



# basic education

---

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**MARINE SCIENCES P1**

**NOVEMBER 2023**

**MARKS: 150**

**TIME: 2½ hours**

**This question paper consists of 15 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: Consists of QUESTIONS 2 and 3.  
Answer BOTH questions in this section.  
SECTION C: Consists of QUESTIONS 4 and 5.  
Answer any ONE of the two questions in this section.
2. Answer ALL the questions in the ANSWER BOOK.
3. Start EACH question on a NEW page in the ANSWER BOOK.
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 the SECOND decimal place, 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 provided 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 A form of agriculture that combines raising fish together with plant cultures that have no soil:

- A Hydroponics
- B Aquaponics
- C Hydroculture
- D Aquaculture

1.1.2 The tonnage that can be caught in the following season without compromising the future sustainable health of that fish stock is referred to as ...

- A Maximum Allowable Catch.
- B Catch Per Unit Effort.
- C Total Allowable Catch.
- D Maximum Species Yield.

1.1.3 Which ONE of the following factors contributes the most to the carbon dioxide concentration in the atmosphere?

- A Rising global temperatures
- B Oxygen levels
- C Activities producing CFCs
- D Agricultural activities

1.1.4 Which ONE of the following is the CORRECT Köppen-Geiger classification for the north-west coast of South Africa?

- A BWk
- B BSb
- C CWb
- D BWh

1.1.5 Destructive waves occur when ...

- A there is a stronger swash than backwash.
- B swash is equal to backwash.
- C deposition is greater than erosion.
- D there is a stronger backwash than swash.

1.1.6 Which of the following is CORRECT for the commercial use of algae?

	TYPE OF ALGAE	COMPOUND	USE
A	Red algae	Alginic acid	Yellow food colourant
B	Red algae	Agar	Gelling agent for ice cream
C	Green algae	Beta-carotene	Gelling agent for ice cream
D	Brown algae	Alginic acid	Yellow food colourant

1.1.7 The statements below refer to the climate along the south-west coast of South Africa.

- (i) Mediterranean climate
- (ii) Prevailing winds are NW in winter and SE in summer
- (iii) Dry season occurs during winter
- (iv) Strongest winds occur on mid-summer afternoons
- (v) Rainfall occurs mostly in the form of summer thundershowers

Which of the following combinations is CORRECT for this type of climate?

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

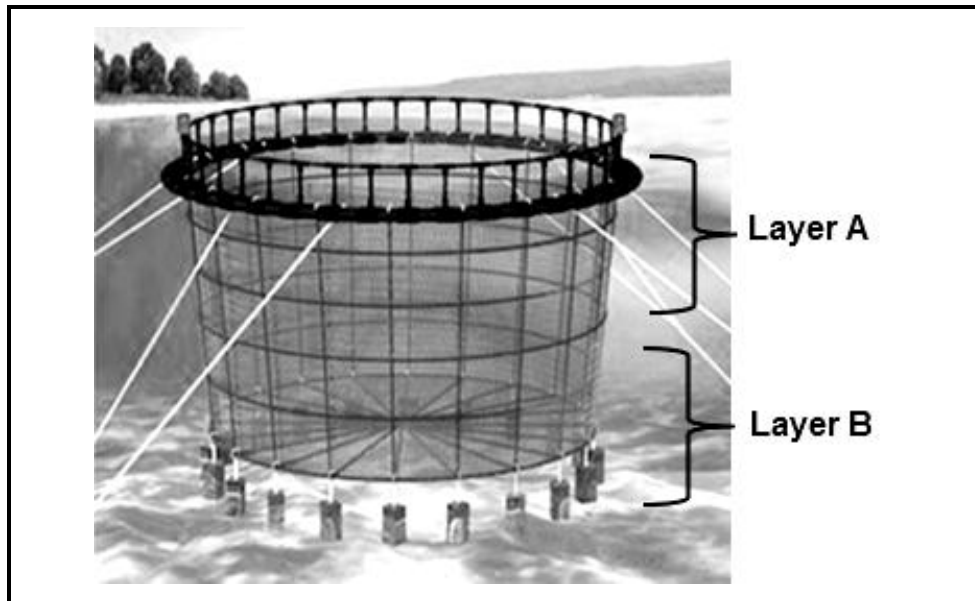
1.1.8 Which gas is NOT one of the greenhouse gases found in the Earth's atmosphere?

