Surname		Other Names	
Centre Number			Candidate Number									
Candidate Signature												

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General Certificate of Education
January 2005
Advanced Level Examination

ASSESSMENT and QUALIFICATIONS ALLIANCE

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

Thursday 27 January 2005 9.00 am to 11.15 am

In addition to this paper you will require:
- Section B provided as an insert (enclosed).
- 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**.

For Examiner's Use			
Number	Mark	Number	Mark
1			
2			
3			
4			
5			
6			
7			
8			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

NO QUESTIONS APPEAR ON THIS PAGE

SECTION A

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

1 The mule deer is a large mammal that lives in hot deserts. It is most active for a few hours around dawn and dusk each day. During the day it keeps cool by lying in the shade. Its large ears also help it to keep cool.

(a) Explain how the ears of the mule deer help it to keep cool.

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(2 marks)

S (b) Explain **one** way in which activity during the day would raise body temperature.

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(2 marks)

4

2 Attempts are being made to conserve the natterjack toad, which breeds in ponds. A number of recommendations have been made about how to do this. Some of these are shown in the table, together with a reason for each one.

Recommendation	Reason
Keep, or create, shallow ponds.	Deep ponds contain insect predators that eat natterjack tadpoles.
Keep pH of ponds between 5 and 7.	Optimum pH for natterjack tadpoles.
Keep vegetation content of ponds low.	Large amounts of vegetation attract insect predators.
Remove shrubs from around ponds.	Shrubs provide cover for common toads, whose tadpoles kill natterjack tadpoles.
Keep grass around ponds short by mowing, or allowing rabbits to graze.	Short grass suits beetles that natterjack toads eat.

(a) Explain **two** ways in which these recommendations could reduce populations of animals other than common toads.

1 .....

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2 .....

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(2 marks)

S (b) Most of the UK populations of natterjack toads are found on sand dune systems. The communities of plants and animals on such systems usually change over time as a result of succession. Explain how the natterjack conservation recommendations could affect succession in a sand dune system.

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(3 marks)

3 (a) Describe **two** problems caused by the use of non-specific insecticides.

1 .....

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2 .....

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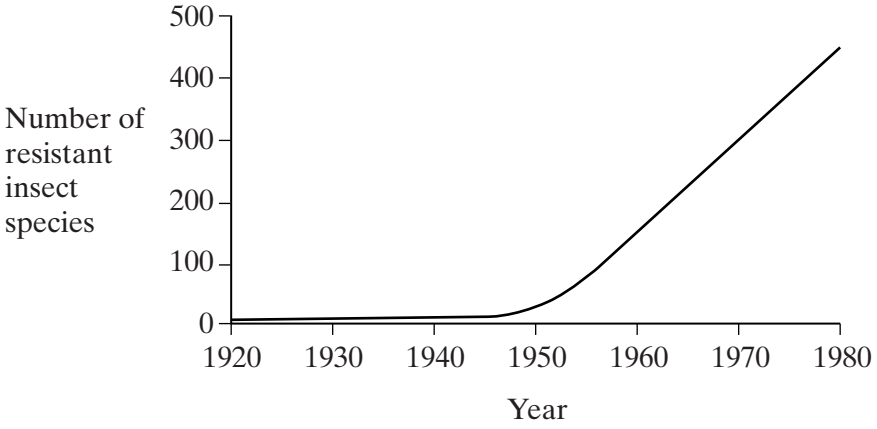
(2 marks)

(b) The graph shows the number of species of insects reported to be resistant to at least one insecticide between 1920 and 1980.



(i) Suggest **one** reason why there was a rapid rise in resistant species after 1950.

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(1 mark)

S (ii) Explain how an insect population can become resistant to an insecticide.

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(3 marks)

6

Turn over ▶

4 The mesquite tree grows in dry areas which have soils with low concentrations of ions. Its roots grow down to 25 metres and contain nitrogen-fixing bacteria. It is considered a pest in areas where farm animals graze because it out-competes grass. In some areas, young mesquite trees are cut down and then ploughed into the ground. This is expensive but makes the soil slightly more fertile for a few years.

