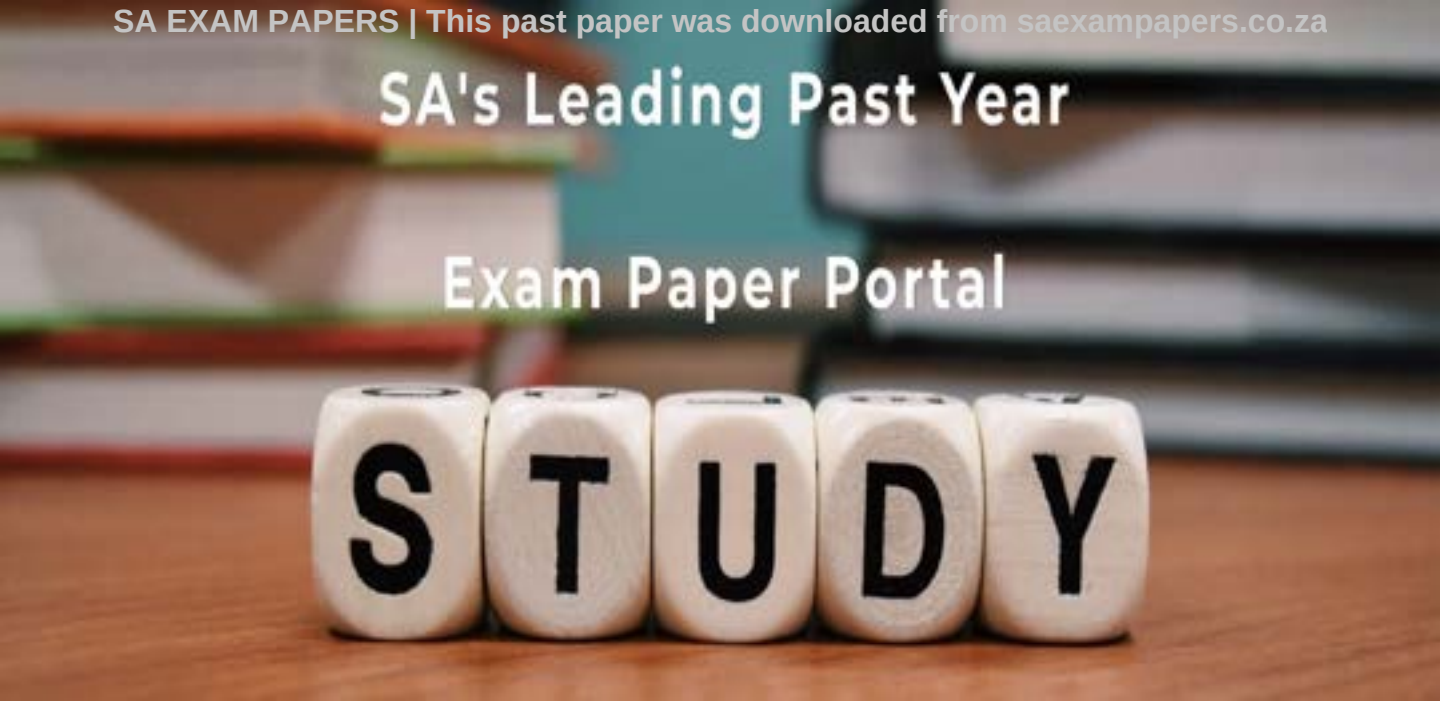


basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MARINE SCIENCES P2

NOVEMBER 2023

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: 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.

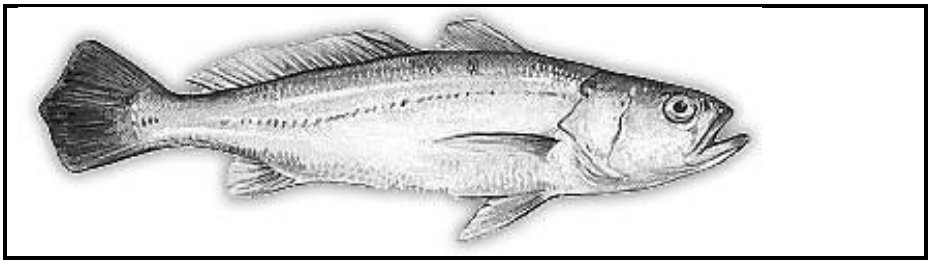
1.1.1 Pneumatophores are gaseous exchange structures found in …

A white mussels.
B kelp.
C red algae.
D mangroves.

