basic education

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

# SENIOR CERTIFICATE EXAMINATIONS/ NATIONAL SENIOR CERTIFICATE EXAMINATIONS

## MARINE SCIENCES P2

## MAY/JUNE 2024

**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: 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.

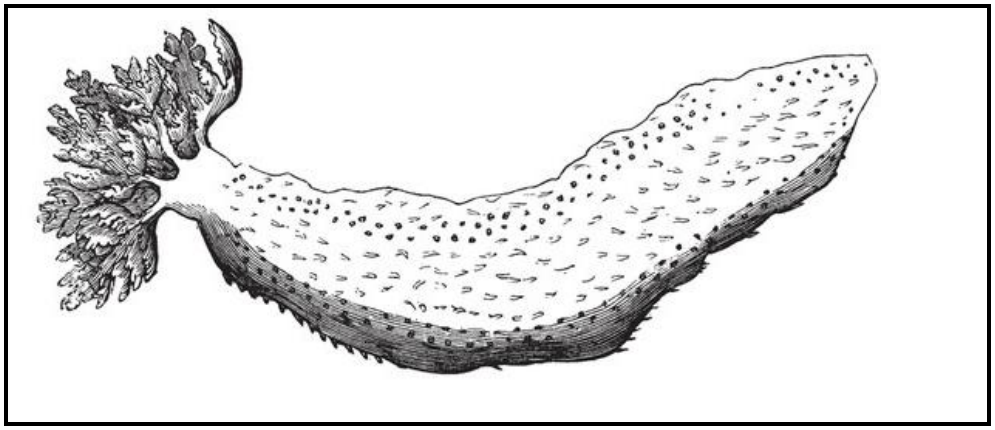
13. Write neatly and legibly.

## 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 The image below shows an animal classified as an echinoderm.



[Source: https://www.shutterstock.com/]

Which class does this echinoderm belong to?

A Ophiuroidea
B Asteroidea
C Holothuroidea
D Crinoidea

1.1.2 The upper eulittoral zone, where small winkles are dominant, is called the … zone.

A littorina
B argenvillei
C cochlear
D oyster belt

1.1.3 The outer protective covering made of cellulose in ascidians is called a/an …

A mantle.
B tunic.
C shell.
D exoskeleton.

1.1.4 The image below shows sea urchins in a rock pool.

[Source: https://qph.cf2.quoracdn.net/]

Which abiotic factor is the cause of the behavioural adaptation illustrated in the image?

A Light intensity
B Salinity
C Sand cover
D Wave action

1.1.5 The image below shows a crustacean found along a sandy beach.

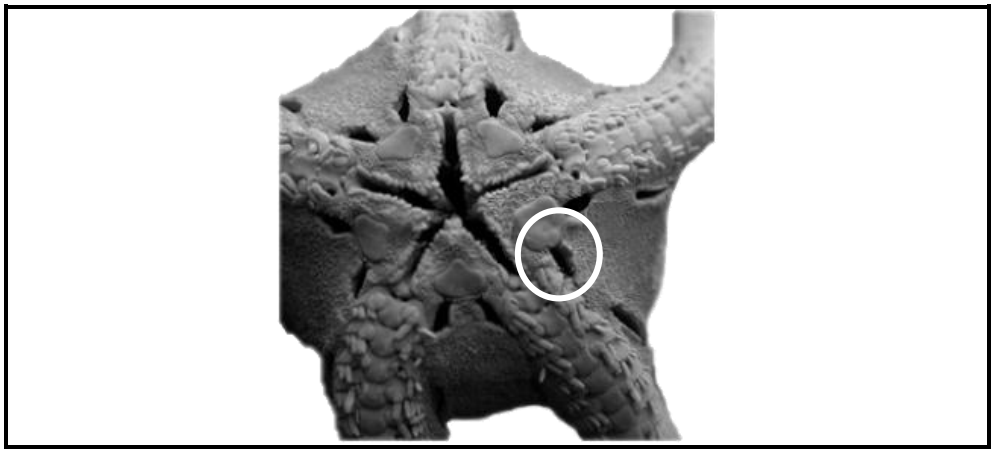
[Source: https://www.shutterstock.com/]

Which statement regarding the crustacean is CORRECT?

