deaths and injuries of people and animals because of wind, floods and storm surges.
Starvation because of lack of food.
Outbreak of diseases e.g. cholera, typhoid etc.
Major financial strain on families.
Subsistence farmers lose everything.
Swell of waves is dangerous for fisherman/humans

Environment

Strong winds cause storm surges which can cause rapid rise in sea-levels.
Floods and salt water destroy agricultural crops.
Flooding and rise in river levels because of rain can cause mudslides and landslides.
Destroy ecosystems and biodiversity.
Livestock drowns. /Lack of clean water.
Threatening of food security.
Damaged sewerage pipes result in pollution

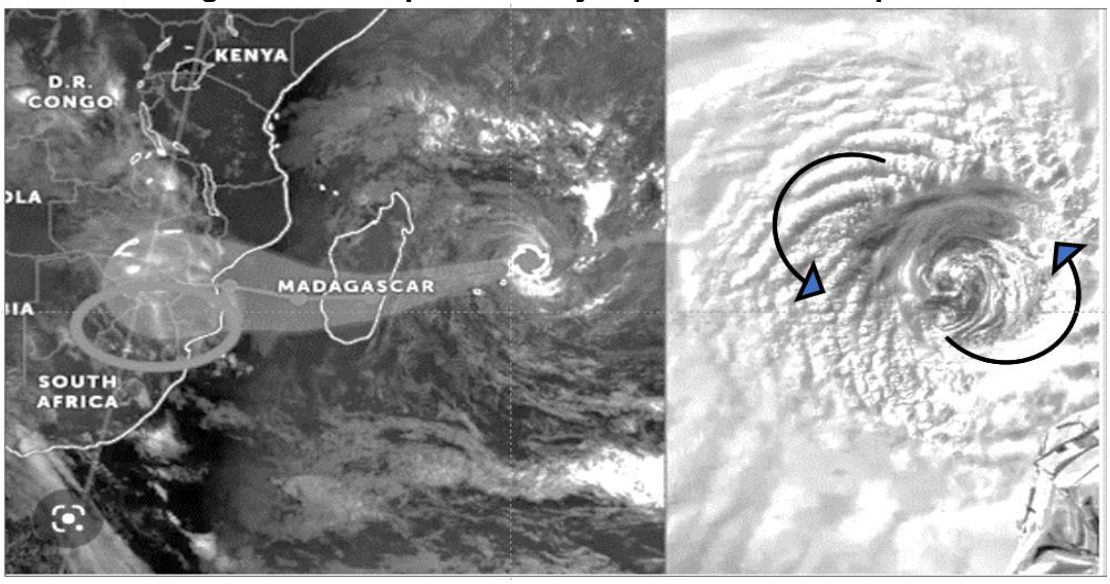
Economy

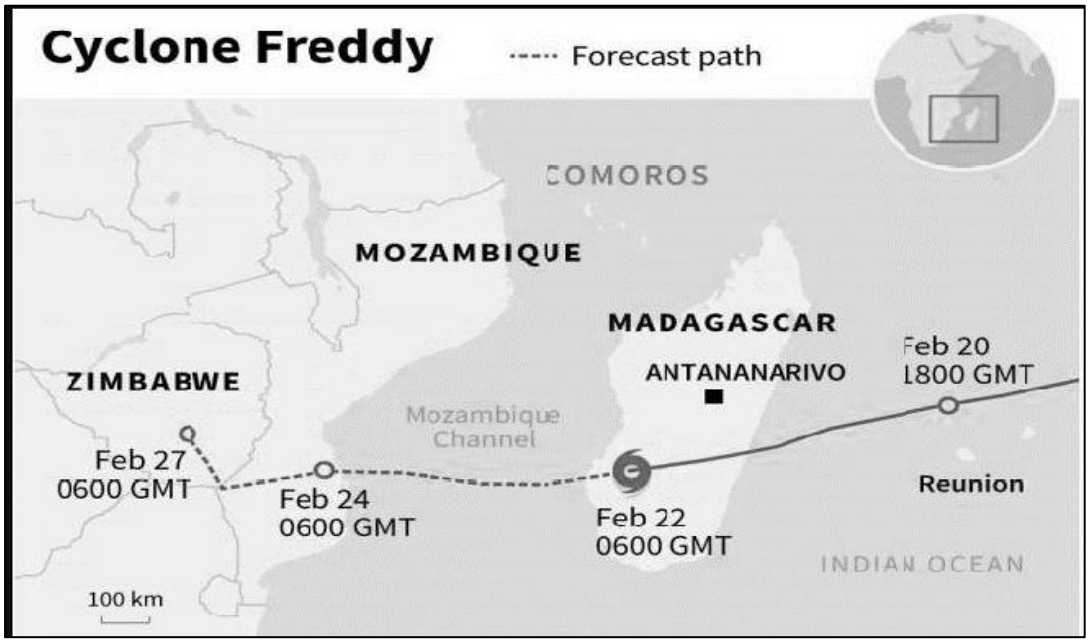
Airports are closed.
Damage harbor facilities.
Businesses are closed.
No trading is possible.
Costly to repair damages.
Job losses, unemployment
High medical expenses.
Costly insurance claims (business and personal).
Put a strain on local civic services.
Limits export. Increases imports (food and other commodities).

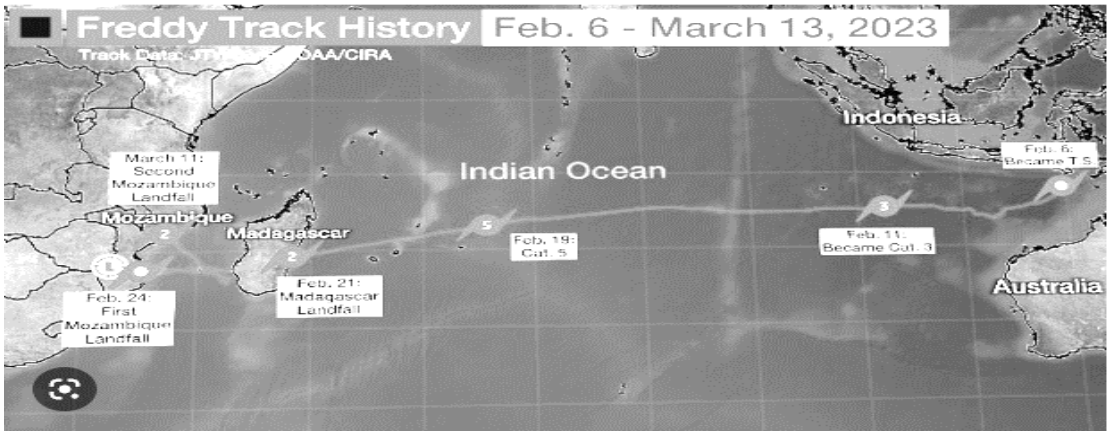
Pre-cautionary and management strategies to manage the effects of tropical cyclones

Monitoring the development of Tropical cyclones.
Satellite tracking can monitor the development and path.
Satellite censors to collect details e.g. rainfall rates.
Advanced weather predictions and warnings.
Early warning and communication for people to prepare.
Evacuate low lying areas to protect people against floods.
Ensure that infrastructure is of good quality.

