Confidential

basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MARINE SCIENCES P2

NOVEMBER 2025

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: 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. Write ALL the answers in the ANSWER BOOK.

3. Start the answers to EACH question at the top of a NEW page.

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 TWO decimal places, where applicable.

12. Do NOT write outside of the margins in the ANSWER BOOK.

13. Write neatly and legibly.

SECTION A

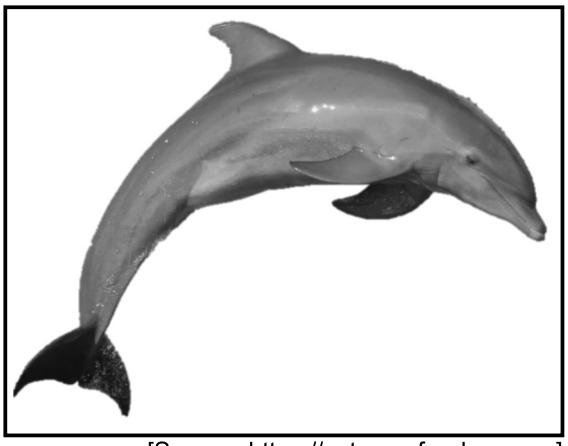
QUESTION 1

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 Animals found in the lower eulittoral zone are not well adapted to …

A predation.
B wave action.
C desiccation.
D turbulence.

1.1.2 The image below shows a species of cetacean that is found along the coast of South Africa.



[Source: https://cetacea.fandom.com]

Which ONE of the following options gives the CORRECT common name for the cetacean?

A Humpback Whale
B Bottlenose Dolphin
C Bryde's Whale
D Humpback Dolphin

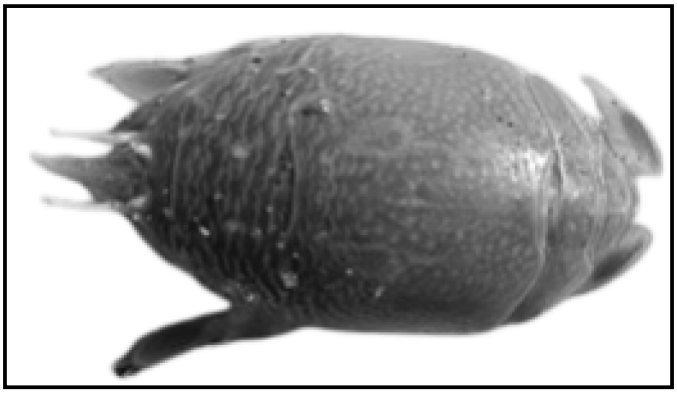
1.1.3 Which ONE gives a CORRECT key principle of The International Ecotourism Society (TIES)?

A Allowing tourists to interact with wild animals
B Avoiding tourism activities in natural areas
C Allowing tourists to experience local traditions
D Prioritising the environment over the community

1.1.4 Which option will exclude an area from being a community-managed local marine reserve?

A Presence of rare species
B Supports overexploited species
C Area has a large economic development
D Area is aesthetically appealing

1.1.5 The image below shows a Mole Crab (*Emerita austroafricana*) found along a sandy beach.



[Source: https://upload.wikimedia.org/wikipedia/commons]

Which statement regarding the Mole Crab is INCORRECT?

The Mole Crab …

A emerges to be rolled around by the rising tide.
B remains in the turbulent zone to feed.
C returns to the low-tide mark with the tide.
D migrates in the sand column to filter feed.

1.1.6 Which ONE of the following comparisons is INCORRECT with regard to reproduction in amphibians and reptiles?

	AMPHIBIANS	REPTILES
A	Undergo metamorphosis	Born identical to the parents
B	Soft, permeable shell	Leathery, permeable shell
C	External fertilisation	Internal fertilisation
D	Eggs require water	Eggs do not require water

1.1.7 The structures below are found in echinoderms:

(i) Papulae
(ii) Pyloric caecae
(iii) Water vascular system
(iv) Pedicellariae
(v) Coelomocytes

Which combination contains only structures that deal with BOTH circulation and excretion in echinoderms?