The crustacean …

A emerges during the night to feed on rotting animals.
B burrows in the sand or shelters in the rotting plants.
C emerges with the rising tide to 'surf' to the high tide mark.
D filters out microscopic organic material that is deposited by rising waves.

1.1.6 The diagram below shows the oral surface of an animal.



[Adapted from https://4.bp.blogspot.com/]

What is the main effect that the absence of the structure circled in the image above will have on this animal?

It will reduce …

A the amount of waste being produced.
B the ability to feed.
C gaseous exchange.
D the carbon dioxide intake.

1.1.7 The statements below are structural characteristics found in BOTH sea urchins and sea cucumbers.

(i) Lacks a test
(ii) Pentaradial symmetry
(iii) Has ossicles
(iv) Aristotle's lantern
(v) Respiratory tree

Which combination contains only INCORRECT statements for BOTH sea urchins and sea cucumbers?

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

1.1.8 Which statement is INCORRECT about osmoregulation in marine bony fish?

A Hypotonic to their surroundings
B Kidneys can cope with a large amount of salt
C Produce concentrated urine
D Hypertonic to their surroundings

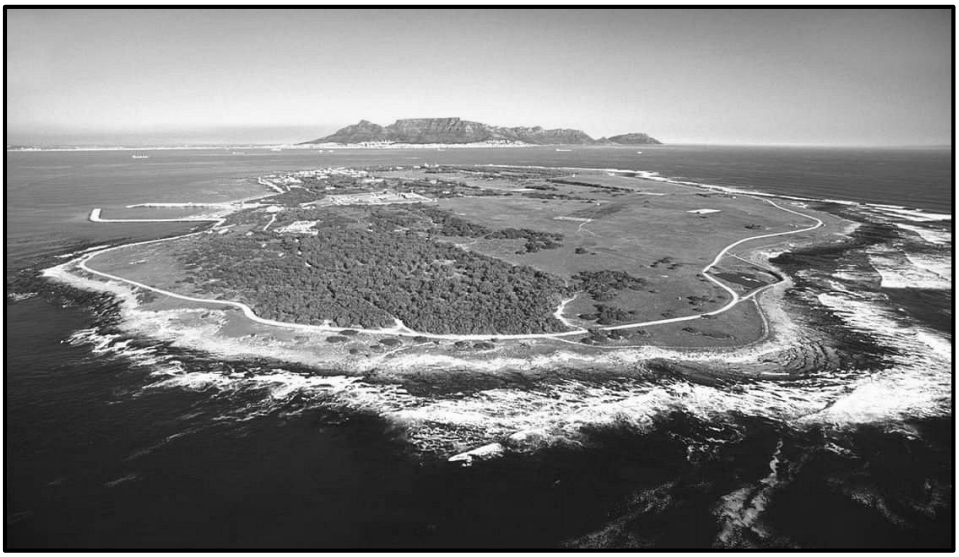
1.1.9 The options below refer to key benefits of marine protected areas (MPAs).

(i) Protecting critical habitats for the reproduction and growth of species
(ii) Increasing space for the development of commercial companies
(iii) Promoting ecosystem stability and ecosystem resilience
(iv) Aiming to establish sites for mineral exploration
(v) Increasing fish catches in surrounding fishing grounds

Which combination is INCORRECT for the key benefits of MPAs?

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

1.1.10 The image below shows Robben Island which is a marine protected area.



[Source: https://dynamic-media-cdn.tripadvisor.com/]

Under which IUCN category does this area fall?

A Protected Landscape and Seascape
B Managed Resource Protected Area
C Strict Nature Reserve
D Natural Monument (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 combination of regions on Earth occupied by living organisms

1.2.2 The first body opening that forms in the early stages of embryo development

1.2.3 Giving false or misleading information in terms of the environmental benefits of a product or service

1.2.4 The population size of an individual species of any form of sea life regarded as food by humans

1.2.5 Dense clusters of digestive glands extending from the stomach of an echinoderm and into the arms, assisting in the digestion and distribution of food

