Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MARINE SCIENCE **9693/32**

Paper 3 A Level Theory **October/November 2024**

1 hour 45 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages. Any blank pages are indicated.

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Section A

Answer **all** questions in this section.

1 **(a)** Fig. 1.1 is a diagram of a mangrove leaf cell under an electron microscope.

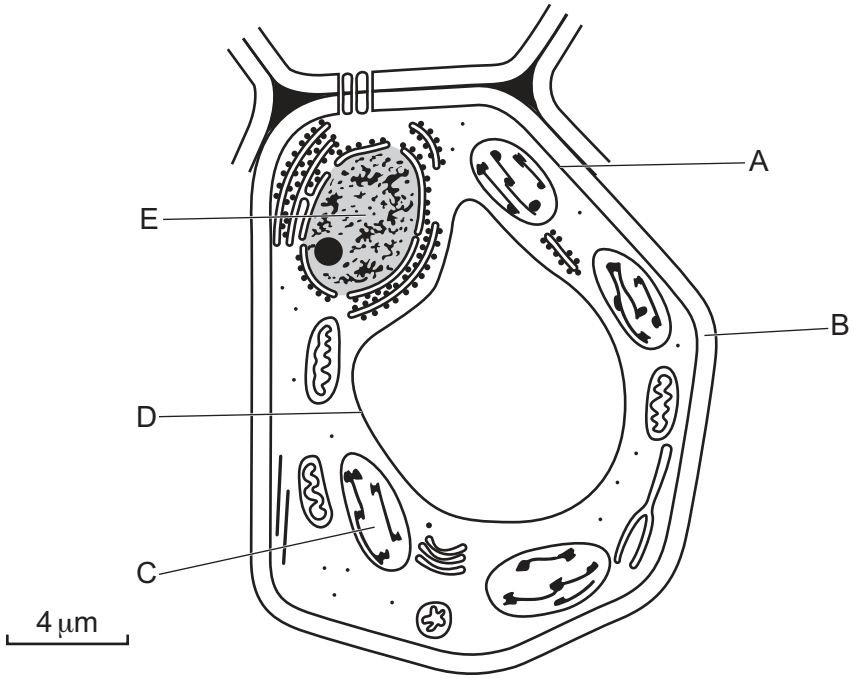

Fig. 1.1

(i) Circle the correct magnification for this cell.

×50 ×500 ×5000 ×50 000

[1]

(ii) Match the function in Table 1.1 with the correct letter from Fig. 1.1.

Table 1.1

function	letter
contains cellulose	
is fully permeable	
is a selectively permeable membrane	
is where starch is stored	
contains DNA	

[3]

(b) (i) State the meaning of the term water potential.

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..... [1]

(ii) Glucose produced from photosynthesis is soluble. Glucose is converted to starch for storage. Starch is insoluble.

Explain the advantage of converting glucose to starch in terms of water potential in plant cells.

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..... [4]

[Total: 9]

2 Fishmeal is an important component of fish feed used in aquaculture. It is obtained from low-value fish, such as anchovies and sardines as well as from fish trimmings. Fish feed usually contains around 30% fishmeal. Fishmeal contains between 55% and 65% protein and has the correct balance of essential amino acids.

(a) State why a high protein content is required in fish feed.

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..... [1]

(b) Fig. 2.1 shows the percentage change in use of fishmeal as a food source for agriculture, aquaculture and other animals between 1980 and 2010.

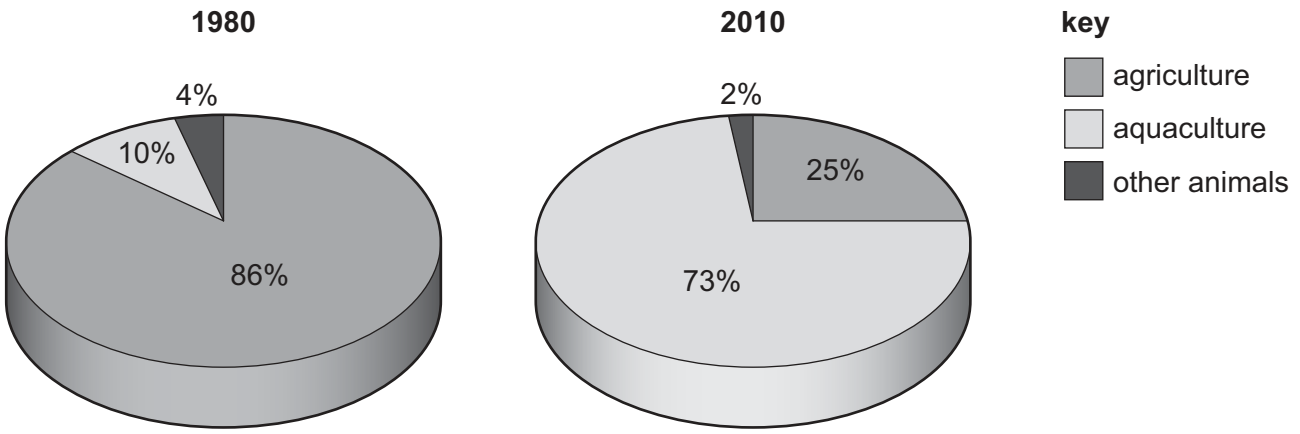

Fig. 2.1

(i) Use the information in Fig. 2.1 **and** your own knowledge to suggest why fish farmers are looking for alternative feeds that contain less fishmeal.

