

Surname					Other Names				
Centre Number					Candidate Number				
Candidate Signature									

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General Certificate of Education
June 2004
Advanced Level Examination



BIOLOGY (SPECIFICATION B)
Unit 6 Section A Applied Ecology

BYB6/A

Friday 25 June 2004 1.30 pm to 3.45 pm

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.

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

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** the 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 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 advised to spend 1 hour on **Section A**.
- You are reminded that **Section A** requires you to use your knowledge of different parts of the specification as well as Module 6 in answering synoptic questions. These questions are indicated by the letter **S**.

NO QUESTIONS APPEAR ON THIS PAGE

SECTION A

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

1 (a) (i) What is meant by an *abiotic* factor?

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(1 mark)

(ii) Do abiotic factors exert a density-dependent or a density-independent effect on a population? Using an example, explain your answer.

Effect

Explanation

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(1 mark)

(b) Describe how you would collect the necessary data to estimate the size of a population by the mark-release-recapture technique.

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(3 marks)

5

Turn over 

2 (a) Farmers who grow wheat sometimes leave a field fallow for a year by not growing a crop in it. The concentration of nitrate ions in the soil decreases when a field is left fallow.

(i) When grass is grown in the field, fewer nitrate ions are lost than when the field is left with bare soil. Explain why.

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(1 mark)

(ii) A crop of leguminous plants such as clover may be grown in the field and then ploughed in. Explain why less fertiliser would be needed for the wheat crop in the following year.

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(2 marks)

- (b) The table gives information about the yield and profitability of a wheat crop grown using different amounts of fertiliser.

Nitrogen fertiliser applied/ kg ha^{-1}	Grain yield/ tonnes ha^{-1}	Grain protein/ %	Value added by using fertiliser/ £ ha^{-1}	Cost of using fertiliser/ £ ha^{-1}	Benefit : cost ratio
0	2.4	11.7	–	–	–
25	2.5	12.5	19	11	1.7 : 1.0
50	2.5	12.9	25	22	1.1 : 1.0
75	2.5	13.3	31	33	0.9 : 1.0
100	2.5	13.5	37		

- (i) Describe the effects of increasing fertiliser application on the yield and protein content of the grain produced.

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(2 marks)

