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TOTAL MARKS

NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2024

MARINE SCIENCES: PAPER I

EXAMINATION NUMBER

Time: 2½ hours 150 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 24 pages. Please check that your question paper is complete.
2. Read the questions carefully.
3. This question paper consists of THREE sections. Answer the questions as follows:
   SECTION A (40 marks): COMPULSORY
   SECTION B (75 marks): COMPULSORY
   SECTION C (35 marks): Consists of QUESTIONS 6 and 7. Answer only ONE of the two questions in this section.
4. **Answer ALL the questions on the question paper and hand it in at the end of the examination. Remember to write your examination number in the blocks above.**
5. Non-programmable calculators may be used.
6. Please **do not write in pencil** as work in pencil will not be marked. However, any sketches or diagrams may be done in pencil.
7. It is in your own interest to write legibly and to present your work neatly.
8. Four blank pages (pages 21–24) is included at the end of the paper. If you run out of space for a question, use this page. Clearly indicate the question number of your answer should you use this extra space.

Allocation of marks

Q1	Q2	Q3	Q4	Q5	Q6		Q7	TOTAL
						OR		
40	23	10	10	32	35		35	150

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SECTION A

QUESTION 1

1.1 Ten multiple-choice questions are given below. Choose the most correct option for each question and write the letter of your choice in the space in the table at the bottom of the page.

1.1.1 Estuaries are highly productive ecosystems due to …

A low nutrient content from seawater.
B intense sunlight exposure.
C high nutrient content from river runoff.
D absence of aquatic vegetation. (2)

1.1.2 The orbital motion of water particles due to surface waves stops at a depth …

A of about twice the wavelength.
B equal to the wavelength.
C of about one-half of the wavelength.
D of about one-tenth the wavelength. (2)

1.1.3 Which of the following statements about water is TRUE?

A Water is a nonpolar molecule.
B Water has a low boiling point.
C Water is an excellent solvent for nonpolar substances.
D Water exhibits hydrogen bonding. (2)

1.1.4 A surfer notices that waves at a beach that he surfs at are consistently bigger and stronger than waves at nearby beaches. What is the main reason for this?

A The angle at which the waves approach the shore.
B The water depth at the beach where the waves are breaking.
C The distance from the coastline to the nearest deep-water source.
D The prevailing wind direction in the area. (2)

1.1.5 As waves move towards the shore, they start to bend in a way that aligns more with the coastline. This change in direction is known as ...

A longshore drift.
B swash.
C tidal surge.
D refraction. (2)

1.1.1	1.1.2	1.1.3	1.1.4	1.1.5

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1.1.6 Which of the following describes the collapse of a fishery?

A When fish stocks are reduced to less than 10% of historic productivity.
B When fish stocks are fully restored to previous levels.
C When fish stocks are over 50% of historic productivity.
D When fish stocks are unaffected by fishing. (2)

1.1.7 Which type of energy provided by the ocean is the most consistently available in South Africa?

A Tidal energy
B Wave energy
C Thermal energy
D Wind energy (2)

1.1.8 A diver releases 1-litre of air into a lift bag from 25 m below the surface where the temperature is 25°C. What volume will the lift bag occupy when it ascends to a depth of 0 meters if the temperature remains constant?

A 0,5 litres
B 1,5 litres
C 2,5 litres
D 3,5 litres (2)

1.1.9 In the Southern Hemisphere, how does the Coriolis effect influence the direction of the Eckman spiral?

A It causes the water movement to spiral clockwise.
B It causes the water movement to spiral counterclockwise.
C It has no effect on the direction of the Eckman spiral.
D It causes the water movement to spiral inward towards the centre. (2)

1.1.10 An anion is …

A an atom that has lost one or more electrons and has a positive charge.
B subatomic particles that orbit the nucleus of an atom and have a negative charge.
C an atom that has gained one or more electrons and has a negative charge.
D made up of two or more atoms and held together by chemical bonds. (2)

[20]

1.1.6	1.1.7	1.1.8	1.1.9	1.1.10

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1.2 Definitions are provided in COLUMN A below. Write the correct term for each of the definitions in the space provided in COLUMN B.

