

Surname						Other Names					
Centre Number						Candidate Number					
Candidate Signature											

For Examiner's Use

General Certificate of Education
January 2007
Advanced Level Examination



**BIOLOGY (SPECIFICATION B)
Unit 5 The Environment**

BYB5/W

Wednesday 24 January 2007 9.00 am to 10.15 am

<p>For this paper you must have:</p> <ul style="list-style-type: none"> a ruler with millimetre measurements. <p>You may use a calculator.</p>
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Time allowed: 1 hour 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.
- Answer the questions in **Section A** and **Section B** in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The maximum mark for this paper is 66.
- The marks for questions are shown in brackets. One mark will be awarded for Quality of Written Communication.
- You are reminded of the need for good English and clear presentation in your answers.
- Use accurate scientific terminology in your answers.
- Answers for **Section A** are expected to be short and precise.
- Answer questions in **Section B** in continuous prose where appropriate. Quality of written communication will be assessed in these answers.
- You are reminded that this test requires you to use your knowledge of Modules 1-4 as well as Module 5 in answering synoptic questions. These questions are indicated by the letter **S**.

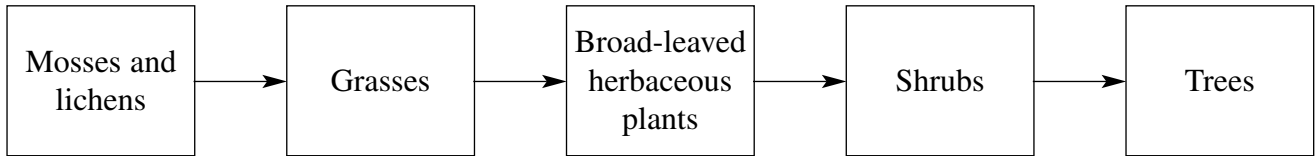
For Examiner's Use			
Question	Mark	Question	Mark
1			
2			
3			
4			
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6			
7			
8			
Total (Column 1) →			
Total (Column 2) →			
Quality of Written Communication			
TOTAL			
Examiner's Initials			

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SECTION A

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

1 The diagram shows the stages in a succession from colonisation of bare soil to the formation of woodland.



(a) What name is used to describe the final stage in a succession?

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(1 mark)

(b) Explain **one** way in which farming practices prevent the formation of woodland.

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(1 mark)

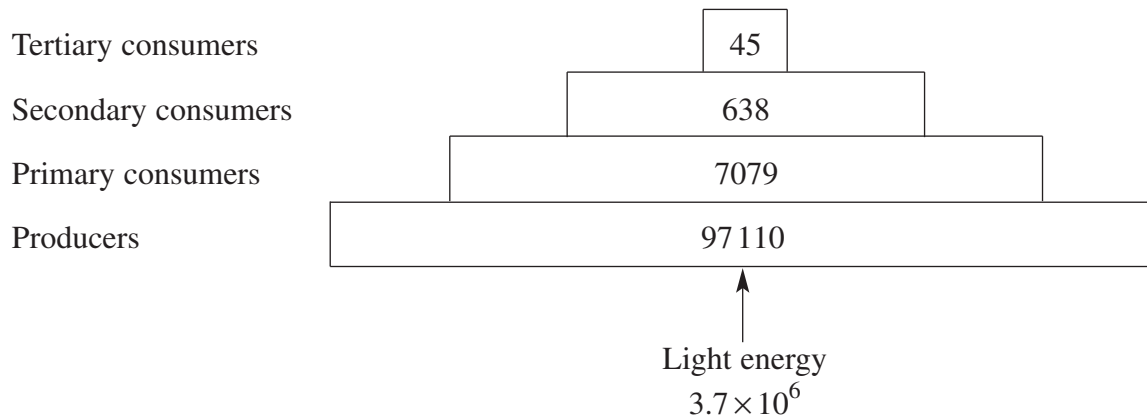
S (c) Clover plants are able to reproduce by vegetative propagation. Suggest **three** advantages of this form of reproduction when clover colonises a new habitat.

