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

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General Certificate of Education  
January 2004  
Advanced Level Examination



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

**BYB5/W**

Thursday 22 January 2004 Morning Session

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| <p><b>In addition to this paper you will require:</b></p> <ul style="list-style-type: none"> <li>a ruler with millimetre measurements.</li> </ul> <p>You may use a calculator.</p> |
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| For Examiner's Use  |      |        |      |
|---------------------|------|--------|------|
| Number              | Mark | Number | Mark |
| 1                   |      |        |      |
| 2                   |      |        |      |
| 3                   |      |        |      |
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| 7                   |      |        |      |
| 8                   |      |        |      |
| QWC                 |      |        |      |
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| Total (Column 1)    | →    |        |      |
| Total (Column 2)    | →    |        |      |
| TOTAL               |      |        |      |
| Examiner's Initials |      |        |      |

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 in **Section A** and **Section B** in the spaces provided. All working must be shown.
- Do all rough work in this book. Cross through any work you do not want marked.

**Information**

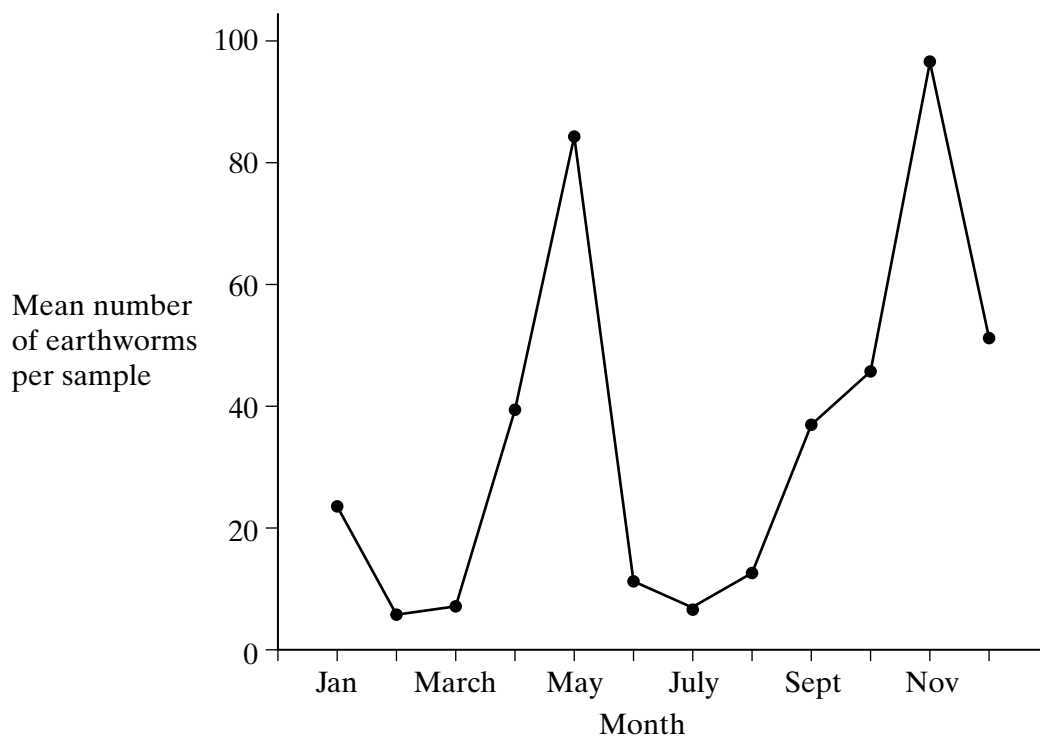
- The maximum mark for this paper is 66.
- Mark allocations are shown in brackets.
- Answers for **Section A** are expected to be short and precise.
- Questions in **Section B** should be answered in continuous prose where appropriate. Quality of Written Communication will be assessed in these answers.
- In addition to the mark allocations indicated within **Section B**, you will be awarded up to 1 mark for your ability to use an appropriate form and style of writing, to organise relevant information clearly and coherently, and to use specialist vocabulary, where appropriate. The legibility of your handwriting and the accuracy of your spelling, punctuation and grammar will also be taken into account.
- 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**.

