Surname		Other Names	
Centre Number			Candidate Number									
Candidate Signature												

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General Certificate of Education
January 2003
Advanced Level Examination

AQA
ASSESSMENT and QUALIFICATIONS ALLIANCE

BIOLOGY (SPECIFICATION B) BYB5/W
Unit 5 The Environment

Thursday 23 January 2003 Morning Session

In addition to this paper you will require:
- a ruler with millimetre measurements.

You may use a calculator.

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 degree of legibility of your handwriting and the level of 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**.

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

SECTION A

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

1 Lady's smock is a plant which grows in wet fields. In an investigation, leaf length in two different populations of lady's smock was measured. On each plant the length of the second leaf above the base of the stem was measured. The results are shown in the table.

Length of leaf / mm	Number in population **A**	Number in population **B**
1-10	1	1
11-20	25	12
21-30	39	21
31-40	10	24
41-50	7	13
51-60	2	12
61-70	0	2

(a) What is meant by a *population*?

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(1 mark)

(b) The standard deviation of the results for population **A** is 10.1. The standard deviation for population **B** is 13.7.

Use information in the table to explain why the results for population **B** give a larger value for the standard deviation than those for population **A**.

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(2 marks)

S (c) Suggest **one** abiotic factor that might have resulted in population **B** having longer leaves. Explain how this factor would result in longer leaves.

Factor .....

Explanation .....

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(2 marks)

S (d) Both populations of lady's smock show variation in leaf length.

(i) Suggest how leaf length is genetically controlled.

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(1 mark)

(ii) The mean leaf length of the two populations is different. Give a genetic explanation for this difference.

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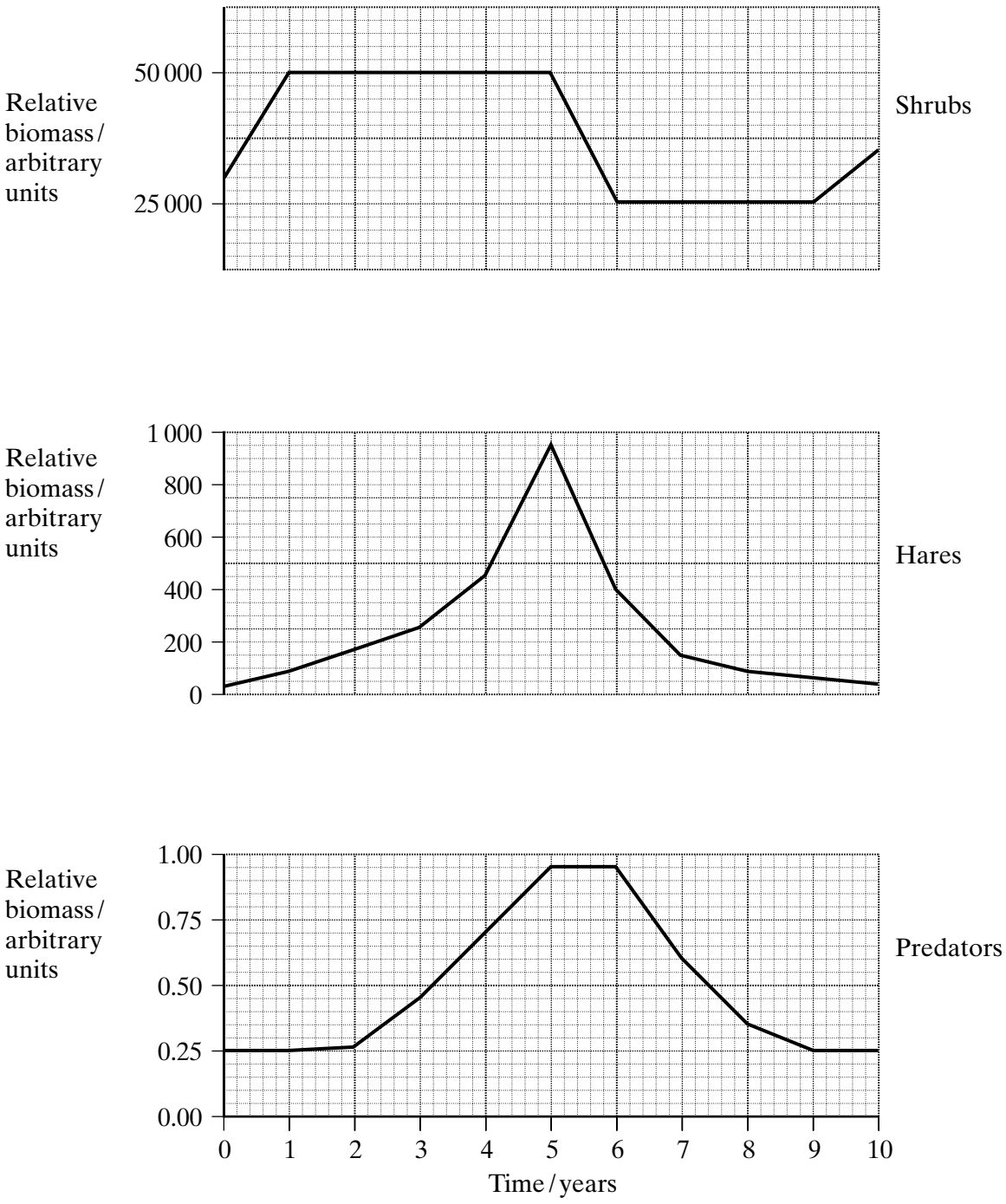
(1 mark)