Identification of stages of development on synoptic weather maps







Activity 3

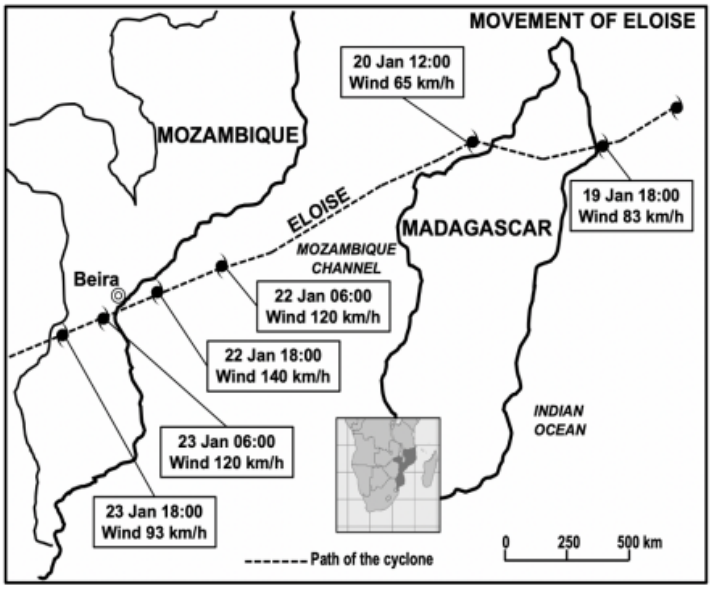
3.1 Study the infographic below

DESCRIPTION OF THE DISASTER

Tropical Cyclone Eloise made landfall on 23 January 2021, 20 km south of Beira in Mozambique, as a category 2 tropical cyclone. Wind speeds of up to 160 km/h were recorded. Tropical Cyclone Eloise also caused heavy rainfall with 250 mm of rain in 24 hours. Other areas were already flooded ahead of Eloise's landfall, resulting in thousands of displaced people.

ELOISE IN NUMBERS

Affected	441 686 people
Displaced people	42 327
Deaths	7
Injured	15
Houses destroyed	20 798
Houses damaged	35 566
Houses flooded	27 127
Impassable roads	63
Flooded areas	219 124 ha



3.1.1 Give ONE piece of evidence in the infographic that the tropical cyclone is in the Southern Hemisphere. (1x1) (1)

3.1.2 State TWO weather conditions associated with tropical cyclones indicated in the infographic. (2x1) (2)

3.1.3 Give ONE reason for the decrease in wind speed from 19 January to 20 January 2021. (1x2) (2)

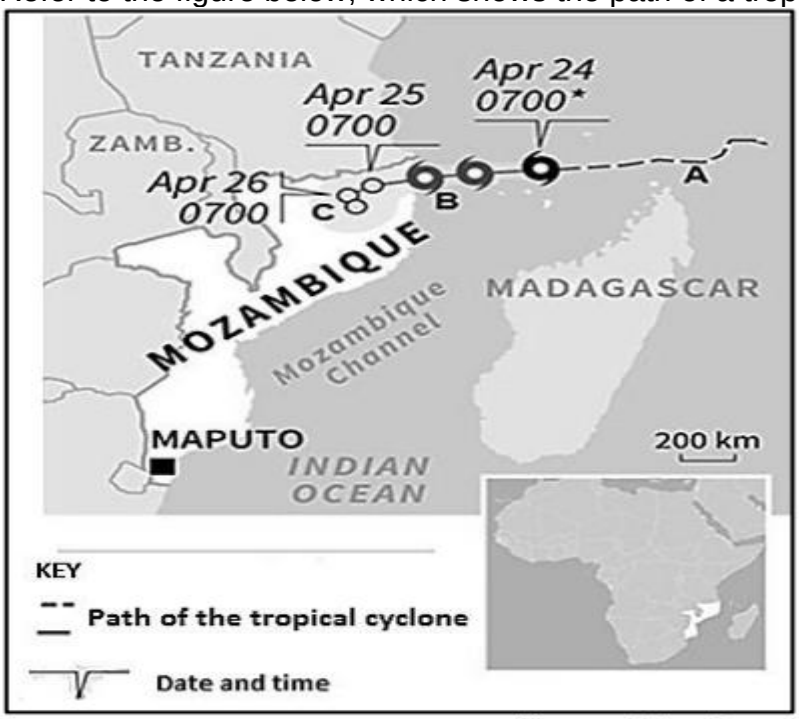
3.1.4 Account for the increase in wind speed of Tropical Cyclone Eloise from the 20 January to 22 January 2021. (2x2) (4)

3.1.5 According to the infographic the negative impact of Tropical Cyclone Eloise was devastating. Suggest THREE strategies that could be put in place to reduce this impact. (3x2) (6)

(15)

Activity 4

Refer to the figure below, which shows the path of a tropical cyclone.



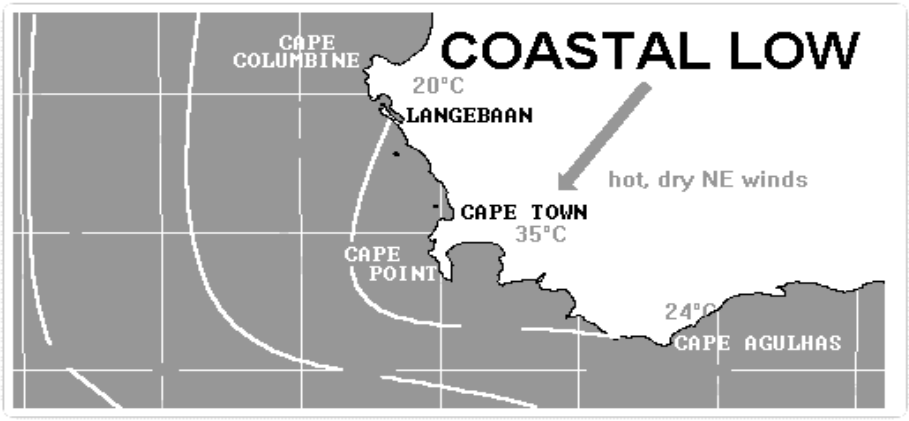
[Source: Meteo France]

4.1.1	Give evidence that this tropical cyclone is in the Southern Hemisphere.	(1x1)	(1)
4.1.2	Why is the Mozambique Channel usually ideal for the increase in temperature within the tropical cyclone?	(1x2)	(2)
4.1.3	Explain how the intensity of the tropical cyclone increased as it moved from area **A** to area **B**.	(2x2)	(4)
4.1.4	Discuss the conditions that could have caused the cyclone to weaken as it reached area **C**.	(2x2)	(4)
4.1.5	In a paragraph of not more than eight lines, evaluate the physical (natural) negative impact of tropical cyclones along the coastline of Mozambique.	(4x2)	(8)
			(19)

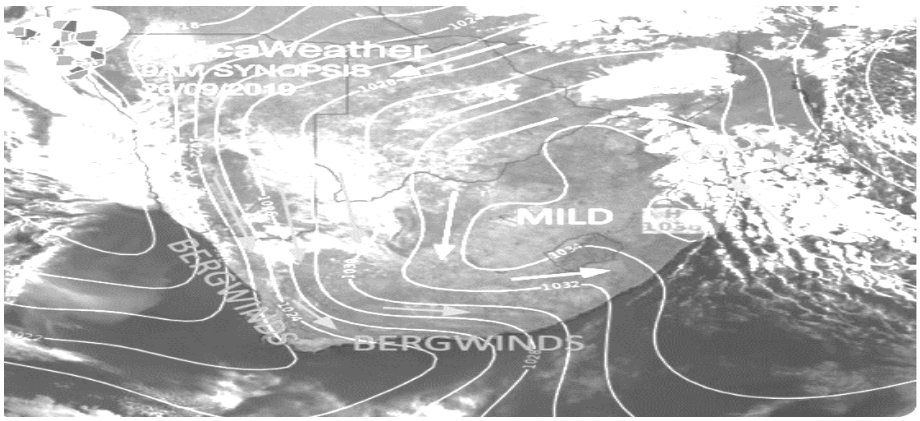
Development of travelling disturbances associated with anticyclonic circulation examination guidelines

Moisture front and line thunderstorms
Coastal low pressure
South African berg wind
Resultant weather and impact (and strategies to reduce the impact) associated with moving disturbances
Identification of moving disturbances on synoptic weather maps and satellite images
Reading and interpretation of synoptic weather maps and satellite images that illustrate weather associated with anticyclonic conditions