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

1.1.8 The high productivity found in kelp forest ecosystems is a result of …

A shedding of kelp fronds.
B constant sunlight exposure.
C lack of predators.
D high salinity levels.

1.1.9 The following statements relate to sea stars:

(i) Digestive enzymes partially digest the food source.
(ii) The stomach is everted outside of the sea star's mouth.
(iii) Nutrients are drawn into the sea star's body.
(iv) The lower part of the stomach is on the food source.

Which combination CORRECTLY describes the order of feeding and digestion in sea stars?

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

1.1.10 The image below shows a hatchling of a vertebrate.

[Source: https://i.pinimg.com/564x/6c/26/f1/]

The main role that the temperature of the sand plays in the development of the hatchling of the vertebrate above is that it …

A determines the size of the hatchlings.
B affects the sex of the hatchlings.
C indicates the number of eggs that will hatch.
D speeds up their ability to swim. (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 High-pitched sounds emitted by bats and cetaceans to detect objects in dark or poor visual environments

1.2.2 A notochord divided into flexible segments of cartilage or bone

1.2.3 The thin strips fanning out from the gill arches of fish to provide a broad gaseous exchange surface

1.2.4 Benefits to a habitat provided by nature and healthy ecosystems, such as provision of nutrients and good water quality

1.2.5 A process in many diving animals, where the blood supply to non-critical organs and tissues is restricted while they are diving, enabling all available oxygen to go to the brain and muscles responsible for swimming

1.2.6 The region just below the spring low-tide mark

1.2.7 Structure found in marine birds that produce oil for waterproofing the feathers

1.2.8 Experiences offered to tourists centred on wild or natural environments

1.2.9 Feathery branches found in sea cucumbers extending into the coelom from the rectum that draw in sea water to aid gaseous exchange

1.2.10 A bony plate covering the gill chamber of a fish (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	Ecotourism business plan	A: B:	building infrastructure upskilling communities
1.3.2	Star-shaped inhalant siphon	A: B:	ascidian White Mussel
1.3.3	IUCN category of Robben Island	A: B:	habitat management area protected landscape
1.3.4	Middle shore	A: B:	Ghost Crab sand hopper
1.3.5	Toxic to most predators	A: B:	*Chelonia mydas* *Eretmochelys imbricate*

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

TOTAL SECTION A: 40

SECTION B

QUESTION 2

2.1 Study the investigation below and answer the questions that follow.

African Penguins (*Spheniscus demersus*) are critically endangered seabirds that depend on small pelagic fish such as sardines and anchovies for survival. Industrial purse-seine fishing also targets the same fish species, creating competition between penguins and commercial fisheries. The penguins forage on prey up to a depth of 40 m. This is the same depth at which purse-seine nets are used to catch the small pelagic fish.

To investigate the potential benefits of Marine Protected Areas (MPAs) for penguin conservation, researchers studied two African Penguin colonies in Nelson Mandela Bay: St Croix Island and Bird Island, located 50 km apart. Both areas around the colonies were open to purse-seine fishing activities in 2008. As part of a larger initiative, from 2009 to 2010, a 20 km radius no-take zone was established around St Croix Island, while Bird Island remained open to fishing throughout 2009 and 2010.

The scientists used the following method:

- Penguins taking care of chicks were tagged with GPS dive sensors.
- The tags recorded the average dive depth (in metres) per feeding trip.
- The hours spent at sea, per feeding trip, were recorded.
- The average dive depth at sea was used to calculate the energy that the penguins used to find food.

The table below shows the data collected in this study.

YEAR	AVERAGE DIVE DEPTH (m)	
	BIRD ISLAND	ST CROIX ISLAND
2008	25,0	26,4
2009	26,8	23,0
2010	28,6	32,1

[Adapted from Pichegru et al. 2012. *Journal of Applied Ecology*, No. 56]

2.1.1 Give the independent variable for this investigation. (1)

2.1.2 Draw a bar graph to show the data above. (8)

2.1.3 Explain how an increase in the average dive depth could impact the survival rate of penguin chicks. (3)

2.1.4 Explain TWO ways in which penguins are adapted to reduce the amount of energy used when diving deeper for small pelagic fish. (2 x 2) (4)

