

Confidential



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATIONS/ NATIONAL SENIOR CERTIFICATE EXAMINATIONS

MARINE SCIENCES P2

MAY/JUNE 2025

MARKS: 150

TIME: 2½ hours

This question paper consists of 16 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. 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 the margins in the ANSWER BOOK.
13. Write neatly and legibly. ...



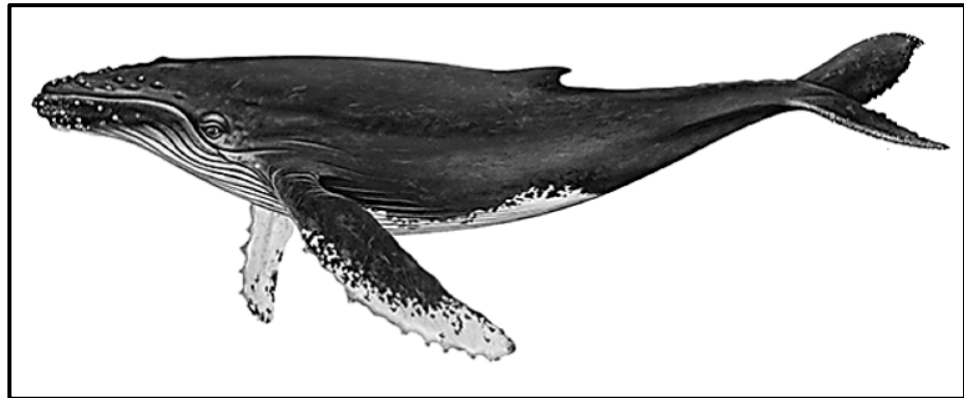
SECTION A**QUESTION 1**

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 The tunic of Red Bait (*Pyura stolonifera*) consists of ...

- A cellulose.
- B glycogen.
- C protein.
- D cellulite.

1.1.2 The illustration below represents a Humpback Whale (*Megaptera novaeangliae*).



[Source: <https://www.fisheries.noaa.gov/>]

ONE of the characteristics used to classify Humpback Whales as Mysticeti is that individuals ...

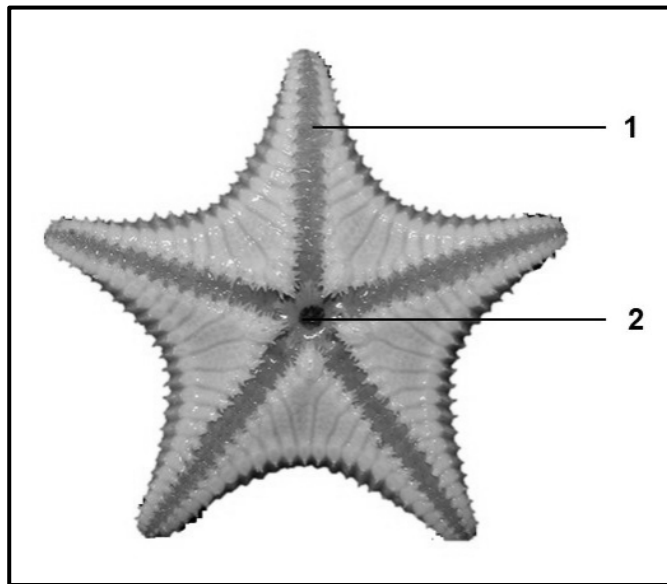
- A are fast and agile when hunting.
- B breathe through single blowholes.
- C have baleen to filter food from water.
- D use echolocation to detect prey.

1.1.3 The organism that does NOT belong to the same phylum as the rest of the organisms:

- A Green Turtle
- B Starfish
- C Red Bait
- D Hagfish



1.1.4 The image below represents a cushion star.



[Source: <https://www.jaxshells.org/0286.htm>]

Which ONE of the following options is CORRECT for the image?