Berg Winds
Coastal Low



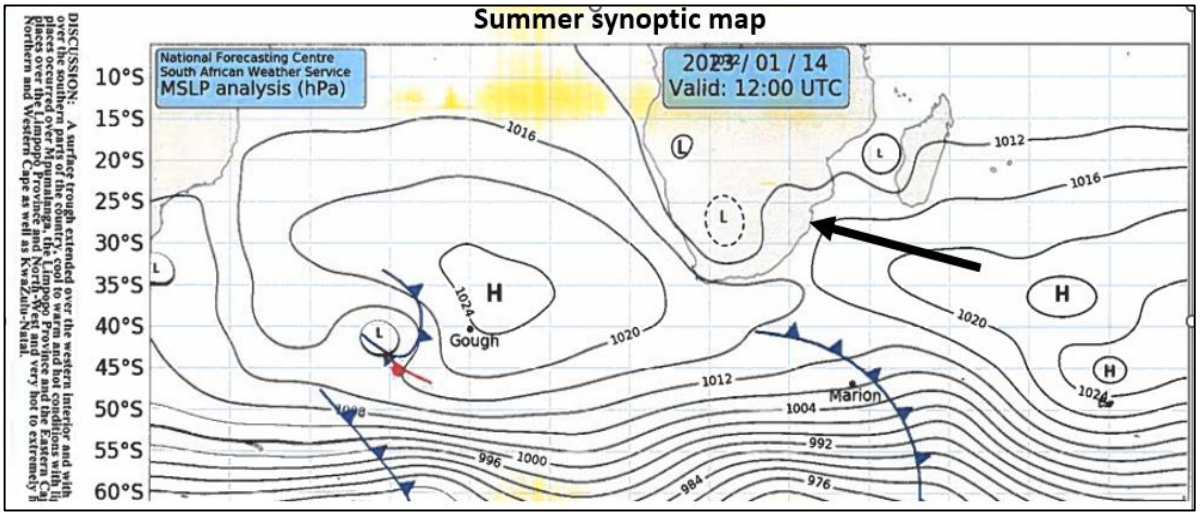
Berg Winds



IMPORTANT TERMS AND DEFINITIONS

Adiabatic heating	Heating which occurs when the air is compressed.
Berg wind	A local wind that blows down the escarpment from the plateau to the coast, bringing hot, dry weather.
Coastal low	A localised low-pressure system that brings changeable weather to a coastal region.
Cut-off low	A low-pressure cell which has become completely displaced over the land and moves independently of any air around it.
Line thunderstorm	Summer storms that occur when a trough of low pressure develops over the interior between the thermal low and coastal low.
Ridge	An extension of a high-pressure cell when the isobars extend along the east -west axis. This happens when the south Atlantic high sometimes extends behind a passing cold front in winter or around the southern tip of South Africa in summer.
Trough	Occurs between two low pressure cells or an extension of a low pressure cell.

Summer Weather Conditions:



- The Kalahari high pressure system lifts due to continental heating.
- This allows the moist tropical air masses to bring in humid air over the interior which causes summer rain over the interior
- The Indian Ocean and Atlantic Ocean high pressure systems are situated more southward of the country.
- A trough of low pressure is positioned over the central and eastern parts of the country with moisture being advected from the tropical Indian Ocean anticyclone which results in greater rainfall towards the eastern parts of the country and less towards the west

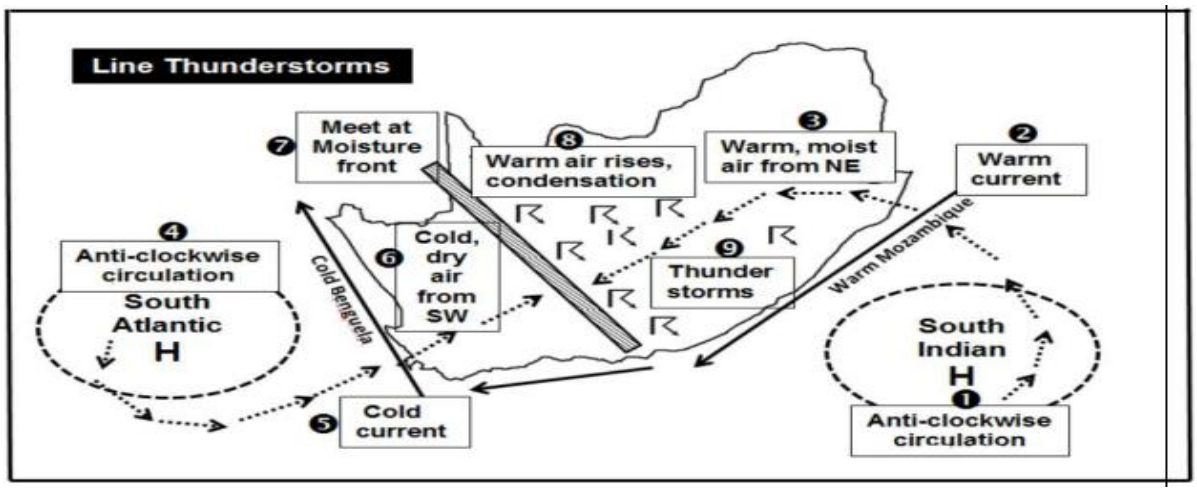
Line Thunderstorms/ The Moisture Front

The moisture front develops where the **cool dry air from the South West** pushed into the country from the South Atlantic HP **meets** the **warm moist air from the North East** (South Indian HP).

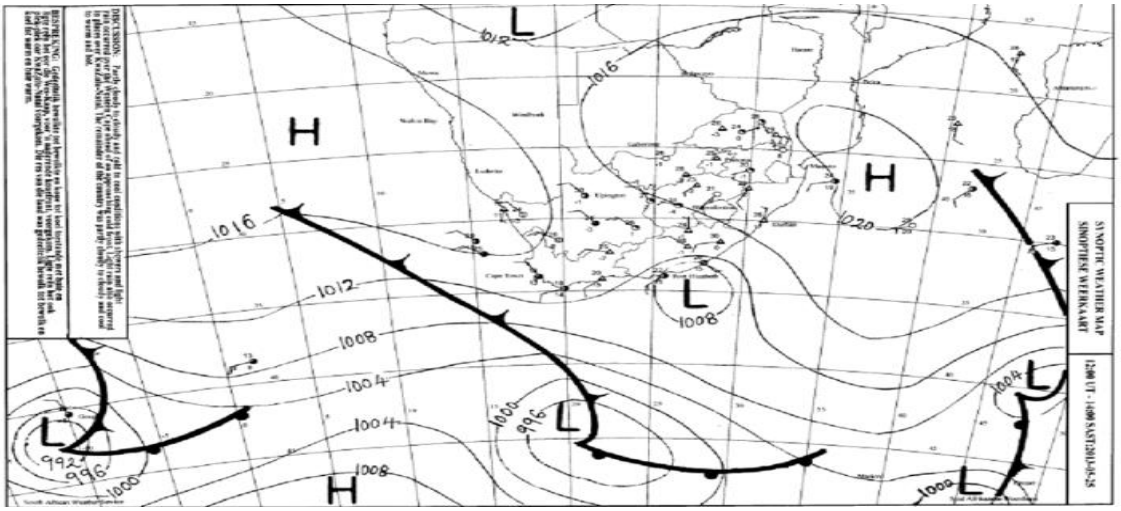
The cool air lifts the warm air and line thunderstorms develop along this boundary

Moisture front develops in summer when the land heats up enough to cause low pressure cells in the interior of the country.