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3
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(3 marks)

5

Turn over ►

2 The diagram shows a pyramid of energy for an ecosystem.



(a) Suggest suitable units for the measurement of energy transfer in this pyramid of energy.

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(1 mark)

(b) (i) Calculate the percentage of energy transferred from primary consumers to tertiary consumers.

Answer
(1 mark)

(ii) Give **one** reason why the percentage of energy transferred between consumers is generally low.

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(1 mark)

- (c) (i) Give **one** reason why all the light energy reaching the producers cannot be used in photosynthesis.

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(1 mark)

- S (ii) Explain how light energy is used to generate ATP in plants.

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(3 marks)

7

Turn over for the next question

Turn over ►

- 3 In an investigation on leaf decomposition, the population density of earthworms and pH of the soil were measured in different habitats. The results are shown in the table.

Habitat	pH of soil	Number of earthworms per m ²
Deciduous woodland	7.5	410
Lawn	5.1	23
Meadow	6.5	180
Pasture	7.1	372
Coniferous woodland	4.7	5

- (a) Describe the relationship between the pH of the soil and the population density of earthworms.

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 (1 mark)

- (b) Give **one** method for measuring the pH of the soil.

.....

 (1 mark)

- (c) Pouring a dilute solution of washing-up liquid on soil causes earthworms to come to the surface. Describe how you could use this technique to compare the population density of earthworms in different habitats.

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 (3 marks)

S (d) (i) The burrows produced by earthworms improve drainage and aeration of the soil. Suggest how these burrows help to increase the rate of leaf decomposition.

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(2 marks)

(ii) Apart from affecting the number of earthworms, suggest how a decrease in the pH of the soil slows down the rate of leaf decomposition.

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(2 marks)

Turn over for the next question

4 Many farmers in California plant hedges around the fields in which crops are grown. They plant a large variety of plant species with a range of flowering times. These hedges are called insectary hedges because they are designed to attract insects.

(a) Explain why these insectary hedges attract a large variety of insect species.

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(3 marks)

(b) Give **one** advantage to farmers of attracting insects to their crops.

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(1 mark)

S (c) Many of the plant species in the hedges can survive periods of water shortage.

Give **three** structural adaptations and explain how each could help these plants survive periods of water shortage.

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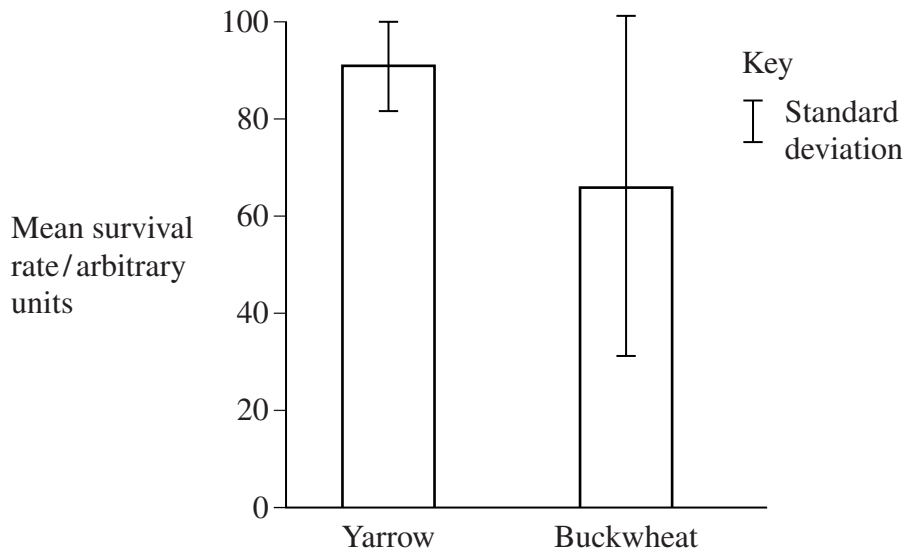
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3

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(3 marks)

- (d) Two years after planting, the survival rates of the different plant species were recorded in a number of different sites. The bar chart shows the mean survival rates of two of these species for all the sites combined and their standard deviations.