	COLUMN A	COLUMN B
1.2.1	A submerged or exposed sand, gravel, or sediment ridge parallel to the shoreline.	
1.2.2	Mature individual fish used by the aquaculture industry for breeding.	
1.2.3	A steep slope or cliff that is found at the backshore of a beach.	
1.2.4	The law that states that at a constant temperature, the pressure of a gas is inversely proportional to its volume.	
1.2.5	A raised area of sediment or land between the backshore and dunes or vegetation line.	
1.2.6	Electrons in the outermost region of atoms that enter into the formation of chemical bonds.	
1.2.7	A device that converts mechanical into electrical energy.	
1.2.8	The capacity of a solid item to float on a fluid by displacing a volume of that fluid that is equal in weight to that item.	
1.2.9	Long and narrow channels used for the controlled rearing and cultivation of aquatic organisms.	
1.2.10	Organisms that produce shells, skeletons, and other structures that would be highly affected by ocean acidification.	

(10)

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1.3 Study the following table that consists of a term in COLUMN I and TWO items (numbered 1 and 2) in COLUMN II. Choose which item(s) relate to the term. Write down your choice in the space provided in the Answer column, making use of the following codes:

A only item 1 relates to the term
B only item 2 relates to the term
C both items 1 and 2 relate to the term
D neither item 1 nor 2 relates to the term

	COLUMN I	**COLUMN II**	**Answer**
1.3.1	Total Allowable Catch (TAC)	1. The total number or tonnage of fish that can be caught annually. 2. Is not a reliable method of comparing data due to superior and more efficient fishing equipment.	
1.3.2	MPAs	1. Increase in the size and quantity of fisheries species in surrounding fishing grounds. 2. Not all of them have a section where no harvesting of living organisms takes place.	
1.3.3	South African MPAs	1. 47 declared by August 2019. 2. Protect approximately 87% of marine ecosystem types.	
1.3.4	Marine Ecotourism	1. Accounts for 15% of the world's Gross Domestic Product. 2. Accounts for one out of every ten jobs in some form.	
1.3.5	Greenwashing	1. The process of genuinely improving environmental practices within a company to align with sustainable goals. 2. The deceptive practice of portraying a company, product, or service as environmentally friendly or sustainable when it is not.	

(10)

40 marks

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SECTION B

QUESTION 2

Study Source 1 and answer Questions 2.1–2.4.

SOURCE 1

Will El Niño, on top of global heating, create the perfect climate storm?

Recent increases in North Atlantic surface temperatures have concerned scientists, who fear a shift to a more unpredictable climate phase. This temperature rise is linked to both an El Niño event and human-induced global warming, causing significant Arctic ice loss since April 2023 and a drop in global sea ice by over 1 million square kilometres.

The head of the UK Met Office's climate monitoring team has warned about the rapid pace of climate change. The stronger El Niño, combined with human-caused global heating, poses serious challenges to millions of people and ecosystems, potentially leading to severe consequences.

Scientists emphasise the connection between burning fossil fuels and more extreme weather events like hurricanes, droughts, heatwaves, wildfires, and floods. The North Atlantic temperature anomaly highlights the long-term impact of human emissions on the climate system, raising concerns about increasing ocean heat content.

Coastal waters near Ireland and the UK have warmed significantly, causing Atlantic storms to form earlier than expected. While human activities and El Niño are the main drivers of this temperature rise, other factors like Saharan dust levels, water vapour in the stratosphere, ocean currents, and El Niño frequency require further study.

These trends are consistent with climate models from the Intergovernmental Panel on Climate Change (IPCC), indicating faster warming unless emissions are reduced. The severity and duration of the current El Niño will determine the situation's seriousness, particularly concerning the Amazon rainforest, which suffered during the 2015–16 El Niño event, making it more vulnerable to fires.