(a) (i) Using the information given, explain **one** way in which mesquite trees are adapted for survival.

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(1 mark)

S (ii) Name the type of competition occurring between mesquite and grass.

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(1 mark)

S (iii) Explain how ploughing the mesquite into the soil makes it more fertile.

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(3 marks)

(b) Attempts have been made to use biological control to prevent the spread of mesquite, using beetles whose larvae eat the seeds of mesquite. Describe the principles involved in biological control.

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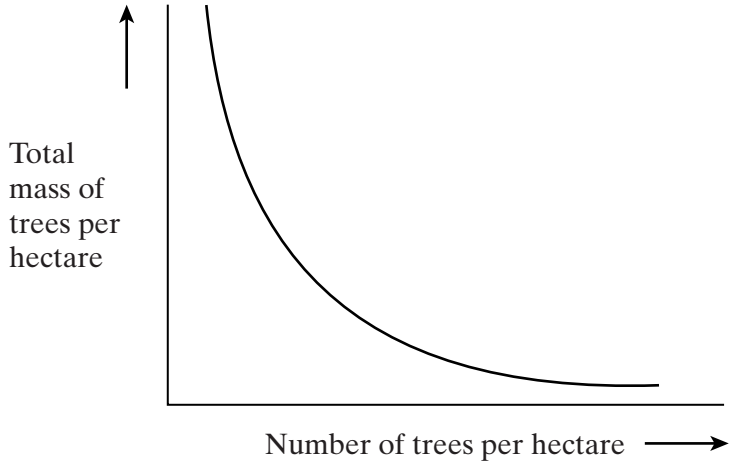
(3 marks)

8

5 (a) In a plantation, young pine tree seedlings were planted close together. As they grew, they competed for space and some died. The graph shows the relationship between the number of trees and the total mass of trees as the plantation got older.



(i) Explain the shape of the curve.

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(1 mark)

(ii) Explain why the spacing of the seedlings has a density-dependent effect on the population.

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(1 mark)

S (b) In an old plantation, the smaller trees get less sunlight. Explain how this can reduce the movement of water from the roots to the leaves.

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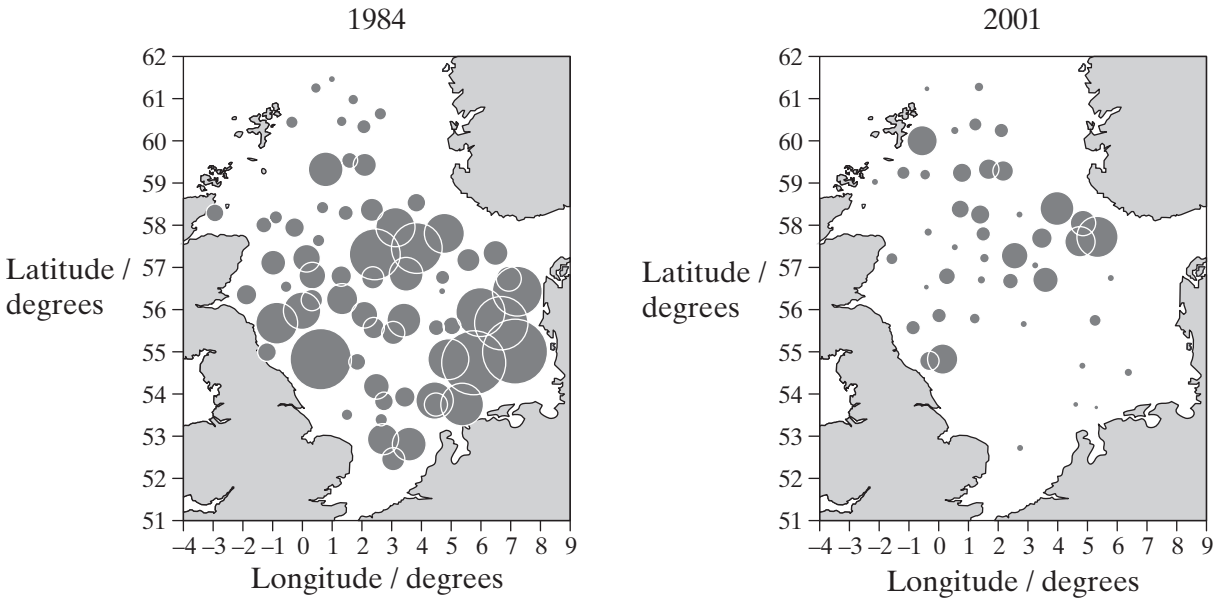
(2 marks)