- (i) Explain what is meant by standard deviation.

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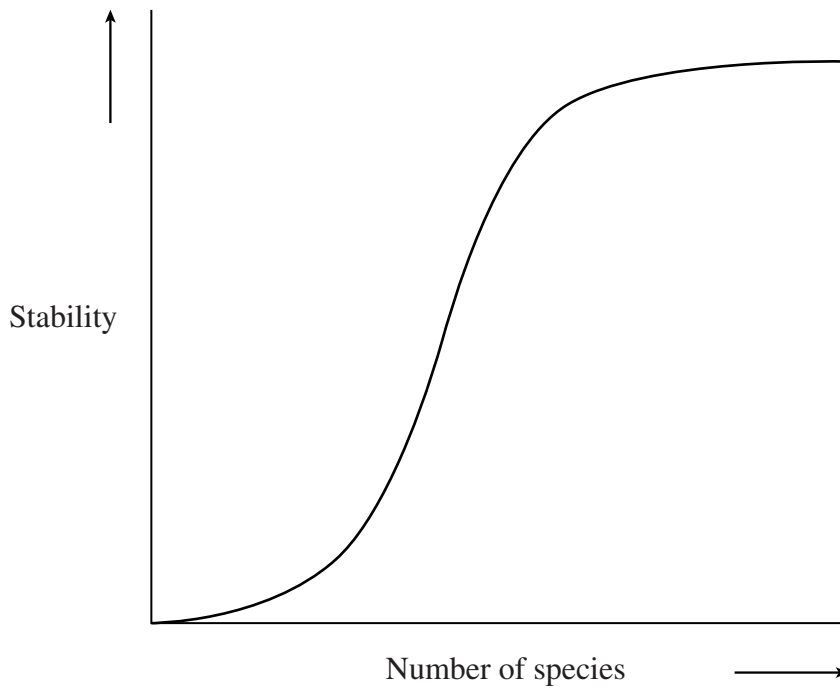
(1 mark)

- (ii) Use the data to compare the survival rate of yarrow with the survival rate of buckwheat at the different sites.

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(2 marks)

5 Populations of different species form communities. The graph shows how the stability of a community is related to the number of species it contains.



S (a) What is a species?

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(2 marks)

(b) Describe and explain how the stability of a community is related to the number of species it contains.

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(3 marks)

6 The use of organochlorine pesticides has been severely restricted, due partly to their bioaccumulation in food webs. They have been replaced by organophosphate pesticides, which do not accumulate in food webs.

(a) Explain how bioaccumulation of some pesticides can occur in food webs.

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(2 marks)

S (b) Organophosphates act by inhibiting the enzyme acetylcholinesterase, which is involved in synaptic transmission. Explain how this makes organophosphates toxic to animals.