7

2 Shrubs and small trees cover large areas of northern Canada. In winter there is deep snow for several months. Few species of mammal are adapted to survive in these conditions. The commonest primary consumer is the snowshoe hare, which feeds on the young leaves and shoots of the shrubs and small trees. When a shrub is damaged by grazing it produces toxins in the leaves and shoots. These toxins make the leaves and shoots too unpleasant for the hares to eat. Several mammalian predators feed on the hares.

The graphs show changes in the relative biomass of the shrubs, hares and predators over a period of 10 years. The measurements of biomass were taken at the beginning of each winter.



(a) (i) Calculate the ratio of the biomass of the hares to the biomass of the predators in year 5. Show your working.

Ratio = ...

(2 marks)

(ii) Use your knowledge of energy transfer to explain the difference in biomass between the hares and their predators.

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(2 marks)

(b) (i) Describe how the pattern of change in biomass over the ten years for the predators differs from the pattern for the hares.

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(2 marks)

(ii) Use the information in the passage and the graphs to explain the changes in the biomass of the hares over the ten years.

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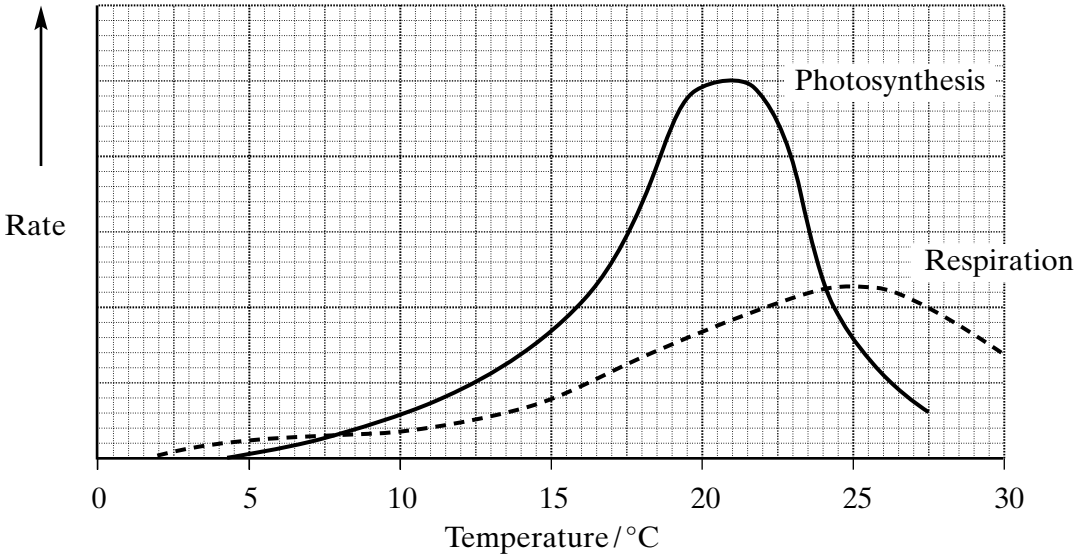
(3 marks)

9

3 Potato plants originate from the Andes mountains in South America. They are adapted for survival in a cool climate. The potatoes we eat are food storage organs, called tubers, and are produced on underground stems.

The graph shows the rates of photosynthesis and respiration for one variety of potato plant.



(a) Between which temperatures is there a net gain in energy by the potato plant?

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(1 mark)

S (b) When this variety was grown in a hot climate, with a mean daytime temperature of 23.5 °C, it failed to produce tubers.

Use information in the graph to explain why no tubers were produced.

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(2 marks)

S (c) Suggest what causes the rate of photosynthesis to decrease above 21°C.

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(2 marks)

(d) Describe how the temperature of the soil around developing tubers could be measured throughout their growing period.

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(2 marks)

7

TURN OVER FOR THE NEXT QUESTION

4 Small clearings in woods may occur when large trees die or are blown down. This allows herbaceous plants to grow for a few years. One plant species that commonly colonises woodland clearings is the foxglove.

(a) Name and describe the ecological process which will result in the disappearance of foxgloves from a clearing after a few years.

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(3 marks)

S (b) The foxglove is a biennial plant, which means that it lives for two years. In the first year it produces leaves but no flowers. In the second year it flowers and each plant releases about 300 000 very small seeds.

(i) Suggest how being a biennial enables a foxglove plant to produce very large numbers of seeds.

