Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education
General Certificate of Education Ordinary Level

ENVIRONMENTAL MANAGEMENT

0680/04
5014/02

Alternative to Coursework

May/June 2006

1 hour 30 minutes

Candidates answer on the Question Paper.
Additional Materials: Ruler

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 soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
Study the appropriate Source materials before you start to write your answers.
Credit will be given for appropriate selection and use of data in your answers and for relevant interpretation of these data. Suggestions for data sources are given in some questions.
You may use the source data to draw diagrams and graphs or to do calculations to illustrate your answers.
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.

For Examiner's Use

This document consists of **18** printed pages and **2** blank pages.

Fig. 1 Caribbean Sea

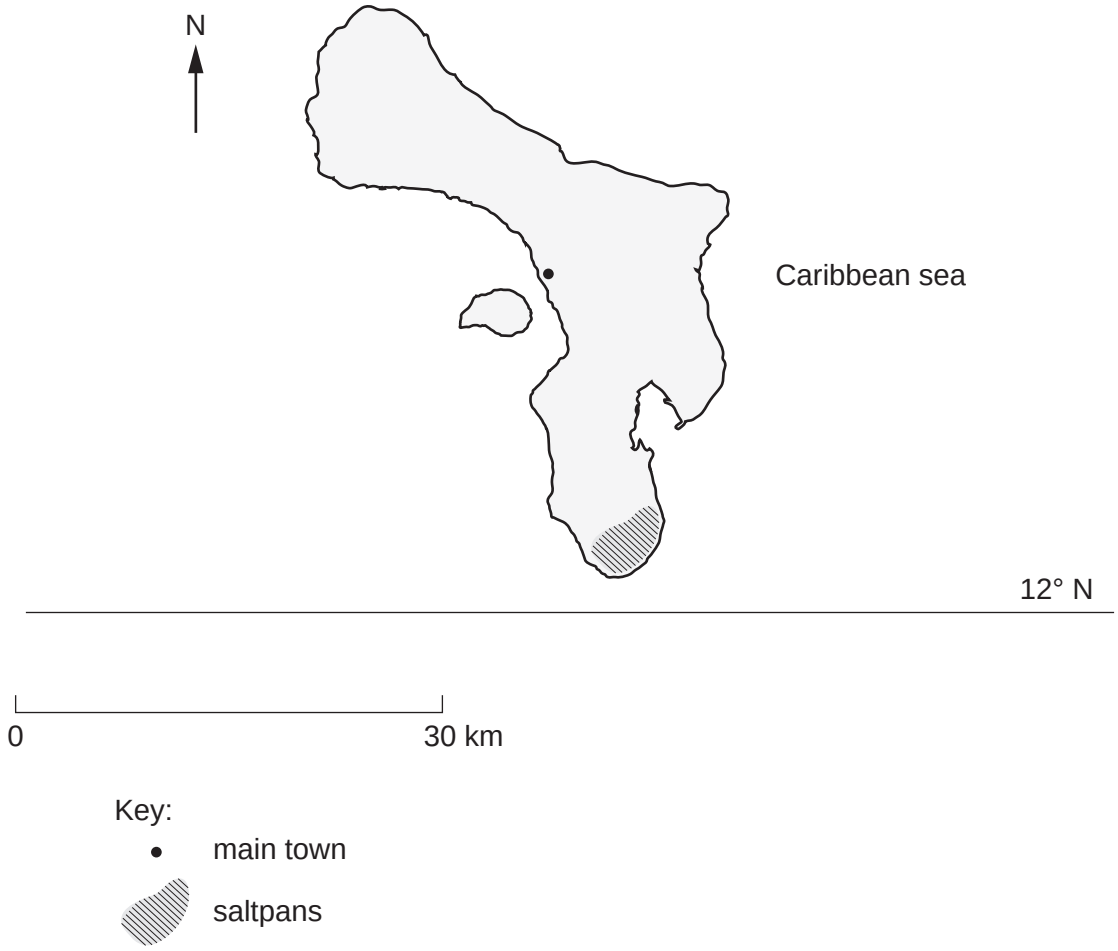
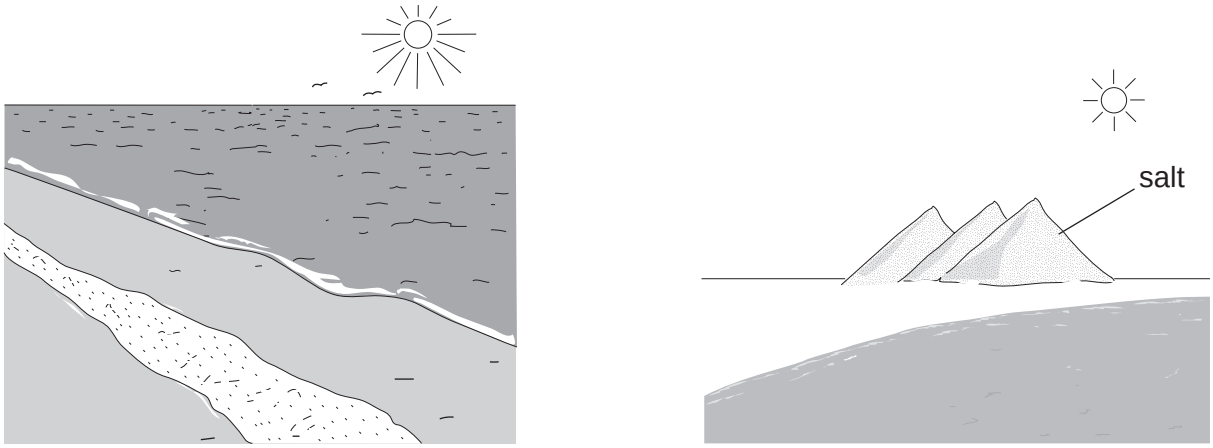


