



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MARINE SCIENCES P1

NOVEMBER 2025

MARKS: 150

TIME: 2½ hours

This question paper consists of 17 pages.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of THREE sections. Answer the questions as follows:

SECTION A: COMPULSORY
SECTION B: COMPULSORY
Consists of QUESTIONS 2 and 3.
Answer BOTH questions in this section.
SECTION C: Consists of QUESTIONS 4 and 5.
It is COMPULSORY to answer ONLY ONE of the two questions in this section.
2. Write ALL the answers in the ANSWER BOOK.
3. Start the answers to EACH question at the top of a NEW page.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Present your answers according to the instructions of each question.
6. Do ALL drawings in pencil and label them in blue or black ink.
7. Draw diagrams, tables or flow charts only when asked to do so.
8. The diagrams in this question paper are NOT necessarily drawn to scale.
9. Do NOT use graph paper.
10. You must use a non-programmable calculator, protractor and a compass, where necessary.
11. Round off your FINAL numerical answers to TWO decimal places, where applicable.
12. Do NOT write outside of the margins in the ANSWER BOOK.
13. Write neatly and legibly.

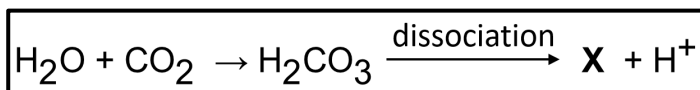
SECTION A**QUESTION 1**

1.1 Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question numbers (1.1.1 to 1.1.10) in the ANSWER BOOK, e.g. 1.1.11 D.

1.1.1 An example of soft engineering:

- A Granite extensions out into the sea
- B Structures built with concrete
- C Geotextile tubes at artificial reefs
- D Stone barriers around harbours

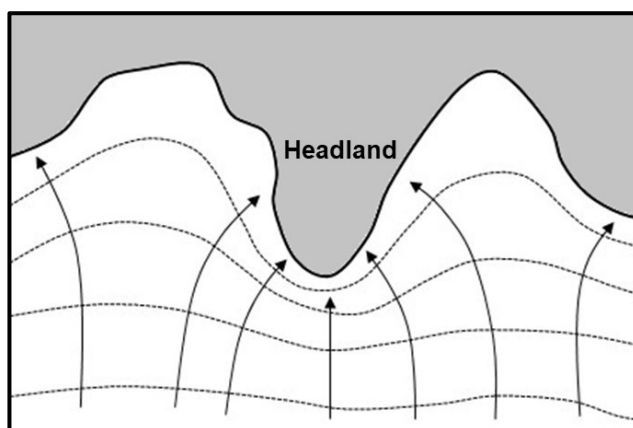
1.1.2 The equation below shows the chemical formula for the process of ocean acidification.



The correct option for **X** is ...

- A CO_3^-
- B HCO_2^-
- C CO^-
- D HCO_3^-

1.1.3 The image below shows a type of wave transformation. The arrows indicate the direction of the wave movement.

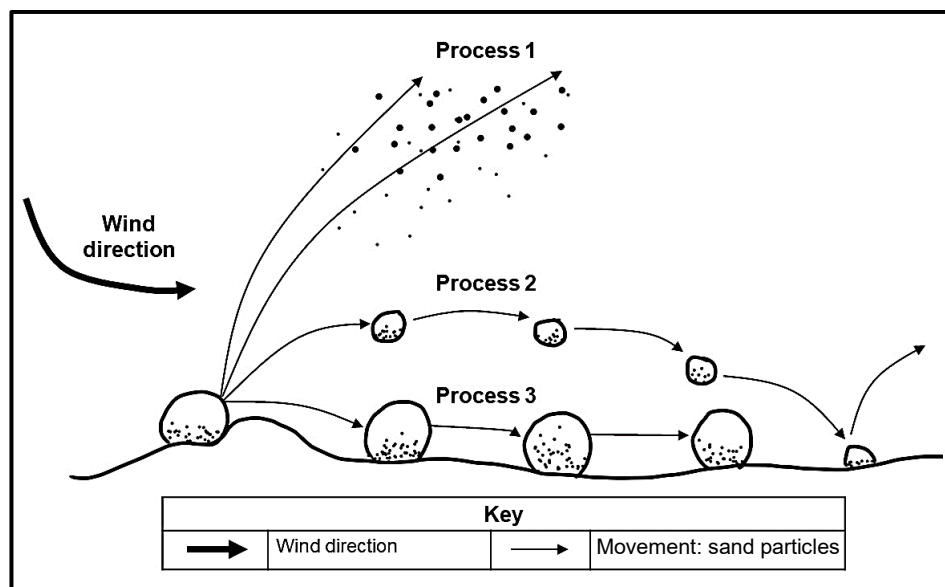


[Adapted from <https://geo.libretexts.org/Bookshelves/Oceanography/>]

The term that CORRECTLY identifies the type of wave transformation above:

- A Refraction
- B Diffraction
- C Reflection
- D Deflection

- 1.1.4 The image below shows aeolian processes during the formation of dunes.



