



# Cambridge International AS & A Level

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**MARINE SCIENCE**

**9693/01**

Paper 1 AS Structured Questions

**October/November 2021**

**1 hour 30 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

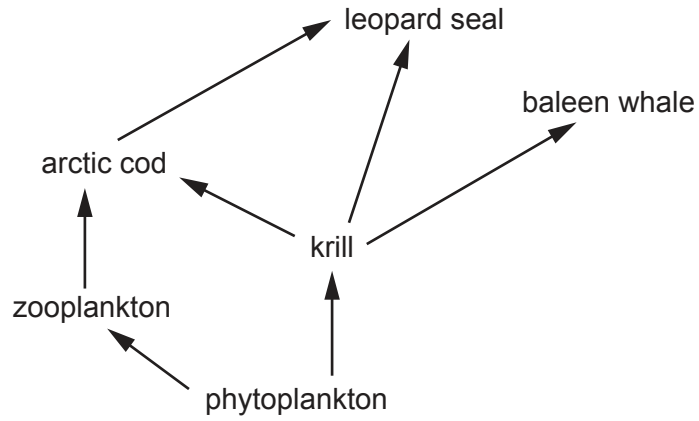
- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].

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



Answer **all** the questions in the spaces provided.

1 (a) Fig. 1.1 shows a food web in a marine ecosystem.



**Fig. 1.1**

(i) Use Fig. 1.1 to write the food chain that includes a baleen whale.

..... [1]

(ii) State the number of trophic levels in the food web in Fig. 1.1.

..... [1]

(b) Fig. 1.2 is a photograph of a krill.



**Fig. 1.2**

(i) Suggest how a lack of dissolved calcium in sea water may affect krill.

.....  
..... [1]

(ii) Explain how a lack of nitrogen may affect krill.

.....  
.....  
.....  
..... [2]

(c) Fig. 1.3 is a pyramid of energy for a marine food chain.

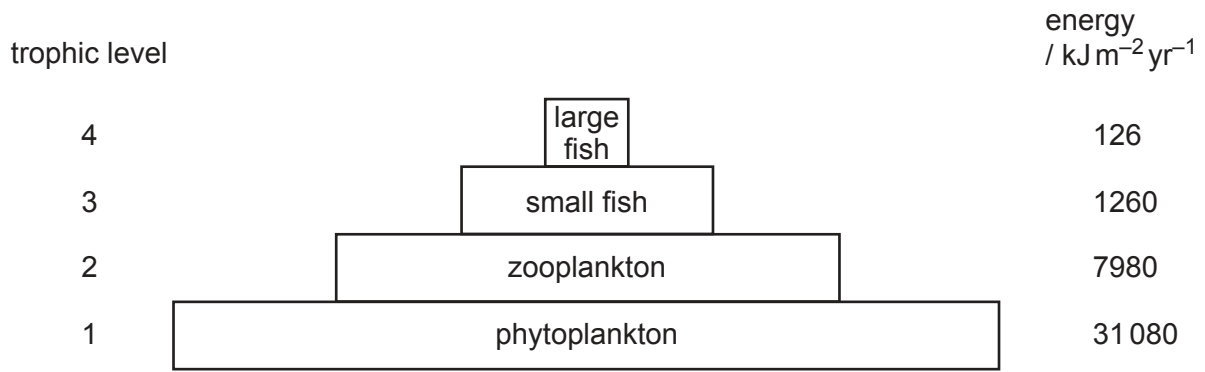


Fig. 1.3

(i) Calculate the efficiency of transfer of energy between the phytoplankton and the zooplankton.

Show your working.

.....% [2]

(ii) Describe how the shape of a pyramid of **biomass** for trophic levels 1 and 2 may differ from the one shown in Fig. 1.3.

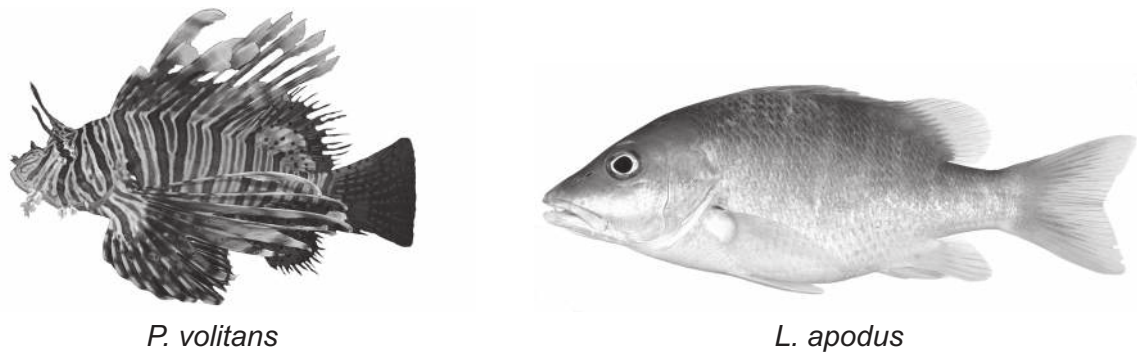
Explain reasons for this difference.