Fig. 2 map of Bonaire

Bonaire is a tropical island, 39 km long and from 5–12 km wide. Its only natural resource is salt and only 10% of the land area is suitable for growing crops because it is too dry. The economy of the island mainly relies on petroleum transhipment, production of industrial grade salt and tourism.

- Area: 290 km^2
- Population: 13 000
- Currency: Netherlands Antillian Guilder (ANG) 1.80 = 1US dollar
- Languages: Dutch (official), Papiamento, English widely spoken, Spanish
- Climate: tropical and influenced by easterly trade winds all year
- Main Exports: salt, tropical fruit, aloes



a) salina filled with sea water

b) water evaporating and salt crystals forming

Fig. 3

Each salina (salt pan) is filled with sea water and closed. The water evaporates leaving the salt behind. While some salt water remains the food chain supports up to 10 000 wading birds.

Food chain in salinas (salt pans)

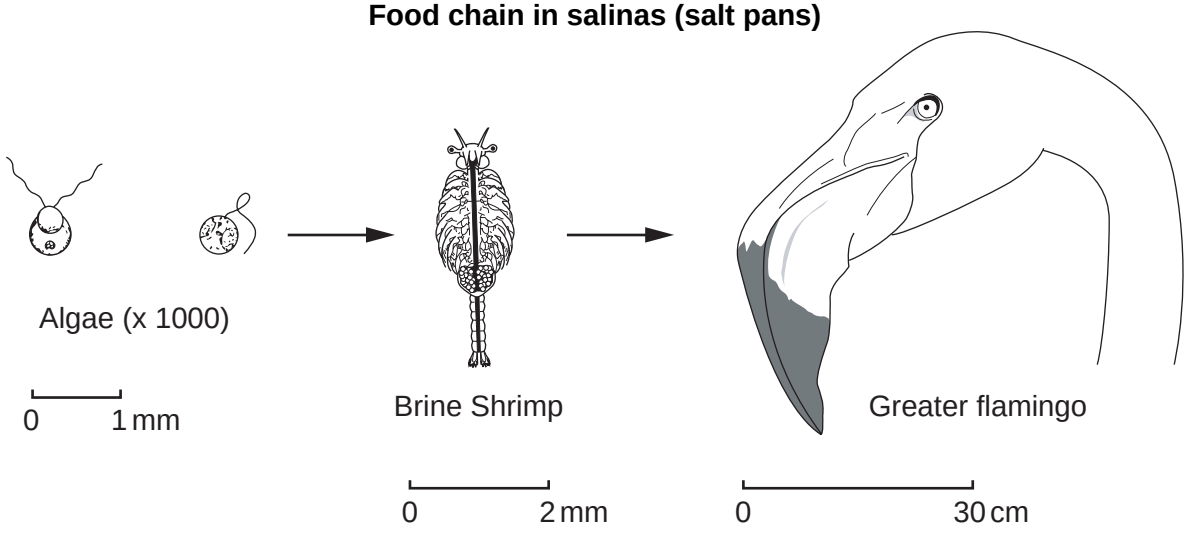


Fig. 4

1 **(a)** There are very few places in the world where salt can be extracted from the sea in large amounts. Explain why Bonaire is a good location for this process.