The ongoing El Niño is already causing extreme weather events worldwide, including record-breaking heatwaves in Mexico, Texas, China, and Europe, as well as unusually high temperatures in Iran. Despite uncertainties about the extent of El Niño's impact and the potential decrease in the North Atlantic's heat anomaly, scientists agree that without significant cuts in greenhouse gas emissions and the protection of natural climate stabilisers like the Amazon, the situation will worsen.

[Modified from: <https://www.theguardian.com/environment/2023/jul/03/a-perfect-storm-scientists-ponder-if-climate-has-entered-a-new-erratic-era>]

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2.1 Define the following terms:

El Niño: _____

_____

Global warming: _____

_____

(4)

2.2 List THREE potential consequences of the extra heat energy in the ocean due to global warming.

1. _____

2. _____

3. _____

(3)

2.3 What other factors may be contributing to the North Atlantic spike, other than human-made global warming and El Niño?

_____

_____

_____

_____

(3)

2.4 How have various regions around the world been affected by the current El Niño?

_____

_____

_____

(2)

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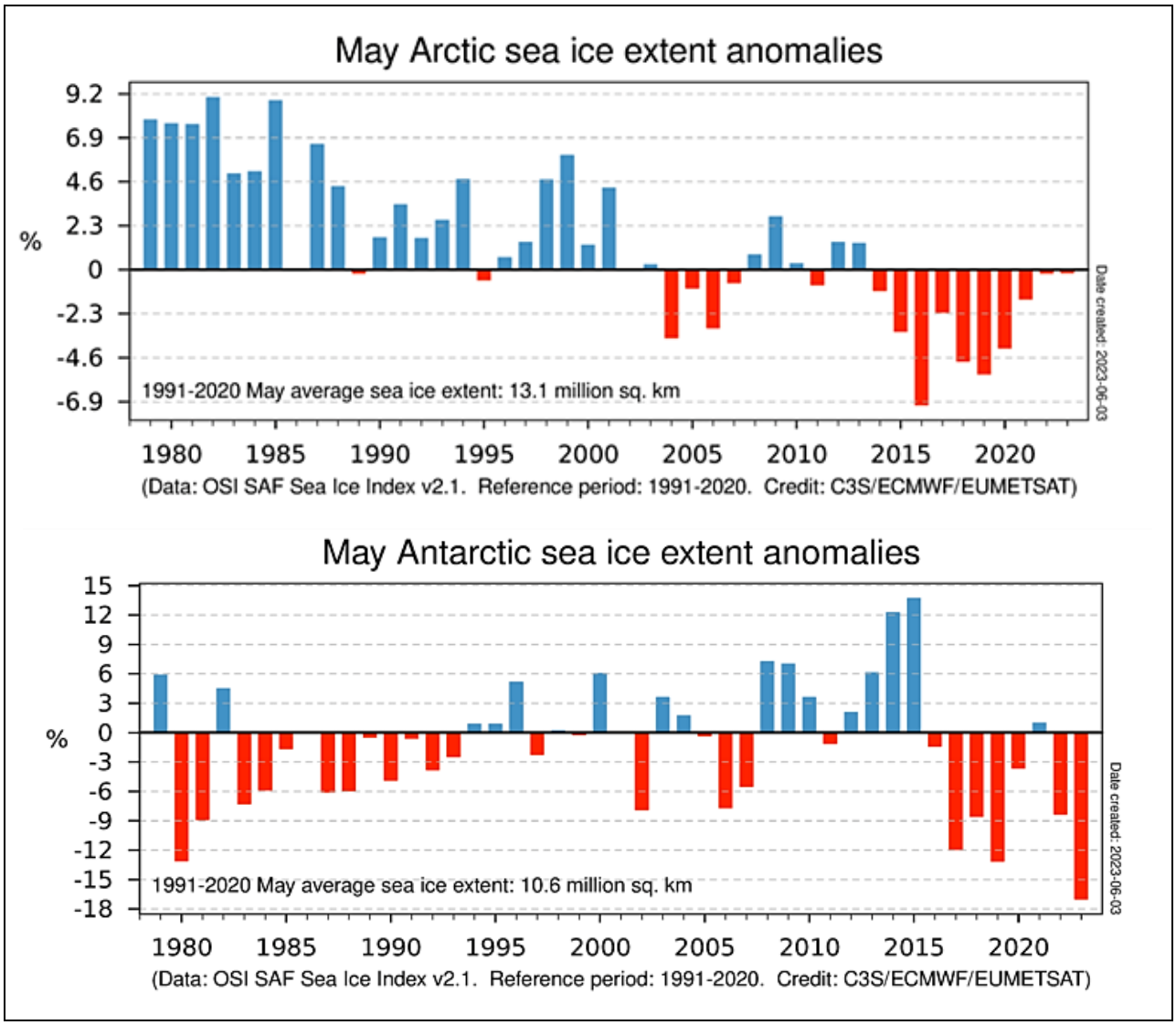
Study Source 2 and answer Question 2.5.

