

Surname					Other Names				
Centre Number					Candidate Number				
Candidate Signature									

General Certificate of Education
 June 2005
 Advanced Subsidiary Examination



ENVIRONMENTAL SCIENCE
Unit 3 The Biosphere

ESC3

Wednesday 8 June 2005 Afternoon Session

No additional materials are required.
 You may use a calculator.

Time allowed: 1 hour

Instructions

- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions 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 60.
- Mark allocations are shown in brackets.
- You will be assessed on 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.

For Examiner's Use			
Number	Mark	Number	Mark
1			
2			
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6			
Total (Column 1)	→		
Total (Column 2)	→		
TOTAL			
Examiner's Initials			



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

- 1 (a) Give a reason why **each** of the following properties of water is important to living organisms.

Property	Importance to living organisms
Good solvent	
Ice less dense than liquid water	
Transparent	

(3 marks)

- (b) Explain why the temperature range found on Earth is suitable for the survival of living organisms.

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(2 marks)



2 The diagram shows part of a food web for a grassland ecosystem in the UK.

The diagram is not reproduced here due to third-party copyright constraints.

(a) What is an *ecosystem*?

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(1 mark)

(b) With reference to the diagram, give the name of:

(i) an organism that feeds at more than one trophic level;

.....
(1 mark)

(ii) the trophic level of the song thrush.

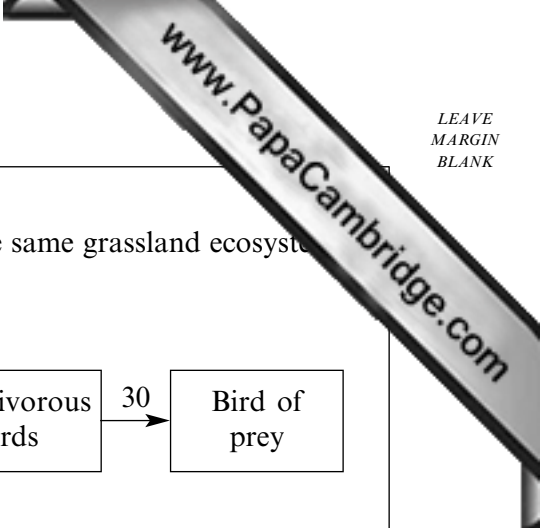
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(1 mark)

(c) Using the food web, suggest **one** consequence of the killing of all the earthworms by pesticide use.

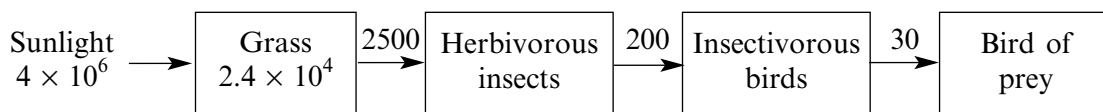
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(1 mark)

QUESTION 2 CONTINUES ON THE NEXT PAGE

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- (d) The diagram shows the stores and flow of energy through the same grassland ecosystem. The figures are in $\text{kJ m}^{-2} \text{yr}^{-1}$.



- (i) Suggest **two** reasons why only a small proportion of the energy falling on the leaf of a plant is used in photosynthesis.

1.

 2.

(2 marks)

- (ii) Suggest why carnivores, such as insectivorous birds, convert food into new growth more efficiently than herbivores.

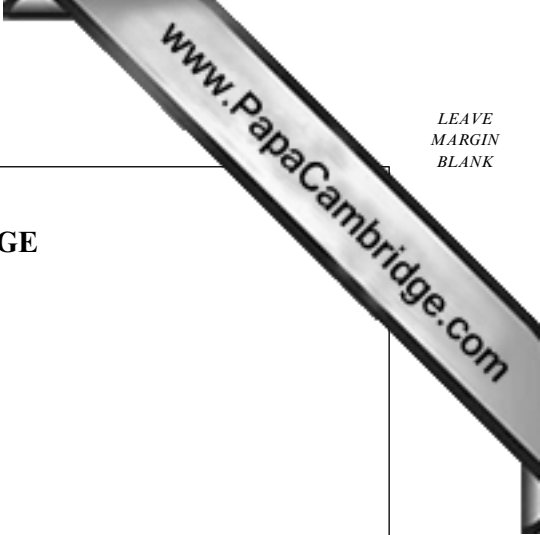
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(1 mark)

- (iii) Explain why a food chain rarely contains more than four trophic levels.