[Adapted from <https://www.jncpasighat.edu.in/file/ppt/geo/aeolian>]

Which ONE of the following options shows ONLY CORRECT terms for **Process 1**, **Process 2** and **Process 3** in the image above?

	PROCESS 1	PROCESS 2	PROCESS 3
A	Surface creep	Suspension	Saltation
B	Suspension	Saltation	Surface creep
C	Saltation	Surface creep	Suspension
D	Suspension	Surface creep	Saltation

- 1.1.5 Which ONE of the following statements is CORRECT regarding the molecular structure of sea salt?

- A The sodium atom gains an electron and the chlorine atom loses an electron.
- B The sodium and the chlorine atoms are connected in a non-polar, covalent bond.
- C Sodium and chlorine atoms are arranged in a crystal lattice structure.
- D The sodium and the chlorine atoms are connected in a non-polar, ionic bond.

- 1.1.6 Which ONE of the following options is the CORRECT description of the Köppen-Geiger classification of Cwb?

	REGION	DRY SEASON	TEMPERATURE
A	Tropical	Winter	Hot
B	Temperate	None	Very cold
C	Tropical	Summer	Very hot
D	Temperate	Winter	Hot

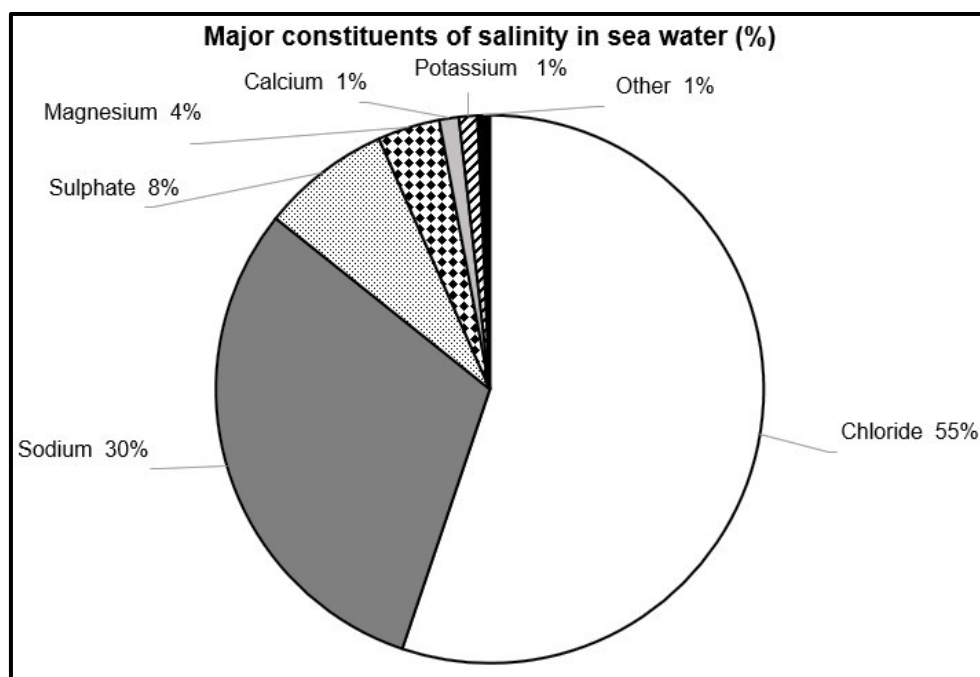
1.1.7 The list of phrases below refers to stone fish traps.

- (i) Gentle seabed slope enables fish to swim easily into the trap
- (ii) Gaps between the stones are not large enough for fish to fit
- (iii) Fish swim over the wall during spring high tide
- (iv) Water drains between the stones as the tide subsides
- (v) Fish get trapped during low tide and caught by fishers

Which ONE of the following combinations gives the CORRECT sequence for how the stone fish trap functions?