**SECTION A**

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

- 1 Earthworms burrow to different depths in the soil depending on the conditions. They eat decaying leaves and make burrows by swallowing soil which passes through the gut and out of the anus.

Earthworms in samples of soil measuring 1 m<sup>2</sup> by 15 cm deep were collected from a field at monthly intervals. The graph shows the mean numbers of earthworms collected.



- (a) Suggest **two** abiotic factors that could affect the burrowing behaviour of the earthworms.

1 .....

2 .....

(1 mark)

**S** (b) (i) What does the graph suggest about the burrowing behaviour of the earthworms in July?

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(1 mark)

(ii) Suggest **one** advantage of this behaviour.

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(1 mark)

**S** (c) Explain **one** way in which the burrowing action of the earthworms may result in an increase in the activity of soil microorganisms.

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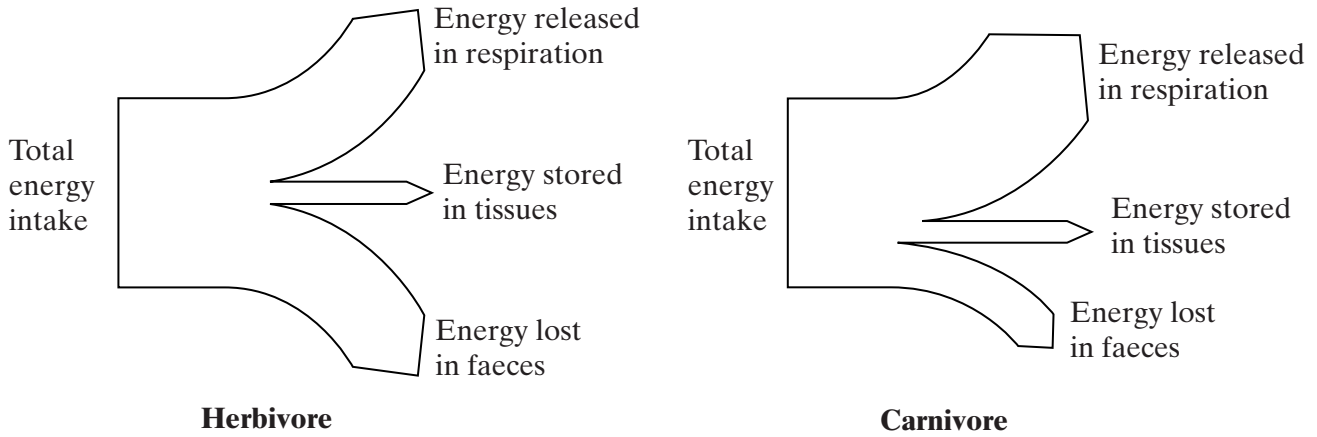
(2 marks)

5

**TURN OVER FOR THE NEXT QUESTION**

**Turn over** ▶

- 2 (a) The diagram compares the transfer of energy through a herbivore and through a carnivore of similar size. The width of each arrow is proportional to the energy value.



- (i) Use the diagram to calculate the percentage of energy lost in faeces by each animal. Show your working.

Herbivore

Carnivore

.....%

.....%

(2 marks)

- (ii) Suggest an explanation for the percentage of energy lost in faeces for the herbivore being larger than that for the carnivore.

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(2 marks)

- S (b) Explain why small mammals have a higher rate of respiration than larger mammals.

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(2 marks)

**3** In an attempt to control the huge numbers of an insect pest, low doses of a pesticide were sprayed on a lake. After spraying, the concentration of pesticide in the lake water was 14 parts per billion. After spraying, diving birds which fed on small fish in the lake were found to be dying. The concentration of the pesticide in these birds was more than 1 part per thousand.

(a) Explain why the pesticide was in such a high concentration in the diving birds.

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(3 marks)

**S** (b) The lake was sprayed three times. The first spraying killed almost all of the insects, as did a second application five years later. When the lake was treated for a third time it was found that some insects were resistant to the pesticide.

Explain how resistance to the pesticide evolved in the insect population.

