

Surname						Other Names					
Centre Number						Candidate Number					
Candidate Signature											

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General Certificate of Education
June 2003
Advanced Level Examination



BIOLOGY (SPECIFICATION B)
Unit 5 The Environment

BYB5/W

Monday 16 June 2003 Morning Session

In addition to this paper you will require:

- 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			
8			
QWC			
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.

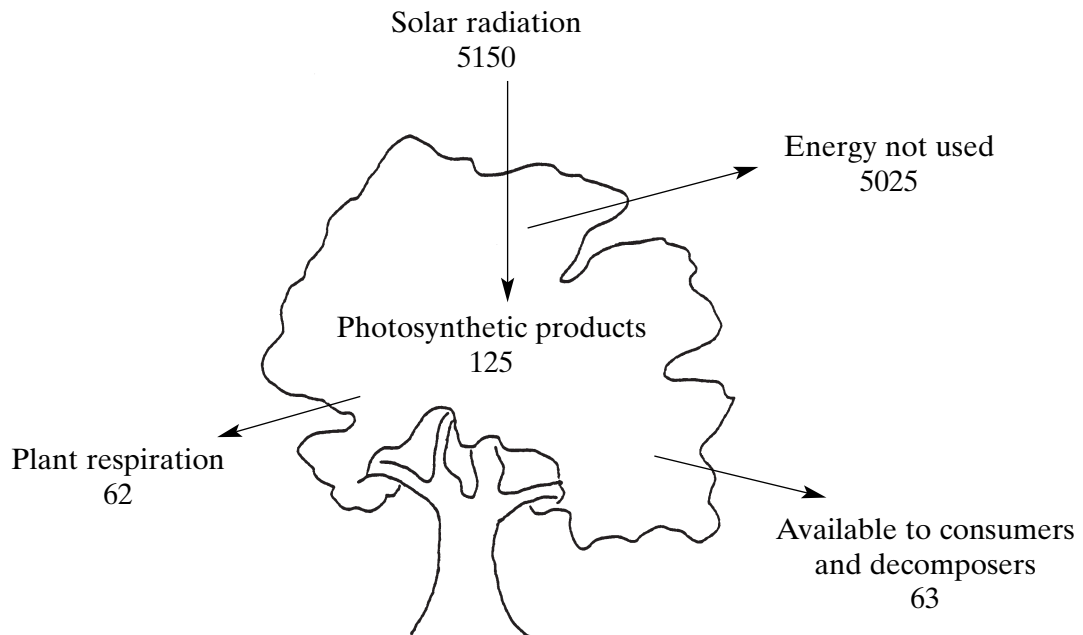
Information

- 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 The diagram shows the flow of energy through trees in a woodland ecosystem. The numbers represent mean inputs and outputs of energy in $\text{kJ m}^{-2} \text{day}^{-1}$.



- (a) Use information in the diagram to

- (i) give the amount of energy incorporated into tree biomass;

.....
(1 mark)

- (ii) calculate the percentage of solar energy that is fixed by photosynthesis.

Answer %

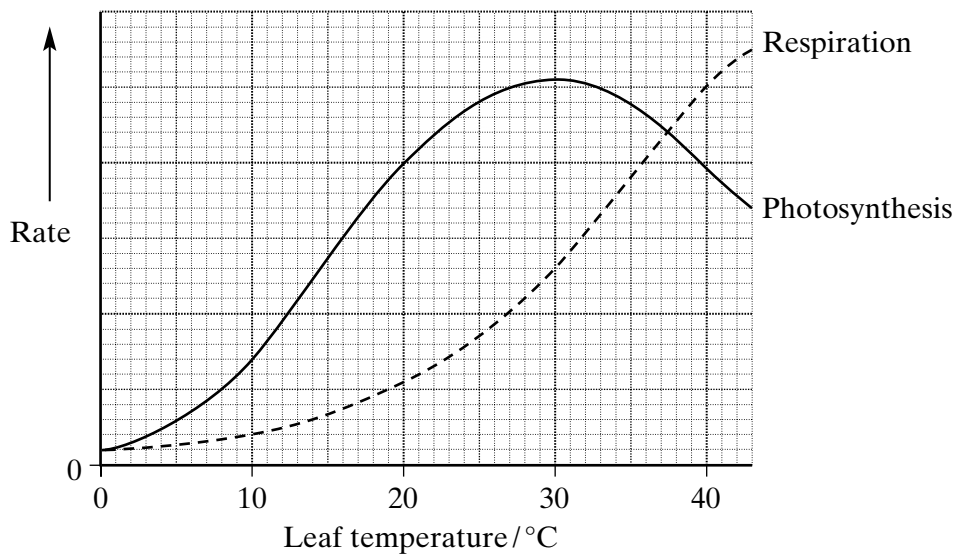
(2 marks)

(b) Not all the solar radiation reaching the leaves of the tree is used in photosynthesis. Give **two** explanations for this.