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.....[3]

(b) Explain why algae are called producers in the food chain shown in Fig. 4.

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.....[2]

(c) Suggest why there are only two consumers in this food chain.

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.....[2]

(d) Explain why the human activity of salt extraction is

(i) sustainable,

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(ii) helping wildlife conservation.

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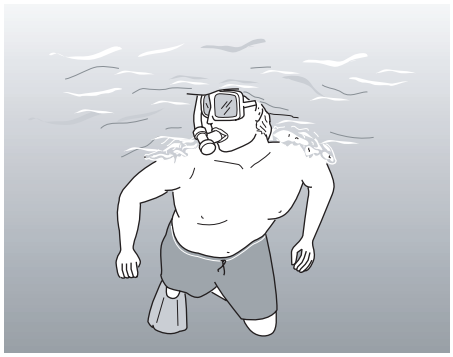
.....[3]

2

a diver



a snorkeller

Tourism is vital for the island economy. Tourists come to Bonaire to dive and to see the colourful corals as the seawater is very clear. To cater for the tourists some building work has started along the coastal fringe. Already there are some reports of increased sediment in the sea from building work and nutrient enrichment caused by sewage discharges.

If the quality of the diving goes down the island economy will suffer.

(a) Suggest **two** ways to reduce further damage to the coastal waters.

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.....[2]

(b) (i) Each diver is given a welcome pack that explains how to enjoy the colourful corals and act in an environmentally responsible manner.

Complete the leaflet below with your suggestions for being an environmentally responsible diver.

Diving – your environmental responsibilities

- Report any damage you see
-
-
-

[3]

