Surname		Other Names	
Centre Number			Candidate Number					
Candidate Signature								

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General Certificate of Education
January 2005
Advanced Level Examination

ASSESSMENT and QUALIFICATIONS ALLIANCE

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

Monday 24 January 2005 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.

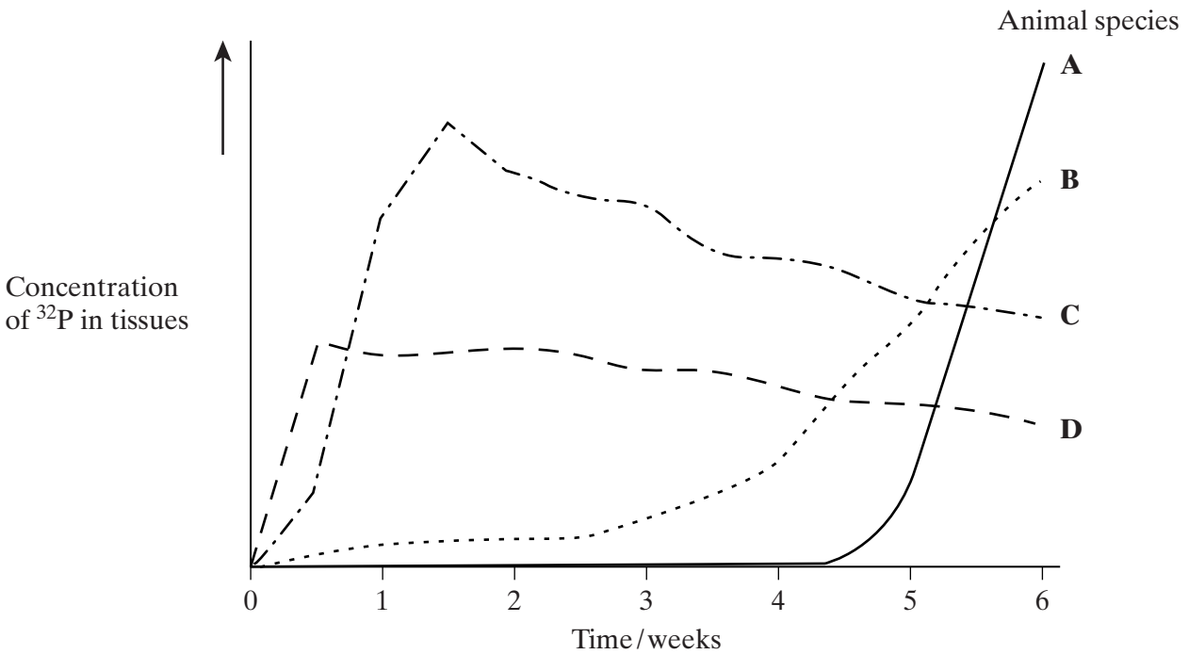
Information
- The maximum mark for this paper is 66.
- Mark allocations are shown in brackets.
- Answers for **Section A** are expected to be short and precise.
- Questions in **Section B** should be answered in continuous prose where appropriate. Quality of Written Communication will be assessed in 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 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**.

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 Plants growing in a field were supplied with a radioactive isotope of phosphorus, ^{32}P. The plants took up this isotope and incorporated it into substances in their tissues. At intervals, four different species of animal living in the field were sampled and the amount of radioactive phosphorus in their tissues was measured. The results are shown in the graph.



The four species of animal, **A** to **D**, were the consumers in a single food chain.

(a) To which trophic level does species **C** belong? Give a reason for your answer.

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(2 marks)

(b) Explain why a food chain does not usually have more than five species.

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(1 mark)

S (c) Name **two** biological compounds into which radioactive phosphorus could be incorporated.

1 .....