- A (i), (ii), (iii) and (iv)
- B (iii), (i), (iv) and (v)
- C (i), (v), (ii) and (iv)
- D (iii), (v), (ii) and (iv)

1.1.8 The pie chart below shows the major constituents of salinity in sea water (%).



[Adapted from <https://player.slideplayer.com/25/7637748/data/images/img9.jpg>]

The total salinity in 1 000 g of sea water is 34,8 g. Calculate the mass of chloride ions in the sea water:

- A 19,14 g
- B 2,78 g
- C 10,62 g
- D 1,94 g

1.1.9 Below are statements regarding the legislation that governs the production of food using aquaculture.

- (i) Permits are not required for the release of endemic species.
- (ii) Aquaculture should meet the highest standard of hygiene.
- (iii) It provides protection for food consumers and the environment.
- (iv) Labels on produce must include scientific names.
- (v) Details regarding the origin of produce must be on labels.

Which ONE of the following combinations shows ONLY CORRECT options?

- A (ii), (iv) and (v)
- B (i), (ii) and (iv)
- C (ii), (iii) and (v)
- D (i), (iii) and (iv)

1.1.10 The species of seaweed commercially harvested in Simon's Town, South Africa:

- A Sea bamboo
- B Purple laver
- C Sea lettuce
- D Split-fan kelp

(10 x 2) **(20)**

1.2 Give the correct **scientific term/phrase** for each of the following descriptions. Write only the term/phrase next to the question numbers (1.2.1 to 1.2.10) in the ANSWER BOOK.

- 1.2.1 Structures built out into the sea at right angles to the beach to slow down and trap the longshore transport of sediment
- 1.2.2 Little waves on the surface of water caused by the wind or by something moving in or on the water
- 1.2.3 Flat area along the coast at the top of a cliff face
- 1.2.4 A bar of ocean sediment joining an island to the coast
- 1.2.5 Geological intervals of warmer global average temperature lasting thousands of years
- 1.2.6 The living, harvestable portion of a population from which catches are taken in a fishery
- 1.2.7 Production of plants for food, using nutrient-rich water instead of soil
- 1.2.8 The short-term conditions of the atmosphere in the troposphere
- 1.2.9 Repeated movement away from an equilibrium state and back to the equilibrium state, such as the swinging of a pendulum
- 1.2.10 The first ridge that is formed as an obstacle to the movement of sediment in sand dune formation (10 x 1)

(10)

- 1.3 Indicate whether each of the descriptions in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the question numbers (1.3.1 to 1.3.5) in the ANSWER BOOK.

COLUMN I		COLUMN II	
1.3.1	OTEC	A:	osmotic pressure gradient
		B:	temperature gradient
1.3.2	Methane and carbon dioxide	A:	covalent bonds present
		B:	non-polar molecules
1.3.3	Archaeological evidence found on the south-west coast	A:	Smitswinkelbaai Cave
		B:	Melkhoutboom Cave
1.3.4	Diving sciences gas law where temperature remains constant	A:	Charles's law
		B:	Gay-Lussac's law
1.3.5	Prior to the industrial revolution	A:	more aragonite
		B:	higher pH

(5 x 2)

(10)

TOTAL SECTION A: 40

SECTION B**QUESTION 2**

2.1 Read the information below.

Water serves as a universal solvent for major ions (Na^+ , Cl^- , Ca^{2+} , Mg^{2+}). Fresh water transports these major ion concentrations from terrestrial habitats into the ocean, causing an increase in salinity, which results in an increase in the density of sea water.

The coast of Chennai (in India) is known for receiving large amounts of rainfall during the North-East Monsoon period. Rainfall data are collected by the India Meteorological Department (IMD). Scientists have monitored the average rainfall and sea water density in the waters off the coast of Chennai. Scientists wanted to determine the relationship between the average rainfall and the average density of sea water.

[Adapted from Sharma et al., 2022, mausam.imd.gov.in]

The following method was used to carry out the investigation:

- The study area was selected near an estuary.
- Sterile 500 ml sampling bottles were used to collect three sea water samples at 1 m depth.
- Samples were collected in summer, winter and autumn.
- The samples were then sent to laboratories to measure the density.
- Data on the average rainfall per season were obtained from the IMD.

The data were recorded in the table below.