(16)

2.2 Read the case study below and answer the questions that follow.

NEST RAPID RESPONSE TEAM

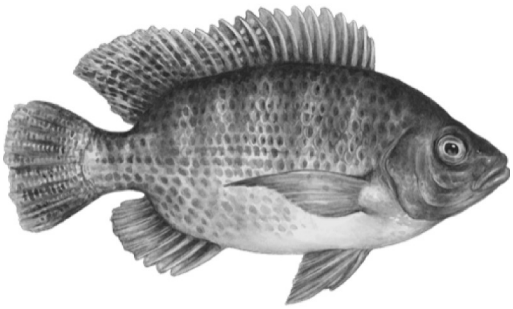
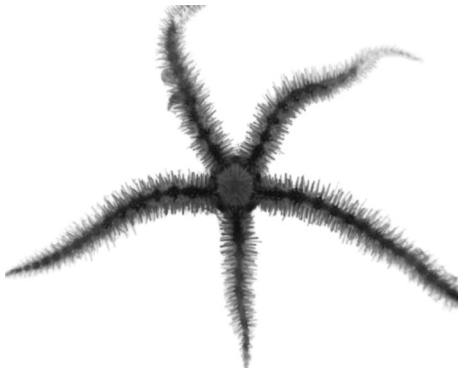
Cape Bream (*Pachymetopon blochii*) colonies and the Common Brittlestar (*Ophiothrix fragilis*) are found in the kelp forests.

The male Cape Bream maintains a nest to attract one female. After mating has taken place, the males remain at the nest to look after the developing eggs.

When the water flows away from the kelp forest, the scent of the eggs is carried away from the nests. The Brittlestars then detect this scent and swarm the Cape Bream nests to eat the eggs.

To defend the eggs, the Cape Bream males pick up the Brittlestars with their mouths and carry them away from the nests. Bream males on the inside of the colony assist those on the outskirts of the kelp forest to prevent the Brittlestars from getting to their nests.

[Source: https://www.theguardian.com and https://www.youtube.com]

Cape Bream (*Pachymetopon blochii*)	**Common Brittlestar (*Ophiothrix fragilis*)**
	
[Source: https://www.pngplay.com/image/]	[Source: https://www.marlin.ac.uk/species]

2.2.1 Discuss why Cape Breams build their nests in kelp forests. (2)

2.2.2 State the relationship taking place between the Common Brittlestar and the Cape Bream eggs. (1)

2.2.3 (a) Name the reproductive strategy found in the Cape Bream. (1)

(b) Evaluate whether the reproductive strategy named in QUESTION 2.2.3(a) is advantageous to the Cape Bream. (2)

2.2.4 (a) Discuss how the Common Brittlestars are able to detect the scent of the Cape Bream eggs. (3)

(b) Describe how the Common Brittlestars would move itself forward towards the Cape Bream nests. (2)

(c) In your opinion, would an increase in wave activity along the West Coast of South Africa negatively or positively affect the Common Brittlestar's ability to sense Cape Bream eggs? Motivate your answer. (2)
(13)

2.3 Study the text and the image below regarding the African Black Oystercatcher and answer the questions that follow.

OYSTERCATCHER FINE DINING

The near-threatened African Black Oystercatcher (*Haematopus moquini*) shown below, is native to the rocky shores of Southern Africa. The African Black Oystercatcher has a diet predominantly consisting of molluscs, including black mussels.

[Adapted from https://www.tandfonline.com]

AFRICAN BLACK OYSTERCATCHER
(*Haematopus moquini*)

[Source: https://thebdi.org]

2.3.1 Give the name of the rocky shore zone in which the African Black Oystercatcher is found when feeding on black mussels. (1)

2.3.2 Discuss ONE advantage of predation on the populations of prey species living in rocky shore ecosystems. (1 x 2) (2)

2.3.3 Describe ONE biotic factor that black mussels have to deal with, OTHER than predation. (1 x 2) (2)

2.3.4 Discuss the impact that the increased poaching of black mussels would have on Black Oystercatcher numbers. (2)
(7)
[36]

QUESTION 3

3.1 Read the infographic about the Knysna Estuary below and the data in the table. Answer the questions that follow.

KNYSNA ESTUARY

The Knysna Estuary is located in the Western Cape on the southern coast of South Africa. The estuary is a popular tourist destination, as a variety of unique recreational experiences are offered. These commercial activities make use of different types of vessels. These vessels could potentially pose a threat to the ecological state of this estuarine environment. Therefore, permits are applied for annually.