	SURFACE	LABEL 1	LABEL 2
A	Dorsal	Ambulacral groove	Mouth
B	Ventral	Bursae	Anus
C	Dorsal	Bursae	Anus
D	Ventral	Ambulacral groove	Mouth

1.1.5 The structures below are found in the respiratory system of birds:

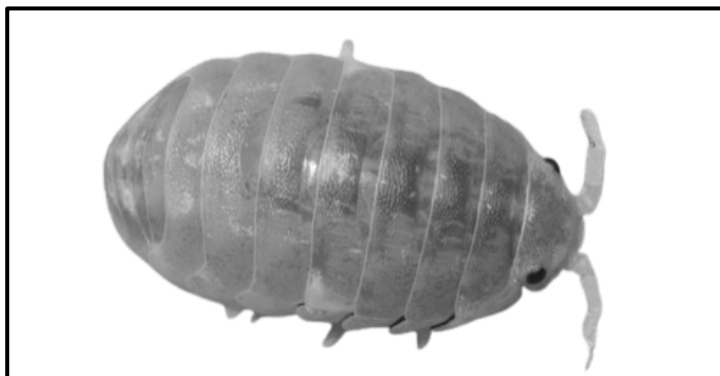
- (i) Posterior air sacs
- (ii) Nostrils
- (iii) Anterior air sacs
- (iv) Lungs
- (v) Trachea

The CORRECT sequence of the movement of air in the respiratory system of birds is:

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



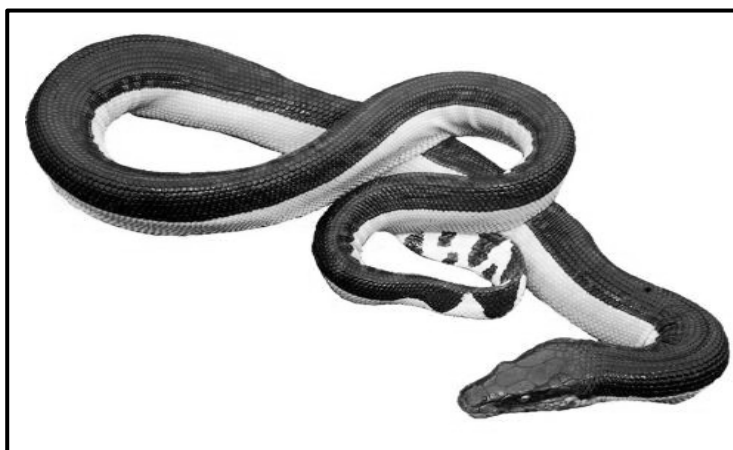
- 1.1.6 The image below shows an animal found on sandy beaches in South Africa.



[Source: <https://www.inaturalist.org/photos/525301322>]

Which ONE of the following is NOT a behavioural adaptation of this animal to avoid predation?

- A Shelters in rotting kelp
 - B Emerges at night
 - C Surfs waves up the shore
 - D Blends in with the environment
- 1.1.7 The illustration below represents a reptile.



[Source: <https://www.reptiles.org.nz/>]

Which ONE of the following characteristics is INCORRECT for this animal?

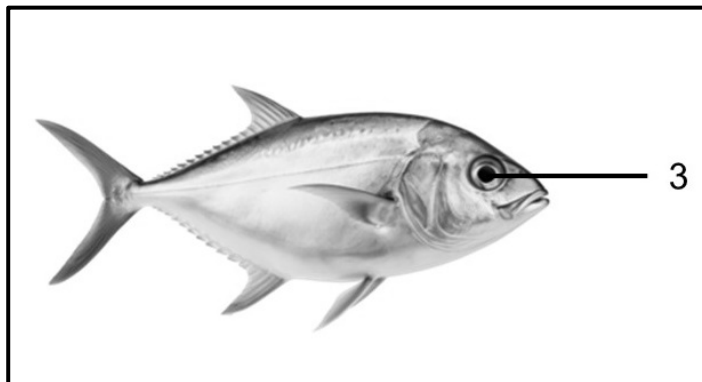
- A Flattened body
- B Skin flaps over the nostrils
- C Large lung capacity
- D Salt glands in its nostrils



- 1.1.8 The Upright Codium (*Codium fragile*) thrives along a beach that is exposed to regular storm surges. After these storm surges, the seaweed is covered in sand.

Which ONE of these adaptations allows the Upright Codium to thrive in this area, despite being covered in sand for long periods of time?

- A Thin fronds allow sand to fall off
 - B Holdfasts attach the seaweed to the sand
 - C Chloroplasts migrate to the surface for photosynthesis
 - D Complete cell walls provide structural support
- 1.1.9 Which of the following processes is NOT an adaptation to desiccation by organisms that live on rocky shores?
- A Shells to trap water
 - B Burrowing to avoid dehydration
 - C Gels which bind water
 - D Taking water up quickly
- 1.1.10 The image below represents a bony fish living in shallow waters.