1.1.2 The phagocytic cells found in the water vascular system of echinoderms are called …

A pneumatocysts.
B coelomocytes.
C mast cells.
D papulae.

1.1.3 The Kabeljou illustrated below is a marine species that can be found regularly in estuarine waters.

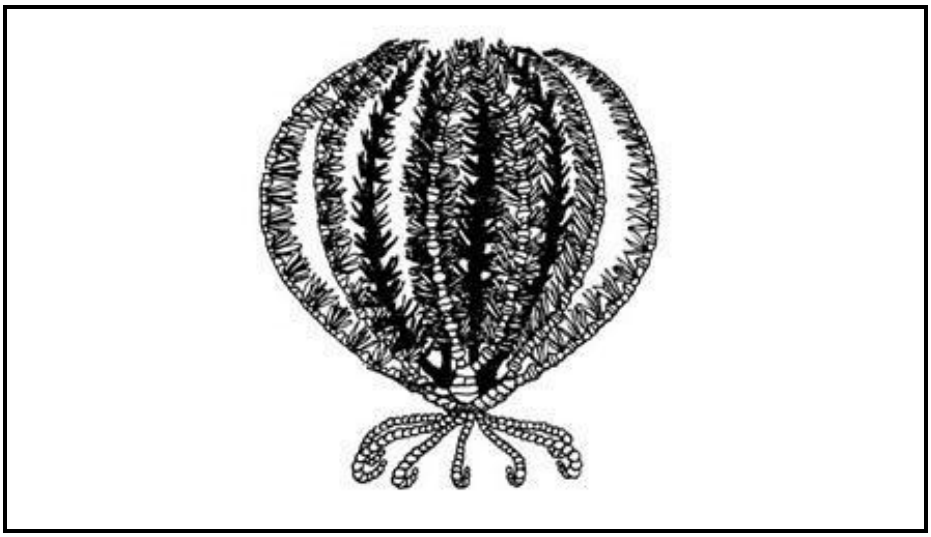


[Source: https://www.cellstop.com.na/weather/kabeljou.html]

The reason why this species can survive in brackish estuarine waters is because it is …

A euryhaline.
B isohaline.
C stenohaline.
D equahaline

1.1.4 The image below represents an adult specimen of an echinoderm class.



[Source: https://respirationsystem.weebly.com/uploads]

Which of the following is CORRECT for this adult organism?

	CLASS	MOTILITY
A	Crinoidea	Can swim
B	Ophiuroidea	Benthic
C	Crinoidea	Only planktonic
D	Ophiuroidea	Can swim

1.1.5 Which of the following comparisons is INCORRECT with regard to circulation in Chondrichthyes and Aves?

	CHONDRICHTHYES	AVES
A	Single circulation	Double circulation
B	Two-chambered heart	Four-chambered heart
C	Blood rich in haemoglobin	Blood rich in myoglobin
D	Veins transport blood to the heart	Arteries transport blood away from the heart

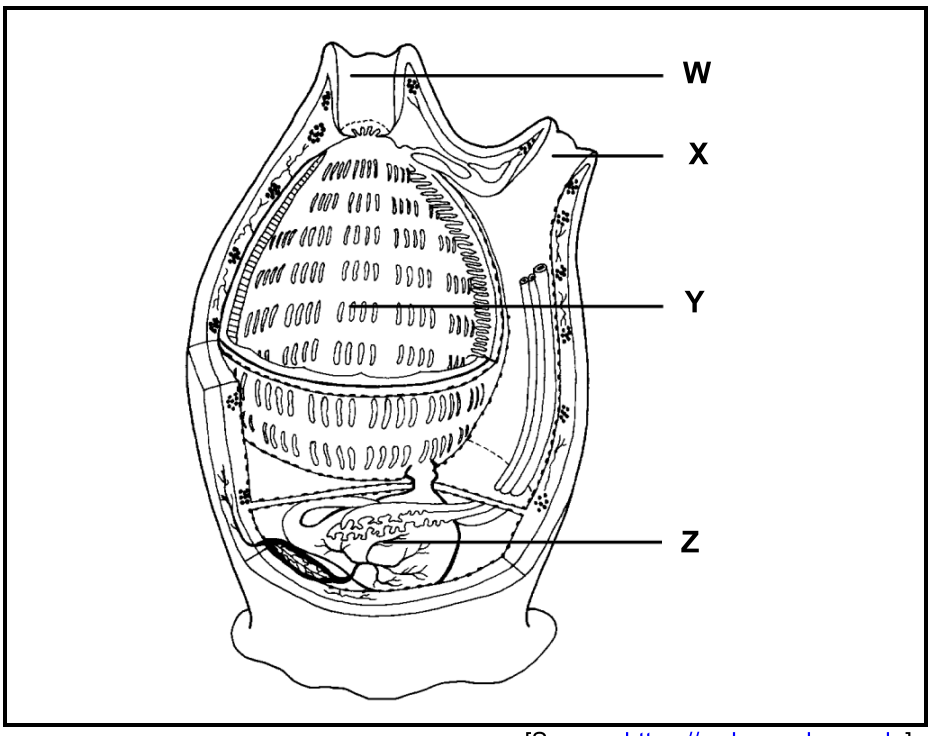
1.1.6 An ecological significant role of kelp holdfasts:

A Promotes biodiversity
B Increases the productivity of kelp forests
C Reduces the effects of wave action
D Food source for the kelp limpet

1.1.7 Island-like stands of *Laminaria pallida* are found in the …

A intermediate zone.
B split fan kelp zone.
C offshore zone.
D inshore zone.

1.1.8 The image below represents a typical tunicate.



[Source: https://web.augsburg.edu]

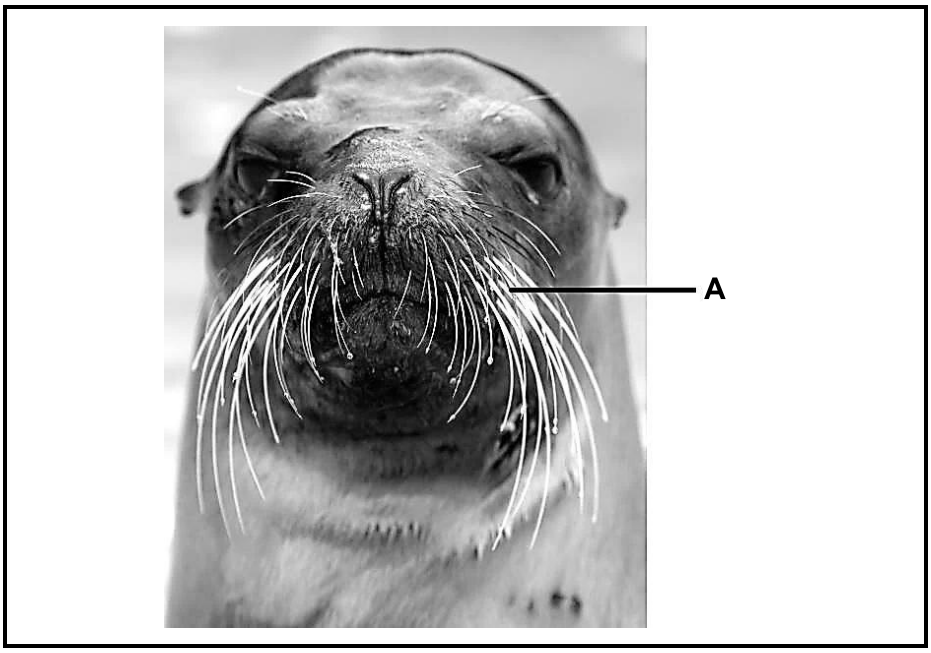
In which structure would you find the lowest oxygen and the highest waste concentration?

A W
B X
C Y
D Z

1.1.9 Which ONE of the characteristics is unique to Agnatha?

A Bony skeleton for structural support
B Glandular skin as an epidermal protective layer
C Rigid tongue with keratin rings
D Barbels for detecting chemical changes in the water

1.1.10 The image below represents a fur seal.



[Source: https://www.istockphoto.com/photos]

If a fur seal is born without **A**, it may NOT be able to …

A detect predators on land.
B move in confined spaces.
C take part in mating.
D maintain balance under water. (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 surface of an echinoderm opposite the surface with the mouth

1.2.2 A falling or outgoing tide

1.2.3 Thin projections extending inwards from the gill arches of fish, to prevent food from being lost through the gill slits