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..... [3]

(ii) One possibility is to replace some of the fishmeal with soybean. Soybean consists of 47% protein. Fermented soybean consists of 56% protein.

Table 2.1 shows the results of an experiment where fish were fed on either fishmeal, a mixture of fishmeal and soybean or a mixture of fishmeal and fermented soybean.

Table 2.1

feed	mean percentage mass gain of fish after seven weeks	mean percentage growth rate of fish per day	percentage survival of fish
control 30% fishmeal	391	3.54	70
24% fishmeal + 6% soybean	379	3.48	68
18% fishmeal + 12% soybean	370	3.44	68
24% fishmeal + 6% fermented soybean	426	3.96	68
18% fishmeal + 12% fermented soybean	380	3.47	70

Use **all** the information provided to evaluate whether soybean and/or fermented soybean are suitable replacements for fishmeal.

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(c) Automatic feeders are commonly used in aquaculture as an alternative to feeding fish by hand.

Suggest **two** advantages and **two** disadvantages of using automatic feeders to feed fish.

advantages

1 .....

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2 .....

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disadvantages

1 .....

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2 .....

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[4]

[Total: 12]

3 **(a)** Producers at hydrothermal vents fix energy into a form that consumers can use.

(i) Name these producers.

..... [1]

(ii) State **two** reasons why photosynthesis cannot occur at hydrothermal vents.

1 .....

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2 .....

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[2]

(b) Countries around the world are gradually increasing their supply of energy from renewable sources instead of from fossil fuels.

(i) State **one** disadvantage of using fossil fuels as a source of energy.

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..... [1]

(ii) Batteries are increasingly used to store energy from renewable sources. Batteries power electric vehicles, mobile phones and computers. Battery components include cobalt, copper, lithium and other rare elements. These elements are currently mined from localised deposits on land.

Fig. 3.1 shows the price in USD ($) per tonne of two of these elements for the month of January 2021. Lithium prices followed the same trend.

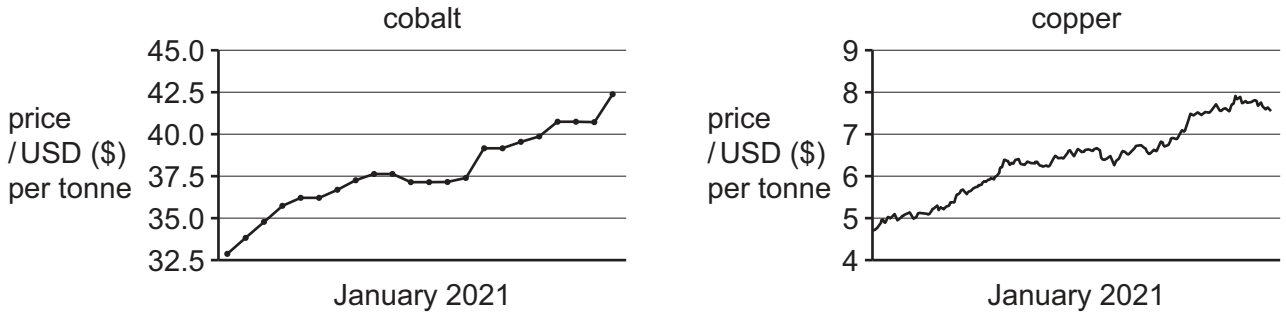

Fig. 3.1

Hydrothermal vents are rich in elements required to make batteries.

Use Fig. 3.1 **and** your own knowledge to suggest reasons why companies are now considering mining at hydrothermal vents as a new source of these elements.

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..... [2]

(iii) Oil and gas have been extracted from the sea bed for many years.

Suggest **two** reasons why mining at hydrothermal vents will be more challenging than extracting oil and gas from the sea bed.

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[2]

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(iv) Fig. 3.2 shows a possible method for mining at a hydrothermal vent.

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Fig. 3.2

Use Fig. 3.2 to suggest **and** explain why conservation organisations oppose deep-sea mining in this area.

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[Total: 12]

4 **(a)** Gaseous exchange is a process that occurs in all organisms, including coral polyps and marine fish.

(i) State the importance of gaseous exchange in living organisms.

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(ii) Explain why fish have gills for gaseous exchange, whereas coral polyps do not.