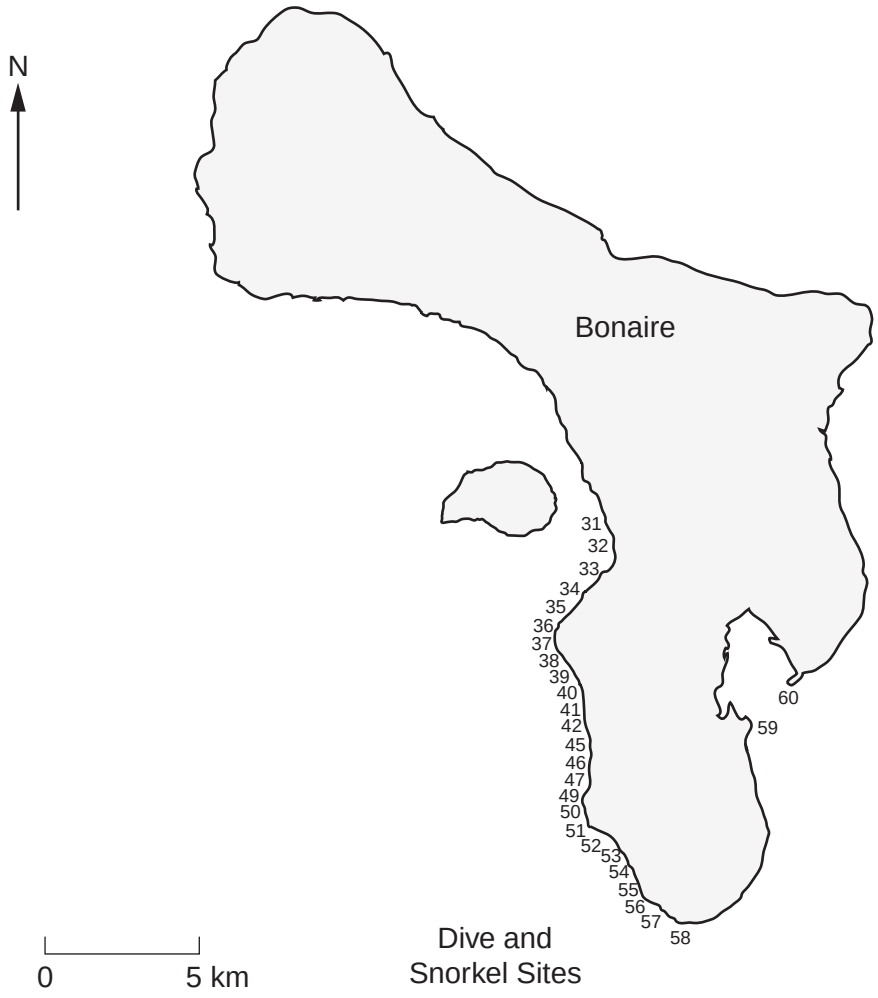

Fig. 5

31. Calabas Reef (dive Bonaire)	**S**		
32. Eighteen Palms	**S**		**B**
33. Windsock	**S**		**B**
34. North Belnem	**S**		**B**
35. Bachelor's Beach	**S**	**A**	**B**
36. Chez Hines	**S**		**B**
37. Lighthouse Point	**S**	**A**	**B**
38. Punt Vierkant	**S**		**B**
39. The Lake	**S**		**B**
40. Hilma Hooker	**S**	**A**	**B**
41. Angel City	**S**		**B**
42. Alice In Wonderland	**S**		**B**
43. Aquarius	**S**		
44. Larry's Lair	**S**		
45. Jeannie's Glory	**S**		**B**
46. Salt Pier	**S**		
47. Salt City	**S**		**B**
48. Invisibles	**S**		**S**
49. Tori's Reef	**S**		**B**
50. Pink Beach	**S**		**B**
51. White Slave	**S**	**A**	
52. Margate Bay	**S**		**B**
53. Red Beryl	**S**	**A**	
54. Atlantis	**S**	**A**	
55. Vista Blue	**S**	**A**	
56. Sweet Dreams	**S**	**A**	
57. Red Slave	**S**	**A**	**B**
58. Willemstoren Lighthouse	**S**		
59. Blue Hole	**S**		
60. Cai	**S**		

Key:

S	land access to shore
A	advanced diving
B	boat access

Fig. 6

Look at Fig. 6.

(ii) How many dive sites **cannot** be reached by boat?

.....[1]

(iii) You have been asked to carry out a survey to find out how much damage has already been done to these dive sites. You only have time to visit **twelve** dive sites. Explain how you would make sure your sample fairly represents all the dive sites.

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.....[3]

(c) Fig. 7 shows the percentage of coral that was found to be damaged in another survey in 2002 at 10 sites.

Shore access only	Shore and boat access
2.4	3.4
2.6	3.1
3.1	3.2
2.7	4.0
2.8	3.0

Fig. 7

Several dive sites with boat and shore access have been reported as being some of the most damaged sites.

(i) Explain how the data supports this claim.

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.....[2]

(ii) Suggest **three** reasons why dive sites with boat access might become more damaged.

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An environmental scientist suggested that mooring posts, to which boats can be tied, should be carefully built in selected dive sites to find out if the corals can be protected. A plan for one dive site is shown in Fig. 8.