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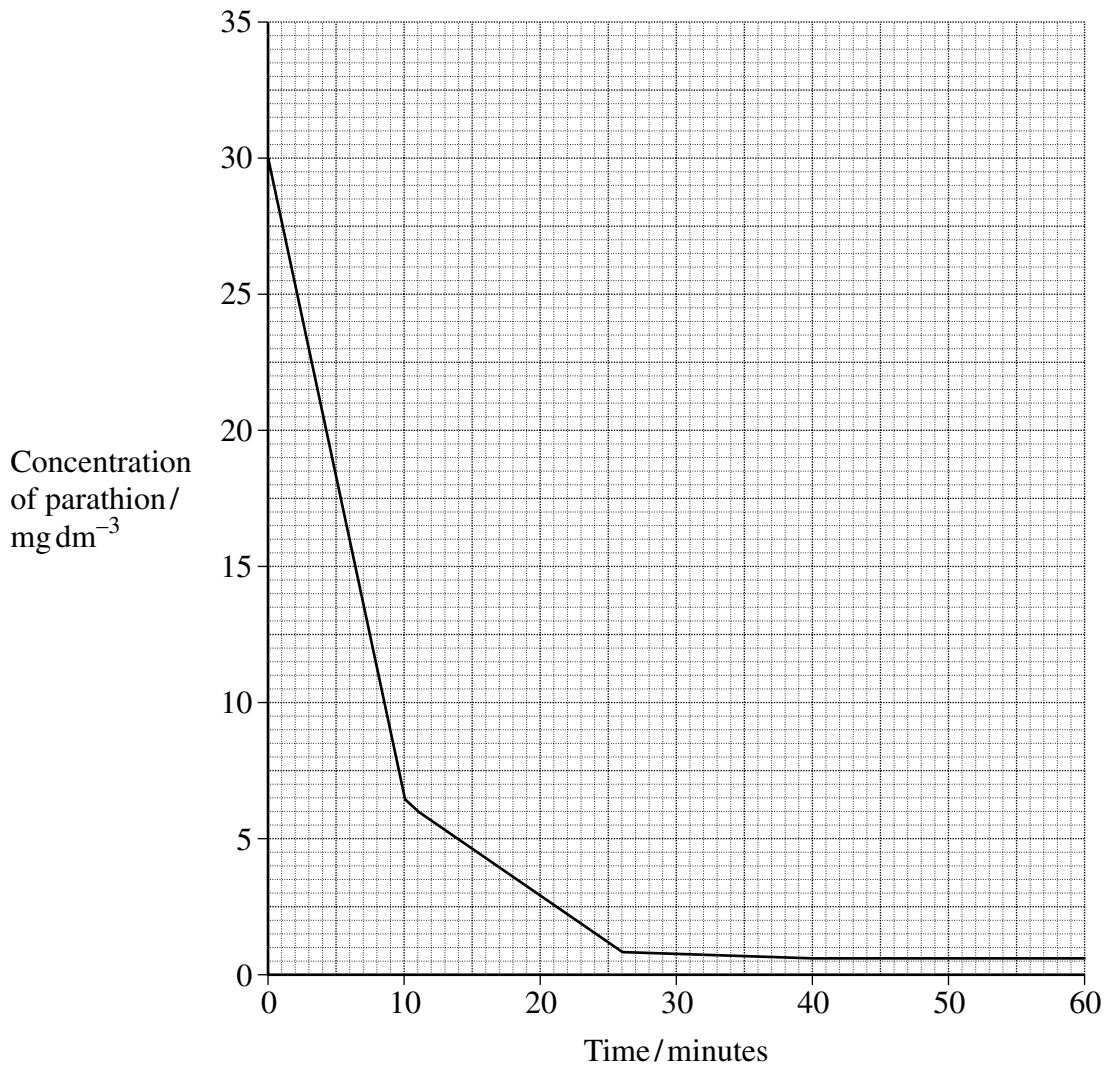
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Parathion is an organophosphate pesticide used to control insect pests on cotton plants. Although parathion is biodegradable, its breakdown by soil bacteria can take several weeks.

An enzyme was isolated from a species of bacterium found in soil. Parathion was mixed with a solution of this enzyme. The graph shows the rate of breakdown of parathion in the mixture.



- (c) Calculate the rate of breakdown of parathion in the first 10 minutes of this trial.

Rate = $\text{mg dm}^{-3} \text{ minute}^{-1}$ (1 mark)

S (d) Suggest why parathion is broken down more rapidly by the isolated enzyme than by a soil bacterium containing the same enzyme.

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(1 mark)

S (e) The molecular structure of some pesticides makes them non-biodegradable. Explain why.

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(2 marks)

8

Turn over for the next question

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SECTION B

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

Answer in continuous prose, where appropriate.
Quality of Written Communication will be assessed in these answers.

- 7 In tropical rain forests there are very rapid rates of decomposition and of uptake of mineral ions from the soil by plants. The table shows the percentage of organic carbon-containing and organic nitrogen-containing compounds in the living organisms of a tropical rain forest and a Scottish pine forest.

	Organic carbon-containing compounds in living organisms / %	Organic nitrogen-containing compounds in living organisms / %
Tropical rain forest	80	58
Scottish pine forest	40	6

- (a) Attempts to convert areas of tropical rain forest to productive agricultural land have generally proved unsuccessful. Explain why.