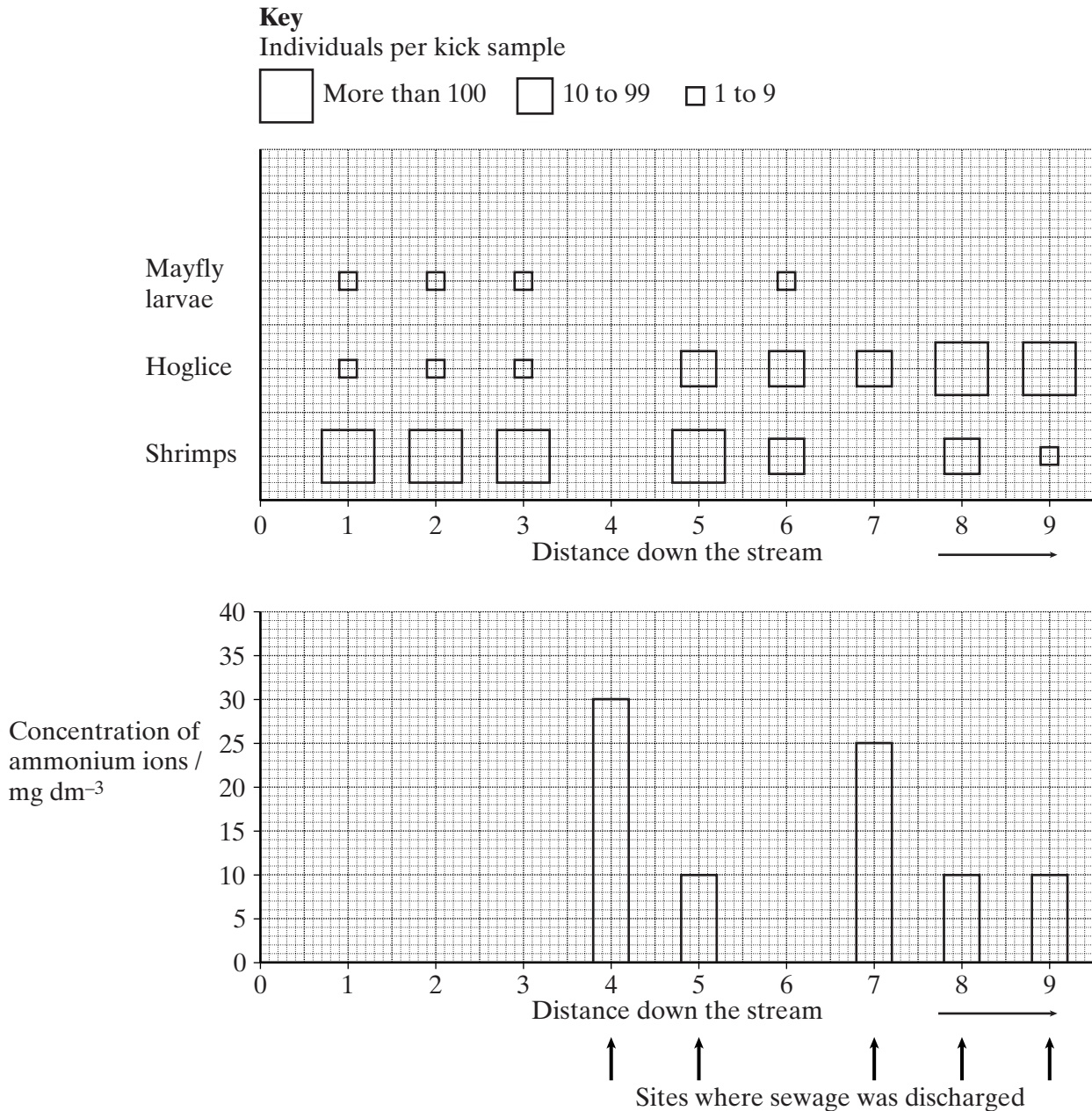
- (ii) Use the data in the table to estimate the benefit : cost ratio for a fertiliser application of 100 kg ha^{-1} . Write your answer in the table.

(1 mark)

6

Turn over ►

- 3 The charts show some results from a survey of water quality and species diversity at nine sites along a stream on the Isle of Wight in 1988. Sewage was discharged into the stream at certain points.



- (a) The animals were collected by kick sampling. In this technique, a net is held in the water. Animals disturbed by kicking the streambed are collected inside the net.

Describe **one** precaution that should be taken to ensure that valid comparisons could be made between samples taken from different sites.

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(1 mark)

(b) List the species in order of their tolerance to pollution by sewage.

Most tolerant
Medium tolerance
Least tolerant

(1 mark)

S (c) Explain why the concentration of ammonium ions was high in the samples of water taken from the sites where sewage was discharged into the stream.

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(2 marks)

S (d) In 1989 all houses in the area were connected to drains and so sewage no longer entered the stream. Following this, the oxygen concentration in the stream increased. Explain why.

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(3 marks)

7

Turn over 

4 The National Vegetable Research Station stores a collection of seeds from many species and varieties of vegetables. These include old and rare varieties.

S (a) Why is it important to keep seeds from old and rare varieties of vegetables?

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(2 marks)

S (b) Every few years, seeds of each variety in the collection are germinated and grown into mature plants. New seeds obtained from these plants are added to the collection.

(i) Suggest why it is necessary to obtain new seeds every few years.

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(1 mark)

(ii) Within each variety, the scientists cross plants with different genotypes. Explain the advantage of this.

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(2 marks)

5

5 (a) Give **two** advantages of farming fish rather than obtaining fish from wild stocks.

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(2 marks)

S (b) Fish and cattle are both farmed. When farmed, the mass of fish produced is greater than the mass of cattle produced from the same dry mass of food. Explain why.

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(2 marks)

(c) Salmon are farmed in sheltered bays on the sea coast. Fish lice are parasites that cause a fatal disease in salmon. The lice feed on the mucus on the scales of salmon and damage the muscles and gills of the fish they infect.

(i) Explain why salmon in a fish farm are particularly susceptible to infestation by fish lice.

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(1 mark)

S (ii) Wild salmon migrate from the sea into rivers. Fish lice on wild salmon die when the salmon swim into freshwater rivers. Explain why.