1.2.4 A range of tiny protective nippers extending from the skin of some echinoderms

1.2.5 The small bones in the inner ear of a fish, which assist with hearing

1.2.6 A reflective layer in the eyes of sharks, which improves their vision in low light conditions

1.2.7 A group of animals that have a notochord which is not divided into vertebral segments and where the notochord may only be present in the larval form

1.2.8 A combination of different shapes of teeth to perform different feeding functions

1.2.9 A strategy in some ovoviviparous sharks where the pups that hatch feed on unfertilised eggs in the ovary

1.2.10 A separate opening in the body unique to mammals for the release of urine or gametes (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 Respiratory trees	A: mangroves B: Holothuroidea
1.3.2 Penguins diving deep	A: anaerobic respiration B: diving bradycardia
1.3.3 Live in burrows	A: estuarine crabs B: white mussels
1.3.4 Pinnules	A: sea stars B: brittle stars
1.3.5 Podia are used for …	A: locomotion B: sensing

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

TOTAL SECTION A: 40

SECTION B

QUESTION 2

2.1 Read the article below and answer all the questions that follow.

MICROPLASTICS IN THE VAAL RIVER

The Vaal River in South Africa supports almost 50% of the country's gross domestic product. The river supplies water for drinking, agriculture, industries and municipal services to around 11 million people in Gauteng, Mpumalanga, North West and the Free State.

Microplastics are tiny plastic particles that are smaller than 5 mm in diameter. Primary microplastics are manufactured in microscopic size to be used as fibres, films, foams and pellets. In natural environments, such as rivers, plastics are degraded to smaller pieces through processes driven by thermal, chemical, microbial and mechanical forces.

It is estimated that between 0,8 and 2,5 million tonnes of microplastics are released into the global marine system per year. Once these microplastics end up in oceans, lakes, rivers and other bodies of water, it absorbs toxic elements and organic contaminants.

[Adapted from https://theconversation.com/fish-in-a-major-south-african-river]

The local municipality employed a group of scientists to investigate the effect of microplastics on the Common Carp (*Cyprinus carpio*) found in the Vaal River in South Africa.

The scientists used the following method:

- From 2019 to 2023, five Common Carp of similar mass were caught along the same area of the Vaal River at the beginning of each year.
- The fish's digestive tracts were carefully removed.
- A sieve was used to sort out the primary microplastics from other contents found in the fish's digestive tracts.
- A calibrated scale was used to weigh the amount of primary microplastic particles and the average weight for each year was determined.

The results of the study were recorded in the table below.

Table showing the average weight of primary microplastics found in the digestive tracts of the Common Carp for each year

TIME (YEARS)	AVERAGE WEIGHT OF PRIMARY MICROPLASTICS (g)
2019	15
2020	8
2021	6
2022	11
2023	12

2.1.1 Draw a bar graph to illustrate the data above. (8)

2.1.2 Discuss the trends of the results as shown in the graph drawn for QUESTION 2.1.1. (2)

2.1.3 Give ONE reason for the trend shown from 2019 to 2021. (1)

2.1.4 Many of the microplastics that were recovered from the samples were small, coloured (dyed) and fibrous. These pieces were traced back to a packaging company claiming that all their products are biodegradable.

(a) What is the marketing approach of the product called? (1)

(b) Explain ONE mitigating strategy that the industry could implement to prevent the type of marketing named in QUESTION 2.1.4(a). (1 x 2) (2)

(14)

2.2 The south coast of South Africa experiences storm surges with large volumes of fresh water discharged by rivers.

2.2.1 Describe the effect that the large volumes of rain will have on the salinity of rock pools. (2)

2.2.2 Explain TWO structural adaptations that organisms on a rocky shore along this coast need to be able to withstand heavy wave action associated with storm surges. (2 x 2) (4)

(6)

2.3 The image below shows a mollusc in search of food on a sandy beach.

[Source: https://t3.ftcdn.net/jpg/02/73/43/98]

2.3.1 In which sandy shore zone will you find the mollusc feeding during high tide? (1)

2.3.2 Describe the water conditions found in the zone named in QUESTION 2.3.1 that are favourable for the organism above. (2)

2.3.3 Significant nutrient cycling occurs on sandy shores. After the mollusc dies, it will contribute to this nutrient cycle.