SOURCE 2



[Source: <https://climate.copernicus.eu/sea-ice>]

2.5 2.5.1 Which of the two ice sheets in Source 2 has exhibited the GREATEST fluctuation in size over the last 30 years? Give a reason for your answer.

_____

_____

_____

(2)

2.5.2 Which of the two ice sheets in Source 2 has exhibited the greatest decline of ice cover over the last 30 years? Give a reason for your answer.

_____

_____

_____

(2)

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2.5.3 Calculate the extent (area) of the Arctic ice in May 2015. Show your calculations.

(4)

2.5.4 Between 2013 and 2016, the Antarctic sea ice area extended dramatically. Climate models predict that the Antarctic should be losing sea ice, and it's exactly the opposite of what happened. Explain this apparent inconsistency.

(3)
[23]

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QUESTION 3

Read the information below and answer the questions that follow.

SOURCE 3

Mussels Inspire Underwater Adhesive

A company named Mussel Polymers Inc has developed a high-performance, non-toxic adhesive known as poly (catechol) styrene, or PCS, mimicking the adhesive proteins mussels use to adhere to surfaces in extreme marine environments. PCS is 300% stronger than other underwater adhesives, and bonds to a wide range of materials. Mussel Polymers will supply this product to several industries, but they are first bringing their PCS product to market for coral restoration, which will aid in a critical conservation intervention.



[Source: <https://www.learnbiomimicry.com/blog/top-10-biomimicry-examples-2021>]

3.1 Define and explain the concept being referred to in Source 3.

_____

_____

_____

(3)

3.2 State TWO properties of PCS that make it a superior product compared to other underwater adhesives.

1. _____

2. _____

(2)

3.3 Describe ONE other example of the concept referred to in Question 3.1 in the marine environment NOT mentioned in the source.

_____

_____

(2)

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3.4 Provide THREE advantages of this concept (described in Question 3.1) over conventional product development.

1. _____

2. _____

3. _____

(3)
[10]

QUESTION 4

Read the information below and answer the questions that follow.

SOURCE 4

A global supermarket chain has proposed plans to support sustainable fishing. The basis of the plan is to buy fish only from fisheries that use sustainable methods and have been certified by the Marine Stewardship Council (MSC). The supermarket chain could then create an 'MSC brand image' to encourage their customers to buy this fish at a slightly increased price.

[Source: <https://findvectorlogo.com/certified-sustainable-seafood-by-msc-vector-logo-svg/>]

4.1 Suggest ONE reason why a global supermarket chain would be interested in supporting sustainable fishing.

_____

_____

(2)

4.2 Suggest ONE benefit for MSC-certified fisheries.

_____

_____

(2)

4.3 Suggest ONE reason why customers might buy fish with the 'MSC brand image' at a higher price.

_____

_____

(2)

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4.4 In your opinion, what is the most significant challenge faced by fisheries in transitioning to sustainable practices, and how can this challenge be addressed?