Seasons	Average rainfall (mm)	Average density (kg/m^3) of sea water
Summer	60	979
Autumn	750	1 025
Winter	120	856

[Adapted from Sharma et al., 2022, mausam.imd.gov.in]

2.1.1 For this investigation, give:

- (a) ONE constant variable mentioned (1)
- (b) ONE dependent variable (1)

2.1.2 Draw a composite graph representing the rainfall as bars and the density as a line. (11)

2.1.3 State TWO ways in which salts and ions can be removed naturally from the sea water in this area. (2)

- 2.1.4 (a) From the graph drawn in QUESTION 2.1.2, identify in which season the monsoon period occurred. (1)
- (b) By referring to both the rainfall and the density of sea water, motivate your answer to QUESTION 2.1.4(a). (3)
- 2.1.5 Describe how climate change could influence the seasonal differences in sea water density off the coast of Chennai. (2)
- (21)

- 2.2 Read the text below about scuba divers using drysuits and answer the questions that follow.

DRYSUIT SQUEEZE

Drysuits are different from wetsuits in that they are loose fitting and completely waterproof, keeping divers warm in cold environments. However, if divers are not properly trained in using drysuits, the suits can cause 'suit squeeze', a type of barotrauma.

[Adapted from <https://www.dansa.org/blog/2018/09/07>]

- 2.2.1 State ONE effect of barotrauma on the human body. (1)
- 2.2.2 A diver wearing a drysuit is diving at a depth of 30 metres where the temperature is 7 °C. The diver begins to ascend to the surface where the temperature is 27 °C.
- If the volume of air inside the suit is 1 litre at 30 metres, what will be the volume of air inside the suit at the surface? (5)
- (6)

- 2.3 Refer to the information below about the effect of climate change on tidal bores and answer the questions that follow.

TIDAL BORES NOT BORING NEWS

Climate change is causing a rise in sea level. Research shows that this has led to an increase in tidal wave height of approximately one metre, as well as an increase in water turbulence and velocity within tidal bores. Areas where these tidal bores occur have experienced an increased frequency of flooding (see image below) and shoreline erosion.

[Adapted from <https://www.tandfonline.com/doi/full/>]