1.2.6 The microscopic heterotrophs in soil or sediment ecosystems that are often referred to as decomposers

1.2.7 An area, with some form of protection, around the perimeter or the edge of a protected area

1.2.8 A middle shore eulittoral zone, characterised by the presence of barnacles

1.2.9 A sieve-like plate that allows sea water to enter the water vascular system of echinoderms

1.2.10 Group of animals having a notochord which is NOT divided into vertebral segments (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 | Objectives of COMPARE | A:<br>B: | Fisheries management<br>Monitoring and research |
| 1.3.2 | Urochordates | A:<br>B: | Protostomes<br>Notochord |
| 1.3.3 | Oyster belt | A:<br>B: | West coast<br>Lower balanoid |
| 1.3.4 | Key pillars of a sustainable ecotourism business plan | A:<br>B: | Environmental protection<br>Human awareness |
| 1.3.5 | Some colonial ascidian species | A:<br>B: | Shared single exhalant siphon<br>Shared single inhalant siphon |

(5 x 2) **(10)**

**TOTAL SECTION A: 40**

## SECTION B

## QUESTION 2

2.1 Research was done along a section of South Africa's coast to determine a baseline of the numbers of four fish species observed in and around kelp forests.

**Counting procedure:**

- Researchers entered the water at the same time of day and at the same site to swim the same transect for each dive.
- They wore wetsuits as the water temperature ranged between 9 °C and 15 °C.
- They were in the water for 30 minutes per session.
- They worked in pairs.
- Each pair was allocated a fish species to count.
- The same transect was swum three times by each pair, for counting.

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

**THE TOTAL NUMBER OF INDIVIDUALS OF FISH SPECIES COUNTED BY PAIRS OF RESEARCHERS**

| Counts | Species counted | Total number of individuals of each fish species counted per session |
|---|---|---|
| Count 1 | Hottentot | 39 |
| | Galjoen | 22 |
| | Strepie | 20 |
| | Blacktail | 18 |
| Count 2 | Hottentot | 35 |
| | Galjoen | 27 |
| | Strepie | 18 |
| | Blacktail | 17 |
| Count 3 | Hottentot | 37 |
| | Galjoen | 20 |
| | Strepie | 19 |
| | Blacktail | 16 |

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

2.1.2 For the results of the study:

(a) Calculate the average number of individuals of each fish species over the three counts. (2)

(b) Draw a pie chart to present the average number for each fish species counted over the three counts. When drawing, round the degrees for each pie chart angle to the nearest whole number. Show ALL calculations. (6)

2.1.3 Name TWO constant variables of this study. (2)

2.1.4 The investigation was done in a kelp forest situated in an MPA.

(a) Along which coast of South Africa was this investigation done? (1)

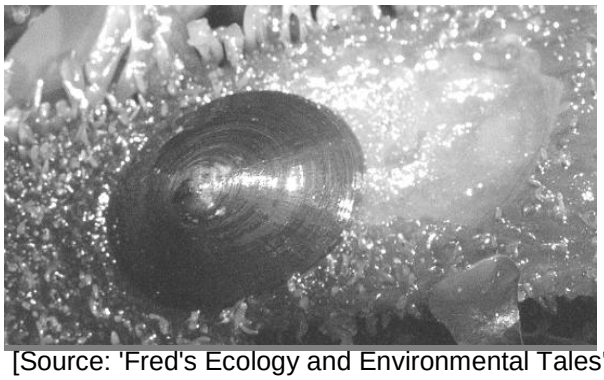
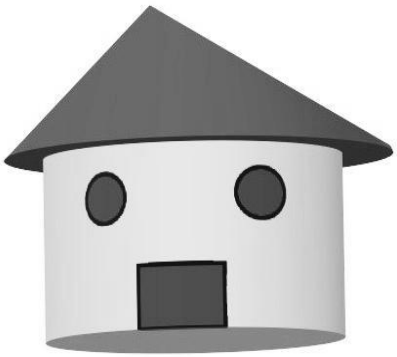
(b) Discuss the environmental conditions that allow the kelp forest to thrive along the coast identified in QUESTION 2.1.4(a). (3)

2.1.5 Which species of fish was seen as most abundant? (1)

2.1.6 Give THREE potential reasons why the species named in QUESTION 2.1.5 was most abundant in this area. (3 x 1) (3)

2.1.7 Is the procedure followed during this research project a suitable method to determine the fish populations along the South African coastline? Motivate your answer. (2)
**(21)**

2.2 Engineers have been studying the shell structures of Kelp Limpets (*Cymbula* spp.) to find applications that can benefit humans, such as the house design shown below.