[Source: <https://pngtree.com/free-animals-png/fish>]

Which ONE of the following is CORRECT for the sensory organ labelled **3**?

- A Limited sight at the surface
- B No colour vision
- C Pupils do not change size
- D Eyelids for protection

(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 The benefits to a habitat provided by nature and healthy ecosystems, such as provision of nutrients and good water quality
- 1.2.2 The sieve-like plate which allows sea water to enter the water-vascular system of echinoderms
- 1.2.3 Tissue beneath the skin of some echinoderms enabling them to extensively alter the flexibility of their skin
- 1.2.4 The low-shore eulittoral zone characterised by pear-shaped limpets
- 1.2.5 The thin strips fanning out from the gill arches of fish to provide a broad gaseous exchange surface
- 1.2.6 The structures found at the base of the tails of marine birds that produce oil
- 1.2.7 When whales push their heads up above the water in order to see above the sea surface
- 1.2.8 The microscopic tooth-like structures growing from the skin of elasmobranchs
- 1.2.9 Tubes extending from the stomach of an echinoderm and into the arms, assisting in the digestion and distribution of food
- 1.2.10 The phagocytic cells in the coeloms of echinoderms, responsible for engulfing excretory products and preventing infection (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	Argenvillei zone	A:	Durban coast
		B:	Gqeberha coast
1.3.2	Socio-economic benefit of Marine Protected Areas (MPAs)	A:	protecting critical habitats from damage
		B:	protecting sites of cultural significance
1.3.3	Diving bradycardia	A:	the heart functions with less oxygen
		B:	the heart rate slows down significantly
1.3.4	Spiral valve in sharks	A:	increases the surface area of the intestine
		B:	increases the surface area of the stomach
1.3.5	<i>Afrolittorina africana</i>	A:	adapted to low light intensity
		B:	adapted to increased desiccation

(5 x 2) (10)

TOTAL SECTION A: 40

SECTION B

QUESTION 2

2.1

There has been an increase in the number of Leatherback Turtles (*Dermochelys coriacea*) nesting on the beaches of Florida on the southeast coast of America.

To measure the success of conservation efforts, researchers investigated the breeding success of Leatherback Turtles. The focus was to determine the breeding success by counting eggs and hatchlings.

- 16 isolated beach areas were selected to be monitored each year from 2008 to 2012.
- Leatherback Turtle nests were counted when eggs were laid.
- The nests were inspected 72 hours after the first sign of hatchling emergence or 80 days after the eggs were laid.
- The number of hatched eggs, unhatched eggs, live and dead hatchlings in each nest was recorded.
- Inspection of the nests was done at night to reduce potential predation.
- Conservation guidelines were followed.

The data of this study are shown in the table below.

YEAR	NESTS	EMERGENCE SUCCESS (%)
2008	800	35
2009	1 800	40
2010	1 000	30
2011	1 200	60
2012	1 700	50

[Adapted from *Endangered Species Research*, Vol:27:53-68]

- 2.1.1 Give ONE constant variable mentioned for this study. (1)
- 2.1.2 Draw a composite graph indicating the number of nests as bars and emergence success as a line. (11)
- 2.1.3 Explain how hatchlings may increase their chance of survival when emerging from the nests. (2)
- 2.1.4 Explain ONE possible impact on the conservation success if researchers uncovered the eggs, before hatching, to get a more accurate count of the number of eggs. (2)
- 2.1.5 Discuss why the location of urban developments close to turtle nesting sites may negatively impact the reproductive success of turtles. (2)

(18)

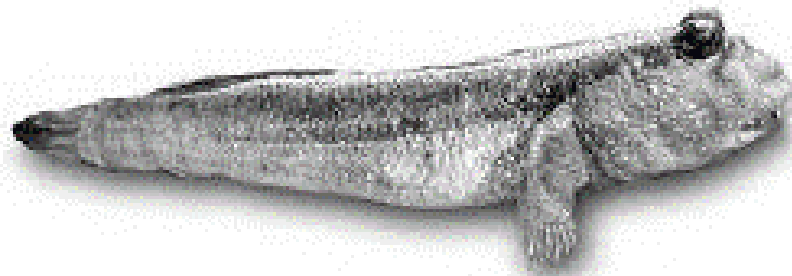


- 2.2 Read the extract below about the African Mudskipper and answer the questions that follow.