TIDAL BORE FLOODING ONTO SHORE

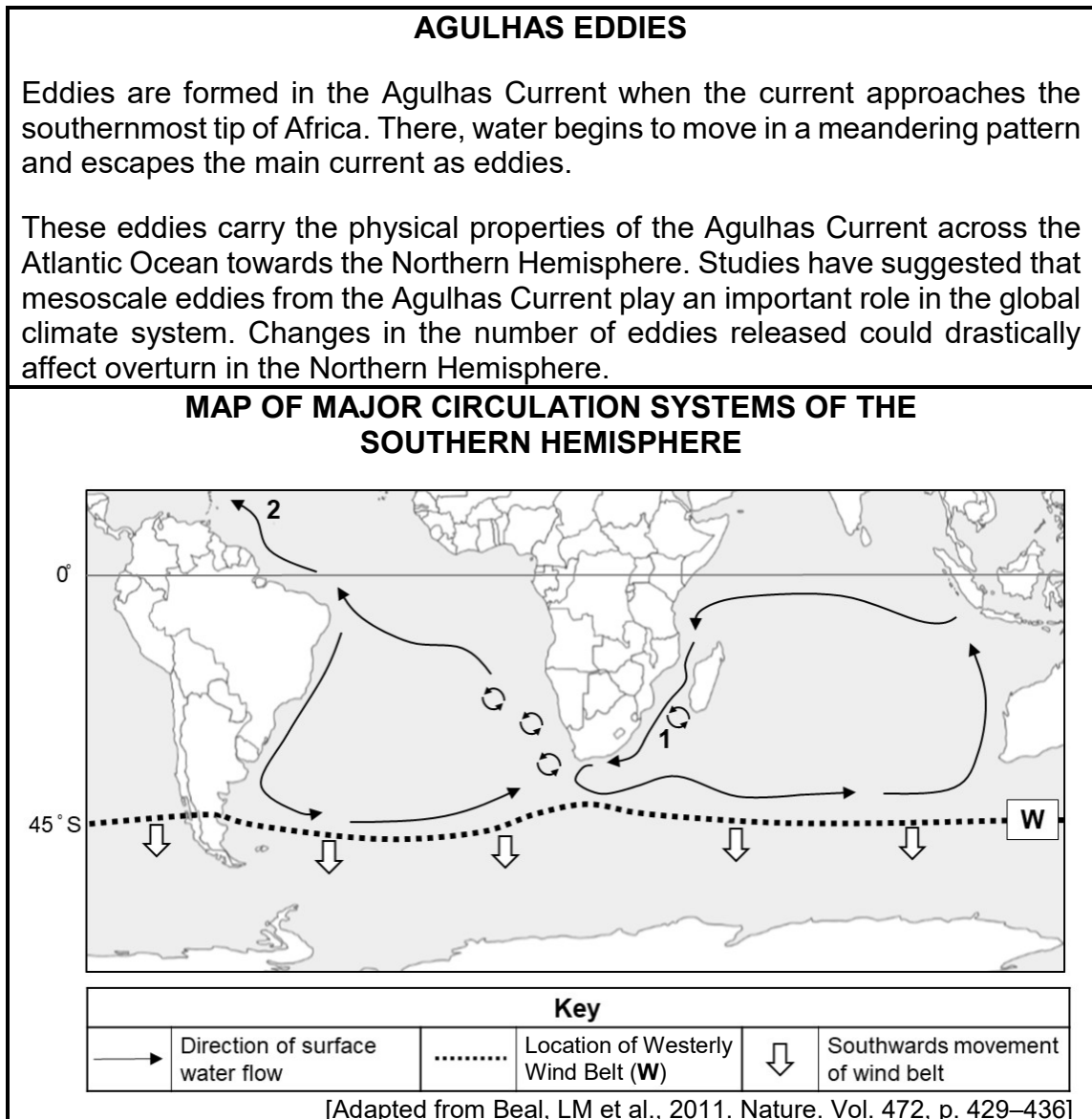


[Source: <https://www.theatlantic.com/photo/2013/08/>]

- 2.3.1 Discuss how the greenhouse effect contributes towards rising sea levels. (3)
- 2.3.2 (a) State TWO conditions that result in the formation of tidal bores. (2)
- (b) Describe the movement of water within a tidal bore once the conditions stated in QUESTION 2.3.2(a) have been met. (1 x 2) (2)
- 2.3.3 Describe ONE benefit of tidal bores for the communities living in these areas. (2)
- 2.3.4 Discuss ONE potential preventative measure that these communities could implement to prevent damage from flooding, as seen in the image above. (2)
- 2.3.5 Give your opinion on whether tidal bores are more harmful or more beneficial to these communities. Motivate your answer. (2)
- (13)**
[40]

QUESTION 3

- 3.1 Refer to the information below on eddies from the Agulhas Current and answer the questions that follow.



