



Cambridge International AS & A Level

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MARINE SCIENCE

9693/13

Paper 1 AS Level Theory

October/November 2023

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 **16** pages. Any blank pages are indicated.

Section A

Answer **all** questions in this section.

1 Fig. 1.1 shows a boxer crab, *Lybia tessellata*, and two anemones.



Fig. 1.1

(a) (i) Complete Table 1.1 to show the hierarchy of classification of the boxer crab.

Table 1.1

group	name of group for boxer crab
.....	Eukarya
kingdom
.....	Arthropoda
class	Malacostraca
order	Decapod
.....	Xanthidae
.....
species	tessellata

[3]

(ii) State **three** features of crabs that are typical of an adult crustacean.

1

2

3

[3]

(iii) State the type of symbiosis between the boxer crab and anemones.

..... [1]

(iv) Describe how the relationship between the boxer crab and anemones shows symbiosis.

.....

.....

.....

(b) Two symbiotic relationships are shown in Table 1.2.

Complete Table 1.2 by identifying the type of symbiosis in each relationship.

Table 1.2

relationship	type of symbiosis
manta rays and remora fish
copepods and marine fish

[2]

[Total: 11]

2 Fig. 2.1 shows the height of the tide at one location over two weeks.

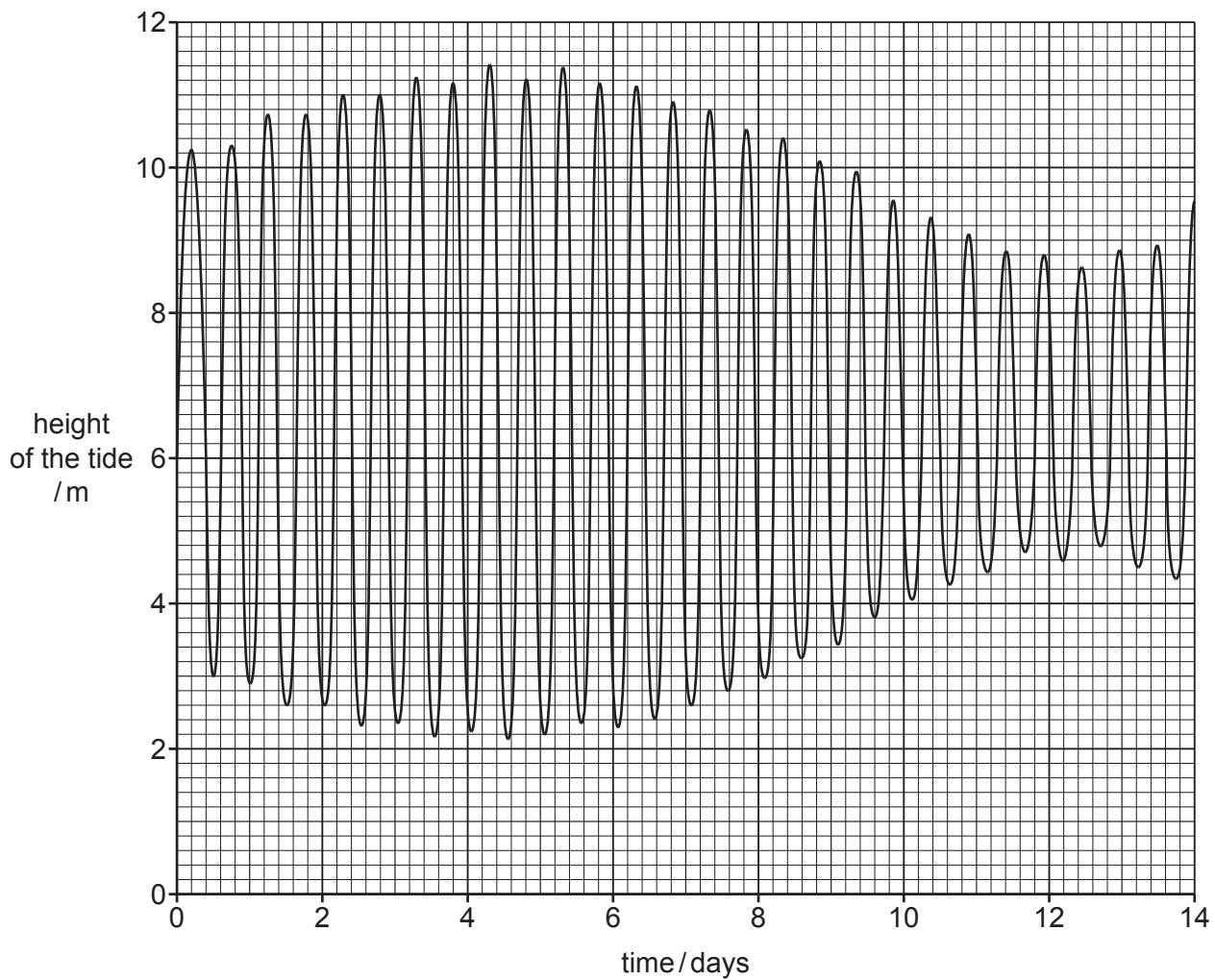


Fig. 2.1

(a) (i) Use Fig. 2.1 to state the day number on which a neap tide occurs.