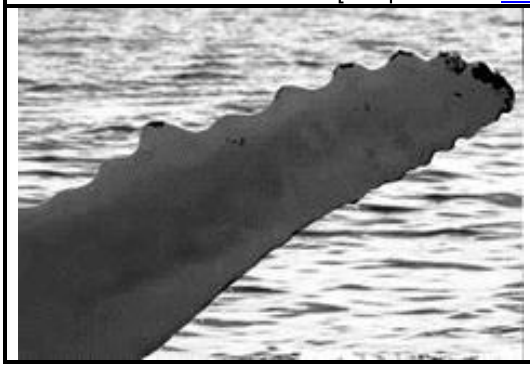
Name AND explain this food chain. (3)
(6)

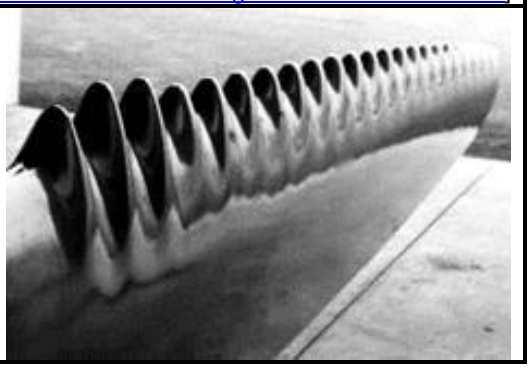
2.4 Read the extract below and answer the questions that follow.

WHALE POWER

The shape of the Humpback Whale's flippers has inspired the creation of a completely new multidisciplinary design for wind turbine blades. This design has been proven to be more energy efficient and also quieter. Unsteady flow and complex shapes can increase lift, reduce drag and delay stall (a dramatic and abrupt loss of lift), more than what existing engineered systems can accomplish. There are even possibilities that this technology can be applied to aeronautical designs, such as helicopter blades, in the future.

[Adapted from https://www.eurekalert.org/news-releases/572158]





[Source: https://blogs.colgate.edu/sustainability]

2.4.1 (a) State ONE advantage of the structure of the Humpback Whale's flippers as illustrated in the image above. (1)

(b) How will the advantage in QUESTION 2.4.1(a) be beneficial to Humpback Whales during their long migratory periods? (1)

2.4.2 Why are engineers using the design process referred to in the extract? (1 x 2) (2)

2.4.3 Explain the multidisciplinary steps that were taken in developing the design process in QUESTION 2.4.2. (4)

2.4.4 List THREE sustainable considerations that engineers should take into account regarding the type of materials that will be used. (3)

2.4.5 In your opinion, should this new technology be used in future aircraft designs? Substantiate your answer. (2)

(13)

[39]

QUESTION 3

3.1 The Six-Gill Hagfish (*Eptatretus hexatrema*) is an opportunistic scavenger that ties its body into a knot to forcefully remove chunks of flesh from large carcasses. The Sea Bass (*Dicentrarchus labrax*) is a highly predatory fish that opens and closes its mouth rapidly, resulting in its prey being engulfed by a vacuum-like mechanism.

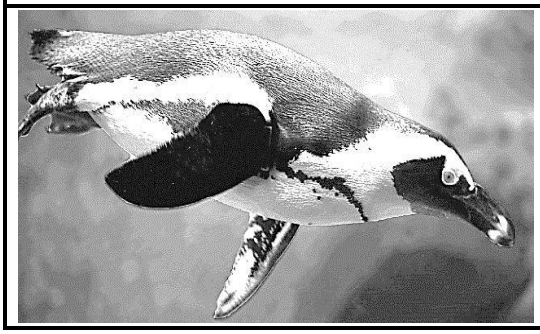
3.1.1 Explain how the Six-Gill Hagfish is able to protect itself from other predators when feeding. (2)

3.1.2 In line fishery, baited hooks and weighted lead sinkers are used. Bycatch of non-targeted species, such as the Six-Gill Hagfish and Sea Bass, is a major concern for this fishing industry.