The African Mudskipper (*Periophthalmus kalolo*) lives in mudflats, swamps and mangrove forests in Southern Africa. Mudskippers spend most of their time on land, where they do everything from mating to hunting.

In some areas the African Mudskipper is under threat as farmers cut down mangrove forests around estuaries to use the land for agriculture.

[Adapted from <https://www.discovermagazine.com/planet-earth/meet-the-mudskipper-the-fish-that-walks-on-land>]



[Source: <https://johnhutchingsmuseum.org/atlantic-mudskipper/>]

- 2.2.1 State ONE characteristic of mudskippers that is used to classify them as Osteichthyes. (1)
- 2.2.2 (a) State TWO adaptations of mudskippers that enable them to survive outside of water. (2)
- (b) Explain the TWO adaptations given in QUESTION 2.2.2(a). (2)
- 2.2.3 Using your knowledge of the swim bladders of fish, explain why mudskippers do not have swim bladders. (3)
- 2.2.4 Discuss what would happen to the population size of mudskippers if the mangrove forests are removed. (2)
- 2.2.5 Evaluate what would happen to the productivity of the estuaries if the mangrove forests are removed. (2)
- (12)**



- 2.3 Read the extract below about the Crab-eating Frog and answer the questions that follow.

UNFROGGING THE MENU

The Crab-eating Frog (*Fejervarya cancrivora*) is a unique frog that lives in fresh water and can acclimatise to salt water. The frog is found in coastal regions from India to Indonesia where it lives in freshwater ponds near beaches. The Crab-eating Frog also moves into areas of higher salinity, such as mangrove forests and swamps, to feed.¹

In Europe billions of frogs are eaten by humans every year. While indigenous frogs in Europe are protected, the high demand for frogs from countries such as Indonesia is resulting in decreases in wild populations of frogs. A campaign has been launched by conservationists requesting that the threatened frogs from other countries be removed from menus.²

[Adapted from 1. <https://scienceandthesea.org/program/201307/crab-eating-frog>
2. <https://natureconservation.pensoft.net/article/93868/>]

- 2.3.1 Give TWO potential reasons why the Crab-eating Frog has adapted to move into salt water environments. (2)
- 2.3.2 Explain why the Crab-eating Frog cannot permanently stay in the salt water. (3)
- 2.3.3 Motivate why a country's conservation efforts should have a global focus. (2)
- (7)
[37]

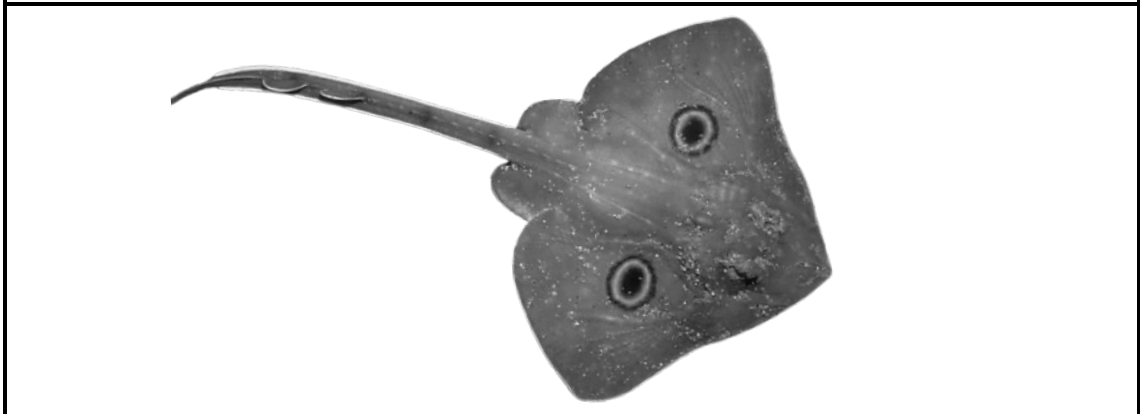


QUESTION 3

- 3.1 Study the extract below about the Big Skate and answer the questions that follow.