..... [1]

(ii) Use Fig. 2.1 to calculate the tidal range on day 2.

Show your working.

State the unit.

..... [3]

(iii) Estimate the mean height of the tide shown in Fig. 2.1.

..... m [1]

(b) Explain how the alignment of the Sun, Moon and Earth causes a neap tide.

.....

 [3]

(c) Table 2.1 lists environmental factors that affect the actual height of the tide.

For each environmental factor in Table 2.1, tick whether the factor causes the height of the tide to be higher or lower than expected.

Table 2.1

factor	causes height of the tide to be higher than expected	causes height of the tide to be lower than expected
onshore wind direction		
high air pressure		

[1]

(d) (i) Organisms in the littoral zone are affected by tides.

Define the exact locations of the top and bottom of the littoral zone.

.....
 [1]

(ii) Rocky shores have a littoral zone.

State **two** other marine habitats that have a littoral zone.

1

2

[2]

[Total: 12]

3 Fig. 3.1 is a diagram of a kelp. Kelp is a macroalga.

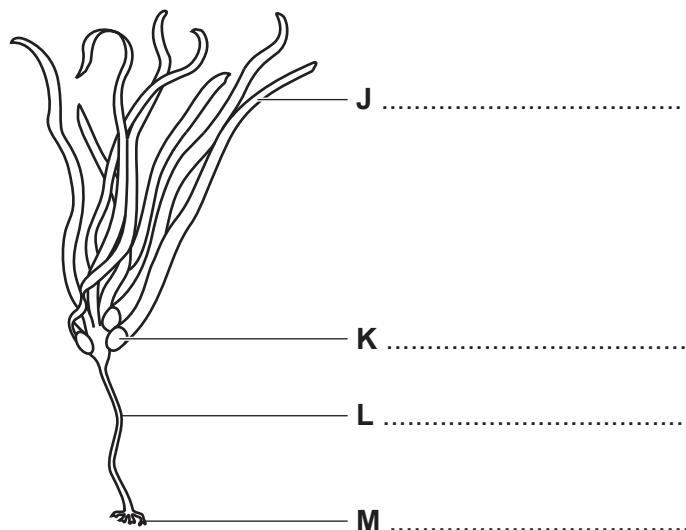


Fig. 3.1

(a) On Fig. 3.1 identify the parts labelled **J**, **K**, **L** and **M**.

[4]

(b) State **two** ways in which kelp is used by humans.

1

.....

2

.....

[2]

(c) Kelp is a type of brown macroalgae.

Fig. 3.2 shows the global mass of harvest of all brown macroalgae.

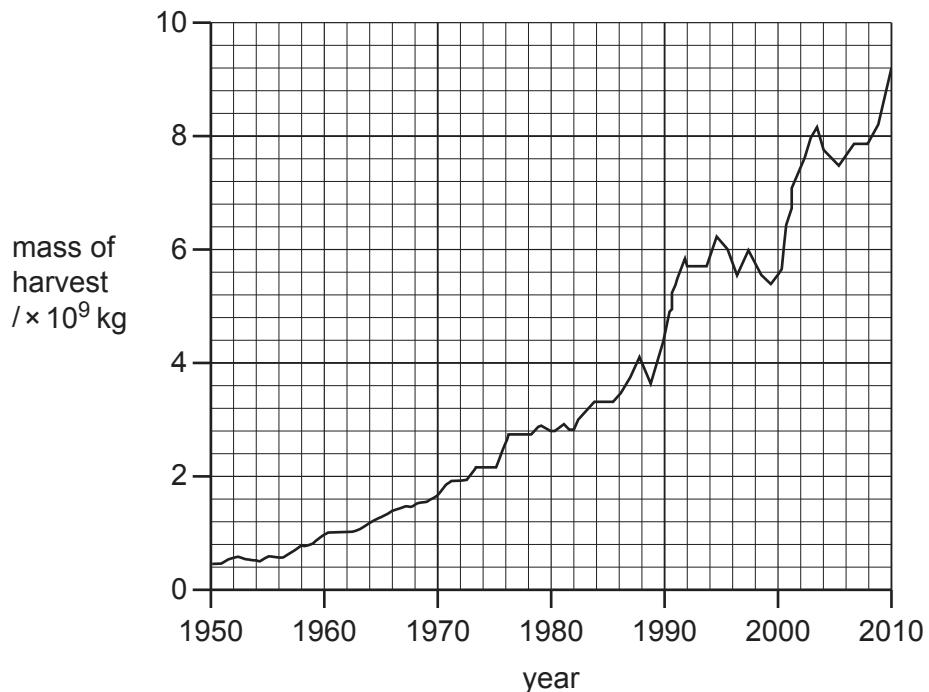


Fig. 3.2

Calculate the percentage increase in mass of brown macroalgae harvested between 1980 and 2010.