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(2 marks)



Turn over 

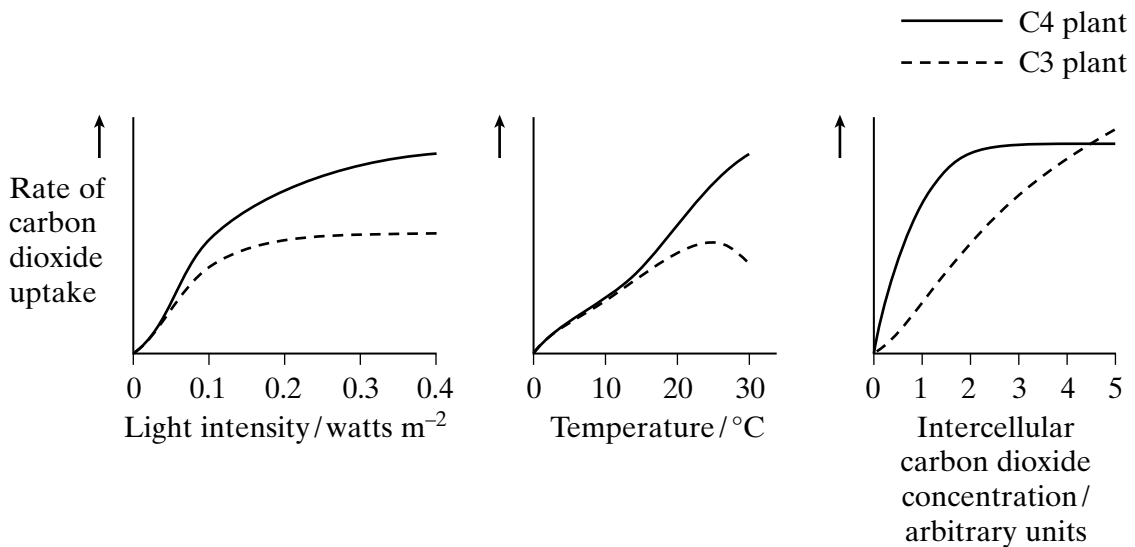
6 (a) Most plants in temperate climates use C3 photosynthesis. Tropical plants often use C4 photosynthesis. Give **three** different ways in which C4 photosynthesis differs from C3 photosynthesis.

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- 3
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(3 marks)

(b) The rate of photosynthesis was compared in two species of desert plant. One species used C4 photosynthesis and the other species used C3 photosynthesis.

The graphs show how three factors affect the rate of carbon dioxide uptake by these plant species.



(i) Under which conditions is it advantageous for plants to use C4 photosynthesis? Give evidence from the graphs to support your answer.

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(2 marks)

(ii) Explain the advantages to tropical plants of using C4 photosynthesis.

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(3 marks)

S (c) RuBP carboxylase (rubisco) is an enzyme used in both C3 and C4 photosynthesis. The enzyme combines carbon dioxide with ribulose biphosphate. Oxygen is a competitive inhibitor of rubisco.

Explain how oxygen inhibits the reaction between carbon dioxide and RuBP.

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(2 marks)

10

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

- 7 (a) Give **three** advantages of using biological control against a crop pest rather than using chemical control.

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(3 marks)

- (b) Lacewings are insects that feed on aphids and mites, which are crop pests. The numbers of six species of lacewings, **A** to **F**, were counted on samples of apple and strawberry crops. The results are shown in the table.

Crop	Number of adults of each species of lacewing						Diversity index
	A	B	C	D	E	F	
Strawberry	31	0	3	29	17	1	3.2
Apple	10	1	1	7	0	1	

The diversity index (d) is calculated from the formula

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

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

- (i) Calculate the diversity index for lacewing species in the apple crop and write the figure in the table. Show your working.

(2 marks)

(ii) Suggest a reason why the diversity index for the lacewings is different between the two crops.

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(1 mark)

S (c) Diazinon is an organophosphate pesticide that kills aphids by inhibiting the enzyme acetylcholinesterase. The aphids die as a result of continuous muscle contraction. Explain why Diazinon affects muscles in this way.

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(4 marks)

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END OF SECTION A
SECTION B IS PROVIDED AS AN INSERT

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