



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER



MARINE SCIENCE
Paper 2 AS Data Handling and Free Response

9693/02
May/June 2013
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	
Total	

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

Section A

Answer **both** questions

- 1 Fig. 1.1 shows a sea cucumber, which is a marine invertebrate with free-swimming planktonic larvae. These larvae settle on a suitable substrate, where they grow and develop into adult sea cucumbers.



magnification $\times 0.2$

Fig. 1.1

Researchers carried out experiments to investigate whether sea cucumber larvae showed a preference towards a particular substrate for settlement. In one experiment, four containers of sea water were set up. Each container had a different substrate:

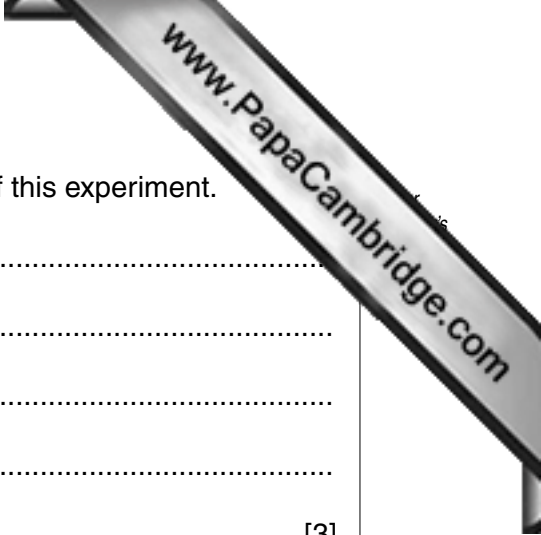
- sea grass leaves
- crushed coral
- sand
- a mixture of crushed coral and sand.

Approximately 550 larvae were released into each container. Physical and chemical variables were carefully controlled.

After 96 hours, the numbers of larvae which had settled on each substrate were counted. These numbers were then expressed as a percentage of the total number of larvae in each container. The results are shown in Table 1.1.

Table 1.1

substrate	numbers of larvae settled, expressed as a percentage of the total (%)
sea grass leaves	10.5
crushed coral	1.4
sand	0.2
mixture of crushed coral and sand	1.1



(a) With reference to the data in Table 1.1, describe the results of this experiment.

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..... [3]

(b) Formulate a hypothesis based on the data shown in Table 1.1.

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..... [1]

(c) Suggest **two** advantages to sea cucumber larvae of being able to select a particular substrate for settlement.

1
2 [2]



Turn over for Q2

- 2 Various nutrients, including carbon, are cycled in marine ecosystems.

Fig. 2.1 below shows part of the carbon cycle in the marine ecosystem in one year.

The figures are in 10^{12} kg of carbon per year.