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(3 marks)

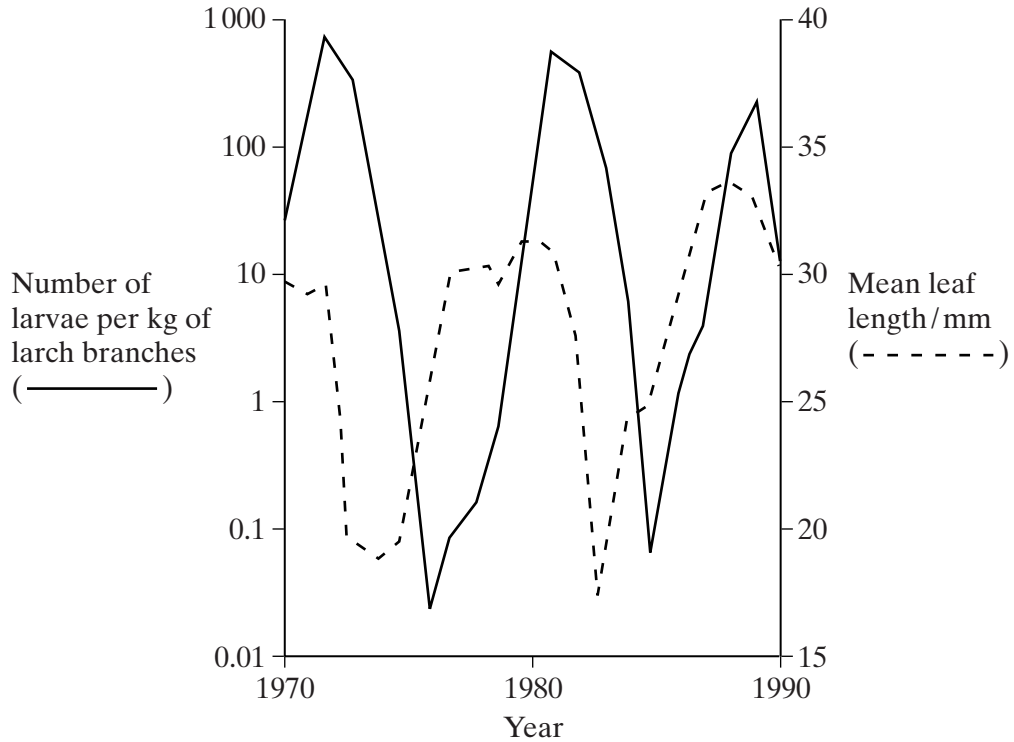
**S** (c) This pesticide is able to pass easily through cell membranes. Suggest why.

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(2 marks)

Turn over 

- 4 (a) A species of moth occurs in forests in Switzerland. The moth larvae feed on the needle-shaped leaves of larch trees that grow in the forests. The graph shows the numbers of larvae and the mean length of leaves over a period of 20 years.



- (i) Describe how the population size of a species of bird that fed mainly on the moth larvae would be likely to change between 1970 and 1980.

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(2 marks)

- S (ii) Larch trees lose their leaves in autumn. When numbers of larvae are large in one year, the leaves in the following year are shorter. Suggest an explanation for this.

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(2 marks)

**S** (b) Most coniferous trees keep their leaves all year. In winter the soil may be frozen and water uptake is limited. Explain the advantage of coniferous trees having needle-shaped leaves in this environment.

