| Surname | | Other Names | |
| Centre Number | | Candidate Number | |
| Candidate Signature | | | |

General Certificate of Education
January 2003
Advanced Level Examination

AQA

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

BIOLOGY (SPECIFICATION B)   **BYB6/A**
Unit 6   Section A Applied Ecology

Tuesday 28 January 2003   9.00am to 11.15am

In addition to this paper you will require:
• Section B (attached).
• a ruler with millimetre measurements.
You may use a calculator.

Time allowed: The total time for Section A and Section B of this paper is 2 hours 15 minutes.

Instructions
• Use blue or black ink or ball-point pen.
• Fill in the boxes at the top of this page.
• Answer **all** questions in **Section A** in the spaces provided. All working must be shown.
• **Section A** and **Section B** will be marked by different examiners.
  You must ensure that any supplementary sheets are fastened to the appropriate question paper answer book.
• Do all rough work in this book. Cross through any work you do not want marked.

Information
• The maximum mark for **Section A** is 50.
• Mark allocations are shown in brackets.
• You are advised to spend 1 hour on **Section A**.
• You are reminded of the need for clear presentation in your answers. All answers should be in good English and should use accurate scientific terminology.
• You are reminded that **Section A** requires you to use your knowledge of Modules 1-5 as well as Module 6 in answering synoptic questions. These questions are indicated by the letter **S**.

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SECTION A

Answer **all** questions in the spaces provided.

1 (a) One cause of acid rain is the release of sulphur dioxide into the atmosphere. Describe **one** way in which sulphur dioxide is released into the atmosphere.

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(1 mark)

(b) Describe and explain **two** specific effects of acid rain on aquatic animals.

1 ....

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2 ....

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(4 marks)

5

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

2 Woodlice are small animals that live under stones in damp conditions. In a study of behaviour, a woodlouse was put into a Petri dish in the light for five minutes. The same woodlouse was then put into another Petri dish in the dark for a further five minutes. The drawings show the paths of the same woodlouse plotted for five minutes in each condition.

Light   Dark

One-minute interval
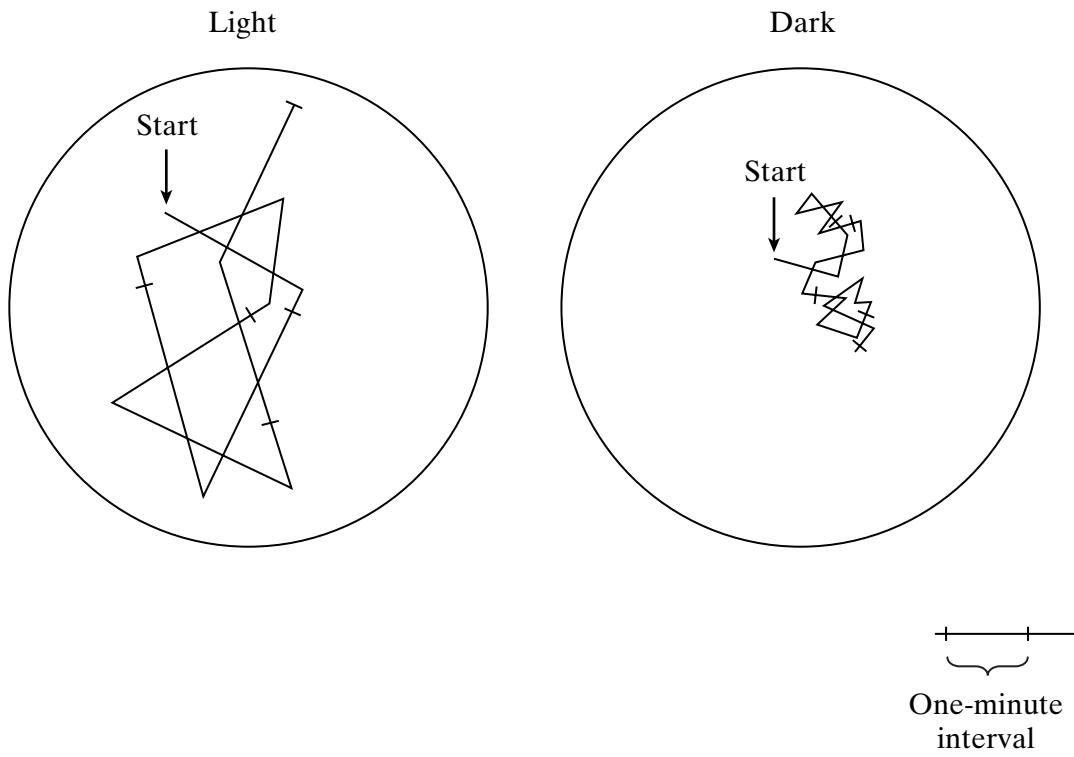
(a) Describe **two** ways in which the behaviour of the woodlouse in the light differed from its behaviour in the dark.