Show your working.

.....% [3]

(d) Describe **three** negative ecological impacts if kelp is overharvested.

1
.....

2
.....

3
.....

[3]

[Total: 12]

[Turn over

4 Fig. 4.1 shows the temperature variation in deep water along a line from south to north in the southern hemisphere in the ocean.

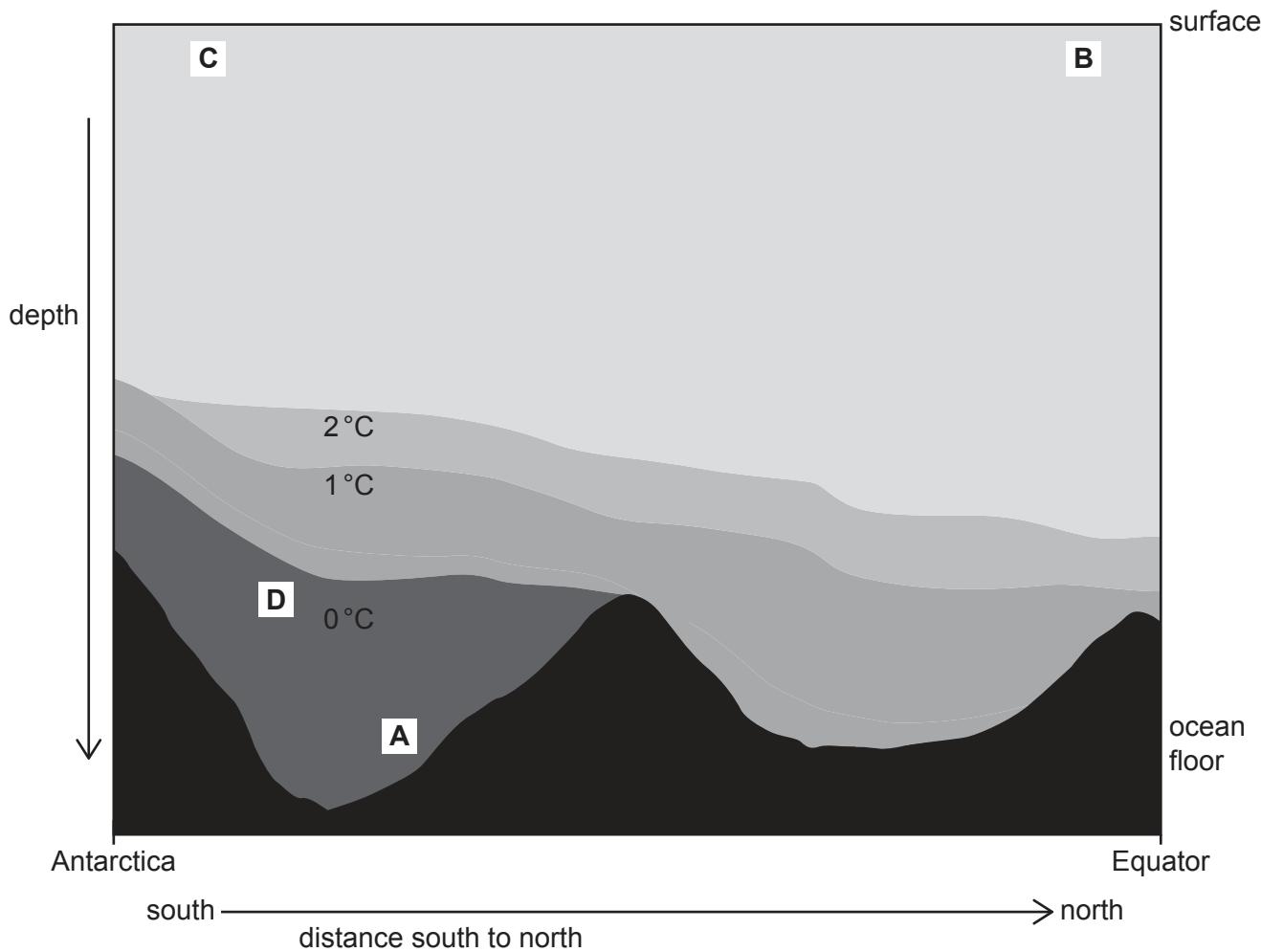


Fig. 4.1

(a) Location **A** is in the deepest zone of the ocean.

State the name of the zone.