| | |
|---|---|
|  <br>[Source: 'Fred's Ecology and Environmental Tales' (aka The FEET) (fredsingerecology.com)] |  <br>[Source: Illustration by examiner] |
| **Kelp Limpet on a stipe** | **House design incorporating limpet features** |

2.2.1 Name THREE roles that kelp forests play in the ecology of Kelp Limpets. (3 x 1) (3)

2.2.2 Why are engineers placing emphasis on researching organisms, such as the Kelp Limpets mentioned above, for human benefit? (2)

2.2.3 Use the images to:

(a) Name TWO qualities of a Kelp Limpet's shell that might be beneficial for designing and engineering houses. (2)

(b) Discuss how ONE of the characteristics named in QUESTION 2.2.3(a) is beneficial for limpets. (1)

(c) Discuss how ONE of the characteristics named in QUESTION 2.2.3(a) might be beneficial for designing homes. (1)

2.2.4 Explain the multidisciplinary approach used to develop new technologies based on the limpet's shell. (3)

2.2.5 Motivate whether characteristics of the limpet's shell structure could be incorporated into the design of a skyscraper. (2)
**(14)**
**[35]**

## QUESTION 3

3.1 Refer to the infographic below and answer the questions that follow.

The Shark Research Institute collects data on Bull Sharks (*Carcharinus leucas*) along the South African coast.

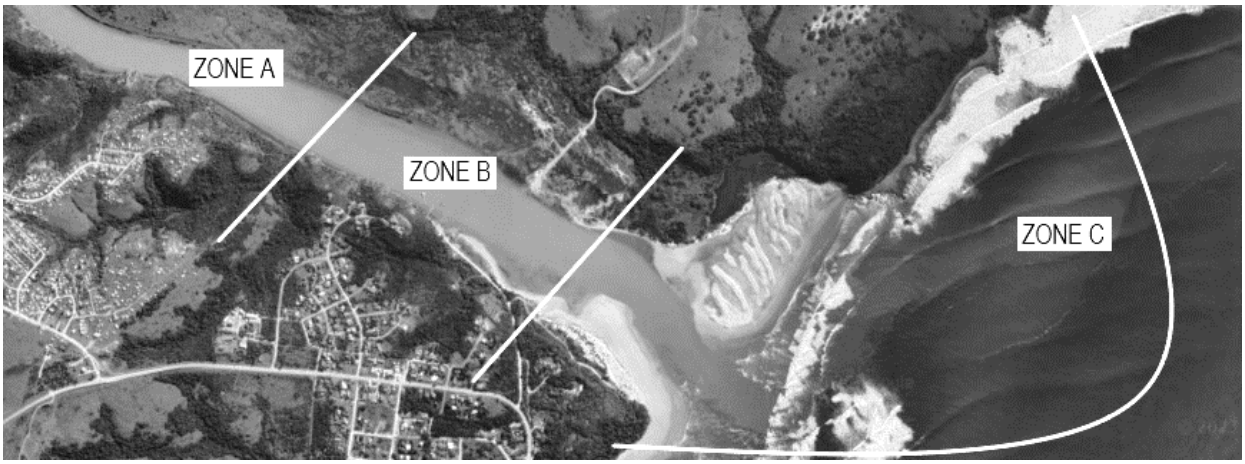
**STUDY GOAL**

The Shark Research Institute partnered with tourist volunteers in a Bull Shark catch-and-release programme in April 2023. Data were collected along the three zones (indicated on the image below). Tourists received a training session in handling sharks. Facilitated by a qualified biologist, the tourists used the 'mark recapture method' to catch sharks and collect the data. The zone in which each shark was caught and tagged was recorded. Sharks were released in the same area as where they were caught.

Results of this study are indicated in the table below.