Thunderstorms will form in a line which can extend laterally for hundreds of kilometres**.**



Winter Weather Conditions

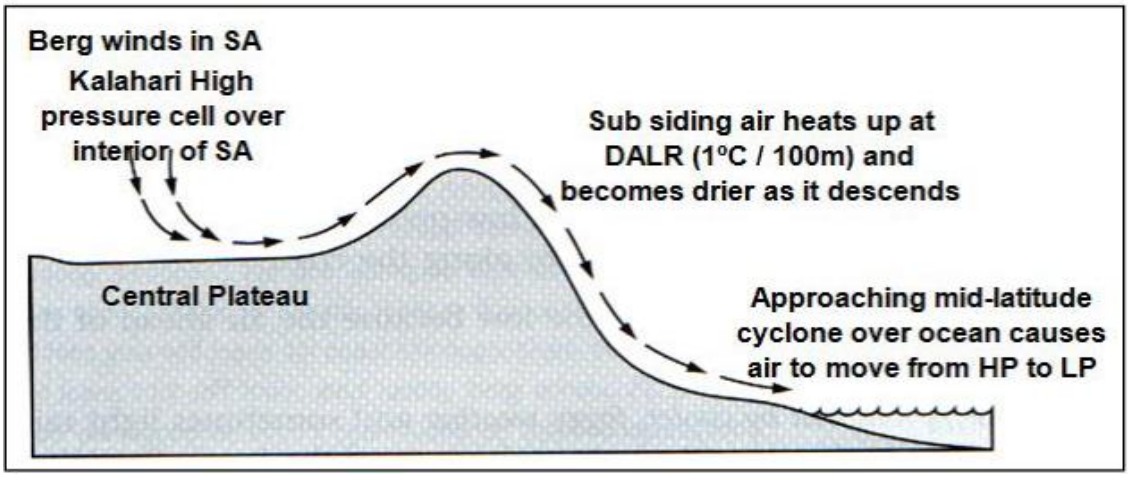


No rain occurs over the interior in winter.

- The South Indian and South Atlantic high pressure systems shift northwards and merge over the country during winter,
- There are largely dry conditions over much of the country.
- Cold fronts, moving mostly over the southern half of South Africa together with the ridging of the South Atlantic high-pressure system behind the cold front cause rain, strong winds and gusts during winter over the south western and southern parts of the country.

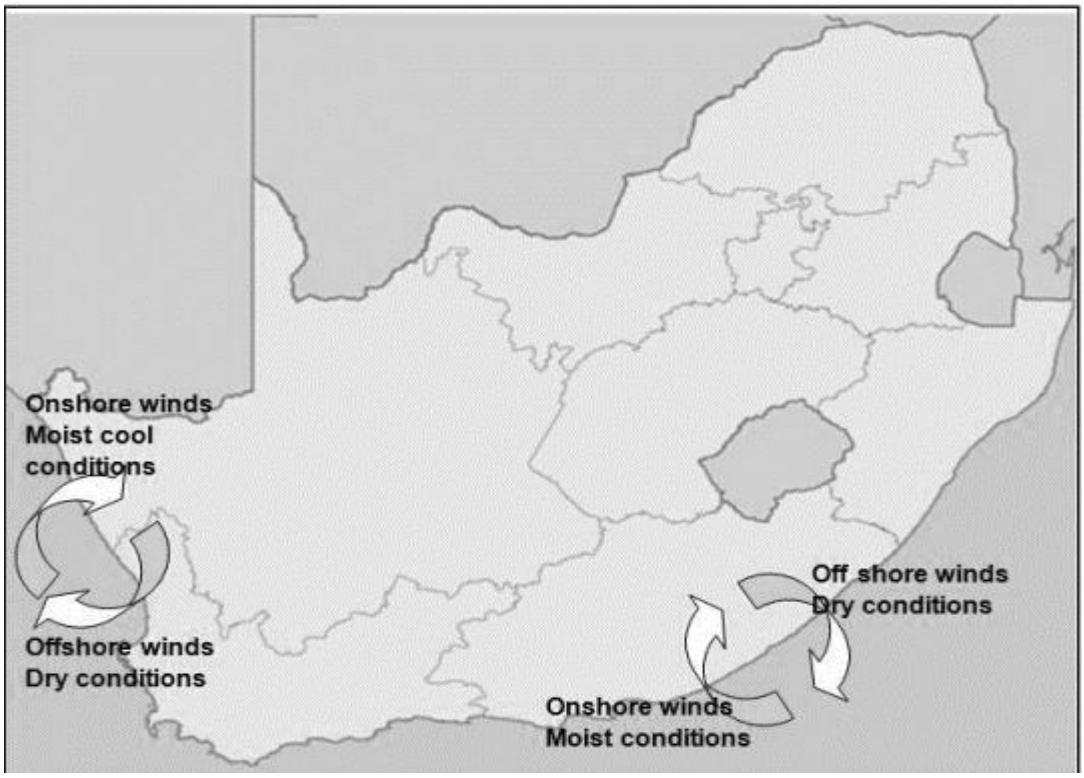
Ber Winds

- Ahead of the mid latitude cyclone, berg wind conditions occur.
- Air blows from the Kalahari High Pressure cell to the costal low pressure
- As the air subsides from the plateau and down the escarpment, it heats at Dry Adiabatic temperature lapse rate and **become drier and hotter**.
- This causes hot dry uncomfortable conditions which is generally replaced quickly with cold conditions associated with the cold front.
- It causes veld fires.



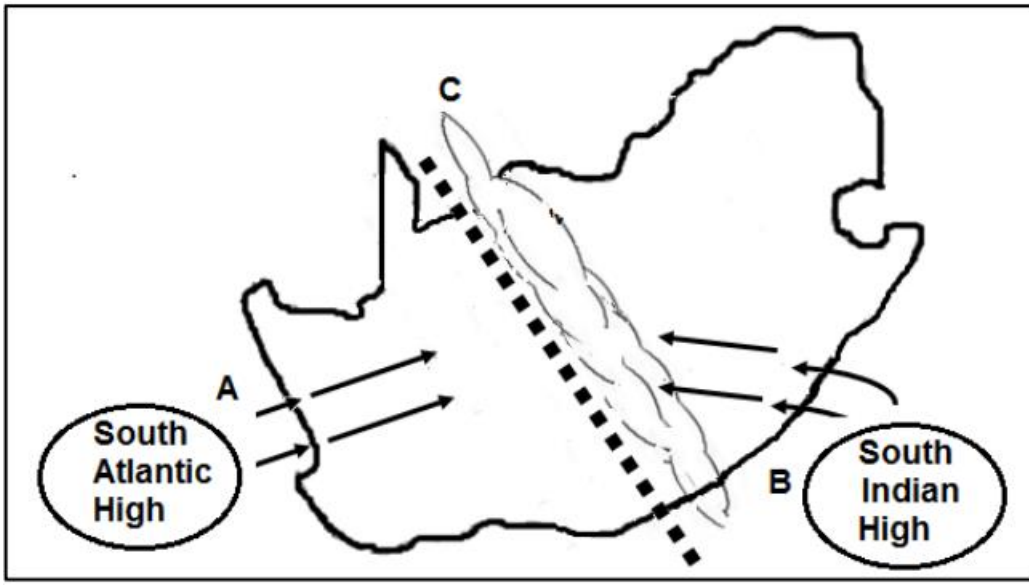
Coastal Low-Pressure Systems

- Coastal Low-pressure systems develop during summer and winter in SA
- The air moves in a clockwise direction around the cell.
- On the **southern** side of the pressure cell, air will move from the land to the sea (**offshore winds**) and will cause warmer drier conditions.
- On the **northern** side of the pressure cell where the air move from the sea to the land (**on shore winds),** moist cloudy conditions will develop that can lead to precipitation along the coastline



ACTIVITY 5

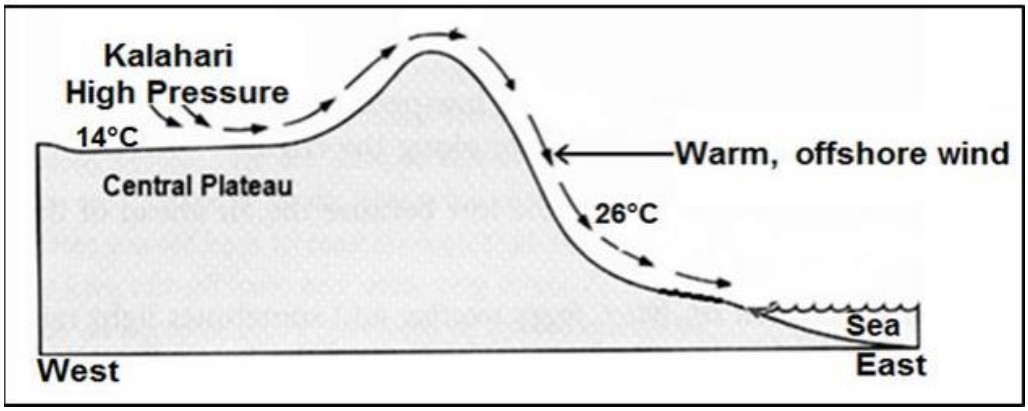
FIGURE below shows the presence of a line thunderstorm across South Africa.