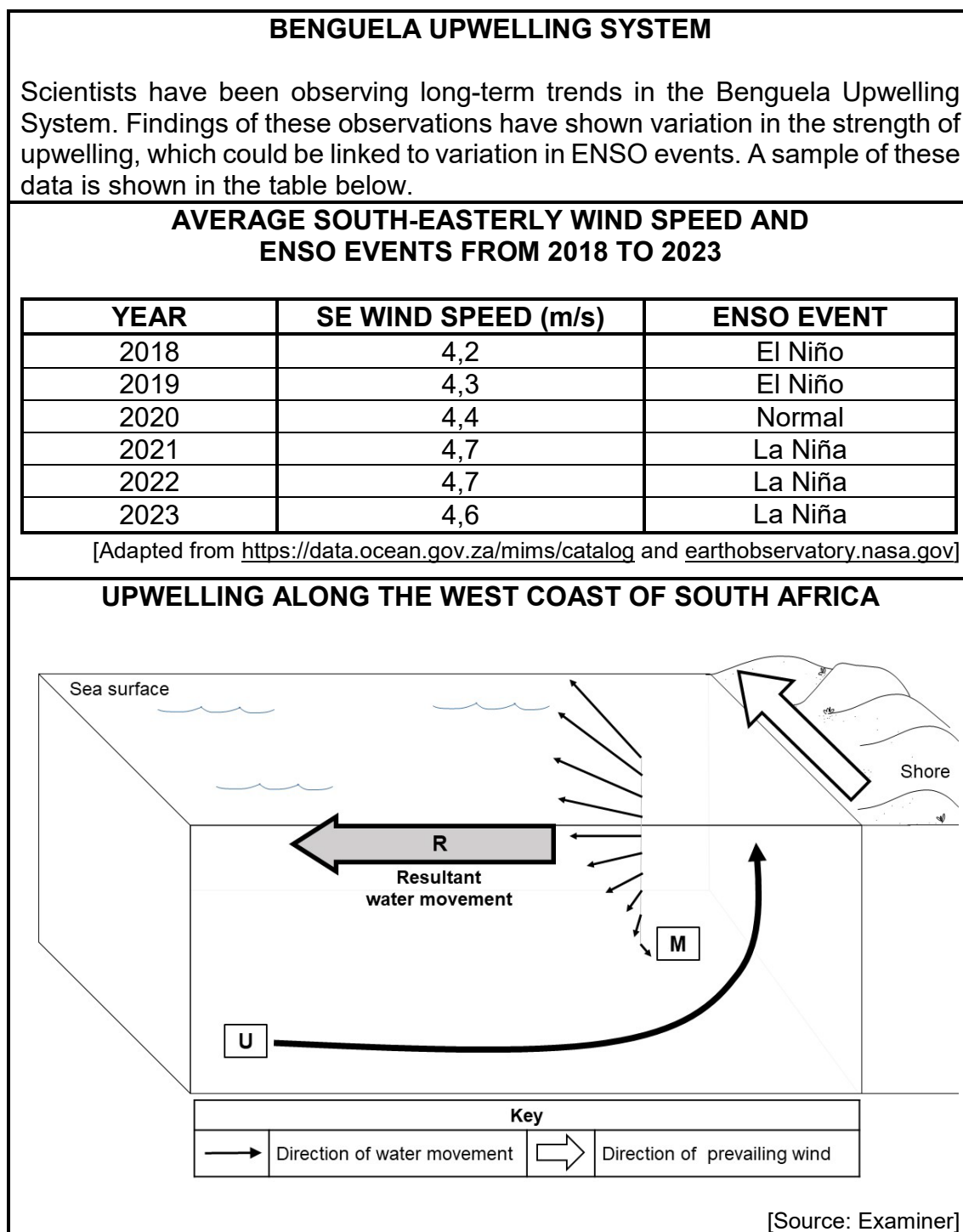
- 3.1.1 Describe the characteristics of a mesoscale eddy, if it originated in the Agulhas Current at **Location 1**. (3)
- 3.1.2 Explain how the mesoscale eddy in QUESTION 3.1.1 could potentially influence overturn when it reaches the Northern Hemisphere at **Location 2**. (2)
- 3.1.3 The Westerly Wind Belt (**W**) influences the southern limit of the surface currents. Climate change data have shown that this belt is shifting southwards, as indicated on the map above.

Explain ONE effect this shift could have on the ocean circulation around Southern Africa. (2)

- 3.1.4 Give your opinion on whether the international research community should support South Africa to do more research on these eddies in the Agulhas Current. Motivate your answer.

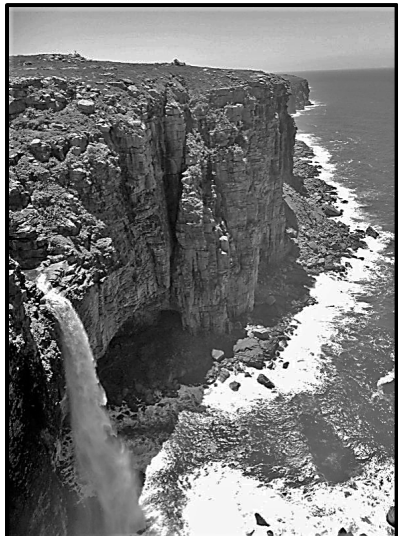
(2)
(9)

- 3.2 Study the infographic below on the Benguela Upwelling System to answer the questions that follow.



- 3.2.1 Refer to the diagram on upwelling along the west coast of South Africa.
- (a) Give the CORRECT scientific term to describe the resultant water movement at **R**. (1)
 - (b) Explain why the water at **M** is moving in the opposite direction from the prevailing wind. (4)
- 3.2.2 Give the relationship between wind speed and the ENSO event. (2)
- 3.2.3
- (a) According to the data given, was upwelling stronger or weaker between 2018 and 2019? (1)
 - (b) Motivate your answer to QUESTION 3.2.3(a). (3)
- 3.2.4 Describe how periods of stronger upwelling would impact the following:
- (a) Climate of the west coast (2)
 - (b) Communities living on the west coast (2)
- 3.2.5 Give your opinion on whether the data shown above can be used to predict the ENSO events of future years. Motivate your answer. (2)
- (17)**

- 3.3 Refer to the text below about the Wild Coast and answer the questions that follow.

