

CANDIDATE
NAME

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MARINE SCIENCE

9693/02

Paper 2 AS Data-Handling and Free-Response

October/November 2016

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Section A

Answer **both** questions in this section.

Write your answers in the spaces provided on the Question Paper.

Section B

Answer **both** questions in this section.

Write your answers in the spaces provided on the Question Paper.

Electronic calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

This document consists of **10** printed pages and **2** blank pages.

Section A

Answer **both** questions in this section.

- 1 Fig. 1.1 shows a mussel (*Mytilus edulis*), a mollusc found in intertidal areas. Mussels are filter-feeders, feeding on small producers such as phytoplankton.



magnification $\times 1$

Fig. 1.1

- (a) State the trophic level occupied by mussels.

.....[1]

- (b) Fig. 1.2 shows part of a food web, including four predators of mussels. The figures show energy in kJ per m² per year.

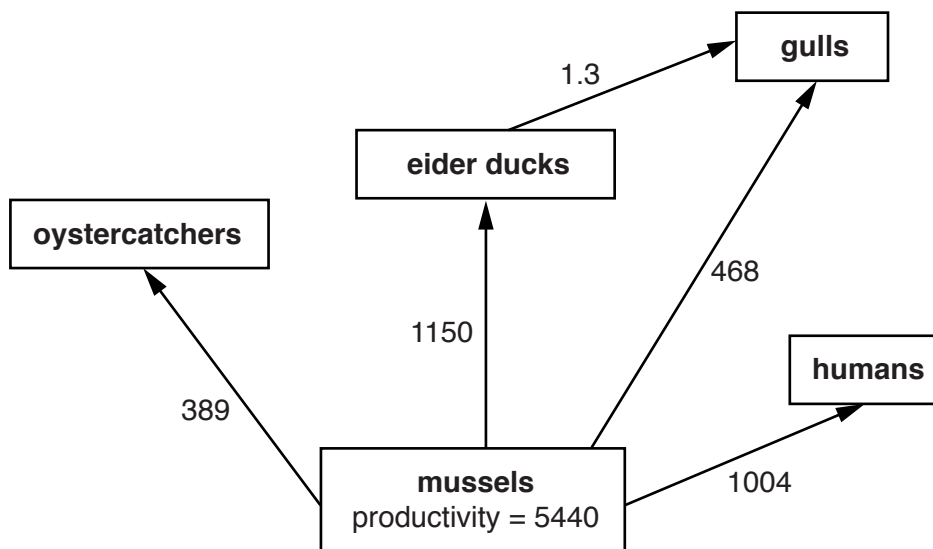


Fig. 1.2

- (i) Using the information in Fig. 1.2, calculate the total energy transferred to predators from mussels.

..... [2]

- (ii) Express your answer to (i) as a percentage of the productivity of mussels.
Show your working.

..... % [2]

- (iii) It has been estimated that mussels in this food web lose a further 2500kJ per m² per year as a result of their metabolism.

Suggest what effect the total energy losses have on the size of the mussel population.

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..... [3]

[Total: 8]

- (b) Changes in the chemical composition of sea water can affect the growth of corals.

In one study, researchers determined the growth rate of coral in two sites, **A** and **B**, in the Mesoamerican Barrier Reef System in the western Caribbean Sea.

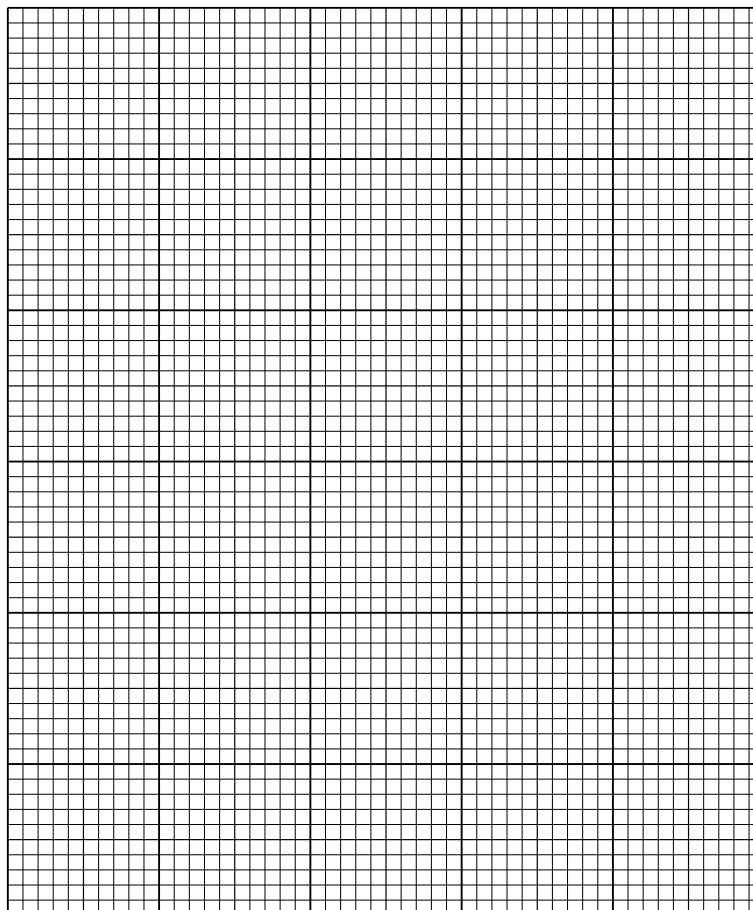
Cores of coral were extracted and growth rates were determined from X-ray images.

The results are shown in Table 2.2.

Table 2.2

years	mean annual growth rate /mm yr ⁻¹	
	site A	site B
1935 to 1949	5.7	4.3
1950 to 1964	4.7	4.6
1965 to 1979	4.6	4.3
1980 to 1994	4.3	4.3
1995 to 2008	3.3	4.5

- (i) On the grid below, plot line graphs of the two sets of data in Table 2.2. Join the points on your graph with ruled, straight lines.



[4]

(ii) Compare the changes in growth rate for the corals from these two sites.

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

(iii) Researchers proposed the following hypothesis:

As the concentration of carbon dioxide in the atmosphere increases, the growth rate of corals decreases.

Do the results of this investigation support or refute this hypothesis?
Give an explanation for your answer.

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.....[3]

[Total: 12]

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