The Big Skate (*Beringraja binoculata*) can grow to lengths of up to 2,4 metres. They are generally found at depths of 100 to 200 metres on sandy or muddy ocean floors. They feed on invertebrates and small fish living in or near the sediment of the sea floor. These skates are preyed upon by large bony fish and sharks.

[Adapted from <https://caseagrants.ucsd.edu/>]



[Source: <https://www.montereybayaquarium.org/animals/animals-a-to-z/big-skate>]

- 3.1.1 (a) Name ONE structure that skates use to detect their prey. (1)
- (b) Explain how the structure named in QUESTION 3.1.1(a) enables the Big Skates to detect prey in their bottom-dwelling environment. (1)
- 3.1.2 Discuss why the Big Skates have spiracles on their dorsal side. (2)
- 3.1.3 Refer to the illustration above showing the dorsal side of a Big Skate. Explain the significance of the contrast and pattern on the skate's dorsal side. (2)
- (6)**



- 3.2 Read the extract below and answer the questions that follow.

SUNFLOWER SEA STARS COULD HELP BRING BACK KELP FORESTS

The Sunflower Sea Star (*Pycnopodia helianthoides*) found off the southern Oregon Coast can grow up to 1 metre in length with up to 24 arms.¹ The population size of the Sunflower Sea Star has decreased due to the sea star wasting disease that causes abnormal twisted arms, arm loss as well as disintegration (breakdown) of the tips of the arms and parts of their bodies.²

A decrease in the Sunflower Sea Star population caused an increase in the population of Purple Sea Urchins (*Strongylocentrotus purpuratus*). This resulted in more kelp being eaten and the size of the kelp forest decreasing. Scientists suspect that kelp forests also provide shelter to marine invertebrates, which is the primary prey of many other marine animals that inhabit this ecosystem.¹

In their efforts to restore the kelp forests, scientists are hoping to reintroduce the Sunflower Sea Stars. They collected sea stars from populations that were not infected by the disease and reared them in laboratories to be released back into the wild. Scientists are concerned, however, as little is currently known about the biology of the Sunflower Sea Stars and the impact they could potentially have if brought back to the kelp forest.¹

[Adapted from 1. <https://news.uoregon.edu/content/study-sunflower-sea-stars-could-help-bring-back-kelp-forests>

2. <https://www.nps.gov/articles/sea-star-wasting-disease.htm>]

- 3.2.1 Explain how the sea star wasting disease can affect the Sunflower Sea Star's ability to sense its prey. (3)
- 3.2.2 Draw a labelled diagram to illustrate a longitudinal section through the arm of a healthy Sunflower Sea Star, showing the different body layers. (5)
- 3.2.3 Explain ONE water condition in a kelp forest that could potentially make this ecosystem a shelter for marine invertebrates. (2)
- 3.2.4 How will a decrease in the size of the kelp forest influence the primary productivity of the southern Oregon Coast? (2)
- 3.2.5 Explain why scientists are concerned about the potential threat of reintroducing the Sunflower Sea Stars. (2)
- (14)**





3.3 Read the extract below and answer the questions that follow.

<p>MICRO-ORGANISMS PULL PLASTICS FROM AIR</p> <p>A company, called Newlight, makes use of micro-organisms from the ocean in a reactor. These micro-organisms utilise carbon, oxygen and hydrogen from the atmosphere, thereby reducing greenhouse gases. They rearrange these elements into different molecules to form a substance called Aircarbon. By melting Aircarbon, biodegradable plastics are produced.¹ If the material ends up in the ocean, it naturally degrades and can be consumed by micro-organisms.²</p> <p style="text-align: right;">[Adapted from 1. https://magazine.urth.co/articles/air-carbon-interview 2. https://asknature.org/innovation/plastic-alternative-biomaterial-inspired-by-ocean-microorganisms]</p>
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- 3.3.1 Discuss the biomimicry process applied by specialists in the production of Aircarbon. (4)
 - 3.3.2 Explain TWO underlying biomimicry principles used in the process described in QUESTION 3.3.1. (2 x 2) (4)
 - 3.3.3 Give your opinion on whether Aircarbon is a sustainable product. Motivate your answer. (2)
- (10)**

3.4 Study the animals in the images below and answer the questions that follow.

ANIMAL A	ANIMAL B
	
[Source: https://www.jungledragon.com/]	[Source: https://png.pngtree.com/]

- 3.4.1 State ONE similar way in which both animals are able to insulate their bodies while hunting in the ocean. (1)
- 3.4.2 Tabulate TWO differences in the digestive systems of Animal A and Animal B. (5)
- 3.4.3 The distribution pattern of both species' food source has changed due to climate change and over-exploitation. Give your opinion on which animal will be more adapted to survive. Motivate your answer. (2)

(8)
[38]

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 tables, flow charts or diagrams.