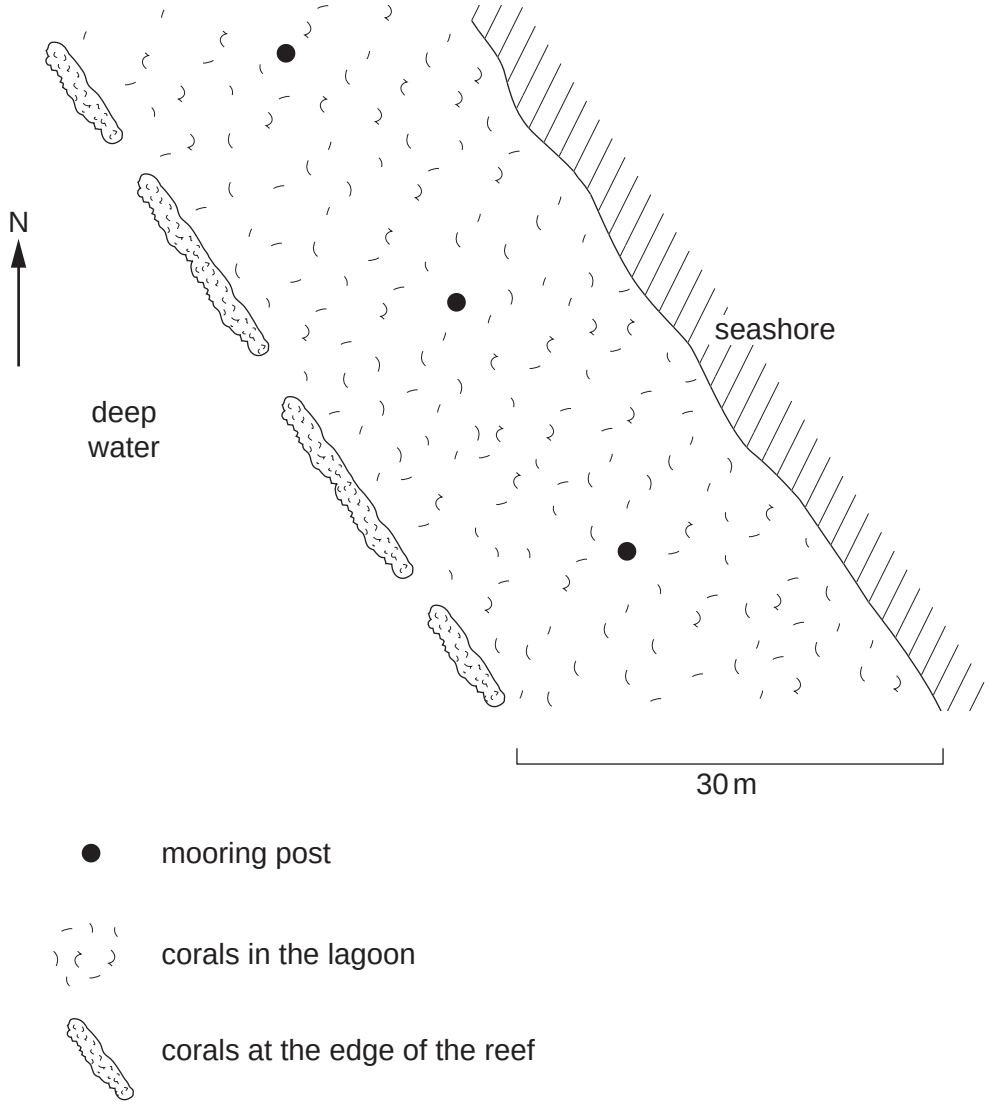

Fig. 8

(iii) How many of the thirty dive sites listed in Fig. 6 would be a sensible number to use for this trial? Explain your answer.

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.....[2]

(d) After the posts are built a coral survey must be carried out. Exactly the same survey can then be done in future years.

Three different survey methods were proposed;

Method one
Swim around one post and count how many corals are damaged.

Method two
Swim around all the posts and count how many damaged corals you can see in five minutes.

Method three
Use a waterproof tape to mark out two 10 metre sample lines, one due north-south, one east-west from each post. Record each damaged and undamaged coral beneath the line.

(i) Explain why environmental scientists decided **not** to carry out methods one and two.

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(ii) Draw on Fig. 8 all the sample lines proposed for method three. [3]

The results of a survey immediately after the posts were built are shown in the table below.

Number of corals

	Mooring post one	Mooring post two	Mooring post three	Total
Damaged coral	7	3	5	15
Undamaged coral	46	41	48	
			Grand total	

(iii) Complete the table. [1]

(iv) Calculate the percentage of damaged corals.

.....[1]

The survey was repeated after two years and the results are shown in the table below.

Number of corals

	Mooring post one	Mooring post two	Mooring post three	Total
Damaged coral	6	7	6	19
Undamaged coral	51	44	50	145

(e) Describe what the second survey shows compared to the first one.

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.....[2]

(f) What additional information would be needed to decide whether or not the findings of the second survey are related to diving?

.....[1]

(g) You are asked to prepare an environmental management plan for the island authorities so that diving can continue as an important part of the island's economy, but at the same time the marine environment can be conserved.

You should consider

- access to dive sites
- coastal developments
- laws and regulations

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.....[6]

3 The low rainfall and free draining soils make growing crops difficult on Bonaire. However *Aloe vera*, a semi-desert plant, is suited to these conditions and is in great worldwide demand for its medicinal properties and as a good source of iron in the human diet.

A farmer planted *Aloe vera* in two fields separated by a rock outcrop two metres high. He noticed that plants in the exposed field did not seem to be growing quite as well as those in the sheltered field.