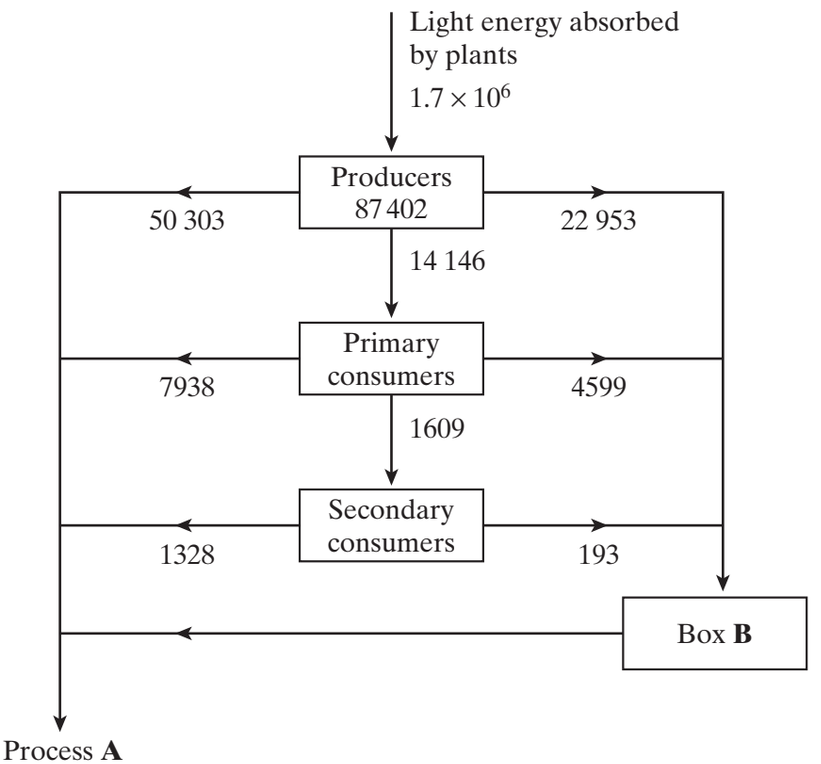
2 .....

(2 marks)

5

TURN OVER FOR THE NEXT QUESTION

2 The diagram shows the energy flow through a freshwater ecosystem. All units are $kJ\,m^{-2}\,year^{-1}$.



(a) Name

(i) process **A**;

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(1 mark)

(ii) the group of organisms represented by box **B**.

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(1 mark)

(b) Calculate the percentage efficiency with which light energy is transferred to energy in producers. Show your working.

Answer .....

(2 marks)

LEAVE MARGIN BLANK

S (c) Describe the effect of light energy in the light-dependent reaction of photosynthesis.

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(2 marks)

S (d) If a plant is kept in the dark it is still able to produce carbohydrates, as long as it is provided with two products of the light-dependent reaction of photosynthesis. Give the name of these products and explain their function in the light-independent reaction of photosynthesis.

Name .....

Function .....

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Name .....

Function .....

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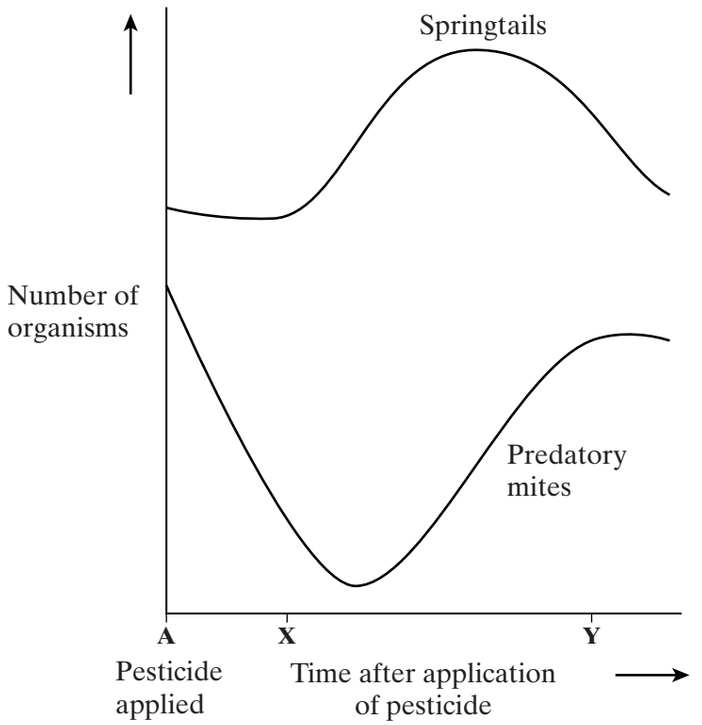
(4 marks)