(4)
[10]

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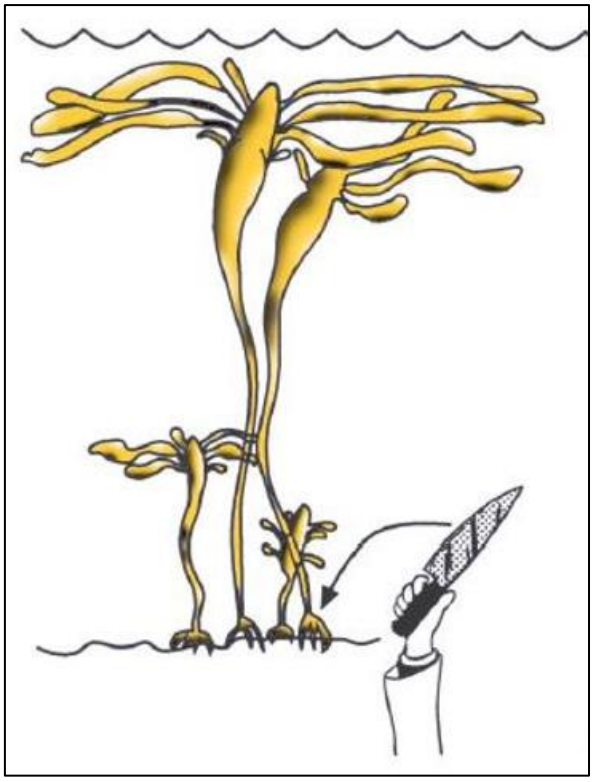
QUESTION 5

Study the diagram below and answer the questions that follow.

A method of harvesting growing kelp in South Africa



[Source: <https://fitopasion.com/2019/06/orejas-de-mar-de-galicia-a-sudafrica.html>]

5.1 Identify the species of kelp represented in the diagram above.

_____

(1)

5.2 Describe TWO adaptations of kelp that enable them to photosynthesise, despite being anchored at such depths.

1. _____

_____

2. _____

_____

(4)

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5.3 Describe TWO ways in which kelp helps to prevent erosion of beaches.

1. _____

_____

2. _____

_____

(4)

5.4 What are the THREE main uses of kelp in South Africa?

1. _____

2. _____

3. _____

(3)

5.5 Describe ONE way in which harvesting kelp using the method shown in the image is more sustainable.

_____

_____

(2)