4

6 (a) The size of the cod stocks in the North Sea is estimated by netting. Each year, boats fish at the same sites in the North Sea and the number of cod caught in one hour in their nets is counted. The charts below show the results for 1984 and 2001. The size of circle is proportional to the number of fish caught at each site.



(i) Describe **two** changes that occurred between 1984 and 2001.

1 .....

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2 .....

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(2 marks)

(ii) To be able to make a valid comparison between the results, it is important to use the same fishing method at each site. Apart from fishing for one hour, suggest **two** other factors that would have to be kept the same.

1 .....

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2 .....

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(2 marks)

(b) (i) Explain what is meant by the *maximum sustainable yield* in fisheries.

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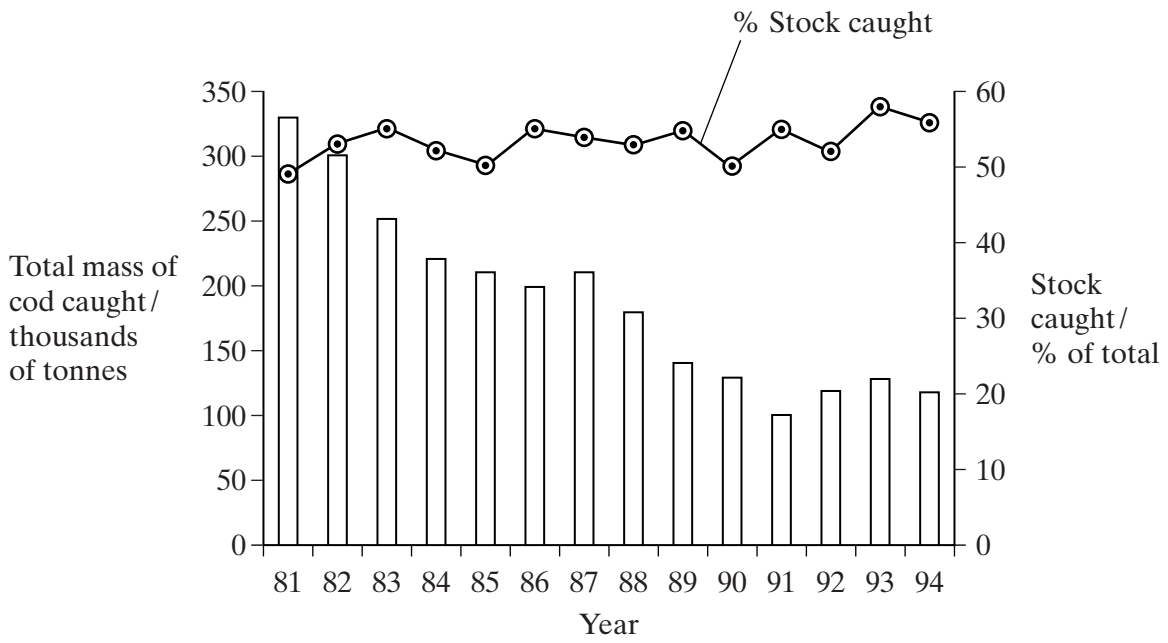
(2 marks)

(ii) The graph shows the total mass of cod caught in a fishery between 1981 and 1994. It also shows the percentage of the total stock caught each year.