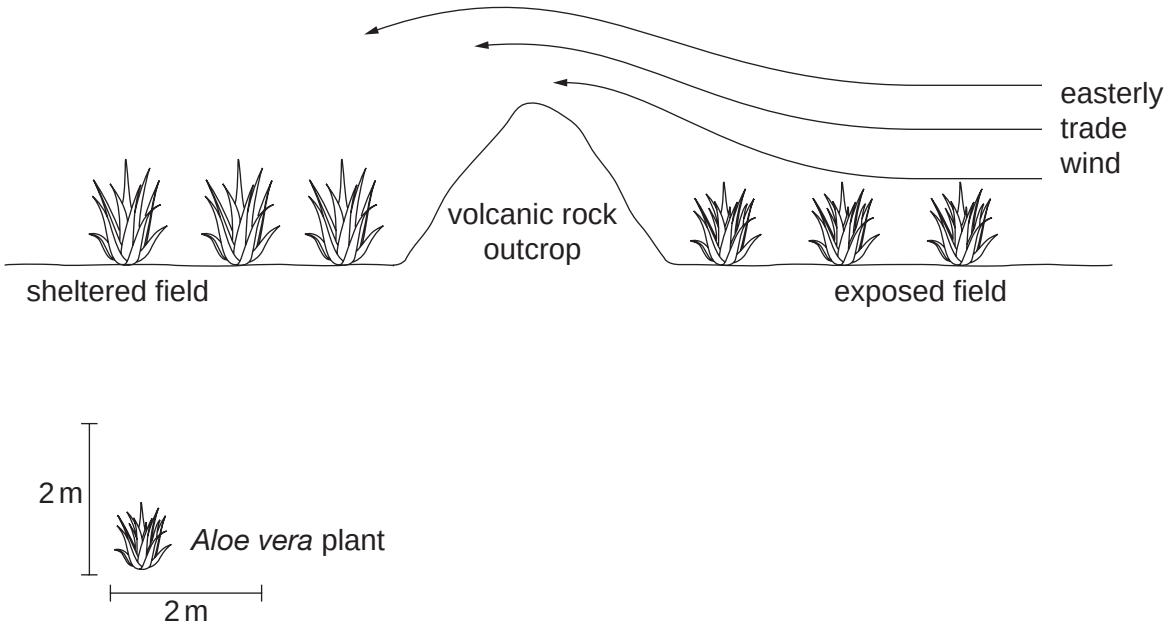

Fig. 9

The farmer selected twenty plants from each field and gathered the data as shown in the table below.

	sheltered field	exposed field
Average number of leaves per plant	10.4	12.1
Average height of the plants (cm)	87.2	76.4

(a) Describe and explain how the trade wind affects the plants.

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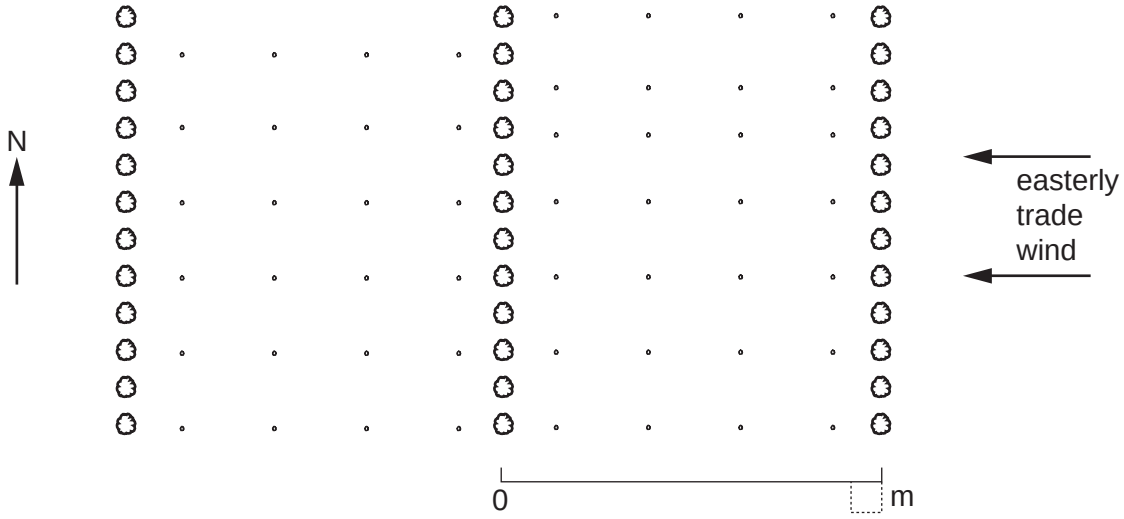
(b) The farmer decided to plant some mature *Aloe vera* plants as a hedge at regular intervals across his exposed field to shelter the new crops from wind.



Aloe vera hedge

new *Aloe vera* crop plants

Fig. 10

(i) The *Aloe vera* hedges grow to an average height of 0.8 m. Some shelter effect is gained in a distance up to ten times the height of a hedge.