.....  
 .....  
 .....  
 .....  
 .....  
 ..... [3]

[Total: 10]

- 2 Scientists recorded the stomach contents of two different types of fish, *Pterois volitans* (red lionfish) and *Lutjanus apodus* (schoolmaster snapper).

Fig. 2.1 shows photographs of the two fish.



**Fig. 2.1**

Table 2.1 shows a summary of the results.

**Table 2.1**

	<i>P. volitans</i>	<i>L. apodus</i>
number of different species found in stomach	21	8
percentage of species that were crustaceans	9	85
percentage of species that were fish	91	15

- (a) (i) The species that was most abundant in the stomach contents of *P. volitans* was the damselfish *Stegastes leucostictus*.

Describe the relationship between *P. volitans* and *S. leucostictus*.

.....

.....

.....

..... [2]

(ii) Use the information in Table 2.1 to compare the niches of *P. volitans* and *L. apodus*.

.....

.....

.....

.....

.....

.....

..... [3]

(b) *S. leucostictus* often has parasites inside its intestine.

Suggest **and** explain the effect of this on the efficiency of energy transfer from *S. leucostictus* to *P. volitans*.

.....

.....

.....

..... [2]

[Total: 7]

3 Fig. 3.1 is a photograph of a hydrothermal vent.

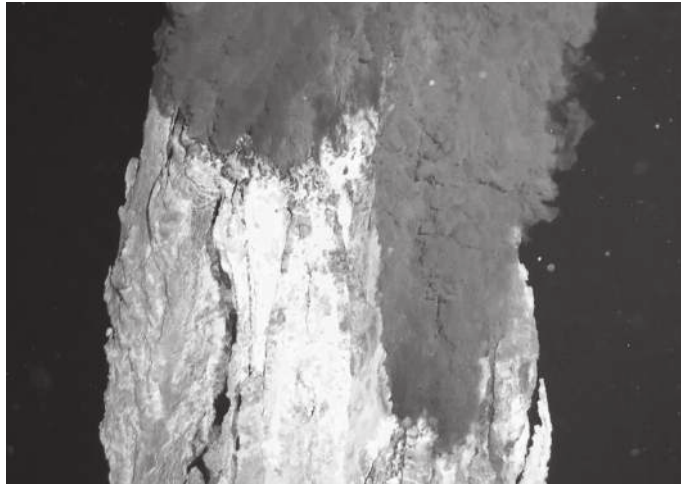


Fig. 3.1

(a) (i) State **two** environmental conditions found at a hydrothermal vent.

- 1 .....
- 2 ..... [2]

(ii) Explain why there is low biodiversity at a hydrothermal vent.

- .....
- .....
- .....
- ..... [2]

(b) With reference to named organisms, describe succession at a hydrothermal vent.

- .....
- .....
- .....
- .....
- .....
- .....
- ..... [3]



(c) (i) State the initial source of energy for the food chain in a hydrothermal vent.

..... [1]

(ii) Explain the meaning of the term productivity.

.....  
.....  
.....  
..... [2]

(iii) Suggest how an increase in underwater volcanic activity can increase productivity at a hydrothermal vent.

.....  
.....  
.....  
.....  
.....  
..... [3]

[Total: 13]

4 Fig. 4.1 is a photograph of a sandy shore.



Fig. 4.1

(a) Describe how the type of shore shown in Fig. 4.1 is formed.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(b) Explain why few producers are able to survive in the type of shore shown in Fig. 4.1.

.....

.....

.....

.....

..... [2]

(c) Describe and explain **two** adaptations that help organisms to survive on a sandy shore.

adaptation 1 .....

.....

.....

.....

adaptation 2 .....

.....

.....

.....

[4]

[Total: 10]

- 5 Table 5.1 shows the chemical composition of two samples of sea water from different locations.

**Table 5.1**

substance	concentration in sea water / g per 100 g of water	
	location A	location B
Na <sup>+</sup>	1.09	4.00
Mg <sup>2+</sup>	0.13	4.30
Ca <sup>2+</sup>	0.04	1.70
K <sup>+</sup>	0.04	0.76
Cl <sup>-</sup>	1.90	21.80
Br <sup>-</sup>	0.01	0.50

- (a) The percentage of dissolved substances (salinity) in sea water at location **A** is 3.21%.

Calculate the percentage of dissolved substances in sea water at location **B**.

..... % [1]

- (b) Environmental conditions affect the salinity of sea water.

Suggest reasons for the differences in salinity between location **A** and location **B**.