10

TURN OVER FOR THE NEXT QUESTION

3 The graph shows the effect of a single application of a biodegradable pesticide on the numbers of predatory soil mites and their principal prey, springtails.



(a) Explain the change in numbers of mites and of springtails during

(i) period **A** to **X**;

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(2 marks)

(ii) period **X** to **Y**.

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(3 marks)

(b) Describe what might be expected to happen to the numbers of mites and springtails over a long time period if pesticide was no longer used.

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(2 marks)

S (c) Organophosphates are pesticides which are usually sprayed onto the leaves of plants to kill aphids. Aphids feed by sucking sugar from the tissue in which it is translocated. Organophosphates are very soluble in water and are transported in the same tissue as sugar.

(i) Name the plant tissue from which the aphid obtains its sugar.

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(1 mark)

(ii) Describe how organophosphates and sugars are moved through this tissue.

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(3 marks)

11

4 A student investigated whether the abundance of the orange star lichen on the walls of a building was influenced by the direction the wall faced. The student recorded the number of colonies within a 50 cm^2 quadrat, placed one metre above the ground on each of three walls. A χ^2 test was applied to the results.

(a) Give a null hypothesis for this investigation.

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(1 mark)

(b) Complete the following table.

	Number of colonies on a wall facing		
	North	**South**	**West**
Observed	21	33	54
Expected			

(1 mark)

(c) How many degrees of freedom were in this χ^2 test?

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(1 mark)

(d) A χ^2 value of 15.5 was calculated from these results. This χ^2 value has a probability of less than 0.001. Explain what this means when applied to this investigation.

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(3 marks)

LEAVE MARGIN BLANK

S (e) Algae are green protoctists. Lichens consist of a fungus and an alga living together in a relationship where both organisms benefit. Suggest how the relationship between the alga and the fungus allows the lichen to survive on an inorganic surface such as a wall.

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(2 marks)

8

TURN OVER FOR THE NEXT QUESTION

5 A species of tropical plant has leaves that fold over to produce sac-like structures. Ants live in these sacs, where they build up a store of dead insects which they eat. The plants benefit from the carbon in the dead insects.

(a) Explain how the carbon in the dead insects is made available to the plant.

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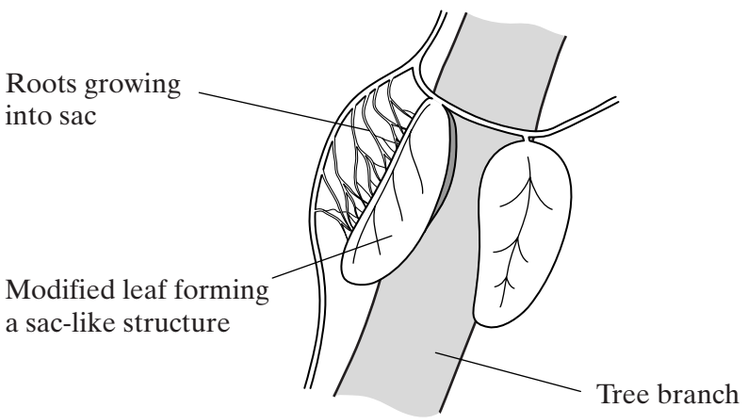
(3 marks)

S (b) The plant grows on the branches of trees. Its roots do not go down into the soil. Instead the roots grow into the sacs containing decomposing insects and ant faeces.