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(3 marks)



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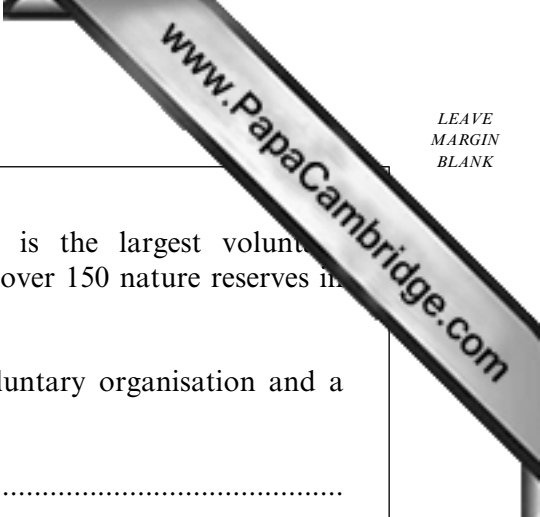
- 3 (a) Conservation of rare habitats and species relies on protection through various designations. These restrict potentially damaging operations which may endanger fragile ecosystems.

Designations	
A	National and Local Nature Reserves (NNR and LNR)
B	Sites of Special Scientific Interest (SSSI)
C	Environmentally Sensitive Areas (ESA)
D	Ramsar sites
E	Special Protection Areas (SPA)
F	Special Areas of Conservation (SAC)

Complete the table using the letter for the appropriate designation from the list.

Description	Designation
Specially protected wetland sites for the conservation of wildfowl habitats	
Sites containing biological (rare species and habitats), geological (e.g. fossils) or physiographic (physical geography) features of importance	
Areas of high landscape or wildlife value which are given grants to maintain traditional farming practices	
Areas important for rare and migratory birds designated under the 1979 'Birds Directive' of the European Union	

(4 marks)



(b) The Royal Society for the Protection of Birds (RSPB) is the largest voluntary conservation organisation in Europe. It owns and manages over 150 nature reserves in the UK, covering nearly 100 000 hectares.

(i) Explain the main difference in funding between a voluntary organisation and a statutory (governmental) organisation.

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(2 marks)

(ii) Name a UK government body whose major responsibility is wildlife conservation.

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(1 mark)

(c) Northward Hill is a National Nature Reserve (NNR) managed by the RSPB. It forms part of a proposed site for a new international airport.

(i) Explain how an environmental pressure group, such as the RSPB, tries to prevent such developments which are detrimental to wildlife.

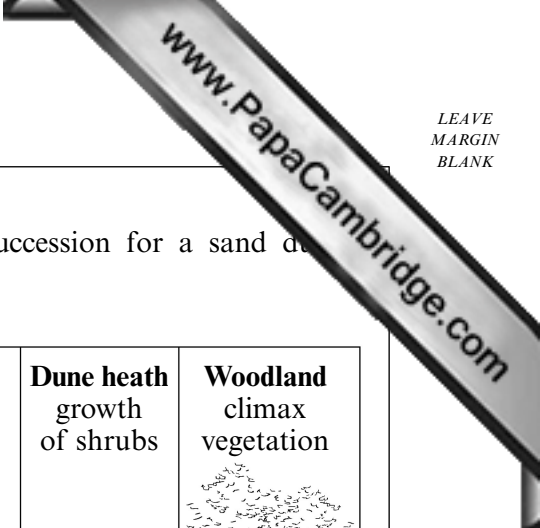
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(2 marks)

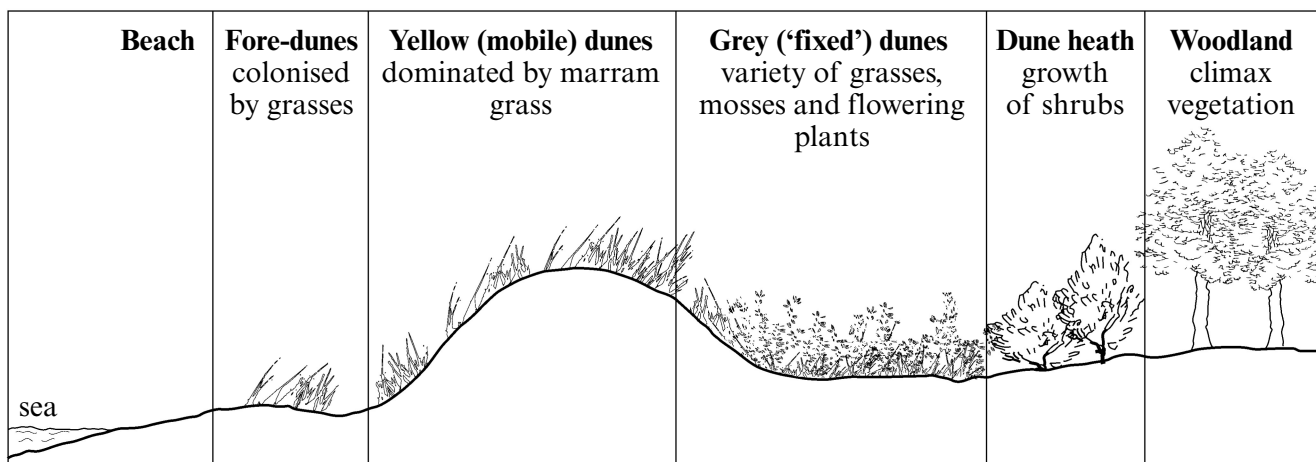
(ii) Suggest why designating an area may not protect it from development.