**DATA COLLECTED**

| NUMBER OF SHARKS CAUGHT AND RELEASED IN APRIL 2023 | | | |
|---|---|---|---|
| | **ZONE A** | **ZONE B** | **ZONE C** |
| Newly tagged juvenile sharks | 10 | 7 | 1 |
| Recaptured tagged juvenile sharks | 13 | 9 | 6 |
| Newly tagged adult sharks | 3 | 2 | 3 |
| Recaptured tagged adult sharks | 2 | 4 | 15 |




[Adapted from https://earth.google.com/web/search/]

3.1.1 The river is not in flood. Give TWO differences between **ZONE A** and **ZONE C** in terms of the water characteristics. (2)

3.1.2 Study the data in the table.

(a) In which zone were most juvenile sharks caught? (1)

(b) Give reasons why more sharks would be caught in the zone named in QUESTION 3.1.2(a). (3)

3.1.3 Name AND explain how THREE sensory organs, OTHER than eyesight, are used by sharks to navigate upstream. (3 x 2) (6)

3.1.4 The residents of the town on the riverbank asked for reasons why the tourists were catching sharks for this research project.

(a) Give evidence from the text to support that this research programme can be considered an ecotourism activity. (2)

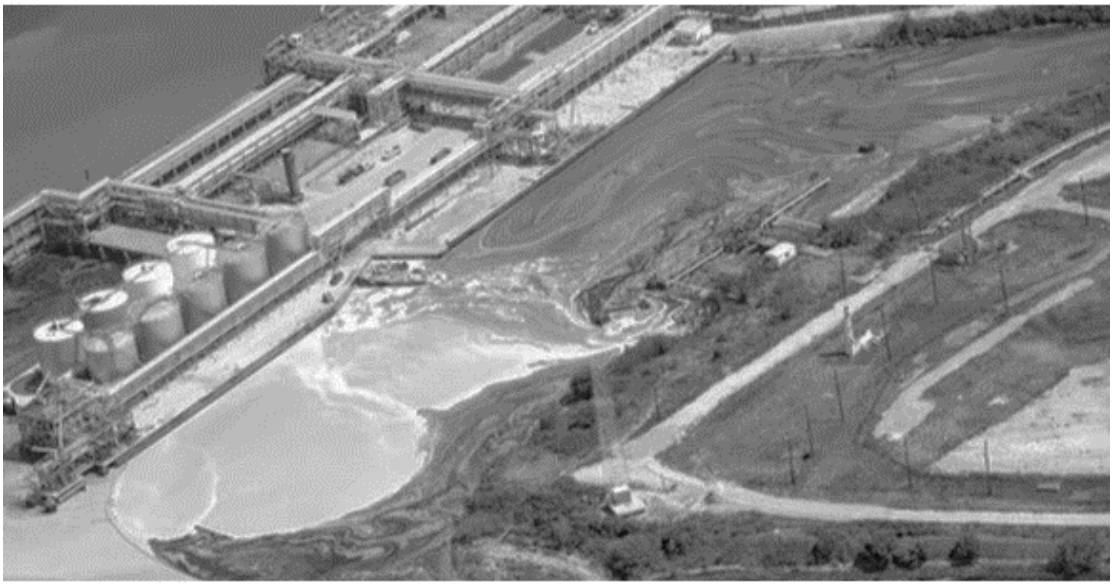
(b) State TWO ways in which overtourism can be prevented within this research programme. (2)

(c) How could this type of ecotourism benefit the sharks? (2)

3.1.5 Motivate whether it is ethical for researchers to conduct this study on sharks. (2)
**(20)**

3.2 Use the information below to answer the questions that follow.

This image was published in a local newspaper and forms part of a series on the possible development of marine protected areas (MPAs) in the area. The oil refinery shown in the image is upstream of the proposed MPA.



[Source: dailyherald.com]