- A Methane
- B H<sub>2</sub>O
- C O<sub>2</sub>
- D CO<sub>2</sub>

1.1.9 Which statement is INCORRECT and NOT associated with ocean acidification?

- A Decrease in the pH of the sea water
- B Increased absorption of carbon dioxide in the ocean
- C Increased proportion of hydrogen ions
- D Decreased proportion of carbonic acid

- 1.1.10 The image below shows a multi-layered cage holding system used in aquaculture.



[Source: <https://s.alicdn.com/>]

The statements below refer to the holding system above.

- (i) Cannot easily be moved from one location to another
- (ii) **Layer B** contains bivalve species or filter feeders
- (iii) Consists of sea cages and sea pens
- (iv) **Layer A** contains animals that absorb and clean the waste products
- (v) Used as a partial mitigation measure to prevent eutrophication

Which of the following combinations is CORRECT for this type of holding system?

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

(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 Substances which promote the growth of micro-organisms
- 1.2.2 Aquaculture facilities where fish eggs are bred out under artificial conditions
- 1.2.3 The proportion of incident light that is reflected by a surface
- 1.2.4 A geological interval of warmer global average temperatures lasting thousands of years
- 1.2.5 Organisms that use calcium carbonate and calcium ions in dissolved ocean water to construct shells and skeletons
- 1.2.6 A fragment of foreign rock trapped within a host rock and having a different composition from the host rock
- 1.2.7 A model of currents or winds near a horizontal boundary in which the flow direction rotates as one moves away from the boundary
- 1.2.8 A narrow piece of land consisting of transported sediment that protrudes into the sea
- 1.2.9 A coastal landform on a resistant rock cliff face that protrudes out into the sea
- 1.2.10 The swirling of ocean waters and the reverse currents created when the water is in a turbulent flow regime (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	Blombos Cave	A:	artefacts dated to 77 000 years ago
		B:	engraved ochre
1.3.2	Weather	A:	average atmospheric conditions over 24 hours
		B:	average atmospheric conditions over 24 years
1.3.3	Increased proportion of carbon dioxide	A:	stimulates calcium carbonate production
		B:	higher proportion of calcium carbonate
1.3.4	Knysna Heads	A:	East Coast
		B:	South Coast
1.3.5	Embryo dunes	A:	grey soil colour
		B:	brown soil colour

(5 x 2)

**(10)****TOTAL SECTION A:****40**

**SECTION B****QUESTION 2**

2.1 Read the text below and answer the questions that follow.

The search for a cleaner source of harvesting electrical energy has made headlines for a while. More attention is also being given to using the ocean for electricity generation. Research suggests that salt water electrolysis, the process of splitting water into oxygen and hydrogen, is a viable solution to the common challenges of freshwater electrolysis. The hydrogen gas can be burned to generate heat for energy production.

[Adapted from <https://www.sustainability-times.com/low-carbon-energy/hydrogen-for-clean-energy-could-be-produced-from-seawater>]

A study was done to determine the effect of salinity on the rate of hydrogen production in the process of electrolysis. Four solutions with different salinities (freshwater, brackish water, sea water and brine) were tested.

For each solution:

- 180 ml of the solution was used
- The electrolysis process was run for three minutes
- This was repeated four times for each solution
- The released hydrogen was captured in a tube
- The volume of gas was measured in millilitres produced per minute (ml/min)
- The average volume of hydrogen captured was calculated for each solution

The results of the study are shown in the table below.