QUESTION 4

Read the adapted extract below to answer the question that follows.

CAPE TOWN LAUNCHES FIRST AMPHIBIOUS 'WATERFRONT DUCK' BUS

The V&A Waterfront in Cape Town is one of Africa's most visited destinations that welcomes almost 24 million visitors annually. This vibrant location is home to many different marine birds, seals, otters, sunfish and occasionally a whale appears inside the harbour.¹

An amphibious vehicle tour started operating in 2024 at the V&A Waterfront. This passenger vehicle transforms mid-journey from a bus into a boat. While entertaining the passengers, the tour guide highlights the historical information of the buildings and the marine ecology of the area. The tour does not leave the harbour.²

[Adapted from 1. <https://www.waterfront.co.za/business/tourism/>
2. <https://thenewspaper.co.za/first-amphibious-waterfront-duck-bus/>]



[Source: <https://thenewspaper.co.za/first-amphibious-waterfront-duck-bus/>]

As a journalist of an environmental newspaper, you have been tasked to write an article about the Waterfront Duck providing information about the following aspects:

- Explain why it was important to do an environmental impact assessment (EIA) before starting the amphibious vehicle operation.
- Discuss in detail the environmental AND social benefits that this operation would provide to ensure the conservation of the area.
- Elaborate on possible negative impacts that this operation may have on the environment AND suggest a mitigation strategy for each potential impact.
- Explain how the principles and guidelines for ecotourism, according to The International Ecotourism Society (TIES), can possibly be achieved through this tour.
- Give your opinion on whether tours with amphibious vehicles should be implemented at other South African harbours. Motivate your answer.

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



QUESTION 5

Read the adapted extract below to answer the question that follows.

ROBBEN ISLAND MPA PUBLIC PARTICIPATION PROCESS

The Robben Island Marine Protected Area (MPA) is classified as a category 3 MPA (Natural Monument). This MPA provides a safe nesting area for African Penguins (*Spheniscus demersus*), Cormorants (*Phalacrocorax spp*) and Terns (*Sterna spp*), and helps the recovery of Abalone (*Haliotis midae*) and Cape Rock Lobster (*Jasus lalandii*) stocks. Robben Island has a number of endemic species which occupy the rocky shores, sandy beaches and kelp forests found along the island's coastline.¹

South African National Parks (SANParks) has started a consultative process aimed at changing Robben Island's MPA status to a category 2 MPA (National Park). Members of the public are invited to provide input on the draft management plan for this MPA. This draft details the biophysical context, desired state, zoning and monitoring programmes that will be coordinated by SANParks.²

As part of the engagement process, a public participation session will be held with interested and affected parties. During the information sessions, participants will have the opportunity to provide input on the draft Robben Island MPA Management Plan.²

[Adapted from

1. <https://www.marineprotectedareas.org.za/robben-island-mpa/>
2. <https://www.capetownetc.com/news/sanparks-calls-for-public-engagement-on-robben-island-mpa-plan/>

You have been appointed to speak at the public participation session for SANParks. Write your speech in which you will address the following aspects:

- Compare the similarities and differences between a *category 3 MPA (Natural Monument)* and a *category 2 MPA (National Park)*.
- Discuss how changing Robben Island's conservation category to a National Park MPA category will likely benefit the island's ecosystem.
- Explain how SANParks will be able to monitor the ongoing effectiveness of the MPA when Robben Island is declared a national park.
- Elaborate on challenges that researchers might experience when monitoring the new category of MPA. Suggest mitigation strategies for each.
- Do you think that a similar consultative process should be used to investigate whether other MPAs have the correct IUCN category? Motivate your answer.

Content: (25)

Synthesis: (10)

(35)

TOTAL SECTION C: 35

GRAND TOTAL: 150