The mudflats in the Knysna Estuary are mainly a habitat for burrowing invertebrates, such as the Mud Prawn (*Upogebia africana*), Blood Worm (*Arenicola loveni*) and mollusc species that are used as bait by recreational and subsistence fishers. This estuary is currently managed by South African National Parks (SANParks).

[Adapted from https://www.sanparks.org/wp-content/uploads/2024/01]

Number of annual permits issued for vessels during the permitting period from 2018 to 2019 for the Knysna Estuary

TYPE OF VESSEL	ANNUAL NUMBER OF PERMITS ISSUED
Inflatable canoe	210
Speedboat	687
Rowing boat	51
Houseboat	12
Kayak	176
Jet ski	4

Inflatable canoes, rowing boats and kayaks are powered by people using oars/paddles.

Speedboats, houseboats and jet skis are powered by engines.

[Adapted from https://www.sanparks.org/wp-content/uploads/2024/01]

3.1.1 Explain ONE potential impact that speedboats might have on the animals living in the Knysna Estuary. (3)

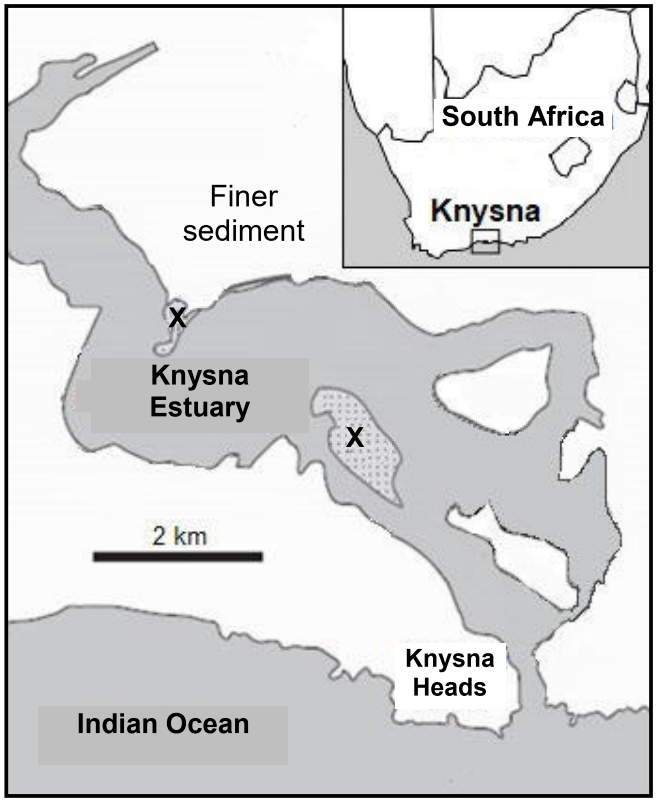
3.1.2 Compare the environmental impact of the rowing boat AND the jet ski. Suggest a measure that SANParks could implement to reduce this environmental impact for the Knysna Estuary. (3)

3.1.3 Study the data in the table. Do you think that the issuing of permits is enough to reduce the effects of overtourism? Justify your answer. (2)

Study the map of the Knysna Estuary, where **X** indicates the location of Blood Worms in the estuary.

MAP OF KNYSNA ESTUARY

The **X** indicates the location of Blood Worms in the estuary.



[Adapted from https://www.sanparks.org/wp-content/uploads/2024/01]

3.1.4 The Knysna area has experienced increased rainfall over a short period of time. This rainfall caused the finer sediment along the riverbanks to wash into the Knysna Estuary. This phenomenon resulted in the deposition of this finer sediment at the locations labelled **X**.