Explain how the roots are able to absorb nitrates from the sacs against a concentration gradient.

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(3 marks)

LEAVE MARGIN BLANK

S (c) All the ants living in a leaf sac have developed from eggs laid by one female and fertilised by one male. Give **two** factors that would cause the ants living in one leaf sac to be genetically different.

1 .....

2 .....

(2 marks)

8

TURN OVER FOR THE NEXT QUESTION

LEAVE MARGIN BLANK

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 Dogwhelks are small, carnivorous snails which live on rocky seashores. They cling to, and move over, the surface of the rocks and feed on animals such as mussels.

S (a) Mussels are permanently attached to rocks. They feed on small photosynthetic organisms which they filter from the water.

(i) Suggest why dogwhelks lose more energy by respiration than do mussels.

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(1 mark)

(ii) A greater proportion of the energy in food eaten is lost in the faeces of mussels compared with the faeces of dogwhelks. Suggest why.

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(2 marks)

(b) Boats used to be painted with a paint that contains the poisonous substance tributyl tin (TBT). TBT is absorbed into the bodies of animals and cannot be broken down. Explain why there is a higher concentration of TBT in the tissues of dogwhelks than in the mussels on which they feed.

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(2 marks)

S (c) Some pollutants released into the environment affect organisms by competitively inhibiting enzymes such as acetylcholinesterase, which breaks down acetylcholine.

(i) Describe how competitive inhibition is different from non-competitive inhibition.

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(3 marks)

(ii) An animal shows signs of poisoning with a pollutant which inhibits acetylcholinesterase. Suggest **one** likely sign, giving an explanation for your answer.

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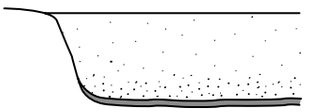
(2 marks)

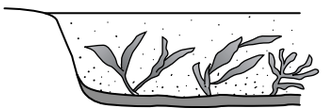
10

TURN OVER FOR THE NEXT QUESTION

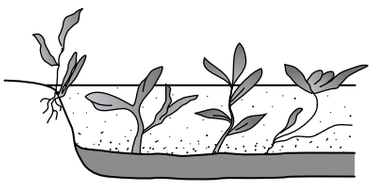
7 (a) The diagram shows a number of stages in an ecological succession in a lake.



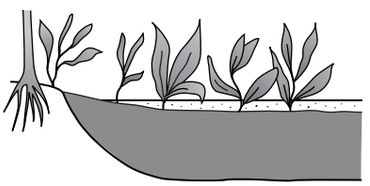
Stage 1
Microscopic plants and animals



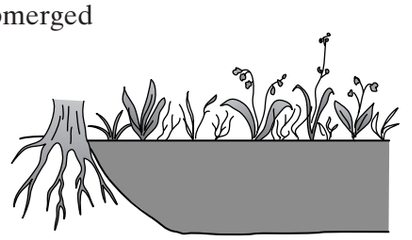
Stage 2
Layer of mud and organic matter settles on the bottom. Submerged plants appear.



Stage 3
Plants growing on surface and edges of pond. Submerged plants die out.



Stage 4
Build up of mud and organic matter forms a marsh.



Stage 5
Community of land plants

Explain how the diagrams illustrate the features of an ecological succession.

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(6 marks)

(b) Several small rivers flow into this lake. These rivers flow through forested areas. Explain how deforestation might affect the process of succession in the lake.

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(2 marks)

S (c) **Stage 5** illustrates the final stage of succession which is known as the climax community. During this stage the number of different species in the habitat and the size of each population remain fairly constant. Explain what limits the size of populations in a climax community.

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(5 marks)

13

END OF QUESTIONS

QWC

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THERE ARE NO QUESTIONS PRINTED ON THIS PAGE