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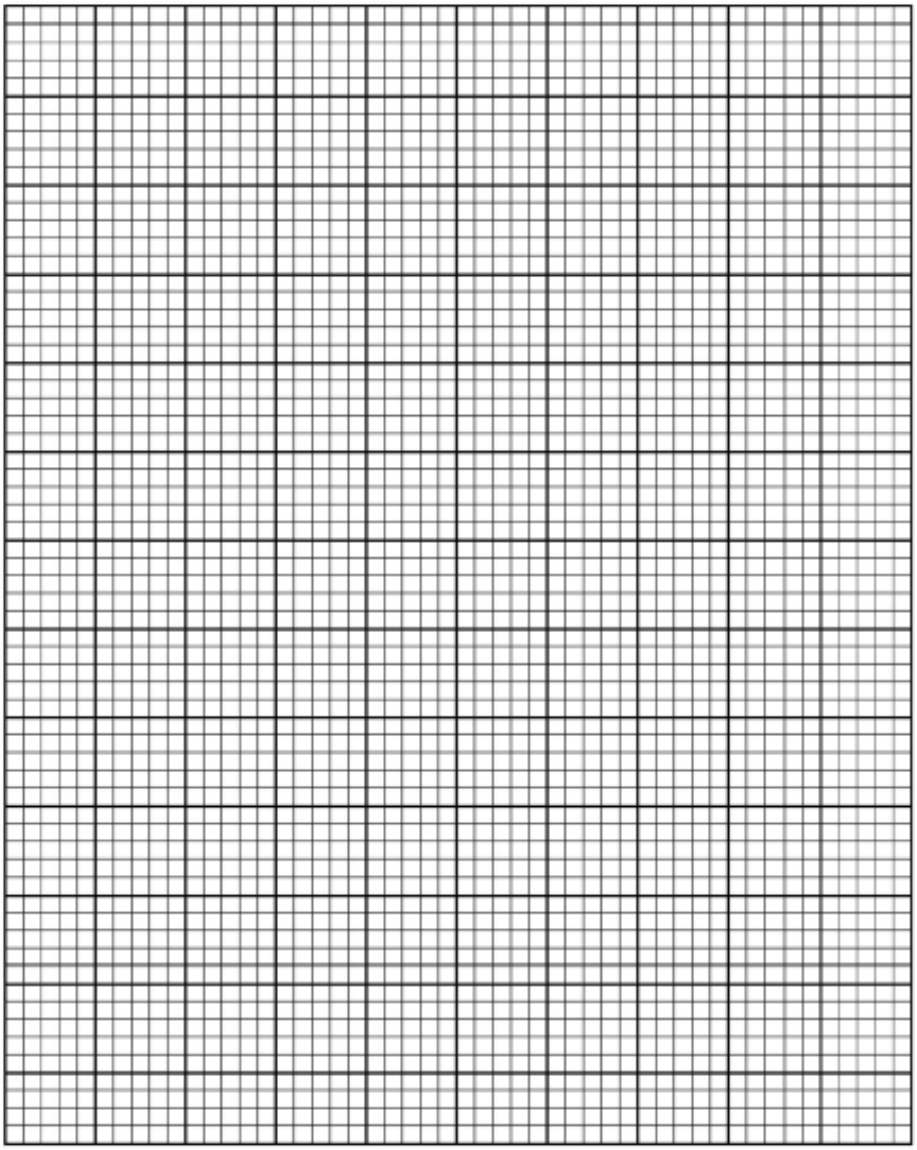
5.6 The table below summarises the kelp yields in 2017 along the Western Cape Coast, compared to the Maximum Sustainable Yields (MSY, as set in permits) to the nearest 100 tonnes.

Wet Weight in tonnes			
MSY fronds only	Fronds only yield	MSY whole kelp	Whole kelp yield
8 800	3 700	18 600	3 400

5.6.1 Plot a graph of the data on the graph paper provided below.



(8)

5.6.2 Explain the meaning of the term Maximum Sustainable Yield.

_____

_____

(2)

5.6.3 Name the dependent variable.

_____

(1)

5.6.4 List TWO fixed variables.

1. _____

2. _____

(2)

5.6.5 What conclusions can be made from the graph?

_____

_____

_____

_____

(3)

5.6.6 Suggest a possible reason for your observations in Question 5.6.5 above.

_____

_____

_____

_____

(2)
[32]

75 marks

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SECTION C

Answer any ONE question in this section.

Clearly indicate the QUESTION NUMBER that you have chosen to answer.

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 6

Zonation refers to the distinct vertical patterns of plant and animal communities along rocky shores. Zonation on the South African rocky shore is influenced by a combination of physical, biological, and environmental factors. Understanding these factors is crucial for comprehending the complex patterns of species distribution and ecosystem dynamics.

Write an essay on zonation on the South African rocky shores, discussing the various ABIOTIC factors influencing the vertical distribution of organisms. Mention where on the rocky shore these factors are most severe and provide examples of organisms and describe how they are adapted to survive these factors.

[35]

OR

QUESTION 7

South Africa's extensive coastline, stretching over 2 500 kilometres, is home to diverse marine ecosystems and habitats. The country's marine environments are characterised by three main bioregions, each with their own unique ecological characteristics and species assemblages. These bioregions are influenced by a combination of factors.

Write an essay describing how the currents along the coastline influence these biogeographical patterns. Discuss the geographical distribution of organisms, including a description of the rocky shore zonation patterns that is characteristic of each of the three regions.

[35]

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[35]

35 marks

Total: 150 marks

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ADDITIONAL SPACE (ALL QUESTIONS)

REMEMBER TO CLEARLY INDICATE AT THE QUESTION THAT YOU USED THE ADDITIONAL SPACE TO ENSURE THAT ALL ANSWERS ARE MARKED.

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