Complete the scale line on Fig. 10 so the farmer will know how far apart to plant hedges. [1]

An environmental scientist wanted to find out if the hedges really had any effect on the rate of growth of *Aloe vera* plants.

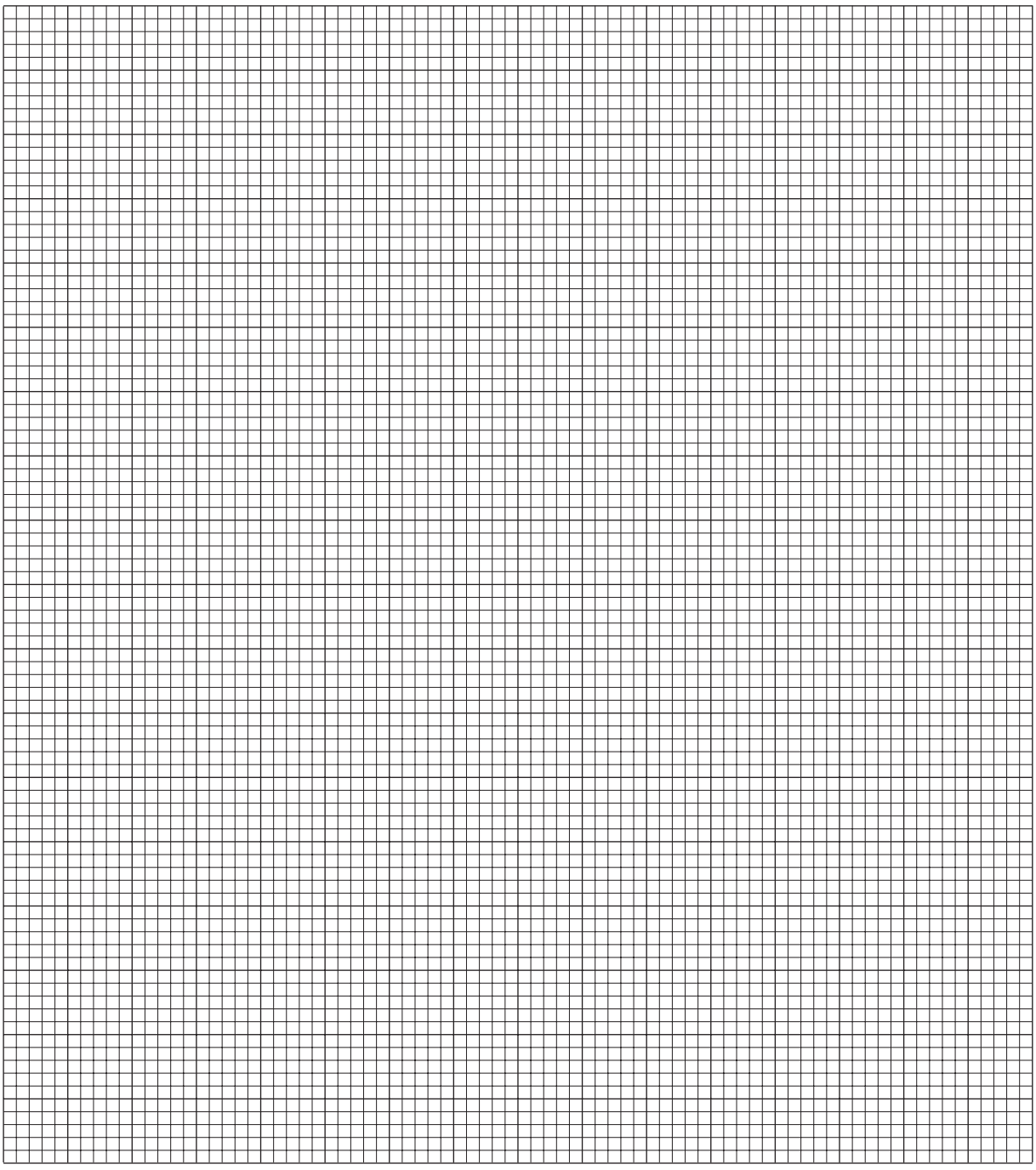
The scientist measured *Aloe vera* plants along an east-west transect line 10 weeks after planting.

(ii) Draw on Fig. 10 the position of an east-west transect line. [1]

Some of the data are shown in the table below.

Distance from hedge (m)	1	2	3	4	5	6
Number of leaves	8	9	8	7	6	6
Height of plant (cm)	57	60	57	52	51	45

(iii) Draw a graph of the data. [4]



(iv) Describe the trends or patterns shown by the graph.