5.1.1	Does the line thunderstorm obtain its source of moisture from ocean **A or B?**	(1x1)	(1)
5.1.2	Why is cold, dry air fed in from the South Atlantic High-Pressure Cell?	(1x2)	(2)
5.1.3	Explain how the formation of the moisture front at C results in line thunderstorms.	(2x2)	(4)
5.1.4	In a paragraph of approximately EIGHT lines, explain the destructive (harmful) nature of line thunderstorms	(4x2)	(8)
			(15)

Activity 6

Study the sketch on berg winds below



6.1.1	Name the season in which South African berg winds develop.	(1x1)	(1)
6.1.2	Give TWO pieces of evidence in the sketch to support your answer to QUESTION 6.1.1.	(2x1)	(2)
6.1.3	Why are berg winds described as being dry?	(1x2)	(2)
6.1.4	What causes the South African berg wind to be a warm offshore wind?	(1x2)	(2)
6.1.5	How does a steep pressure gradient influence South African berg winds?	(2x2)	(4)
6.1.6	Why are emergency services (fire brigades, ambulances and traffic police) placed on high alert (standby) when berg wind conditions occur?	(2x2)	(4)

Drainage basins in South Africa

Concepts (definition, identification, and application) of:

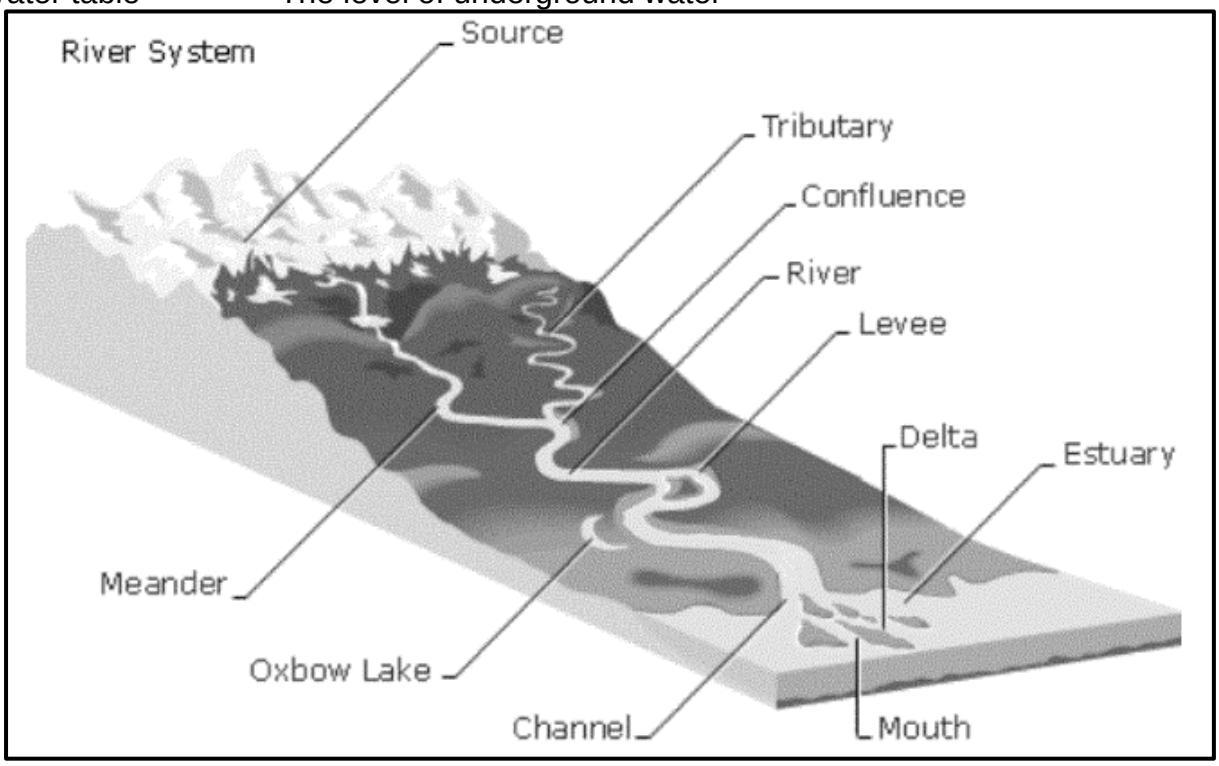
Types of rivers (definition, identification, and application

Identification, underlying rock structure, development and characteristics of the drainage patterns:

Identification, description, formation and significance and impact of fluvial landforms/features

IMPORTANT TERMS AND DEFINITIONS

Drainage basin	an entire river system or an area drained by a river and its tributaries.
Catchment area	an area of land where water collects when it rains, often bounded by hills. As the water flows over the landscape it finds its way into streams and down into the soil, eventually feeding the river.
River system	A river system includes the river, all its tributaries, and any groundwater resources in the area.
Tributary	freshwater stream that feeds into a larger stream, river.
Confluence	The point where a tributary joins a larger river,
Watershed	High lying area diving two drainage basins
Interfluve	an area of higher ground between two rivers in the same drainage system.
Source	the place where a river begins
River mouth	The place where a river enters a lake, larger river, or the ocean
Surface run-off	is the unconfined flow of water over the ground surface
Infiltration	the process by which water on the ground surface enters the soil.
Groundwater	the water present beneath Earth's surface in rock and soil pore spaces and in the fractures of rock formations.
Water table	The level of underground water



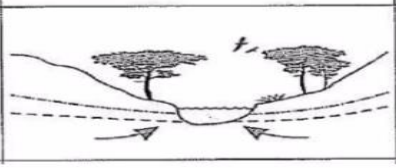
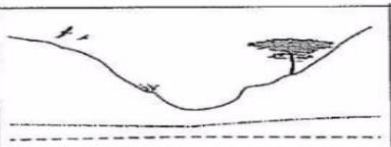
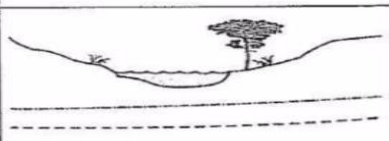
Types of Rivers

Permanent rivers are always flowing even if the level fluctuates. This is common in wet areas. These rivers mostly run into the sea. Only half South Africa's rivers are permanent.

Periodic rivers fed by groundwater only in the rainy season when the water table is higher than the level of the riverbed. These are seasonal rivers.
Common in drier areas. Many periodic rivers never reach the sea but can empty into inland drainage basins.

Episodic rivers never receive groundwater and only flow when there is an episode of heavy rain.