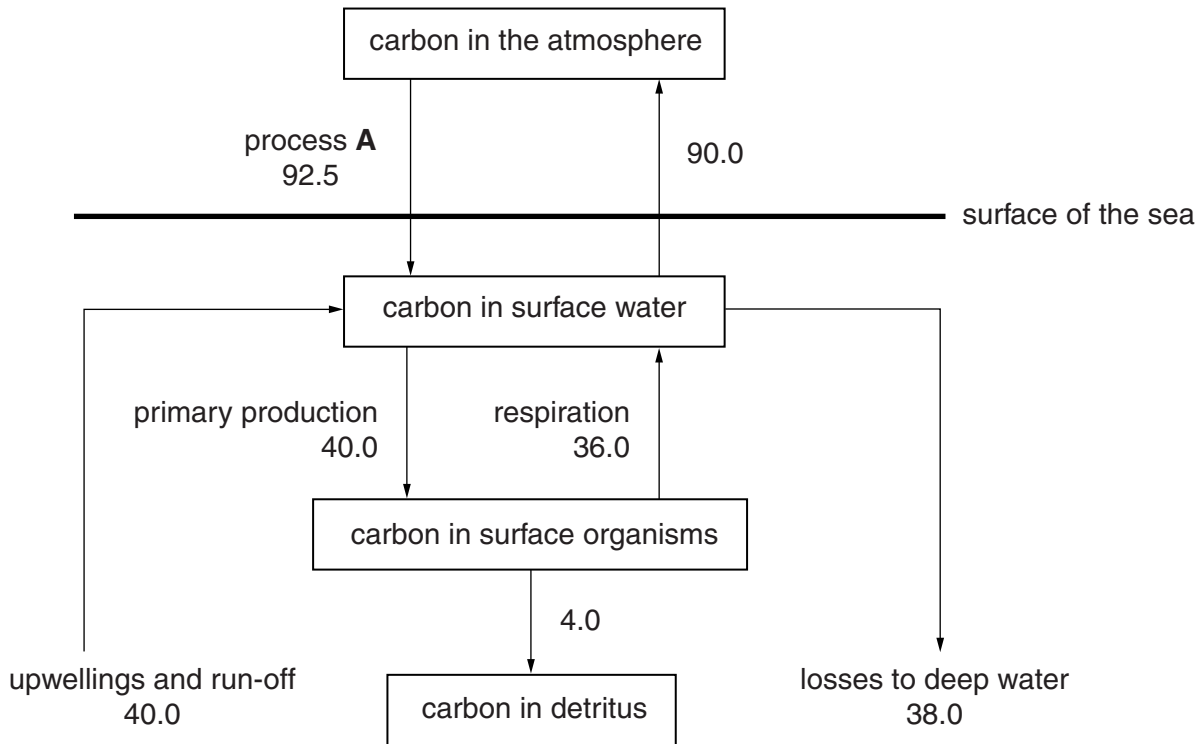


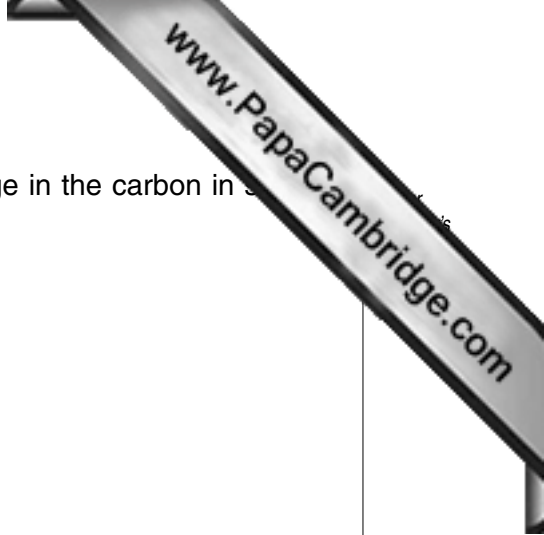
Fig. 2.1

- (a) Explain what is happening in process **A** shown in Fig. 2.1.

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.....

..... [2]



(b) Using the information in Fig. 2.1, calculate the annual change in the carbon in surface water. Show your working.

[3]

(c) With reference to Fig. 2.1, explain why an increase in carbon in the atmosphere could lead to an increase in the productivity of organisms in the surface water of an ocean.

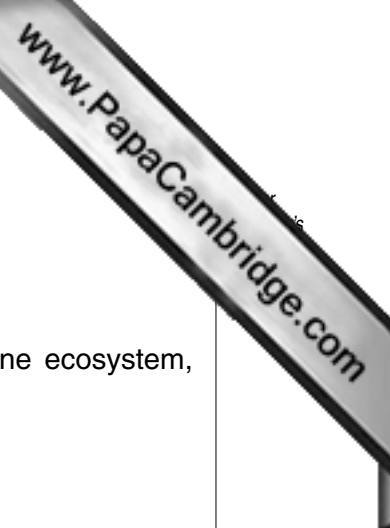
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[3]

[Total: 8]

Section B

Answer **both** questions in this section



3 (a) Describe each of the following types of interrelationship within a marine ecosystem, giving **one** example of each.

(i) symbiosis

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..... [3]

(ii) parasitism

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..... [3]

Copyright Acknowledgements:

Question 1 Photograph
Question 1

© Ref: Z560/0015; L Newman & A Flowers; *Edible Sea Cucumber*; Science Photo Library.

© adapted: A Mercier et al; *Settlement preferences and early migration of the tropical sea cucumber Holothurie scabra*; Journal of Experimental Marine Biology and Ecology; 249; 2000.

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