(a) Discuss TWO characteristics of ONE of the species above that, in your opinion, would increase the likelihood of that species being caught on hooks by the fishing industry. (2 x 2) (4)

(b) For the species chosen in QUESTION 3.1.2(a), explain ONE structural characteristic that might reduce the chances of being caught on hooks. (2)
(8)

3.2 Consider the animals in the images below and answer the questions that follow.

ORGANISM A	ORGANISM B
	
[Source: https://live.staticflickr.com]	[Source: https://i.pinimg.com]

3.2.1 Describe why both animals have darker colouration on the dorsal surface. (2)

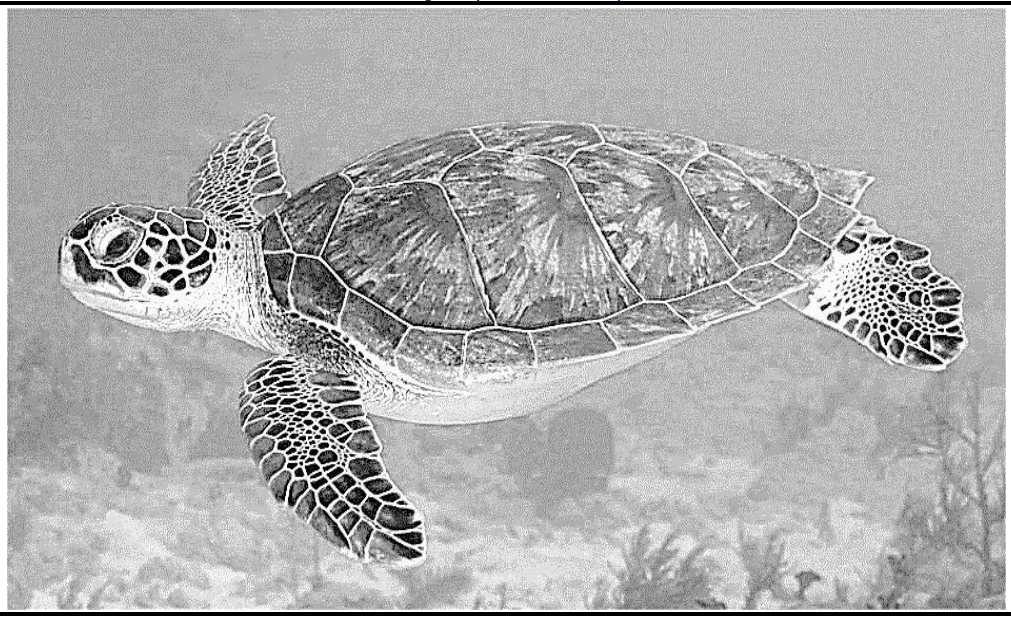
3.2.2 A mutation occurs in Organism B whereby the structure labelled **X** is shortened. Explain ONE way in which this would affect the animal's ability to detect prey. (3)
(5)

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

THE FAMOUS AURORA RETURNS TO HER OCEAN HOME

Aurora has had quite an adventure after being found rolling in the surf in Scottburgh, Durban, where she was taken to the Sea Turtle Hospital. Unfortunately, parasites caused Aurora's red blood cell count to drop, but with ongoing care she recovered quickly.

[Adapted from https://southcoastherald.co.za/486966/]



[Source: https://dinoanimals.com/animals]

3.3.1 What is the common name for this species of turtle? (1)

3.3.2 What effect will the drop in Aurora's red blood cells have on her ability to remain submerged for extended periods? (2)

3.3.3 Give TWO OTHER reasons for the decline in the sea turtle population. (2)
(5)

3.4 Cape Gannets (*Morus capensis*) are specialised ocean divers.

3.4.1 Explain ONE way in which Cape Gannets are able to thermoregulate when they dive. (1 x 2) (2)

3.4.2 The Cape Gannet has an extremely high oxygen demand while flying.

Draw a labelled diagram in which you show the breathing mechanism found in the Cape Gannet. (6)
(8)

3.5 A sudden and intensive drought period impacted a population of wetland frogs.

3.5.1 What effect will the prolonged drought period have on the population of frogs? (1)

3.5.2 Explain TWO reasons for your answer to QUESTION 3.5.1. (2 x 2) (4)
(5)

3.6 Evolution has resulted in marine mammals having adopted specific reproductive strategies for their different environments.

Tabulate TWO differences in the reproductive strategies of pinnipeds and cetaceans. **(5)**
[36]

TOTAL SECTION B: 75

SECTION C

Answer any ONE question in this section.

Clearly indicate the QUESTION NUMBER of the chosen question.

