

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

May/June 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.



Section A

Answer both questions in this section.

1 Nitrogen is an essential nutrient in marine ecosystems. In the form of nitrogen gas, N₂, nitrogen is unavailable to most organisms. Nitrogen fixation converts nitrogen gas into a form that can be used by plants.

In an investigation, the rate of fixation of nitrogen was determined in the sediment of six marine environments. The rate was measured as grams of nitrogen per square metre per year $(g \, m^{-2} \, year^{-1})$.

The results are shown in Table 1.1.

Table 1.1

location	rate of nitrogen fixation / g m ⁻² year ⁻¹
Vostok Bay, Russia	0.002
Rhode River Estuary, Maryland	0.13
Lune Estuary, England	0.14
Waccasassa Estuary, Florida	0.37
Kāneʻohe Bay, Hawaii	0.60
Flax Pond mud flats, New York	0.65
mean rate of nitrogen fixation =	

Comple	te Tab	le 1.1	by cal	lculat	ing t	he m	nean	rate	of r	nitro	gen ⁻	fixat	ion.						[1]
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The mean rate of nitrogen fixation for these locations was found to be Compare the mean rate of nitrogen fixation in locations with bacteria	The mean rate of nitrogen fixation was also determined for six other local were significant numbers of bacteria present. The mean rate of nitrogen fixation for these locations was found to be 17. Compare the mean rate of nitrogen fixation in locations with bacteria present.	The mean rate of nitrogen fixation was also determined for six other locations were significant numbers of bacteria present. The mean rate of nitrogen fixation for these locations was found to be 17.37 g. Compare the mean rate of nitrogen fixation in locations with bacteria present.	The mean rate of nitrogen fixation was also determined for six other locations, in were significant numbers of bacteria present. The mean rate of nitrogen fixation for these locations was found to be 17.37 gm ⁻¹ . Compare the mean rate of nitrogen fixation in locations with bacteria present with the second control of the secon	The mean rate of nitrogen fixation was also determined for six other locations, in whi were significant numbers of bacteria present. The mean rate of nitrogen fixation for these locations was found to be 17.37 g m ⁻² years.	The mean rate of nitrogen fixation was also determined for six other locations, in which the were significant numbers of bacteria present. The mean rate of nitrogen fixation for these locations was found to be 17.37 g m ⁻² year ⁻¹ . 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(c)	The productivity of producers is higher in locations with high rates of nitrogen fixation. Suggest an explanation for this.
	[3]
(d)	Suggest two factors, other than the rate of nitrogen fixation, that may affect the availability of nitrogen in marine ecosystems.
	1
	2
	[2]
	[Total: 9]

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2 Fig. 2.1 shows a shell of a common cockle, *Cerastoderma edule*.



magnification ×2

Fig. 2.1

Cockles are found in intertidal areas around the coasts of most European countries. A cockle has a muscular foot which enables it to burrow in the sediment.

Cockles can occur in large populations, with up to thousands of individuals per square metre.

(a)	(i)	Explain how you would make an accurate estimate of the population of cockles on a coastal location.
		[4]
	(ii)	Suggest why burrowing might be an advantage to cockles.
		[1]

(b) An investigation was carried out into the burrowing ability of cockles.

A total of 139 cockles were collected from the surface of a habitat (Group **A**) and 127 cockles were collected from under the surface of the same habitat (Group **B**).

These cockles were placed in a tank of sea water that had five centimetres of sediment at the bottom. All the cockles were placed on the surface of the sediment. After two hours, the numbers of cockles that had burrowed into the sediment were counted.

The results are shown in Table 2.1.

Table 2.1

group	position from which cockles were collected	number of cockles placed on the surface of the sediment in the tank	nad hiirrowed into the			
A	surface of habitat	139	7			
В	under the surface of the habitat	127	79			

(i) Using the data in Table 2.1, calculate the percentage of cockles that had burrowed in each group.

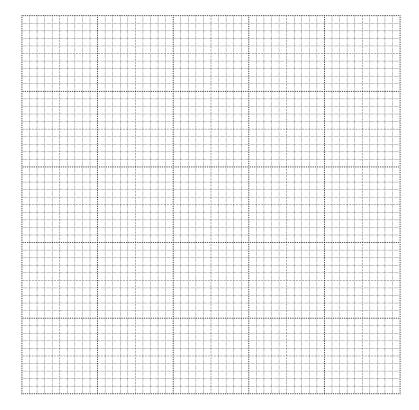
Write your answers in Table 2.2.

Table 2.2

percentage of cockles that burrowed in Group A	percentage of cockles that burrowed in Group B

[2]

(ii) On the grid below, plot a bar graph to show the data in Table 2.2.



Įs	3]
Formulate a hypothesis based on the results of this investigation.	
[1]
[Total: 1	1]

Section B

Answer **both** questions in this section.

3 (a) Explain the meaning of each of the following terms used in ecology. Give **one** example of each from the marine environment.

(i)	succession
	[3]
(ii)	niche
	[3]

b)	Explain how environmental factors influence the ecological communities on a rocky shore	€.
		[6]
(c)	Suggest why sandy shores usually have a lower biodiversity than rocky shores.	
		[3]
	[Total	: 15

(a)	Exp	plain what is meant by the term thermocline.
		[2
(b)	(i)	Outline the effects of evaporation and precipitation on salinity.
		[3
	(ii)	Suggest why the salinity of sea water is often lower near to the coast than it is in the open ocean.
		[9]

(c)	Describe how salinity gradients form to produce ocean layers and explain how mixing of these layers may occur.
	[8]
	[Total: 15]

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