- 1
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- 2
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(2 marks)

(c) The graph shows the rate of photosynthesis and the rate of respiration in tree leaves at different temperatures.



Give the range of temperatures over which the leaves will show the greatest increase in biomass. Explain your answer.

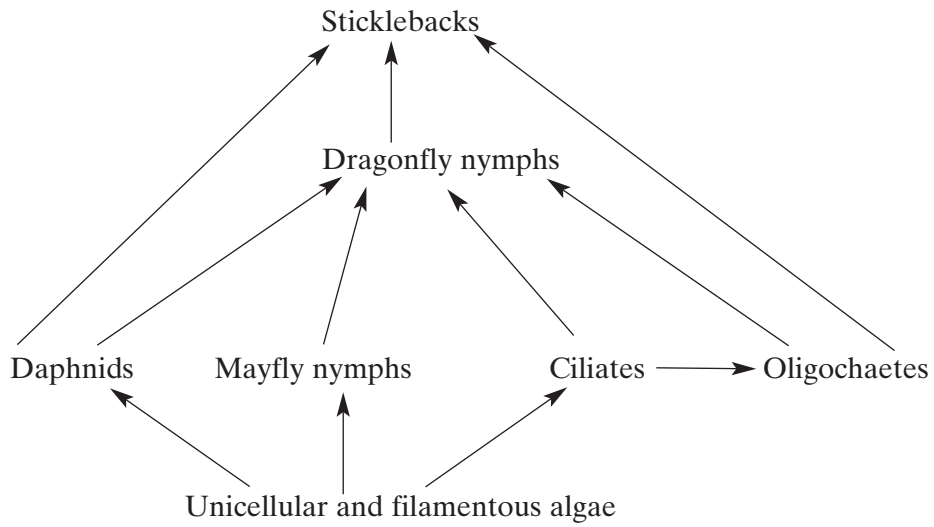
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(2 marks)



Turn over ►

2 The diagram shows a simplified food web in an aquatic ecosystem.



(a) In this food web, which organisms feed as tertiary consumers?

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(1 mark)

(b) The biomass of organisms in an ecosystem can change during the year. In this aquatic ecosystem, the biomass of primary consumers is temporarily greater than that of the producers during the early summer.

(i) Sketch the pyramids of biomass in early summer and autumn for this ecosystem. Name the trophic levels.

Early summer

Autumn

(2 marks)

(ii) Suggest suitable units to represent biomass in these pyramids.

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(1 mark)

(c) Explain why food chains rarely have more than five trophic levels.

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(2 marks)

3 A study was made of a transect through sand dunes, from dunes near the sea-shore to woodland. Samples of quadrats at five positions along the transect were analysed. The results are shown in the table.

	Dunes near sea-shore	Mobile dunes	Fixed dunes	Heath and scrub	Woodland
Mean percentage plant cover	2	25	90	100	100
Number of plant species per unit area	12	36	95	140	92

(a) (i) Woodland is the final stage in this ecological succession. Give the term used to describe the final stage in an ecological succession.

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(1 mark)

(ii) The number of plant species per unit area in the woodland is less than that in the heath and scrub. Suggest an explanation for this.

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(2 marks)

S (b) Several of the species of plants living on the dunes have small leaves and their stomata are located in grooves on the underside of the leaves. What do these features suggest about the soil conditions where they live? Explain your answer.

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(3 marks)

Turn over 

- 4 The numbers of species of woody plants in samples from 227 hedges of different ages were counted. The results are shown in the graph. The size of the solid circles shows the number of hedges in each category.

The graph, from 'Hedges' by Pollard, Hooper and Moore, Collins (1974), is not reproduced here due to third-party copyright constraints.

The full copy of this paper can be obtained by ordering BYB5W from AQA Publications
Tel: 0161 953 1170

- (a) (i) Suggest the age range of the hedges which are likely to support the most complex food webs. Explain your answer.

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(3 marks)

- (ii) Explain how the complex food webs maintained by these hedges may be of benefit to farmers.

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(2 marks)

- (b) (i) Calculate the **maximum** percentage of hedges which are 1000 years old or over in this sample. Show your working.

Answer %

(2 marks)

- (ii) Many hedges have been removed from arable land in recent years. Explain **two** advantages to farmers of removing hedges.