Exotic rivers These are rivers that flow through arid (desert) regions. flows from a wet area and then through a dry area

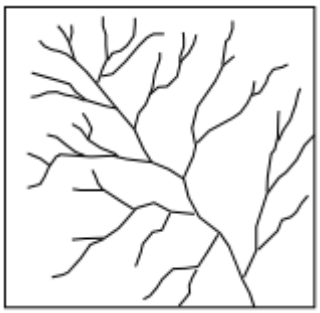
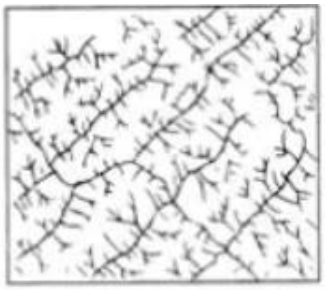
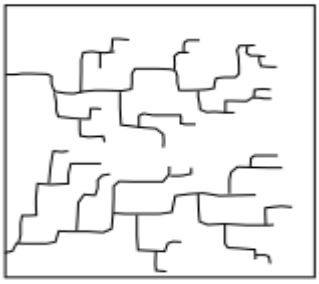
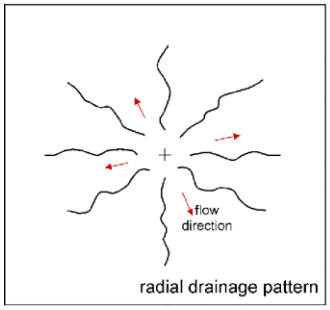
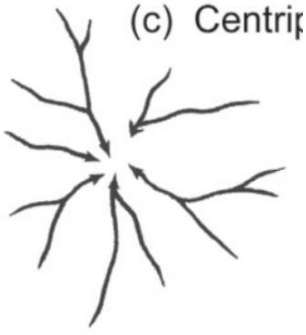
Type	Cross-profile*	Description
Permanent		The river channel intersects both the wet and dry season water table. The river will flow throughout the year. Example - most rivers along the East Coast of SA.
Episodic		The river channel does not intersect either wet or dry season water table and only flows during heavy rains and flash flooding.
Exotic		The river's water source is in a wet area. This supply of water allows the river to flow through drier areas throughout the year. Example - The Gariep River near Upington.

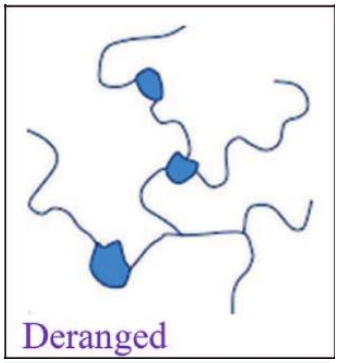
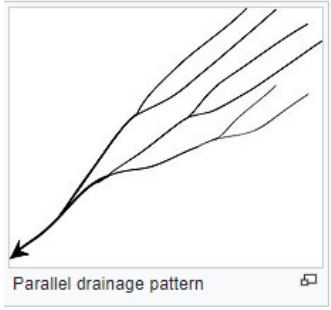
Base flow Underground water seeping into the river.
Water table Upper surface of the zone of saturation in the underlying rocks.
Wet season The time of year when it normally rains in a particular area.
Dry season Season of the year when it does not normally rain in a particular area.
Cross-profile The shape of the river channel from bank to bank.

Wet season water table
Dry season water table
Seeping into the ground water channel as base flow

Orange River Rivers

Drainage patterns

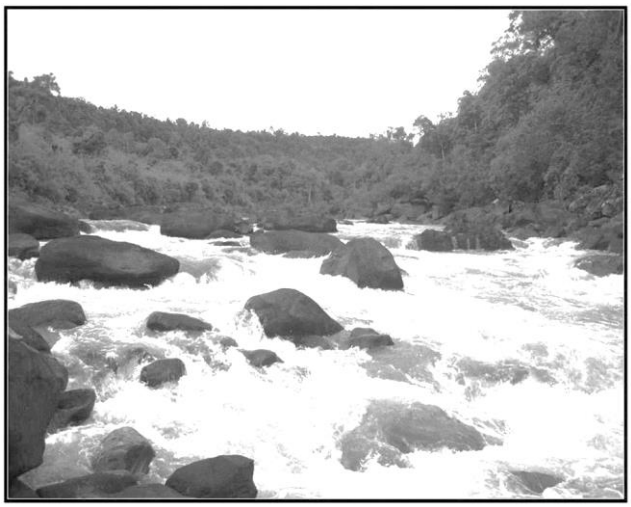
Pattern	Identification	Description	Underlying structure
Dendritic		Tributaries join the main stream at acute angles. Resembles the branches of a tree.	They develop on a land surface where the underlying rock is of uniform resistance to erosion.
Trellis		Tributaries join the mainstream at right angles. Main streams are parallel to each other	Occurs in areas of folded sedimentary rocks. Occurs in areas where hard rocks and soft rocks alternate.
Rectangular		The mainstream displays right-angle bends	Develop where linear zones of weakness, such as joints or faults cause the streams to cut down along the weak areas in the rock.
Radial		Streams radiate from a central point.	develop surrounding areas of high topography where elevation drops from a central high area to surrounding low areas. Deleop on a dome structure
Centripetal		Streams converge into a low-lying area. rivers discharge their waters from all directions in a lake or depression	Basin like structure

Deranged		Streams have irregular patterns. Tributaries do not link up with the main stream	Occur in regions subjected to glaciation
Parallel		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.	A parallel drainage system occurs on elongate landforms like outcropping resistant rock bands), typically following natural faults or erosion (such as prevailing wind scars)

FLUVIAL LANDFORMS

Landforms or features found along the river course that are a result of the fluvial processes

RAPIDS



stretches of fast-flowing water tumbling over a rocky-shallow riverbed.

They are formed when the water goes from one hard rock that resists the water's erosion to a softer rock that is easier eroded.

Used for recreation (river rafting)
Tourist attractions

WATERFALLS o

An area where water flows over a vertical or steep drop in the course of a stream or river
It forms when there are horizontal bands of resistant rock (hard rock) positioned over exposed, less resistant rock (soft rock).

The strong currents near falls are often used to generate electricity.
Waterfalls are sometimes a disadvantage since they form a barrier to infrastructure development.
Waterfalls attract tourists.
Waterfalls are aesthetically pleasing.
Waterfalls also provide opportunities for a wide range of, sometimes incompatible, outdoor leisure activities

FLOODPLAINS

The flat area bordering a river, composed of sediment deposited during flooding

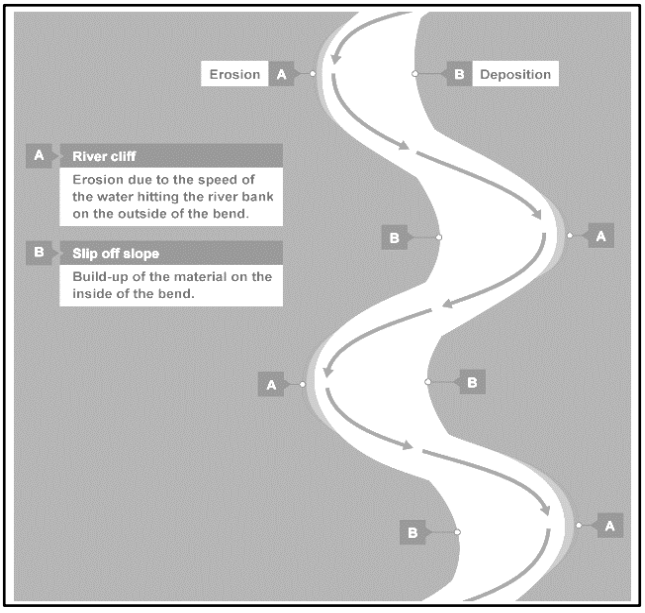
Floodplains form due to mainly deposition.
Because of the gentle gradient, there is more deposition occurring.