1 ....

....

2 ....

....

(2 marks)

(b)   (i)   Which type of innate behaviour is shown by the woodlouse in this investigation?

....
(1 mark)

(ii)   Suggest the importance of this behaviour for survival in woodlice.

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....
(2 marks)

5

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

3 (a) In order to calculate *leaf area index* of a plant **two** measurements need to be made. What are they?

1 ....

....

2 ....

....

(2 marks)

(b) The diagram shows two plants with different leaf arrangements. The mean width of the leaves is the same in both plants.

Plant **A**   Plant **B**

Leaf layers

Ground
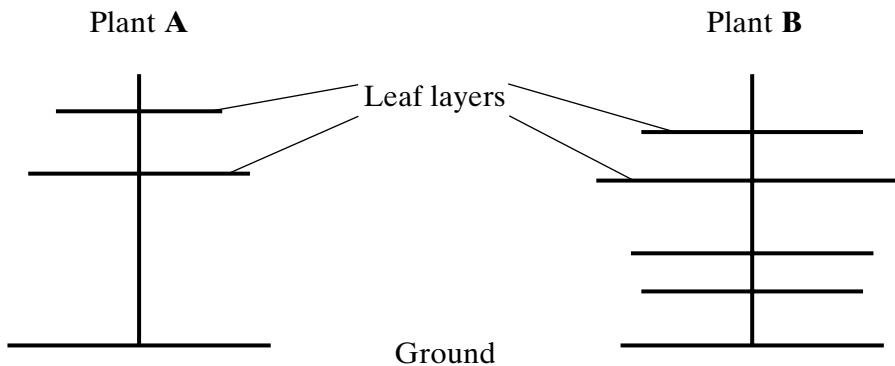
Which plant, **A** or **B**, has the greater leaf area index?
Explain your choice.

Plant **A** or **B** ....

Explanation ....

....

....

(1 mark)

(c) Winter wheat is sown in the autumn and spring wheat is sown in early spring. The graph shows the leaf area index for winter and spring wheat from December to August.
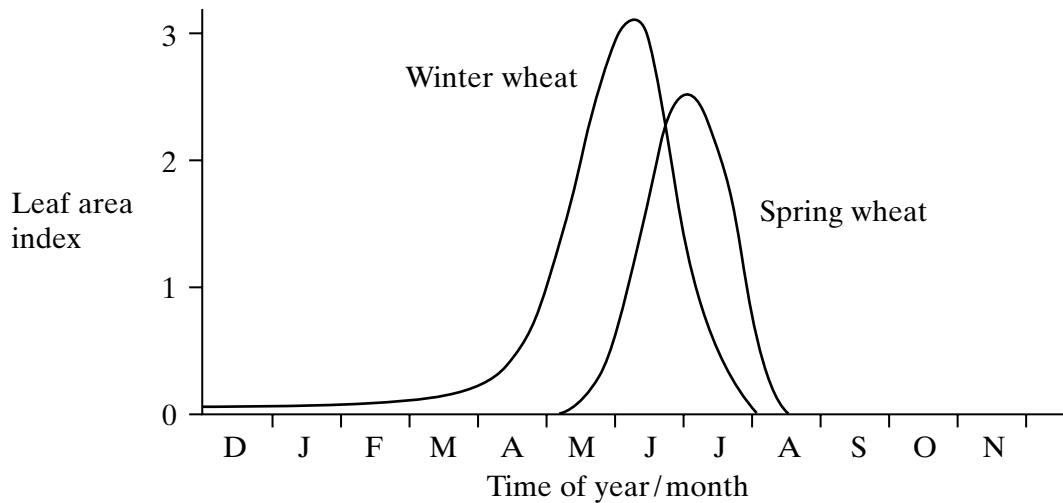
Use the information in the graph to explain which type of wheat is likely to produce the greater yield.