	<p style="text-align: center;">WONDERS OF THE WILD COAST</p> <p>Waterfall Bluff is the final destination on one of South Africa's best hiking trails, located along the Wild Coast. The waterfall is one of the only waterfalls in the world to fall directly into the ocean. The rocky cliffs surrounding the waterfall are approximately 100 metres high and form a large overhanging cave, called Grotto Cave, behind the waterfall. Grotto Cave is a much-loved spot for hikers looking to rest and enjoy the shade inside the cave.</p> <p style="text-align: right;">[Sources: https://www.wildcoastholiday.co.za and https://tracks4africa.co.za]</p>
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- 3.3.1 (a) Name the coastal region where Waterfall Bluff is found. (1)
- (b) Give ONE example of vegetation that hikers may observe along the Wild Coast. (1)
- 3.3.2 Briefly describe the geological processes involved in the formation of Grotto Cave. (2)
- 3.3.3 Draw a fully labelled diagram to show the potential formation of Grotto Cave. (5)
- (9)**
[35]

TOTAL SECTION B: 75

SECTION C

Answer any ONE question in this section.

Clearly indicate the QUESTION NUMBER of the chosen question.

NOTE: Your answer must be in the form of an essay. NO marks will be awarded for answers in the form of a table, flow chart or diagram.

QUESTION 4

This question was adapted from an article in the *Business Live* magazine.

NAMIBIA GOES FOR SALMON GOLD

Namibia's first-ever salmon farming project, African Aquaculture Company (AAC), has received N\$41 million (Namibian dollars), equivalent to about R41 million, in international funding. The project is being implemented near Lüderitz, a town on the Namibian coast.

Salmon farming involves several stages, both onshore and offshore. Hatching takes place in freshwater dams onshore, where the salmon can grow safely. At a certain size (150 g), the fish are transferred offshore to sea cages. Once the salmon are big enough (4,5 kg), they are transported to a processing facility onshore, where they are gutted and put on ice for export.

The World Wide Fund for Nature (WWF) warns that salmon farming could have a negative impact on the environment. These concerns will need to be mitigated by the AAC, following an environmental management plan. The plan will adhere to strict international codes, aligning with Namibia's Ministry of Agriculture, Fisheries, Water and Land Reform.

[Source: <https://www.businesslive.co.za/fm/features/2025-04-24>]

Write an essay about this project that will be published in an aquaculture magazine. Ensure that you discuss EACH of the bullet points below.

- Outline the financial considerations that this salmon project would have had to plan for before implementation.
- Discuss, in detail, important factors that the company needs to keep in mind during ONSHORE operations of this salmon farm.
- Discuss the potential impacts of this OFFSHORE holding system on the environment that the WWF is concerned about.
- Evaluate the potential socio-economic benefits that the project would have for this community.
- Give your opinion on whether more of these salmon farms should be implemented in Southern Africa. Motivate your answer.

Content: (25)
Synthesis: (10)
[35]

QUESTION 5

This question is based on the hypothetical scenario below.

Land-based wind farms used for energy generation have been very successful along the coast in the Eastern Cape of South Africa. This has attracted foreign investors who are interested in increasing the development of these projects.

To date, South Africa had no offshore wind farms, and the investors planned to create the first official offshore wind farm for the country. One possible location for this wind farm was near a newly developed coastal fishing village. This village is located near Gqeberha (often called the Windy City). The village has limited access to electricity; therefore, the wind farm would be beneficial to newly developed fish factories and to local households and industries.

[Adapted from Tshimbiluni, HC and Tabakou, PY, 2019. Vol. 342, p. 5]

Write an essay about this new proposed project that will be published in the local newspaper to explain this development. Ensure that you discuss EACH of the bullet points below.

- Describe, in detail, how wind turbines harvest energy.
- Discuss how this community would benefit from the offshore wind turbine project being implemented near their village.
- Evaluate the factors that need to be considered to reduce challenges experienced when implementing this offshore wind turbines.
- Discuss the similarities and differences of the impacts between land-based wind farms AND offshore wind farms.
- Give your opinion on whether this village would benefit more from land-based wind farms OR from offshore wind farms. Motivate your answer.

Content: (25)
Synthesis: (10)
[35]

TOTAL SECTION C: 35
GRAND TOTAL: 150