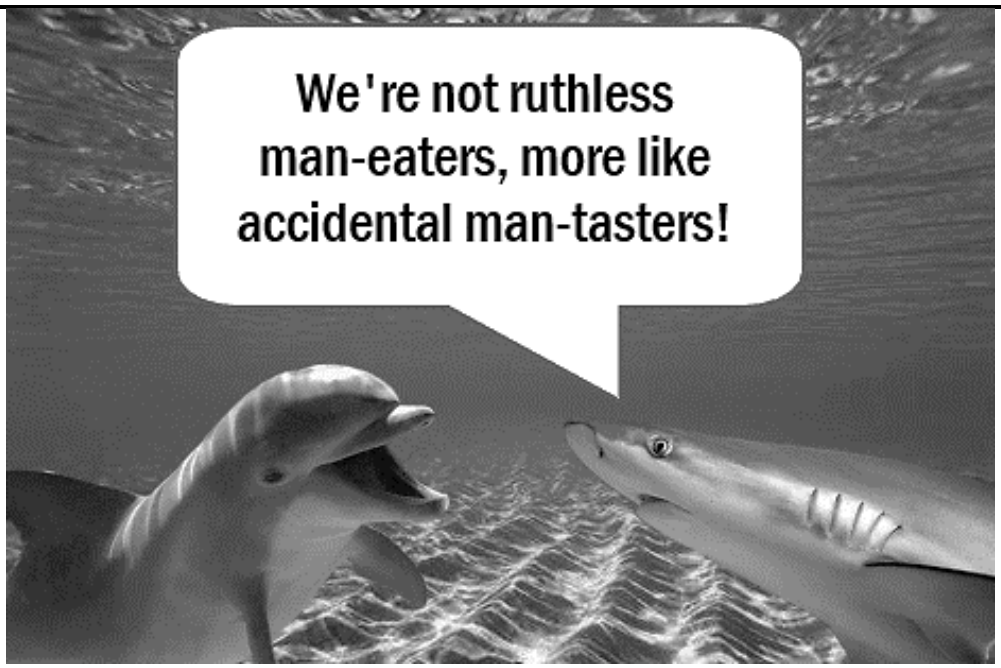
3.2.1 State ONE possible environmental impact that could be caused by the operations of this refinery. (1)

3.2.2 The suitability of this area, and the area downstream, is being investigated as a possible MPA.

State THREE management procedures that need to be used in this investigation. (3)

3.2.3 In your opinion, would it be possible to rehabilitate this area? Motivate your answer. (2)
**(6)**

3.3 Refer to the text in the source below to answer the questions that follow.




[Source: Created by examiner]

3.3.1 Do you agree with the shark's statement? Motivate your answer. (2)

3.3.2 Name the type of structure in the intestine that is unique to all sharks. (1)

3.3.3 Describe what makes the structure you named in QUESTION 3.3.2 beneficial to sharks. (2)

3.3.4 Why are all sharks not classified as apex predators? (2)

3.3.5 How does the dolphin locate and feed on its prey of choice? (2)

3.3.6 Tabulate TWO differences between the circulatory systems of the two organisms shown in the source. (5)
**(14)**
**[40]**

**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

This question is based on the text below.

> Interactions between pinnipeds and sea turtles take place both in the water and on land. At the French Frigate Shoals (islands in north-west Hawaii), both Hawaiian Monk Seals (*Monachus schauinslandi*) and Green Turtles (*Chelonia mydas*) are found lying next to each other on the same beaches, often in close proximity. Turtles often crawl ashore and disturb sleeping seals, sometimes even mothers and pups. Usually this disturbance happens when the turtle digs and throws sand or coral rubble onto the seals. In response to this, the seal may remain where it is and endure the rain of sand and rock, bellowing at the turtle periodically, or at other times the seals move away.
>
> [Adapted from https://www.researchgate.net/publication/275342946]

Write an essay in which you address the following aspects:

- Describe why the islands are important for turtle and pinniped reproduction.
- Explain the thermoregulation mechanisms of both turtles and pinnipeds.
- Expand on the effects that an increase in global temperature, due to climate change, will have on the reproduction and thermoregulation of both classes on the island.
- What implications would climate change have on the behaviour of the seals and the turtles on the island? Motivate your answer.

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

## QUESTION 5

Marion Island is the only location in the world where fur seals (*Arctocephalus* spp.) pursue and kill penguins as large as King Penguins (*Aptenodytes patagonicus*) on land. Some fur seals only eat the stomach contents of the penguins. The contest is by no means a one-sided affair, however, as the interaction is potentially dangerous for seals too. During the struggle, penguins might damage the seals' sense organs. This loss of sense organs can hamper the seals' ability to hunt for prey, leading to death by starvation.

[Adapted from https://www.marionseals.com/furseals]

Write an essay on this interaction in which you address the following aspects:

- The feeding behaviour of seals on Marion Island is unique. Describe how fur seals generally hunt.
- Explain why it is easier for seals to catch penguins on land.
- Describe how the penguins would have hunted the fish that the seals obtain from the penguins' stomachs.
- Discuss the sense organs of the seals that the penguins could damage while defending themselves AND how this may affect the seals' ability to hunt.
- Give your opinion on why these seals have started hunting penguins on land.

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

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