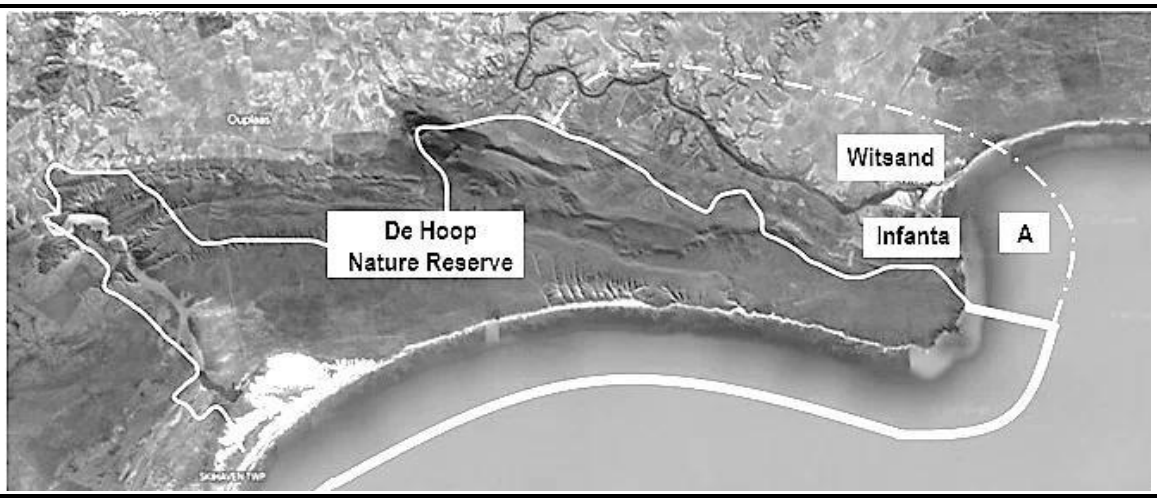
NOTE: Your answer must be in the form of an essay. NO marks will be awarded for answers in the form of a table, flow charts or diagrams.

QUESTION 4

Read the case study and view the map below to answer the question that follows.

The map below is an area found along the south coast of South Africa. The area within the solid white border is referred to as De Hoop Nature Reserve. Location **A** (as shown by the dotted line on the map) is where the Breede River flows into the ocean. The residents of Infanta and Witsand live near the Breede River mouth.

The local government intends to expand the De Hoop Nature Reserve into location **A**, including both areas as part of the marine protected area (MPA). This expansion means that the residents will live within the MPA.



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

As a marine scientist, you have been asked to consult on the MPA expansion project.

In an essay address the following aspects:

- Define and explain what MPAs are.
- Discuss how Pressey's checklist will be used as a participatory approach with the residents and marine users within location **A**, to motivate for the expansion of the MPA.
- Elaborate on how the local government will determine whether the MPA expansion project is successful or not.
- Discuss why location **A** should have been included as part of the original MPA.
- Expand on the potential impact of the MPA extension project on the economic functionality of the residents close to location **A**.

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

QUESTION 5

Read the case study and view the image below to answer the question that follows.

The picture below is of a beach close to a large coastal city. In the past, this area had pristine beaches, a great abundance of biodiversity, large amounts of algae and great fish species diversity. Tourists used the warm ocean water for swimming, snorkelling, recreational diving and sports fishing. Tourism activities increased in the area, up to a point where it started to influence the ecological balance negatively. Due to overtourism, the biodiversity has decreased drastically and the environment has started to degrade.

The International Ecotourism Society (TIES) has recommended closure of the coastal area to the public for a set period of time. The goal of implementing the management strategy is to mitigate the long-term degradation of the area and prevent a relapse (prevent the environment from being damaged again).

[Source: https://www.easybeaching.com/growing-concern-of-beach-pollution]

Write a newspaper article in which you address the following aspects:

- Discuss the influence that overtourism has on this ecosystem.
- Elaborate on how the local government will know whether the closure resulted in successful rehabilitation of the ecosystem.
- Discuss TWO ways in which this area can be utilised sustainably after re-opening.
- Expand, in detail, on how ecotourism can be promoted to avoid a relapse of this ecosystem.
- In your opinion, will the rehabilitation strategy be a sustainable plan for the coastal area indicated in the image?

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

TOTAL SECTION C: 35
GRAND TOTAL: 150