**Table showing the average volume of hydrogen captured (ml/min) during electrolysis of solutions with different salinities**

	<b>SALINITY (ppt)</b>	<b>AVERAGE VOLUME OF HYDROGEN CAPTURED (ml/min)</b>
Freshwater	5	8
Brackish water	20	24
Sea water	35	49
Brine	50	83

2.1.1 Provide the dependent variable for the investigation. (1)

2.1.2 Give a hypothesis for the investigation. (2)

2.1.3 Draw a line graph to show the average volume of hydrogen captured during electrolysis for different salinities of water. (7)



- 2.1.4 Based on the results of this study, describe the relationship between the salinity and the volume of hydrogen captured. (2)
- 2.1.5 Discuss the molecular structure of a water molecule. (4)
- 2.1.6 Why would it be beneficial to use sea water instead of freshwater as an alternative source of energy? (1)
- 2.1.7 In your opinion, is electrolysis of salt water a sustainable alternative to clean energy?  
Give TWO reasons to support your answer. (3)  
**(20)**

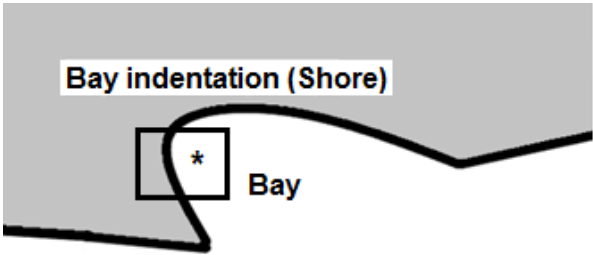
2.2 Refer to the infographic on M-Bay Diving and Ocean Literacy School below and answer the questions that follow.

M-Bay Diving and Ocean Literacy School is an institution based in Mossel Bay, South Africa. It aims to provide experiences for its students through surfing, snorkelling and diving to interact with the ocean in a safe, knowledgeable manner.

DESCRIPTION OF EVENTS OF THE DAY	LOCATION INFORMATION														
<p>Amateur students are taken for an excursion at a selected location in Mossel Bay. They have not yet mastered the fundamentals of safe diving. Therefore, they are not allowed to dive deeper than 18 metres due to the increase in the risk of experiencing the bends.</p>	<table border="1"> <thead> <tr> <th>LOCATION</th> <th>OCEAN DEPTH (m)</th> <th>ACTIVITY</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>3</td> <td>Surfing</td> </tr> <tr> <td>B</td> <td>7</td> <td>Snorkelling</td> </tr> <tr> <td>C</td> <td>11</td> <td>Diving</td> </tr> </tbody> </table>	LOCATION	OCEAN DEPTH (m)	ACTIVITY	A	3	Surfing	B	7	Snorkelling	C	11	Diving		
LOCATION	OCEAN DEPTH (m)	ACTIVITY													
A	3	Surfing													
B	7	Snorkelling													
C	11	Diving													