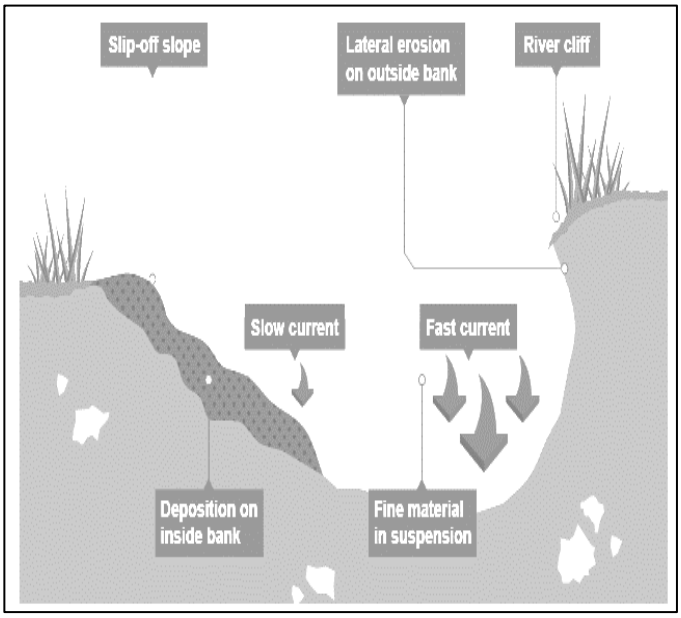
Floodplains provide fertile land for agriculture.
Easy to construct infrastructure.
Flat area is heavily populated.
Settlements develop.
Tourist attraction
Source of water for economic and domestic purposes
They are beneficial for wildlife by creating a variety of habitats for fish and other animals.

It preserves water quality by continuous refreshing due to flooding.
It provided numerous recreational opportunities
Not ideal for settlements as they may be destroyed during times of flooding

MEANDERS

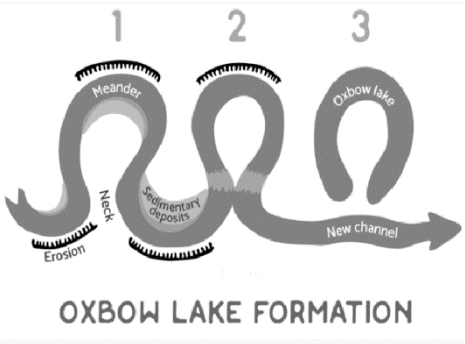
Rivers flowing over gently sloping ground begin to curve back and forth across the landscape
In the middle course the river has more energy and a high volume of water as a result of tributaries joining
Lateral (sideways) erosion starts to widen the river channel.
As the river erodes laterally (to the 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





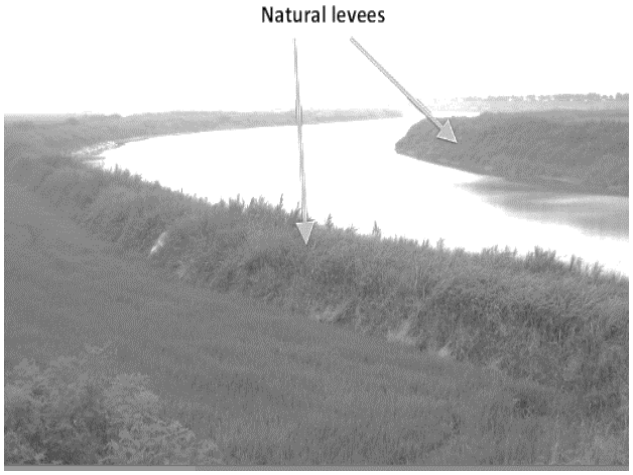
Oxbow lake

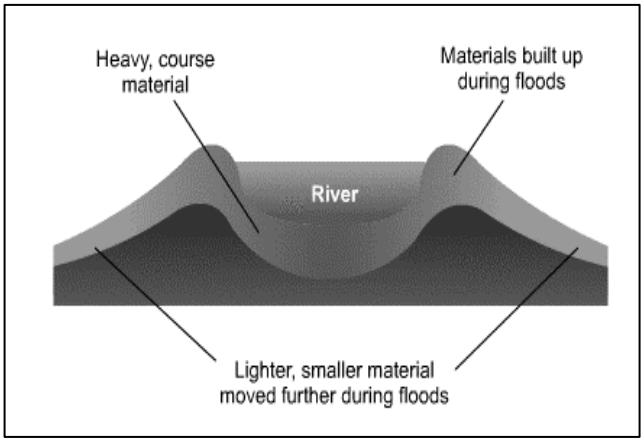
The cut-off loop of a meander filled with water.



Over time the meander loop becomes tighter, until the ends become very close together.
As the river breaks through, e.g. during a flood when the river has a higher discharge and more energy, and the ends join, the loop is cut-off from the main channel.
Some cities are located in and around meanders for trade purposes. Boats and barges can access the town to some extent for some trade.
Oxbow lakes can be rich wildlife habitats.
Can be utilised for agricultural purposes especially crop farming.
Tourist attractions

Natural Levees





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 riverbanks.
Continuous flooding causes repeated deposition on the riverbanks.
The banks form levees made of sediment, silt, and other materials.

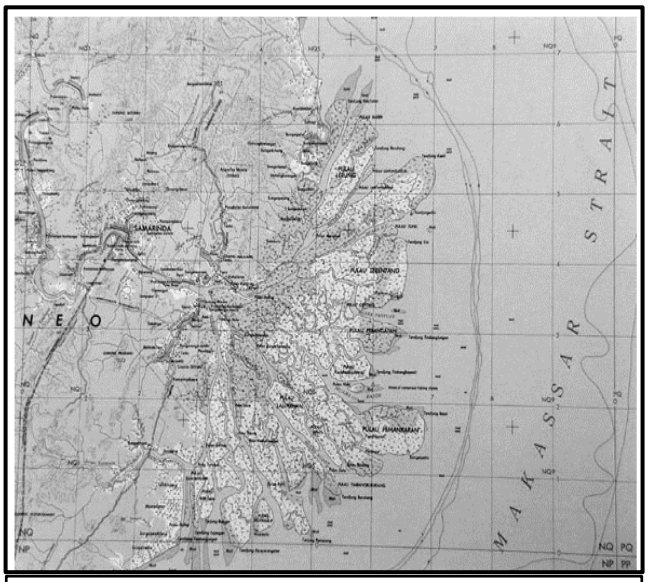
They prevent rivers from flooding.
Levees are usually parallel to the way the river flows, so levees can help direct the flow of the river.
Levees can also provide a measure of protection from invaders.
Fertile soil near levees is suitable for farming.
Levees may be used to increase available land for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

BRAIDED STREAMS

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

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.
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

DELTAS



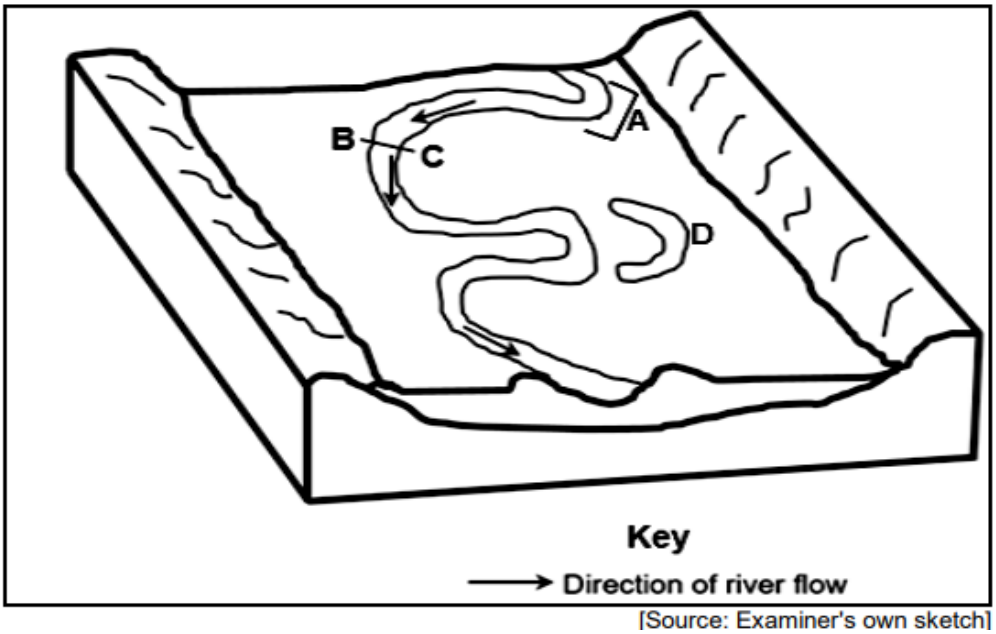
It is landform at the mouth of a river, where different channels (distributaries) of the same river flow into an ocean or sea.