Explain the evidence that the cod stocks were falling.

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(2 marks)

8

Turn over ▶

7 (a) Explain why heavy metal ions may accumulate in food webs.

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(2 marks)

(b) A hormone has been shown to switch on a gene in fish, leading to the increased production of an enzyme. Experiments were carried out to investigate the effects of heavy metal ions on the production of this enzyme, with and without the hormone. The table shows the results.

	Amount of enzyme produced/percentage of maximum	
Heavy metal ion present	**Without hormone**	**With hormone**
None	16	100
Cadmium	15	55
Zinc	17	94
Copper	16	100

(i) Explain how the results suggest that cadmium affects the action of the hormone.

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(2 marks)

S (ii) Explain how switching on the gene leads to the production of the enzyme.

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(3 marks)

(iii) The hormone is oestrogen, which is involved in the sexual maturation of fish. Suggest how pollution of water with cadmium ions may cause a reduction in the size of the fish populations.

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(1 mark)

8

TURN OVER FOR THE NEXT QUESTION

8 (a) Explain what is meant by

(i) leaf area index;

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(1 mark)

(ii) net productivity.

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(1 mark)

Figures 2 and **3** show information about the plant in **Figure 1**. **Figure 2** shows the leaf area index at different heights and **Figure 3** shows the energy gains and losses due to photosynthesis and respiration at different heights.

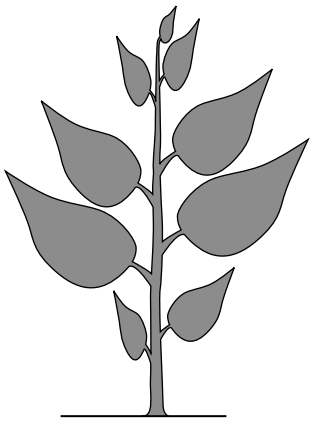

Figure 1

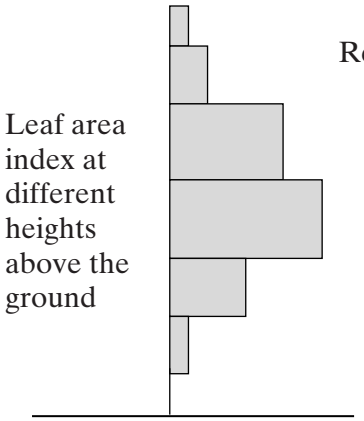

Figure 2

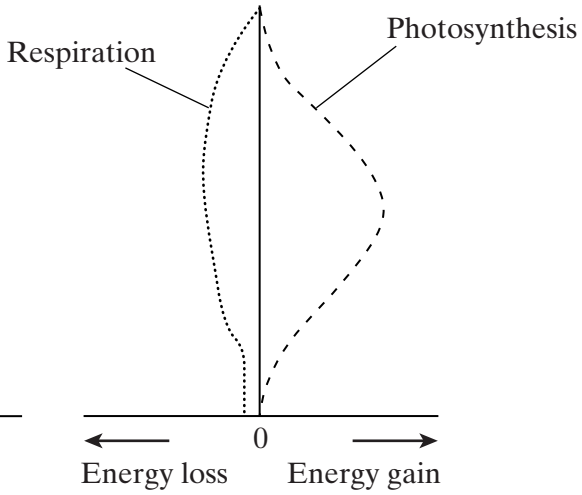

Figure 3

(b) (i) Explain the differences in the leaf area index measured at different heights.

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(1 mark)

S (ii) Explain why the rate of photosynthesis near ground level is zero but the rate of respiration is not.

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(1 mark)

(c) On **Figure 3**, draw a curve to show the net productivity of the plant at different heights above the ground. *(1 mark)*

S (d) Many tropical plants use C_4 photosynthesis, whereas most plants in Britain use C_3 photosynthesis. Describe how the light-independent reaction in C_3 plants differs from that in C_4 plants.

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(2 marks)

7

END OF SECTION A

SECTION B IS PROVIDED AS AN INSERT

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