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(2 marks)

(b) Describe how the action of microorganisms in the soil produces a source of nitrates for plants.

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(5 marks)

S (c) Describe the process involved in the uptake of nitrates by roots.

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(3 marks)

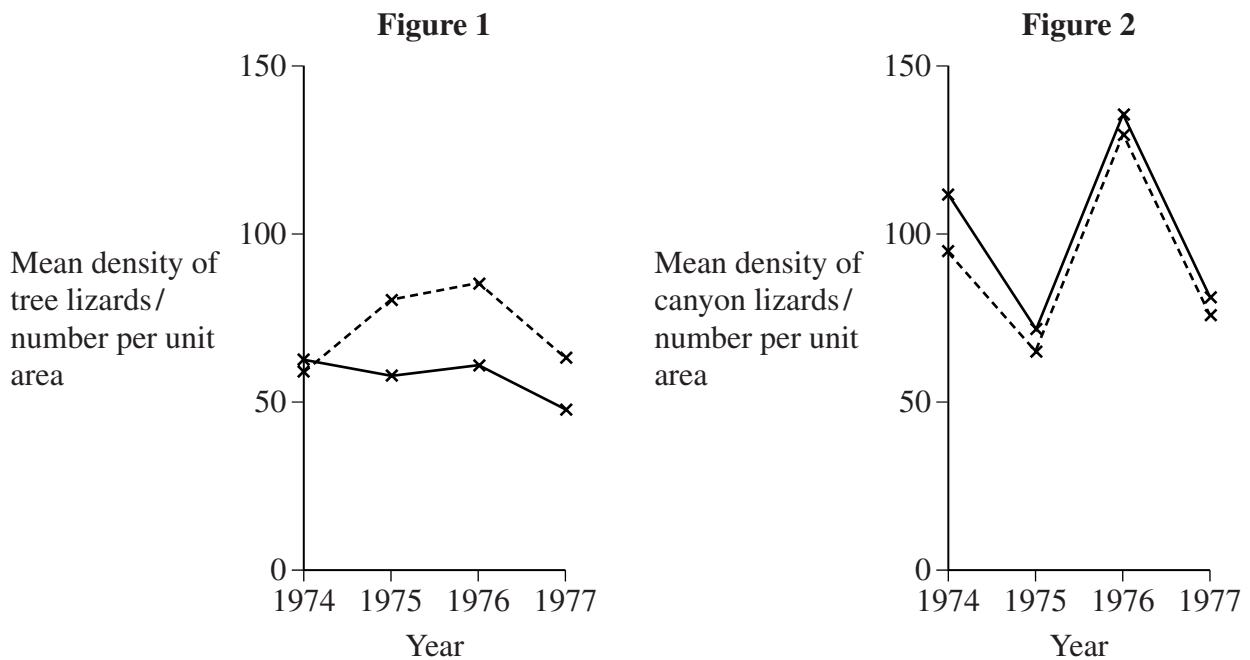
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8 Tree and canyon lizards are found in desert areas in Texas. Both species eat insects. In an investigation the population densities of both species of lizard were measured over a four-year period in:

- control areas, where both species lived
- experimental areas, from which one of the species had been removed.

The results for tree lizards are shown in **Figure 1** and the results for canyon island lizards are shown in **Figure 2**.



Key

- ×——× Control areas, where both species live
- ×-----× Experimental areas, from which one of the species had been removed

(a) Name the type of interaction being studied in the control areas.

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(1 mark)

(b) Describe how the population density of each lizard species is affected by the presence of the other. Give evidence from **Figure 1** and **Figure 2** to support your answer.

(i) Tree lizard

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(1 mark)

(ii) Canyon lizard

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(1 mark)

(c) The investigators concluded that, during the four-year period, an abiotic factor had a greater effect on the canyon lizards than on the tree lizards. What evidence from **Figure 1** and **Figure 2** supports this conclusion?

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(1 mark)

(d) Adult tree lizards were found to have shorter lives in experimental areas than in control areas. Using **Figure 1**, suggest an explanation for this.

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(1 mark)

Question 8 continues on the next page

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