1

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2

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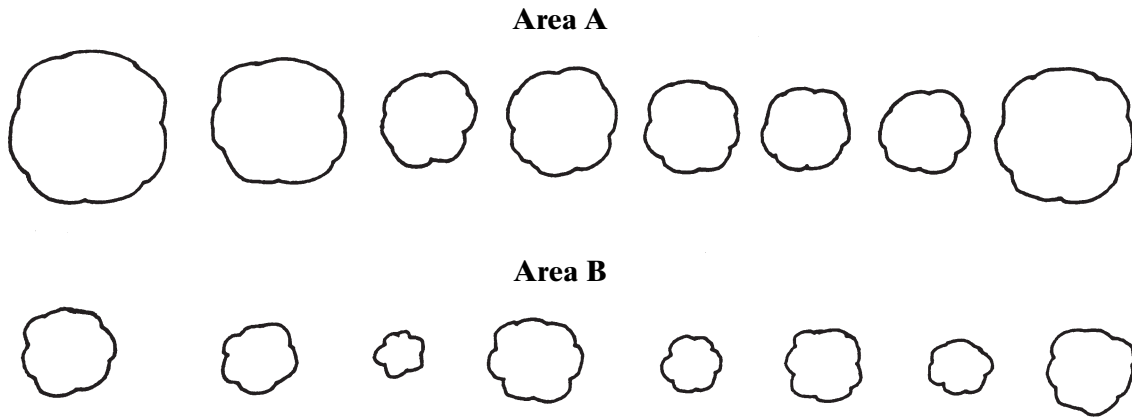
(2 marks)

9

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

5 Marsh pennywort is a plant that grows in wetland habitats such as bogs. An investigation was carried out on the effect of soil conditions on the growth of marsh pennywort. The largest leaf from each plant was collected from two different areas of bog. The drawings show the actual size of some of the leaves from the two areas.



S (a) Name the type of variation shown by these marsh pennywort leaves. Give a reason for your answer.

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 (1 mark)

(b) The means and standard deviations of the leaf diameters in the two samples were calculated. A statistical test showed that there was a significant difference between the means. Explain what is meant by

(i) standard deviation;

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 (1 mark)

(ii) a significant difference.

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 (1 mark)

(c) The difference between the samples was thought to be due to abiotic factors in the soil. Give **two** such factors and suggest how each could be measured.

1

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2

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(2 marks)

$\frac{\quad}{5}$

TURN OVER FOR THE NEXT QUESTION

Turn over 

6 Read the following passage.

The passage, from 'Natural History of the British Isles' by Pat Morris in Country Life (1979), is not reproduced here due to third-party copyright constraints.

The full copy of this paper can be obtained by ordering BYB5W from AQA Publications
Tel: 0161 953 1170

- (a) Give **two** pieces of evidence from the passage which suggest that the reduction in red squirrel numbers is not simply due to competition with grey squirrels.

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2

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(2 marks)

- S** (b) Suggest **two** explanations for red squirrels being unable to survive on a diet of acorns.

1

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2

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(2 marks)

- (c) Surveys have shown that, following a prolonged winter, red squirrels tend to disappear from broad-leaved woodland where both species have previously lived together. Suggest why the red squirrels disappear.

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(2 marks)

6

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

SECTION B

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

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

- 7 The table shows the percentage of certain substances remaining in fallen oak leaves as they decompose.

Time after falling from tree/weeks	Percentage of each substance remaining		
	Starch	Cellulose	Lignin
4	63	98	99
8	50	94	98
12	41	90	96
16	37	64	94
20	30	52	92
24	18	38	90

- S (a) Explain how the activities of saprophytic fungi account for the figures in the table.

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(3 marks)

- S (b) Microorganisms which feed only on sugars are common in the leaves 12 to 16 weeks after they have fallen. Suggest an explanation for the abundance of these microorganisms.

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(2 marks)

S (c) Describe how carbon dioxide released by the decomposition of leaves may become incorporated into storage carbohydrate in the roots of green plants.

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(4 marks)

S (d) Plants which live in peat bogs are decomposed very slowly after their death. This is because the peat contains tannic acid in which only a small number of species of microorganisms can survive. Explain how natural selection could result in microorganisms that can survive in peat bogs.

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(3 marks)

12

Turn over ►

8 S (a) The availability of nitrogen-containing compounds in the soil is often a limiting factor for plant growth. Explain **two** ways in which a shortage of nitrogen-containing compounds could limit plant growth.

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(4 marks)

(b) Farmers apply nitrate fertilisers to improve crop growth.

S (i) Explain why plants may fail to grow if high concentrations of nitrate are applied to the soil.

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(2 marks)

- (ii) Streams and rivers running through farmland can also be adversely affected by application of high concentrations of nitrate fertiliser. Fish cannot survive when the oxygen levels of water are reduced. Explain how high concentrations of nitrate applied to farmland may result in the reduction of the numbers of fish present in aquatic ecosystems.

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(5 marks)

- S (c) Malonate is a substance that inhibits the enzymes of the Krebs cycle. In an investigation, plant roots were placed in a solution containing nitrate and malonate. The solution had air bubbled through it. Explain why these plant roots took up nitrate more slowly than those in a control solution which contained nitrate but no malonate.

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(3 marks)

END OF QUESTIONS

QWC

14

1