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(1 mark)



4 The diagram shows zones which exhibit the typical stages of succession for a sand dune ecosystem.



(a) (i) Explain what is meant by primary succession.

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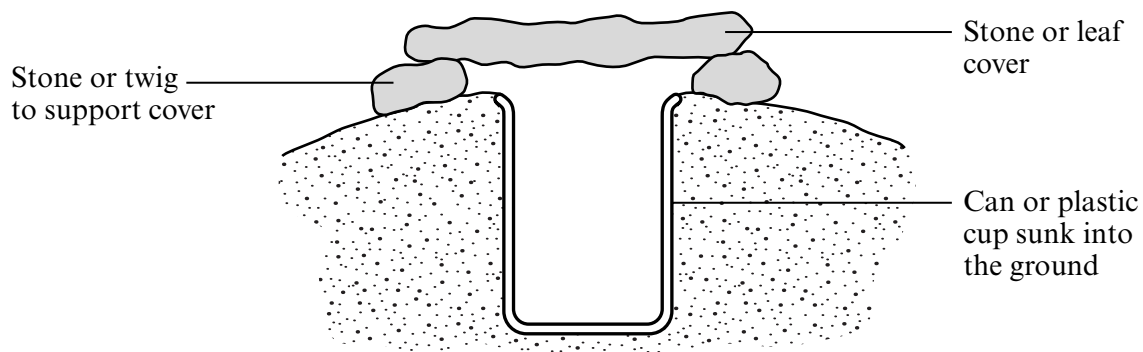
 (2 marks)

(ii) Explain how successional changes make tree growth possible.

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 (3 marks)

(b) Pitfall traps were used to compare the populations of sand dune invertebrates in sample areas of 100 m² in two different areas of the dunes. The diagram shows a typical pitfall trap.





- (i) Suggest how sampling using pitfall traps would have been carried out to produce reliable data.

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(3 marks)

- (ii) The numbers of invertebrates found in the pitfall traps in the fixed dune are shown in the table.

Invertebrate groups	Fixed dune
cockchafer	2
ground beetles	5
spiders	3
springtails	7
millipedes	4
snails	5

Use the data in the table to calculate the index of diversity (**D**) for the fixed dune from the formula.

Show your working.

$$D = \frac{N(N - 1)}{\sum n(n - 1)}$$

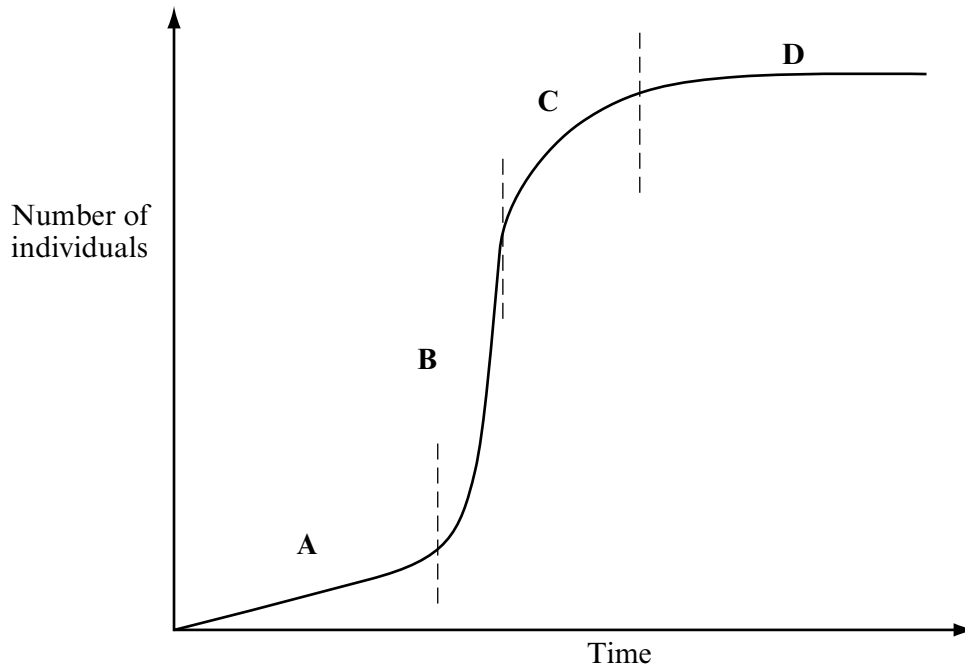
Where **N** = total number of organisms of all species
n = total number of organisms of a particular species
 Σ = the sum of