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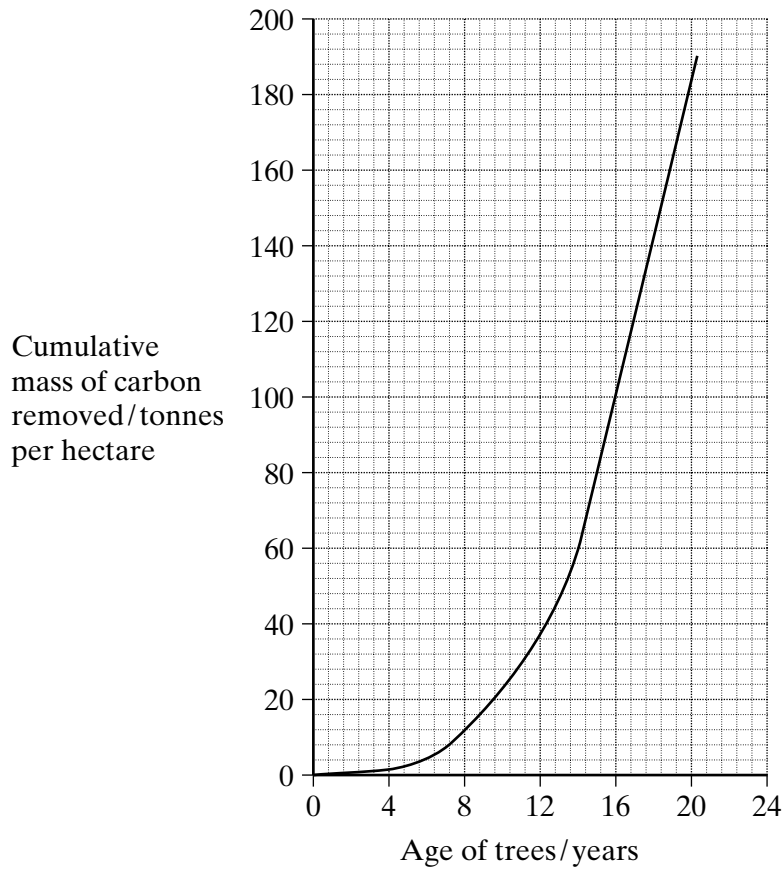
*(2 marks)*

6

**TURN OVER FOR THE NEXT QUESTION**

**Turn over** ▶

- 5 The graph shows the cumulative mass of carbon removed from the atmosphere by a pine forest in the 20 years after planting.



- (a) Explain how the growth of the forest results in a decrease in the carbon content of the atmosphere.

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(2 marks)

- (b) A new power station is to be built which will emit a total of 3800 tonnes of carbon over 20 years. In order to balance the carbon emissions a pine forest will be planted to remove an equivalent amount over 20 years. Use the graph to work out the smallest area of forest that would be needed. Show your working.

Area ..... hectares  
(2 marks)



**S** (c) Explain how carbon-containing compounds present in the pine leaves that fall from the trees are absorbed and used for growth by fungi that live in the soil.

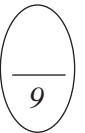
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*(4 marks)*

**S** (d) Give **one** reason to explain why the rate of recycling of carbon would be greater in summer than in winter.

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*(1 mark)*



**TURN OVER FOR THE NEXT QUESTION**

**Turn over**

- 6 In an investigation, the population density of plants in a regularly cut lawn was compared with that in a lawn which was only cut occasionally. The table shows the results.

| Species             | Mean population density/<br>number of plants per m <sup>2</sup> |                          | Result of<br>statistical test<br><br>value of p |
|---------------------|---|--------------------------|---|
|                     | Regularly<br>cut lawn   | Occasionally<br>cut lawn |   |
| Daisy               | 36.0  | 18.6                     | < 0.02  |
| Dandelion           | 10.8  | 3.4                      | < 0.05  |
| Field<br>buttercup  | 1.2   | 10.0                     | < 0.01  |
| Ribwort<br>plantain | 4.3   | 2.8                      | > 0.5   |
| Greater<br>plantain | 0.9   | 1.5                      | > 0.5   |

- (a) Describe a practical technique which you could use to find the mean population density of daisies on a lawn.

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(3 marks)

- (b) Give the null hypothesis for the statistical test on the population density of daisies.

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(1 mark)

(c) What conclusions can be drawn from the results of this investigation?

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(3 marks)

**S** (d) Some plants have adaptations that enable them to grow on lawns that are cut regularly. Suggest **two** of these adaptations and explain the advantage of each.

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(4 marks)

**TURN OVER FOR THE NEXT QUESTION**

**Turn over** ▶

**SECTION B**

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

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

7 A large lake is surrounded by fields. These fields are separated from each other by hedges. One hundred years ago the lake was a habitat for many plants, invertebrates and fish. Today the lake has no fish and few plants or invertebrates.

(a) Explain how increased use of inorganic fertilisers on the fields may have led to these changes.

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(5 marks)

(b) Explain how the removal of hedges near the lake would increase the impact of fertilisers on the aquatic ecosystem.

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(2 marks)

- S** (c) Horses may be kept in stables in winter. Horse manure is a mixture of straw, urine and faeces that accumulates in the stables. It is a useful nitrogen-rich fertiliser. Explain how the nitrogen-containing compounds absorbed from the horses' food become nitrogen-containing compounds in the urine produced.