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(2 mark)

(ii) Suggest how producing large numbers of very small seeds adapts the foxglove for colonising woodland clearings.

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(2 marks)

S (c) The leaves of foxgloves contain a poisonous substance, called digitalis. In high concentrations, digitalis slows down the rate at which impulses pass across the atria of the heart.

Explain how the presence of digitalis may protect foxgloves from being eaten by mammals.

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(3 marks)

10

TURN OVER FOR THE NEXT QUESTION

5 (a) Pesticides may be either biodegradable or non-biodegradable. Explain what is meant by *biodegradable*.

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(2 marks)

(b) In the 1960s large amounts of organochlorine pesticides were used to control insect pests. The table shows the results of an analysis of the concentration of organochlorines in the muscle tissue of some bird species during this period.

Species	**Main contents of diet**	**Concentration of organochlorines in muscles / parts per million**
Sparrowhawk	Small birds	3.6
Barn owl	Small mammals	2.3
Song thrush	Invertebrates and plant material	0.5
Wood pigeon	Plant material	0.3
Heron	Fish	15.2
Great crested grebe	Fish	5.9
Moorhen	Plant material	0.2

(i) Describe and explain the relationship between the contents of the diet and the concentration of organochlorines in the muscles.

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(3 marks)

S (ii) Organochlorines are insoluble in water, but soluble in lipids. One common use of organochlorines was in sheep dips, and some washed into rivers and lakes. The gills of fish were found to absorb organochlorines, even though they are insoluble in water.

Suggest and explain why fish absorb large amounts of organochlorines through the gills.

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(3 marks)

S (c) A fly is found to possess a gene which makes it resistant to an organochlorine pesticide. This means that it can survive doses of this pesticide that would kill a susceptible fly. Suggest how a gene could make this fly resistant to the organochlorine pesticide.

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(2 marks)

10

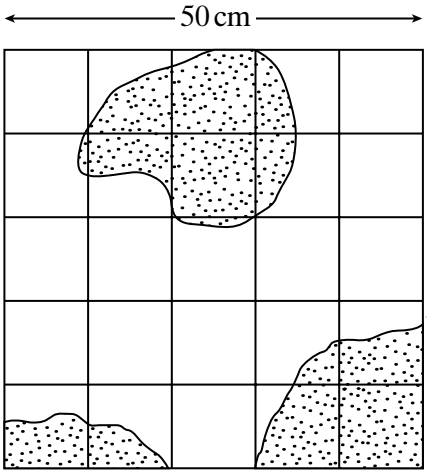
TURN OVER FOR THE NEXT QUESTION

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.

6 (a) Clover is a plant which grows in dense patches in grassland. In an investigation of the distribution of clover in a field, quadrats were placed randomly throughout the field. The drawing shows the areas in one quadrat in which clover was growing. Thin wires were used to divide the quadrat into small squares.



(i) What is the percentage cover of clover in this quadrat?

Percentage cover = ...

Explain how you arrived at your answer.

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(2 marks)

(ii) Describe **one** way in which you could place the quadrats randomly in a field.

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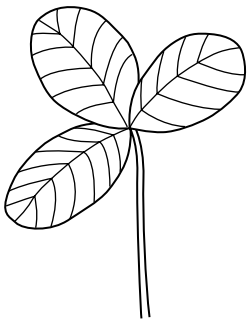
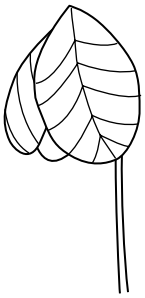
(2 marks)

(b) Clover leaves have three leaflets at the top of a vertical stalk. During daylight these leaflets are normally extended. At night the leaflets fold down like an umbrella, as shown in the diagram.



In daylight



At night

The extending and folding is due to changes in the water content of certain cells at the junction between the three leaflets. The leaflets extend when the cells gain potassium ions from neighbouring cells in the stalk. Folding results when these potassium ions pass back again.

S (i) Suggest an explanation of the method by which the leaflets extend.

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(4 marks)

S (ii) The leaflets may fold down during the day if the soil becomes dry. The stomata are situated on the underside of the leaflets. Suggest how folding helps the clover plant to reduce the effects of water shortage.

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(2 marks)

7 (a) Wet moorland soils often contain low concentrations of nitrogen compounds, as a result of denitrification. Sundew is a plant which lives in wet moorlands. Its leaves have sticky hairs which can trap small insects that are then digested.

(i) Describe the process of denitrification.

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(2 marks)

S (ii) Explain how digestion of insects helps the sundew to obtain additional nitrogen compounds.

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(2 marks)

S (b) Samples of plant and animal tissue were analysed to determine the proportions of the elements, carbon and nitrogen. In the plant tissue the ratio of carbon to nitrogen was 40:1. In the animal tissue the ratio was 8:1.

Explain why the ratio is much higher in the plant tissue than in the animal tissue.

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(2 marks)

(c) Describe how nitrogen in compounds in a dead plant is made available for use by other plants.

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(6 marks)

12

END OF QUESTIONS

QWC

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