.....  
 .....  
 .....  
 .....  
 .....  
 .....  
 ..... [3]

(c) Table 5.2 shows the pH of sea water at both locations.

**Table 5.2**

	location <b>A</b>	location <b>B</b>
pH	8.1	5.9

Suggest reasons for the difference in pH between the two locations.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 7]

6 (a) Fig. 6.1 shows a mid-ocean ridge.

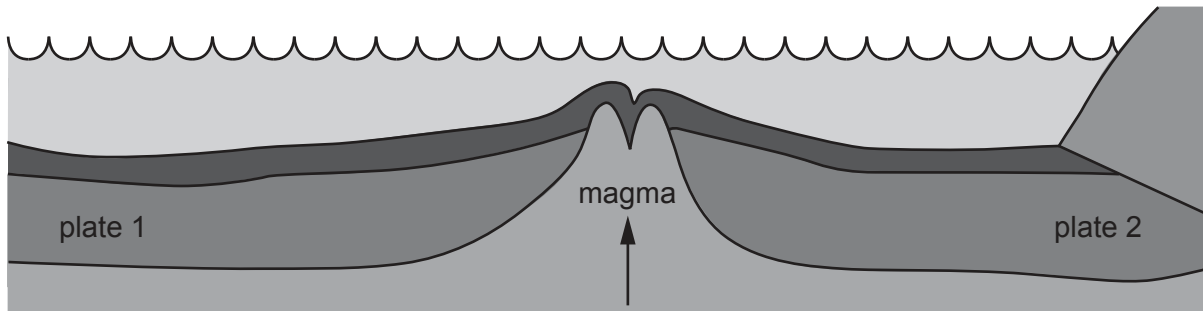


Fig. 6.1

- (i) Draw **two** arrows on the plates on Fig. 6.1 to show the direction of movement of the two plates. [1]
- (ii) Draw a line labelled **X** on Fig. 6.1 to show the location of the youngest rock. [1]
- (iii) State the name of the type of plate boundary shown in Fig. 6.1.  
..... [1]
- (iv) Explain the reason for the movement of the plates shown in Fig. 6.1.  
.....  
.....  
.....  
.....  
.....  
.....  
..... [3]
- (v) The rocks either side of the type of plate boundary shown in Fig. 6.1 can provide evidence for the plate tectonic theory.  
Describe this evidence.  
.....  
.....  
.....  
..... [2]

(b) Underwater earthquakes often occur at convergent boundaries.

(i) Explain how tectonic activity leads to earthquakes.

.....  
.....  
.....  
.....  
.....  
.....  
.....  
..... [4]

(ii) State the name of **one** feature found at convergent boundaries.

..... [1]

[Total: 13]

7 A core sample was taken from a coral reef by drilling down through the reef to a depth of several metres.

The reef was located in a region that experiences one cool season and one warmer season each year.

Fig. 7.1 is a diagram showing the core sample.

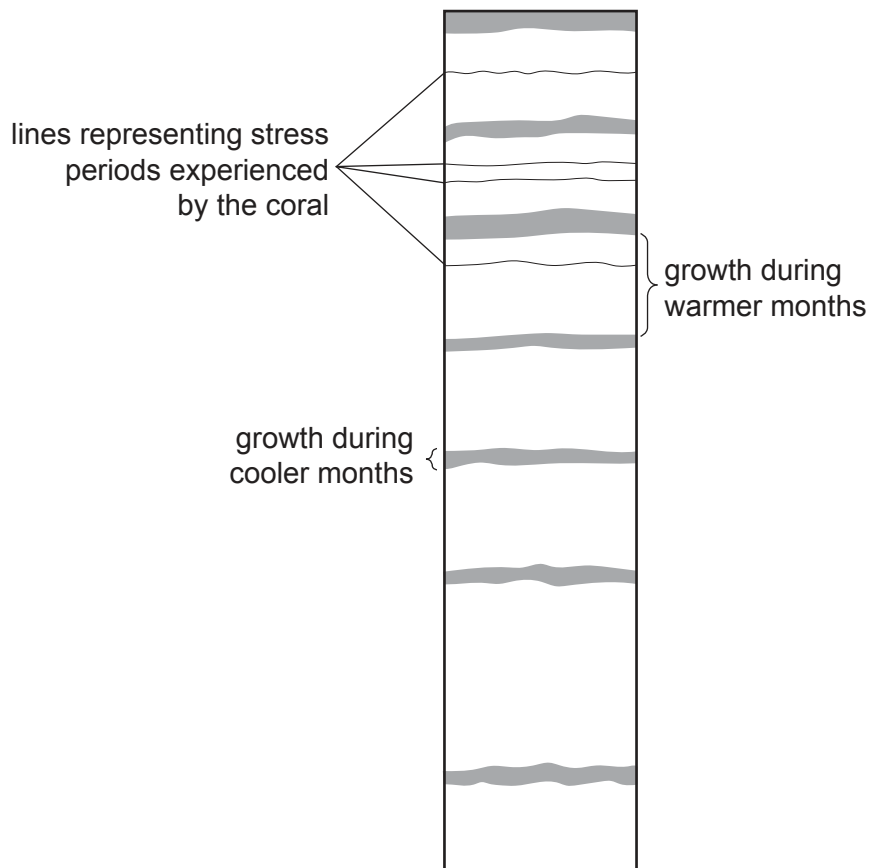


Fig. 7.1

(a) Use Fig. 7.1 to work out how many years of coral growth are represented in this core sample.