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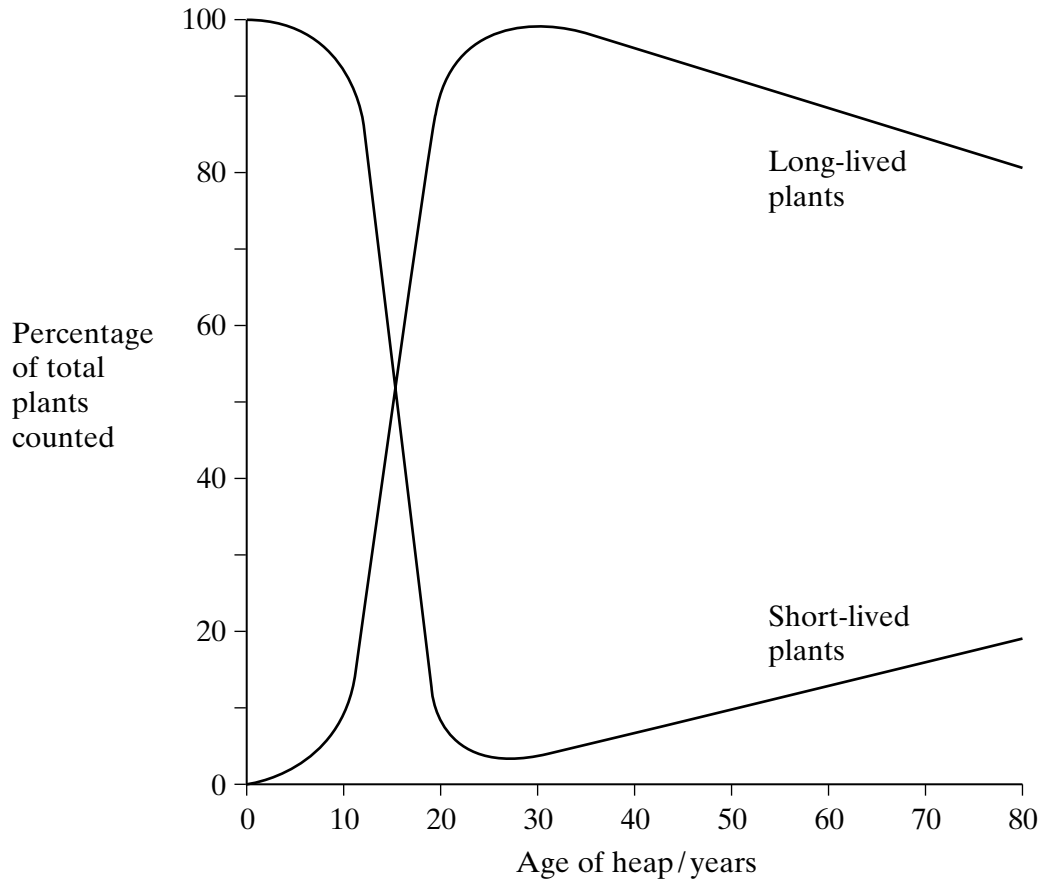
(4 marks)

11

**TURN OVER FOR THE NEXT QUESTION**

**Turn over** ▶

8 The waste material from coal mines is deposited in pit heaps. A particular mine closed and the colonisation of an area of its pit heap was studied for a period of 80 years. Species of plants that were found growing on the pit heap were recorded in two categories, short-lived plants that grow for one or two years before dying and long-lived plants that continue to grow for several years. The graph shows the percentages of short-lived and long-lived plants on the pit heap.



(a) Using your knowledge of succession, suggest explanations for the changes in the percentages of short-lived and long-lived plants

(i) over the first 20 years;

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(ii) between 30 and 80 years.

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(6 marks)

S (b) Mine waste often contains metal ions at concentrations that are toxic to plants. Populations of two species of grass, red fescue and common bent, have been found on pit heaps contaminated with zinc ions.

Describe an experiment you would carry out in order to determine which of the two species has the greater tolerance to zinc ions in the soil.

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(3 marks)

**END OF QUESTIONS**

**QWC**