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.

Sand and gravel are 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)
Deltas are usually highly fertile areas and support extensive crop cultivation

Activity 7

Refer to the sketch on fluvial landforms below

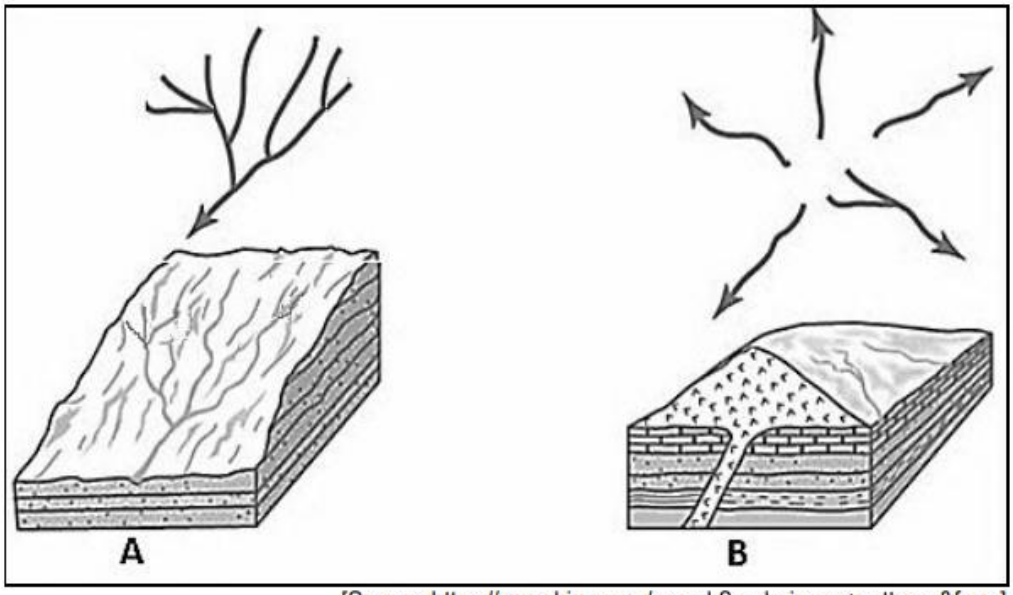


[Source: Examiner's own sketch]

7.1.1	The fluvial landforms, illustrated in the sketch, are mainly found in the (middle/lower) course.	(1x1)	(1)
7.1.2	Identify fluvial landform **A** on the sketch.	(1x1)	(1)
7.1.3	Draw a rough cross-section from **B** to **C**.	(2x1)	(2)
7.1.4	Will erosion take place at **B** or **C**?	(1x1)	(1)
7.1.5	Give a reason for your answer to QUESTION 7.1.4.	(1x2)	(2)
7.1.6	In a paragraph of approximately EIGHT lines, describe the processes that resulted in the change of fluvial landform A to an ox-bow lake at **D.**	(4x2)	(8)

Activity 8

Figure below illustrates drainage patterns.

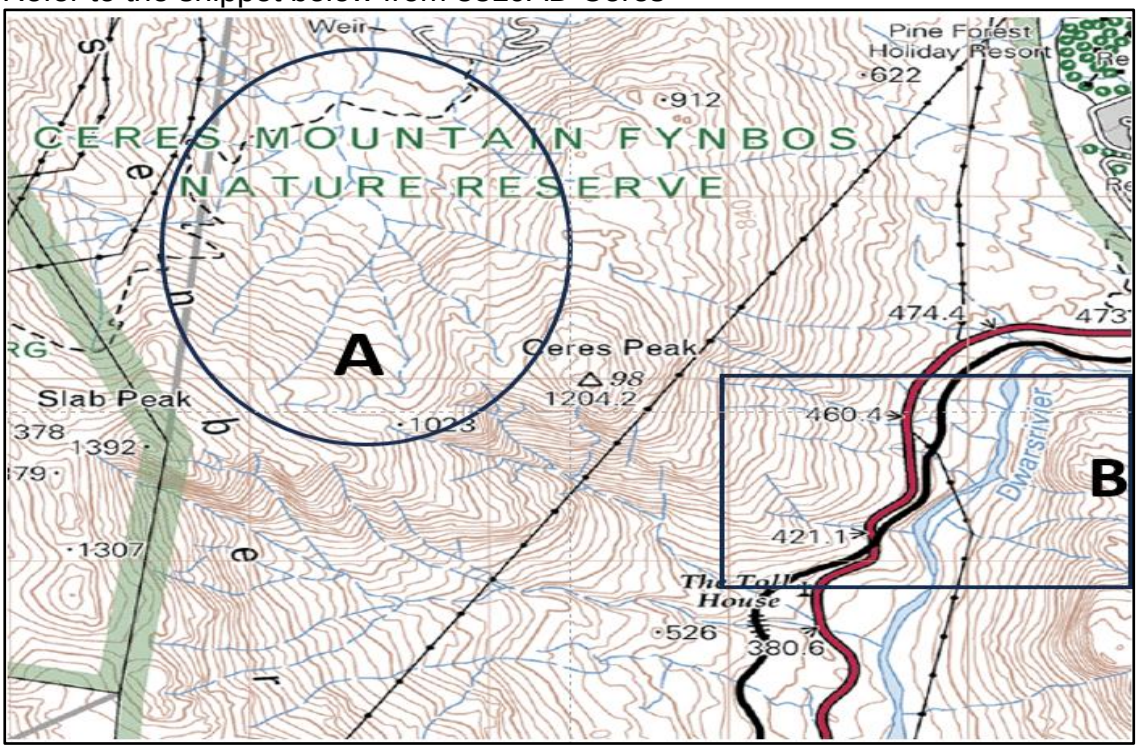


[Source: https://www.bing.com/search?q=drainage+patterns&form]

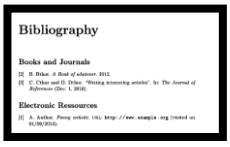
8.1.1	Define the concept drainage pattern.	(1x1)	(1)
8.1.2	Identify drainage patterns **A** and **B**	(2x1)	(2)
8.1.3	Give TWO characteristics of drainage pattern **A** evident in figure above.	(2x1)	(2)
8.1.4	How does the volcanic landscape in sketch result in drainage pattern **B**?	(1x2)	(2)
8.1.5	Why is drainage pattern **A** more suitable for settlements?	(2x2)	(4)
8.1.6	Explain how the characteristics of the underlying rock structure result in the formation of drainage patterns **A** and **B.**	(2x2)	(4)

Activity 9

Refer to the snippet below from 3319AD Ceres



9.1.1	Explain the concept drainage pattern.	(1x1)	(1)
9.1.2	Identify the drainage pattern found in the area demarcated **A**.	(1x1)	(1)
9.1.3	What is the height of Ceres Peak at the center of the mapped area?	(1x1)	()
9.1.4	Describe the rock structure underlying the drainage pattern at **A**.	(1x2)	(2)
9.1.5	Calculate the average gradient of the slope from **trigonometrical beacon 98** and the **benchmark 421.1** on the national road.	(4x1)	(4)
9.1.6	Which data layers have been integrated in the rectangle marked **B** on the map?	(3x1)	(3)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