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(b) Gill structure in fish varies depending on habitat and feeding method. Each gill filament is rich in blood vessels and contains many folds on the surface called gill lamellae. Gill rakers are used to filter the water before it passes over the gill filaments.

Fig. 4.1 shows 2 gills, **A** and **B**. Each gill is from a different species of fish.

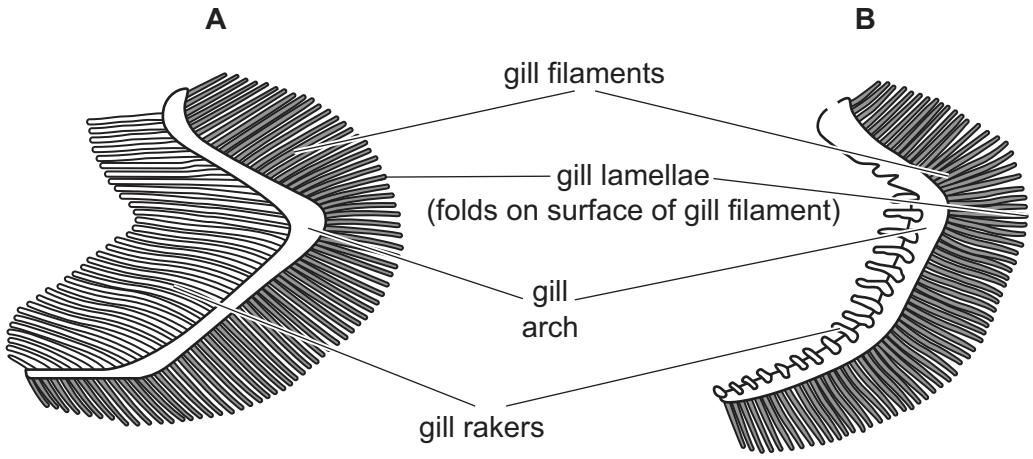

Fig. 4.1

Use Fig. 4.1 to suggest which gill, **A** or **B**, belongs to a plankton feeder **and** give reasons for your answer.

gill .....

reasons .....

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..... [2]

(c) Marine catfish are slow-moving fish found in the benthic zone. Mackerel are fast-moving fish found in the epipelagic zone.

Table 4.1 compares gill lamellae (folds on the surface of the gill filament) in marine catfish and mackerel.

Table 4.1

feature	marine catfish	mackerel
mean thickness of lamellae / μm	25	7
mean distance between lamellae / μm	45	20
mean thickness of lamellae walls / μm	10	>1
area of lamellae	large area	small area

Use the information in Table 4.1 to explain how the differences in lamellae are related to the habitat **and** motility of each fish.

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(d) Fish transfer oxygen into their blood by diffusion from the surrounding sea water.

Fig. 4.2 shows how the oxygen saturation varies with distance along a gill lamella from the gill arch:

- when the blood and sea water are moving in the same direction (method **A**)
- when the blood and sea water are moving in opposite directions (method **B**).

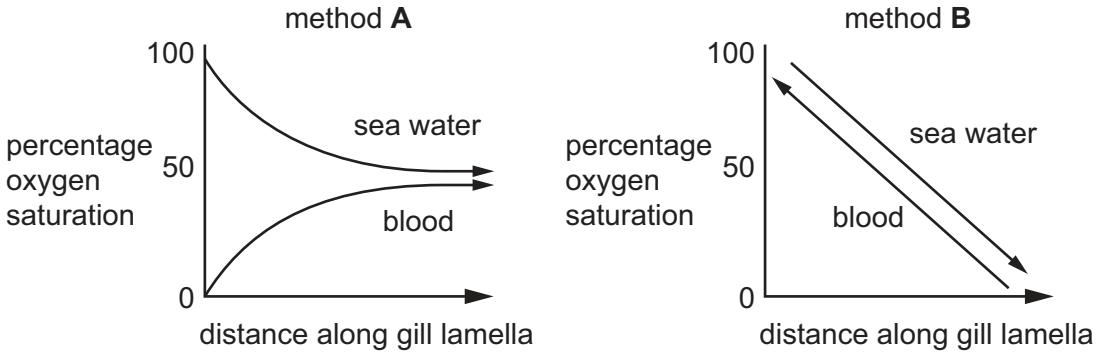

Fig. 4.2

Use Fig. 4.2 to explain why fish use method **B** for gaseous exchange.

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..... [2]

[Total: 12]

Section B

Answer **all** questions in this section.

5 Describe how satellite technology can be used to monitor fishing vessels **and** state the advantages **and** disadvantages of using this method.

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6 **(a)** Discuss the importance of microscopic algae in marine environments.

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(b) Explain how the presence of accessory pigments in marine producers is related to the penetration of different wavelengths of light.

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[Total: 17]

7 Explain why microplastics have increased in the marine environment.

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