(a) Explain how the influx of this finer sediment will affect the fishing industry. (3)

(b) Draw an annotated diagram showing a Blood Worm in a burrow. Use arrows to indicate the direction of water flow. (4)

(15)

3.2 Read the extract on seal whiskers below and answer the questions that follow.

THE WHISKERS OF A SEAL

As animals move in water, swirls are created in the water. The seal's whiskers are designed to vibrate up and down, over and under these swirls. By sensing these swirls with their whiskers, seals can precisely identify the size, speed and direction of other swimming animals. They can then follow their downstream trail, even after the animals have passed.

[Adapted from https://www.whoi.edu/oceanus and https://www.freepik.com]

3.2.1 Describe how the position of the seal's whiskers is suitable for its function. (2)

3.2.2 Explain how the ability of seals to sense other swimming animals is beneficial for the seal. (2)

3.2.3 Engineers are closely examining the design of a seal's whiskers in an effort to design underwater sensors.

(a) Discuss how an underwater sensor that is inspired by the design of a seal's whiskers can benefit a marine rescue operation. (2)

(b) Describe the deeper guiding principle that engineers would have to consider when designing the underwater sensors in order to withstand ocean conditions. (2)

(c) Elaborate on TWO possible challenges to the designing and developing of underwater sensors inspired by the whiskers of seals. (2 x 2) (4)

(d) In your opinion, could ocean conservation initiatives benefit from the development of more advanced sensory technologies inspired by the whiskers of seals? Motivate you answer. (2)

(14)

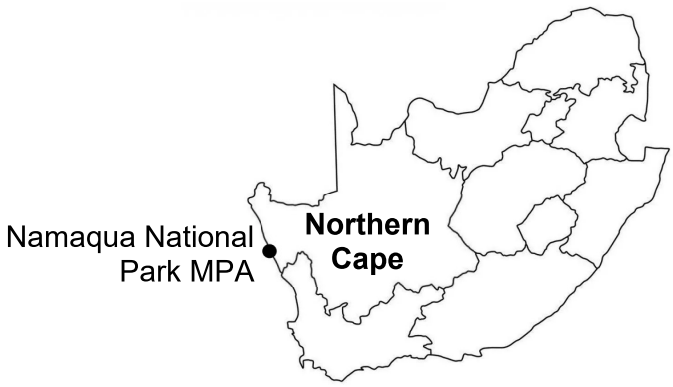
3.3 Read the extract below and answer the questions that follow.

NAMAQUA NATIONAL PARK MARINE PROTECTED AREA

The Namaqua National Park Marine Protected Area (MPA) is the only MPA along the Northern Cape coastline. This area provides protection for habitats of fish species that are valuable in fisheries. The area is a nursery for the Cape Hake (*Merluccius capensis*) and supports the recovery of the West Coast Rock Lobster (*Jasus lalandii*). Furthermore, this MPA serves as a feeding ground and breeding area for many dolphin species, such as the endemic Heaviside Dolphin (*Cephalorhynchus heavisidii*).

[Adapted from https://www.sanparks.org]

MAP OF NAMAQUA NATIONAL PARK MPA



[Adapted from https://southafricanmap360.com/img/1200/blank-map-of-south%20africa.jpg]

3.3.1 Give ONE example of a potential stakeholder who could have been involved in the establishment of the MPA AND give a reason why this stakeholder could have been involved. (1 x 2) (2)

3.3.2 State TWO benefits of this area being a National Park. (2)

3.3.3 Discuss how the protection of the Cape Hake nursery can economically benefit the local community around this MPA. (4)

3.3.4 You have been tasked to monitor the health of the Heaviside Dolphin population for this MPA.

(a) Using your knowledge of marine mammals, identify ONE variable for which data will be collected. (1)

(b) How will you collect the data for the variable that you identified in QUESTION 3.3.4(a)? (1)

(10)
[39]

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 chart or diagram.

QUESTION 4

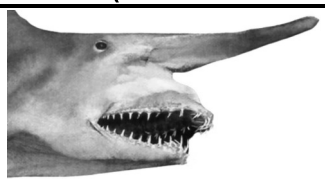
Read the text on the anglerfish and the Goblin Shark below.