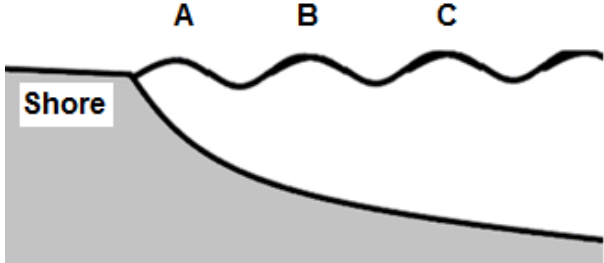
**SELECTED SURFING AND DIVING AREAS**

**TOP VIEW**

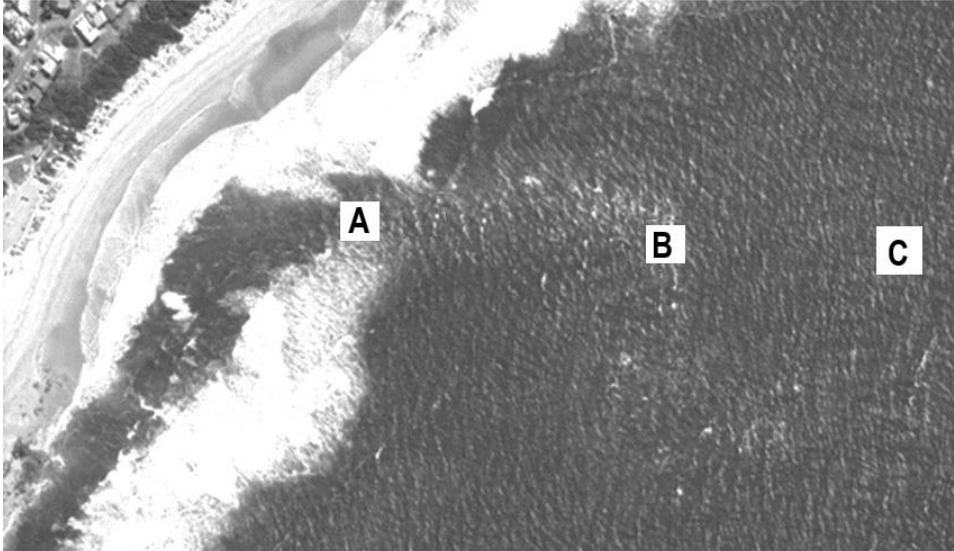


\* refers to section magnified for the side profile

**\*SIDE PROFILE**



**CLOSE-UP SATELLITE IMAGE OF LOCATIONS A, B AND C**



[Adapted from <https://earth.google.com/web/search/mossel-bay>]

- 2.2.1 What will be the predominant wave type for the selected surfing area? (1)
- 2.2.2 Motivate your answer to QUESTION 2.2.1. (2)
- 2.2.3 Describe why the wavelength will decrease as the waves move towards the shore. (2)
- 2.2.4 Consider **A** and **B**.
- (a) What type of current is found at **A** and continues to **B**? (1)
- (b) Explain how this type of current is formed. (4)
- (c) Would this be a suitable area for teaching students to surf?  
Motivate your answer. (2)
- 2.2.5 One of the diving students has a balloon with a volume of 500 ml at the surface. The student dived to the deepest part of **C** with the balloon. The temperature remained constant.
- What would be the volume of the balloon at this depth? Show ALL calculations. (4)
- 2.2.6 These students may not dive deeper than 18 metres due to the increase in the risk of experiencing 'the bends'.
- (a) Explain what occurs when someone suffers from 'the bends' and state ONE symptom. (3)
- (b) Why is there an increased risk of less-experienced divers getting 'the bends'? (1)
- (20)**  
**[40]**

**QUESTION 3**

3.1 Read the text below and answer the questions that follow.

**DUNE REHABILITATION AT TABLE VIEW BEACH TO START IN JULY**

The city plans to rehabilitate the dune system along Table View Beach. Mr E Andrews, Deputy Mayor of the City of Cape Town, said, 'The beach is not as pristine as it used to be: the dune cordon has deteriorated and lost its ability to protect the surrounding infrastructure from windblown sand. The parking facilities, beach access and services such as the stormwater infrastructure are in urgent need of repairs and replacement.'

A combination of heavy machinery, bulldozers, excavators and dump trucks will be used to reinstate and profile the dunes. Thereafter, the sand will be stabilised with wind nets that will be placed perpendicularly to the dominant wind direction. The sand will also be vegetated with dune-specific species and irrigated.

'We will put up fencing to protect the newly profiled dunes. I ask residents and visitors to please use the designated pathways to access the beach, and to stay clear of the dunes so that we can give the vegetation a chance to be established. Dunes fulfil an important function as they help trap sand on the beachfront and prevent it from being blown onto roads and adjacent infrastructure,' said Andrews.

