Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MARINE SCIENCE **9693/02**

Paper 2 AS Data-Handling and Free-Response **October/November 2017**

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.

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Section A

Answer **both** questions in this section.

1 A diversity index (***D***) can be used to compare the biodiversity of two habitats.
One diversity index is calculated using the formula

$$D = \frac{N(N-1)}{\sum n(n-1)}$$

where

N is the total number of organisms found
n is the number of individuals of each species
$\sum$ means 'the sum of'.

For this diversity index, a higher value of ***D*** indicates a higher biodiversity.

Researchers carried out an investigation to compare the biodiversity of two rocky shores, shore **A** and shore **B**. Ten random samples were taken on each shore, using a quadrat, and the numbers of each species were recorded.

Table 1.1 shows the results of this investigation.

Table 1.1

common name of species	number of each species found (*n*)	
	shore A	shore B
beadlet anemone	3	7
dog whelk	12	16
limpet	5	11
mussel	18	23
periwinkle	6	14
shore crab	2	3
topshell	4	5

[Turn over

Table 1.2 shows some of the stages in the calculation of the diversity index, for shore **A**.

Table 1.2

common name of species	**number (*n*) on shore A**	***n*(*n*-1)**
beadlet anemone	3	6
dog whelk	12	132
limpet	5	20
mussel	18	306
periwinkle	6	30
shore crab	2	2
topshell	4	12
	Total (***N***) = 50	$\sum$***n*(*n*-1)** = 508

(a) Complete Table 1.3, by calculating ***N***, ***n*(*n*-1)** and $\sum$***n*(*n*-1)** for shore **B**. Write your answers in the spaces in Table 1.3.

Table 1.3

common name of species	**number (*n*) on shore B**	***n*(*n*-1)**
beadlet anemone	7	
dog whelk	16	
limpet	11	
mussel	23	
periwinkle	14	
shore crab	3	
topshell	5	
	Total (***N***) =	$\sum$***n*(*n*-1)** =

[3]

(b) The diversity index for shore **A** is 4.8.

Use the information in Table 1.3 to calculate the diversity index for shore **B**.

Show your working.

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[2]

(c) Compare the biodiversity of shore **A** with the biodiversity of shore **B**.

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(d) Based on the results of this investigation, the researchers proposed the following hypothesis.

Dog whelks and mussels are more numerous than other species on rocky shores.

State **two** variables you would need to control in a further investigation to test this hypothesis.

1 .....

2 .....
[2]

[Total: 10]

[Turn over

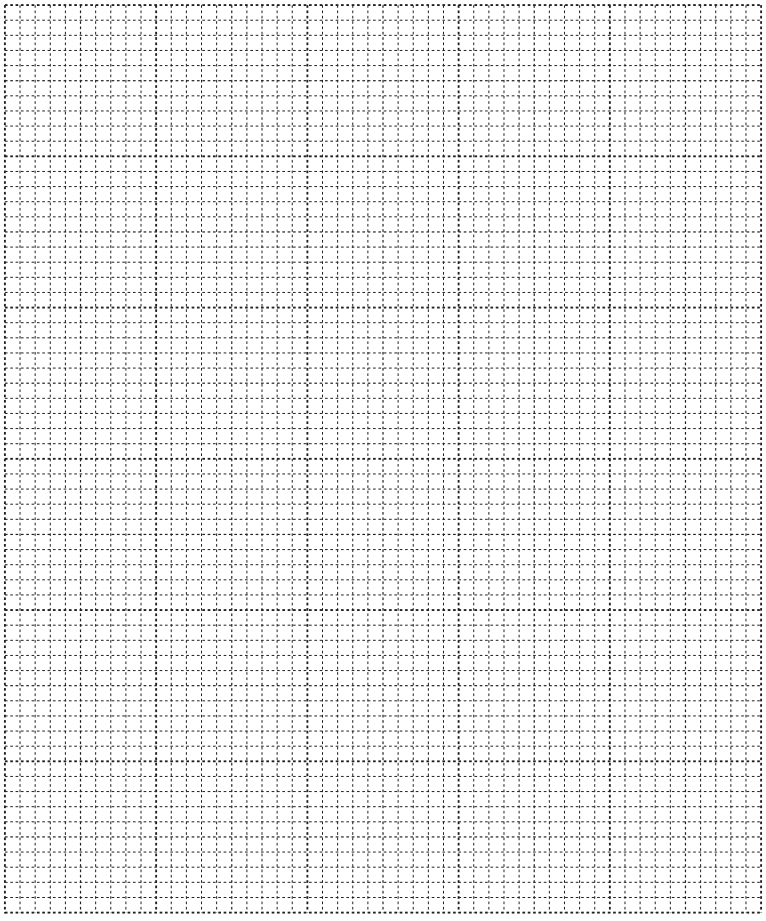
2 The concentration of dissolved oxygen in sea water is affected by a number of different factors.

Table 2.1 shows the concentration of dissolved oxygen in sea water at a range of temperatures.

Table 2.1

temperature/°C	concentration of dissolved oxygen /mg dm^{-3}
0	10.9
10	8.2
20	6.4
30	5.5
40	5.0

(a) On the grid, plot a graph of the data in Table 2.1. Join the points on your graph with ruled, straight lines.



[4]

(b) Use the information in Table 2.1 to describe the relationship between temperature and the concentration of dissolved oxygen.

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(c) Suggest what effect each of the following factors would have on the concentration of dissolved oxygen in sea water.

(i) an increase in salinity

.....[1]

(ii) an increase in atmospheric pressure

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(d) The concentration of dissolved oxygen in the water near a coral reef is higher than in water in the open ocean at the same temperature.

Suggest **two** reasons for this difference.

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2 .....

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[2]

[Total: 10]

[Turn over

Section B

Answer **both** questions in this section.

3 **(a)** Explain what is meant by each of the following terms used in ecology.

(i) *community*

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(ii) *productivity*

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(b) Explain why sandy shores tend to have a relatively low biodiversity.

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(c) Discuss the role of coral reefs in protecting coasts.

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[Total: 15]

4 **(a)** The mean salinity of sea water is about 35 parts per thousand (‰). The salinity in a tropical lagoon was measured and found to be 37‰ and the salinity in an estuary was found to be 20‰.

Suggest explanations for these differences in salinity.

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(b) Describe what is meant by the *Coriolis effect* **and** how it affects ocean currents.

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(c) Explain how temperature and wind produce ocean currents and upwelling.

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(d) The surface layer of the sea contains a reservoir of dissolved nutrients.

With reference to named examples, discuss how these nutrients may be lost from the surface layer.

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[Total: 15]

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