

CANDIDATE  
NAME

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**MARINE SCIENCE**

**9693/02**

Paper 2 AS Data Handling and Free Response

**May/June 2014**

**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 a pencil for any diagrams, graphs or rough work.

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

**DO NOT WRITE IN ANY BARCODES.**

Answer **all** questions.

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.

Electronic calculators may be used.

For Examiner's Use	
1	
2	
3	
4	
<b>Total</b>	

This document consists of **9** printed pages and **3** blank pages.

## Section A

Answer **both** questions

- 1 Fig. 1.1 represents a food chain in the marine environment. The figures show the productivity, measured in  $\text{kJ m}^{-2} \text{ year}^{-1}$ , of each trophic level.

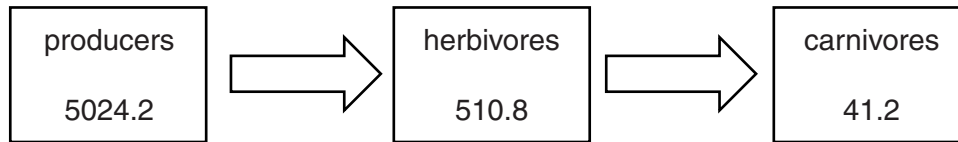


Fig. 1.1

- (a) Explain what is meant by the term *producer*.

.....

.....

..... [2]

- (b) (i) Calculate the difference between the productivity of the herbivores and the productivity of the producers.

[1]

- (ii) Express your answer to (b)(i) as a percentage of the productivity of the producers.

Show your working.

[2]

(c) Suggest **three** reasons to account for the difference between the productivity of the herbivores and the productivity of the producers.

1 .....

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2 .....

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3 .....

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[3]

(d) Suggest why the productivity of producers in an estuary is usually higher than it is in the open ocean.

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..... [2]

[Total: 10]

- 2 Single-celled marine algae, such as *Isochrysis* sp., are grown on a large scale to provide food for cultivated molluscs and fish larvae.

An experiment was carried out to investigate the effect of temperature on the growth of *Isochrysis*. In this experiment, cultures of *Isochrysis* were grown in test tubes containing a culture solution of mineral salts. These solutions included magnesium and phosphorus.

At the beginning of the experiment, each test tube contained  $5 \times 10^4$  cells of *Isochrysis*.

All tubes were illuminated with fluorescent lights and incubated at a range of temperatures from  $14^\circ\text{C}$  to  $34^\circ\text{C}$ . After 10 days, the cells were counted using a counting chamber and a microscope.

The results are shown in Table 2.1.

**Table 2.1**

temperature / $^\circ\text{C}$	number of cells $\text{cm}^{-3}$
14	$250 \times 10^4$
18	$120 \times 10^5$
22	$614 \times 10^5$
26	$845 \times 10^5$
30	$722 \times 10^5$
34	$230 \times 10^5$

- (a) Suggest reasons for each of the following.

- (i) The cultures were illuminated during the experiment.

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

- (ii) The culture solution contained magnesium and phosphorus.

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

**(b)** Using the data in Table 2.1, describe the effect of temperature on the growth of *Isochrysis*.

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..... [3]

**(c)** The growth of *Isochrysis* is also affected by other factors, including salinity.

Outline a laboratory-based experiment to investigate the effect of salinity on the growth of *Isochrysis*.

Your answer should include reference to the control of variables, and the collection of quantitative results.

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..... [4]

[Total: 10]

**Section B**

Answer **both** questions

**3 (a) (i)** Explain what is meant by the term *succession*.

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..... [2]

**(ii)** Outline **one** example of succession in the marine environment.

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..... [3]

(b) Herrings are similar to sardines and form large shoals. Suggest why shoaling may be an advantage to herrings.

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[10]

[Total: 15]

4 (a) Outline the evidence in support of the theory of plate tectonics.

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[3]

(b) Explain how tectonic processes give rise to the formation of each of the following.

(i) ocean trenches

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..... [2]

(ii) mid-ocean ridges

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..... [2]

(iii) tsunamis

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









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*Copyright Acknowledgements:*

Question 2

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