[Adapted from [www.thesouthafrican.com/news/city-of-cape-town-table-view-beach-rehabilitation-sand-dunes-new-walkway-bloubergstand-2025](http://www.thesouthafrican.com/news/city-of-cape-town-table-view-beach-rehabilitation-sand-dunes-new-walkway-bloubergstand-2025)]

- 3.1.1 State TWO conditions that promote dune formation. (2)
- 3.1.2 According to the article, emphasis is placed on stabilising the sand.
- (a) Describe TWO types of natural wind-blown sand movement that can be experienced. (2 x 2) (4)
- (b) Why is it considered necessary to stabilise the wind-blown sediment? (2)
- 3.1.3 The article provides a clear example of human management of a coastline.
- (a) What engineering approach is being applied in the article? (1)
- (b) Provide evidence from the text to support your answer. (2)
- 3.1.4 Is the proposal by the deputy mayor good or poor? (2)
- Explain your answer. (13)

- 3.2 Coastal rock formations are prominent along parts of the South African coastline. Compile an annotated diagram to illustrate the step-wise erosion of a cliff to form a stump. **(10)**
- 3.3 Use the map below to answer the questions on ENSO events that influence global weather patterns.



[Adapted from [bing\\_image/simplemaps](http://bing_image/simplemaps)]

- 3.3.1 (a) Name the atmospheric cell of air movement found above the Pacific Ocean Basin during normal weather patterns. **(1)**
- (b) Explain the air movement in the atmospheric cell named in QUESTION 3.3.1(a). **(2)**
- 3.3.2 Explain TWO conditions that occur along the south-eastern side of ocean basin **A** during an El Niño period. **(2 x 3) (6)**
- 3.3.3 The opposite phenomenon of El Niño is La Niña, which also has an influence on Southern Africa.
- (a) What effect will this event have on the water at location **B**? **(1)**
- (b) What will be the influence on the coastal weather of Southern Africa? **(2)**
- (12)**  
**[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 charts or diagrams.

**QUESTION 4**

The question is based on the hypothetical scenario in the text below.

The president of South Africa has recently mentioned the proposed development of smart cities (powered by modern technology). These cities would be built close to large rivers in areas that have consistent, strong winds at the river mouth. According to this proposal, the cities would be powered using tidal energy by building dams across the mouths of the rivers. The first city is expected to be completed by 2035 with international, private investment in the project being encouraged.

In a meeting with the minister overseeing these developments, you have been asked to provide advice:

- Explain why it has been proposed that a river mouth needs to be dammed for effective tidal power electricity generation.
- Continue by discussing TWO separate alternative forms of electricity generation with the ocean as a source.
- Discuss how South Africa can act immediately to manage energy supply.
- Critically evaluate the government's focus on international private investment in a public-private project.
- In your conclusion, discuss why smart cities need renewable energy.

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

**QUESTION 5**

This question is based on the hypothetical scenario in the text below.

As a young person, you grew up in a fishing town along the West Coast of South Africa. Since then you have left the town to study and your studies focused on aquaculture. Your birth town has recently struggled to make ends meet due to low abundance of target species in catches. An international investor aims to improve food security in the town by introducing aquaculture for the harvesting of seafood.

You have been appointed as the chairperson running the public participation meeting which is part of the environmental impact assessment (EIA) for the development. Your opening speech needs to give clarity to the community regarding the potential positive and negative effects of aquaculture. In your speech you should refer to the following aspects:

- Describe aquaculture to the community.
- Inform the community about TWO socio-economic benefits of aquaculture, OTHER than food security.
- Raise concerns about how aquaculture could result in further risk to local fisheries.
- Critically evaluate whether aquaculture, in reality, would provide food security in the town.
- In your conclusion, motivate whether you (as a previous resident of the town) will recommend the proposed aquaculture industry.

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

**TOTAL SECTION C: 35**  
**GRAND TOTAL: 150**