..... [1]

(b) Identify the band that shows the fastest rate of growth on Fig. 7.1.

Label this with an X. [1]

(c) Suggest reasons for the periods of faster growth shown in Fig. 7.1.

.....  
.....  
.....  
.....  
.....  
.....  
..... [3]



(d) Suggest reasons for the stress periods represented by the lines in Fig. 7.1.

.....  
.....  
.....  
..... [2]

(e) Drilling cores is one way of reconstructing the history of a coral reef.

State **one** other method that can be used.

..... [1]

[Total: 8]

8 Fig. 8.1 shows the major surface currents in the oceans.

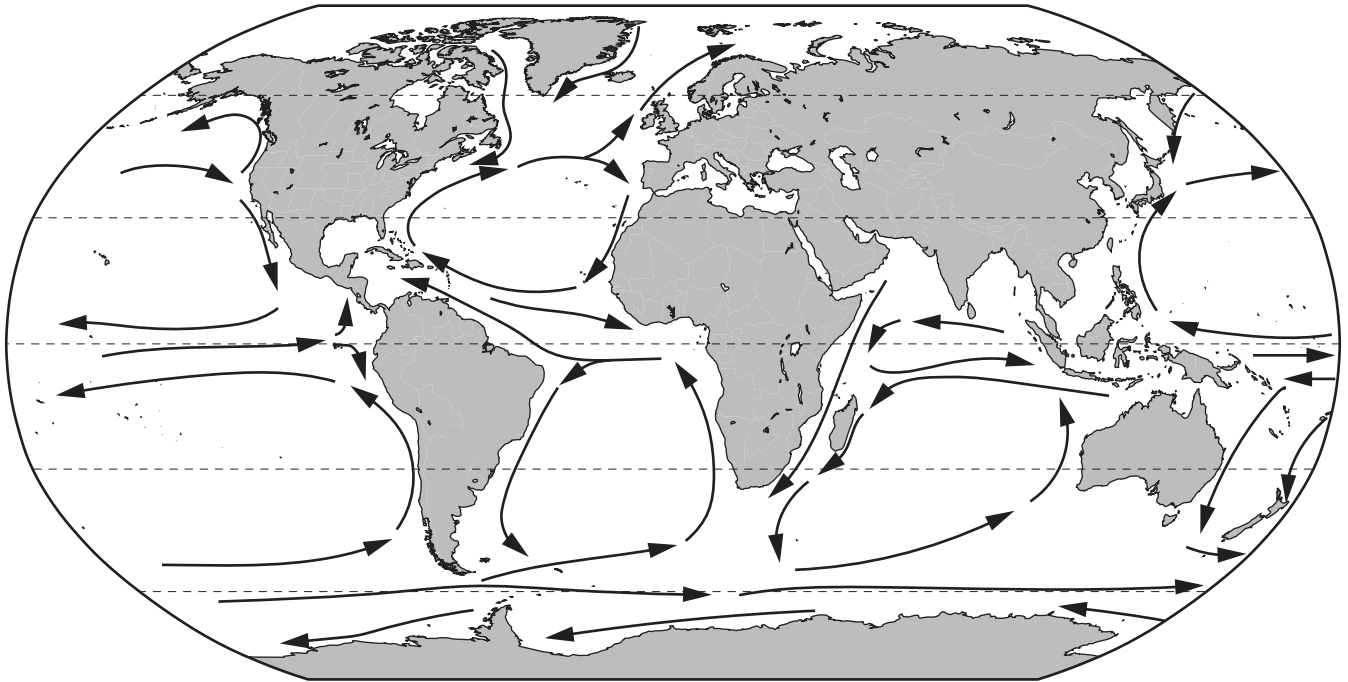


Fig. 8.1

(a) Describe and explain the different direction of currents in the northern and southern hemisphere.

.....  
.....  
.....  
.....  
.....  
.....  
.....  
..... [4]

(b) Mixing occurs between the water at the surface and deep ocean water.

State **two** factors that cause this mixing.

1 .....  
2 ..... [2]

(c) State the name of the process that brings water from the sea bed to the surface.

..... [1]

[Total: 7]



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