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(2 marks)

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

4 The graph shows the effect of carbon dioxide concentration, light intensity and temperature on the rate of photosynthesis of a crop plant.
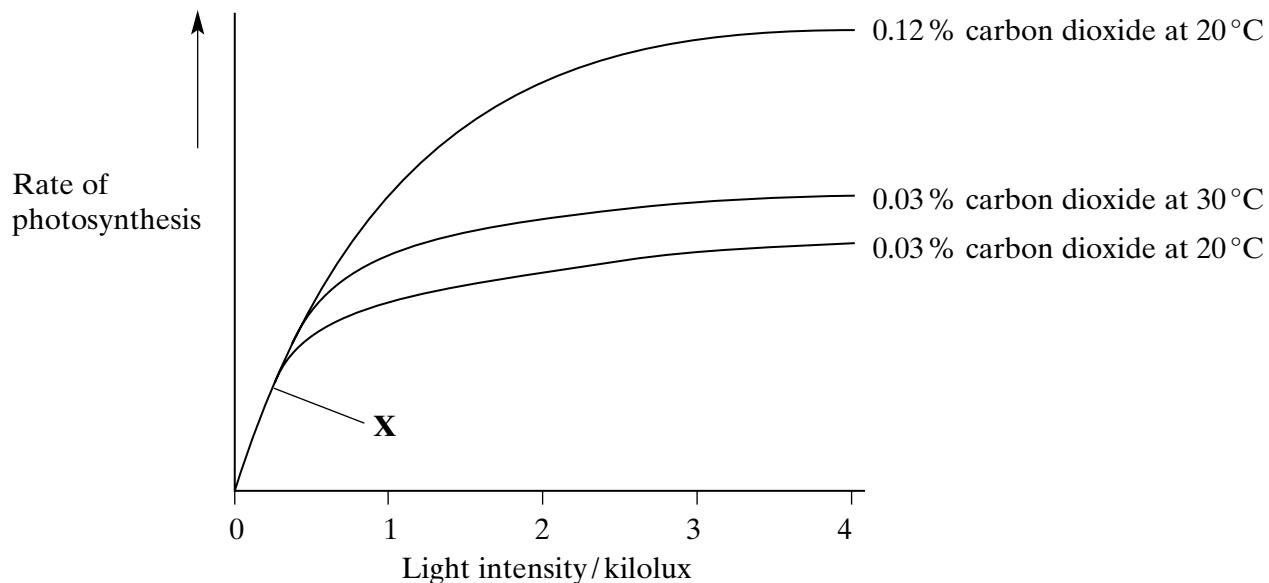
(a) Which factor is limiting the rate of photosynthesis at point **X**? Explain your answer.

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....
(1 mark)

(b) In a glasshouse in winter, the mean carbon dioxide concentration is 0.03 %, the temperature is 20 °C and the light intensity is 3 kilolux.

Using the graph, predict whether increasing the carbon dioxide concentration to 0.12 % or the temperature to 30 °C would result in the greater increase in growth. Using your knowledge of photosynthesis, give an explanation for your answer.

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(2 marks)

(c) Explain why it is not advisable to increase the temperature in a glasshouse on a dull winter day.

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(2 marks)

S (d) Little of the sunlight falling on the leaves of a plant grown in a glasshouse, even under optimum conditions, is used in photosynthesis. Give **two** explanations.

1 ....

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2 ....

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(2 marks)

7

Turn over ▶

5 (a) When sampling organisms in ecological studies, quadrats should be placed at random in the area that is being studied.

Describe how you would place quadrats so as to achieve a random distribution.