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.....[2]

(c) Suggest **one other way** an environmental scientist could take measurements at harvest time to investigate the effect of the hedges.

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.....[1]

(d) The farmer wants to find out the best planting density for use in future years. The *Aloe vera* seeds take about 4 weeks to appear as small plants.

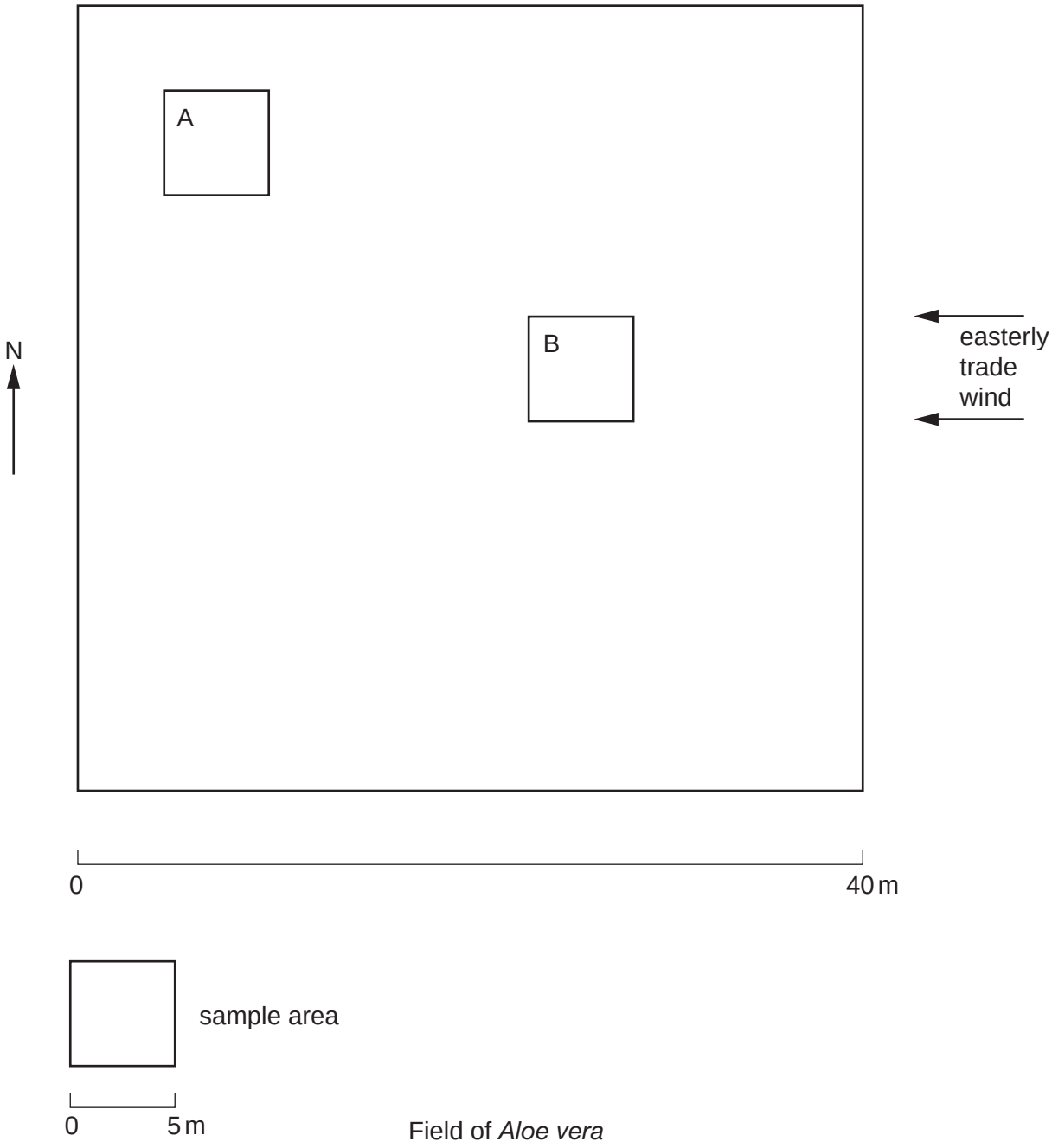

Fig. 11

In the main part of the field *Aloe vera* was planted in rows at 0.5 m intervals with 1.0 m between rows.
Suggest two different planting densities for the trial in sample area

A .....

B .....[2]

(e) Suggest some long term problems that might occur with high density planting.

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