..... [1]

(b) At location **B** the temperature decreases greatly over a small change in depth.

State the name of this ocean layer at location **B**.

..... [1]

(c) Sea water at location **C** is in the Southern Ocean.

Explain why sea water at location **C** sinks.

.....
.....
.....
.....

[2]

(d) Describe how mixing of the sea water in Fig. 4.1 can occur.

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

[4]

(e) Pure water has a freezing point of 0°C at the surface.

Explain why sea water at location **D** is **not** solid.

.....
.....
.....
.....
.....

[2]

[Total: 10]

Section B

Answer **all** questions in this section.

5 (a) Describe the effects of El Niño on human communities along the Eastern Pacific coastline of South America.

[6]

(b) Describe how **abiotic** factors during an El Niño event differ from the abiotic factors during a La Niña event.

[6]

[Total: 12]

6 (a) Kinetic particle theory can be used to explain how water changes state.

Fig. 6.1 shows a particle model of water in three different states.

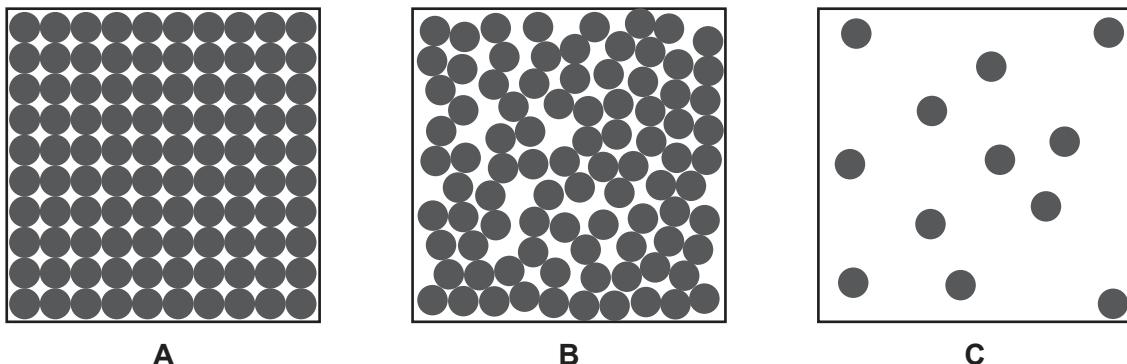


Fig. 6.1

Discuss the strengths **and** limitations of Fig. 6.1 in explaining changes of state in water.

[6]

(b) Fig. 6.2 represents five water molecules.

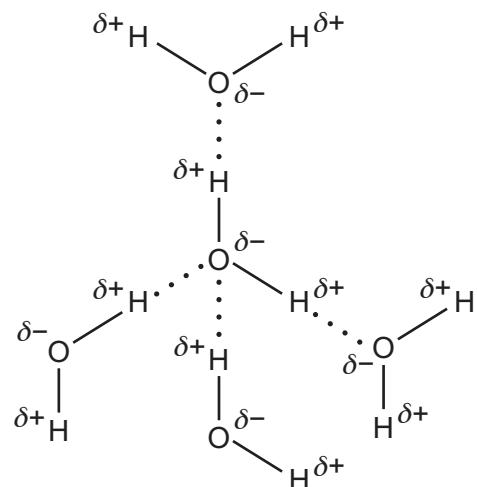


Fig. 6.2

Describe the bonds within **and** between the molecules shown in Fig. 6.2.

[6]

(c) Carbon has important biological roles.

Fig. 6.3 is a diagram of one atom of carbon.

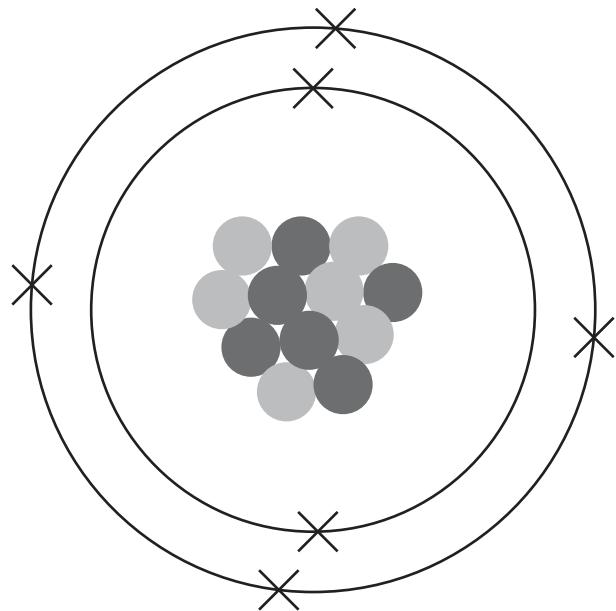


Fig. 6.3

Describe the structure of the carbon atom shown in Fig. 6.3.

[6]

[Total: 18]

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