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....
(2 marks)

(b) The diagram shows a transect across a sand-dune ecosystem.
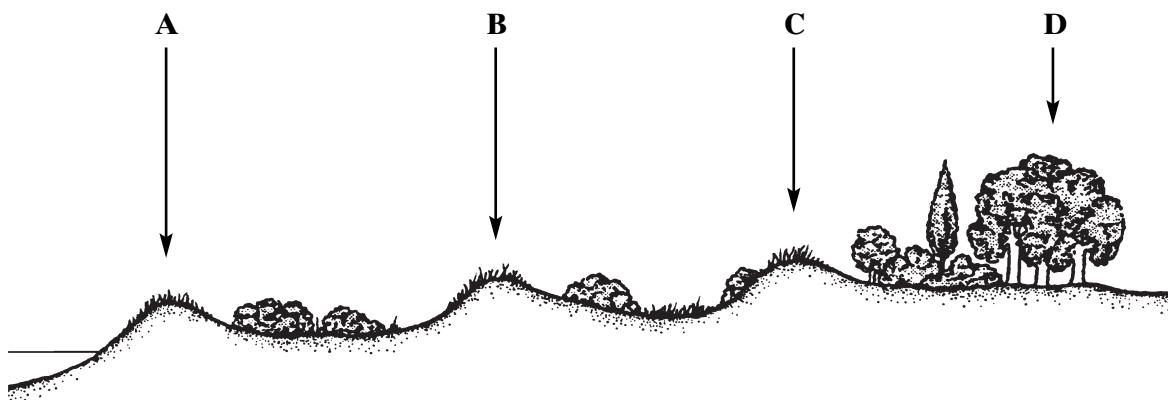
The data in **Table 1** were obtained from a sample of quadrats taken at position **B** on the transect.

Species	Number of plants in sample
Marram grass	40
Ling	9
Bell heather	4
Gorse	1

Table 1

(i) The index of diversity may be calculated from the formula

$$d = \frac{N\,(N-1)}{\Sigma n(n-1)}$$

where N = total number of organisms of all species
and n = total number of organisms of each species.

Use the data in **Table 1** to calculate the index of diversity for this sample.
Show your working.

Index of diversity = ...
(2 marks)

(ii) Explain why the value of the index of diversity increases along the transect from position **A** to position **D**.

....

....
(1 mark)

QUESTION 5 CONTINUES ON THE NEXT PAGE

Turn over ▶

S (c) **Table 2** shows the results of a soil analysis carried out on samples collected from positions **A** and **C** along the transect.

	Sampling positions along transect	
	A	**C**
Percentage humus (dead plant material)	0.2	13.5
Nitrate concentration in parts per million	23.0	138.0
Number of soil bacteria $\times 10^3$ per gram of soil	132.0	653.0

Table 2

Using information in **Table 2** and your own knowledge, explain why the nitrate concentration is greater at position **C** than at position **A**.

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(4 marks)

9

6 (a) Explain how **two** methods introduced to reduce overfishing can help to maintain breeding stocks in wild fish populations.

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2 ....

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(2 marks)

(b) As wild stocks have been overfished, intensive fish farming has become a desirable method of providing fresh fish. Fish farms that are positioned in lakes often pollute the surrounding environment. Suggest how fish farms produce an excess of suspended solids.

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(1 mark)

S (c) Explain how increased nitrate concentration affects the lake ecosystem surrounding the fish farm.

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(4 marks)

S (d) Explain how fish escaping from fish farms may affect wild fish stocks.

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(2 marks)

9

Turn over ▶
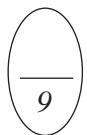
7 Avoiding excess water loss is one of the major problems facing plants and small rodents living in a desert.

(a) Describe and explain **two** structural adaptations of desert plants which limit water loss.

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(4 marks)

S (b) The table shows the change in water potential of the filtrate at certain positions along the kidney tubule of a desert rodent.

	Position in kidney tubule			
	Beginning of distal convoluted tubule	End of distal convoluted tubule	Beginning of collecting duct	End of collecting duct
Water potential of filtrate/kPa	−100	−300	−500	−1200

Explain how this animal would achieve these changes and so avoid excessive loss of water.

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(6 marks)

END OF SECTION A