Submersibles make travel to deeper, previously unexplored areas of the ocean more accessible for both scientists and tourists who can afford such journeys. Using these submersibles and new technology, scientists are able to study the interaction among unique deep-sea animals.

Anglerfish are adapted to live in cold, deep ocean waters where food is difficult to find. Female anglerfish have lures that produce light and are dangled in front of their mouths to attract prey. They also have large mouths and flexible bodies which enable them to swallow prey that can be up to twice their size.

Goblin Sharks (*Mitsukurina owstoni)* feed on anglerfish. The Goblin Shark is adapted to find and catch prey at great depths. Goblin Sharks swim slowly or drift along in a current until they sense their prey with their long, flat rostrums. The Goblin Sharks will then extend their jaws forward to capture their prey.

[Adapted from https://www.afar.com, https://www.nationalgeographic.com and https://creatures-of-the-world.fandom.com]

Anglerfish	**Goblin Shark (*Mitsukurina owstoni*)**
 [Source: https://customstoday.media/]	 [Source: https://ocean.si.edu]

In an essay, write how both the Goblin Shark and the anglerfish have adapted to hunt and thrive in their deep-sea habitat. Ensure that you discuss EACH of the bullet points below.

- Discuss how fish species, such as the anglerfish, are able to produce their own light.
- Describe how the adaptation of Goblin Sharks' long, flat rostrums help them to find their prey in the dark.
- Discuss the ventilation mechanisms used by some fish species that allow them to remain in one place and wait for their prey AND why many shark species must continuously swim to stay alive.
- Explain how Goblin Sharks will thermoregulate in colder, deeper waters.
- Submersibles are more readily available for personal use to people who can afford them. In your opinion, should exploration of the deep ocean be open to all members of the public? Motivate your answer.

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

QUESTION 5

Read the text below on the Blobfish and hagfish.

In 2013, the Ugly Animal Preservation Society (UAPS) held a competition to select the 'ugliest' animal in the world. The aim was to increase awareness of the animals in need of conservation that are not generally considered as 'cute' as others, such as otters or dolphins. In this competition, the Blobfish (*Psychrolutes microporos*) was awarded the title of the 'ugliest' animal, and the hagfish (*Eptatretus stoutii*) was a strong contender for the prize. Both these animals live in cold, deep waters where there is little or no light and high pressure. Blobfish and hagfish are threatened by fishing and require conservation efforts. In 2025, the Blobfish was also named as New Zealand's fish of the year.

Blobfish are different to 'normal' fish. Blobfish do not have swim bladders, have fewer and weaker bones, soft tissue filled with water and fat, and they have loose skins covering their flexible, scaleless bodies. These characteristics make Blobfish perfectly adapted for the pressures of the deep ocean, but their body structure will not keep their bodies in shape at the surface (see Image 1).

Hagfish appear similar to eels (see Image 2), but have skeletons made from cartilage, with no scales or jaws. Although hagfish are mainly scavengers, they are also opportunistic feeders and will eat dying animals if the opportunity presents itself.

[Adapted from https://theecologist.org, https://norwegianscitechnews.com, https://www.bbc.com, https://www.smithsonianmag.com and https://www.aquaticcommunity.com]

IMAGE 1: BLOBFISH (*Psychrolutes microporos*)		**IMAGE 2: HAGFISH (*Eptatretus stoutii*)**
In the deep ocean	**At the surface**	
 [Source: https://westcoastescape.co.za]	 [Source: https://blueridgechristiannews.com]	 [Source: https://www.joelsartore.com]

In an essay, explain how both the Blobfish and the hagfish are adapted to their environment. Ensure that you discuss EACH of the bullet points below.

- Discuss the advantages of the Blobfish having bones and the hagfish having a cartilaginous skeleton AND how EACH is used for movement.
- Why does the Blobfish have fewer and weaker bones AND why does it not have a swim bladder?
- How are hagfish adapted to find and eat food in the dark?
- How is slime beneficial for hagfish, but can be a nuisance for fishers?
- In your opinion, should we have competitions for 'ugliest animals' to create awareness of these animals? Motivate your answer.

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

TOTAL SECTION C: 35
GRAND TOTAL: 150