Answer

(2 marks)

Turn over ►

- 5 (a) The graph shows a theoretical population growth curve for a species showing influence of density dependent factors.



Explain why:

- (i) there is a slow start to population growth at **A**;

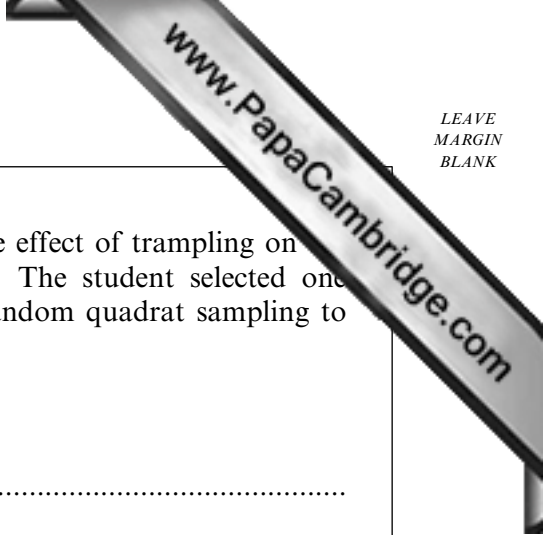
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(1 mark)

- (ii) growth slows down at **C**;

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(2 marks)

- (iii) the population stabilises at **D**.

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(1 mark)



(b) A student decided to carry out an investigation to assess the effect of trampling on populations of plant species growing on chalk grassland. The student selected one heavily trampled area and one not so trampled and used random quadrat sampling to measure the percentage cover of each species.

(i) State **one** advantage of random sampling.

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(1 mark)

(ii) Explain why quadrat sampling was the appropriate technique to use for this study.

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(1 mark)

(iii) Describe how random quadrat sampling would have been used to record the percentage cover of the vegetation.

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(3 marks)

(iv) State **one** disadvantage of measuring percentage cover when assessing plant populations.

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(1 mark)

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- 6 Rain forests are the richest, most productive and most complex ecosystems on Earth yet they cover less than 2% of the Earth's surface. They are currently being destroyed at the rate of 2 football fields per second. If forest clearance continues at the current rate, scientists estimate that nearly all tropical rain forest ecosystems will be destroyed by 2030.

(a) The table shows the rate of rain forest clearance in three countries.

Country	Original extent of rain forest cover / km ²	Present extent of rain forest cover / km ²	Present annual clearance rate / %
Brazil	2 860 000	1 800 000	2.3
Madagascar	62 000	10 000	8.3
Philippines	250 000	8 000	5.4

Source: Rainforest Action Network (www.ran.org)

Calculate:

- (i) the total area of present rain forest which will be destroyed in one year in the Philippines;

Show your working.

Answer
(1 mark)

- (ii) the percentage of the original rain forest already removed in Brazil.

Show your working.

Answer
(2 marks)



(b) Describe **three** activities which result in the loss of tropical rain forest.

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- 2.
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- 3.
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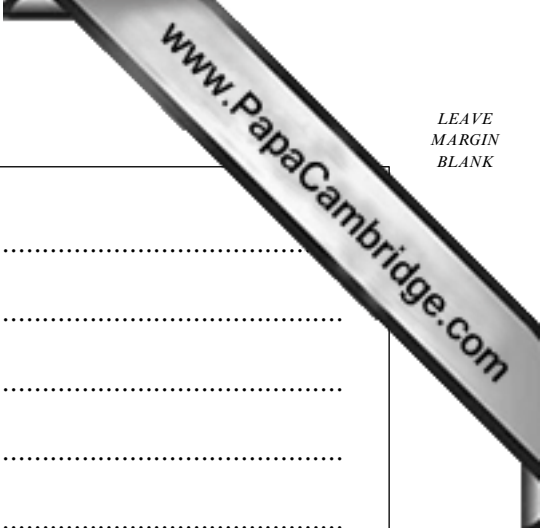
(3 marks)

(c) Outline the reasons why tropical rain forests should be conserved.

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(9 marks)

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END OF QUESTIONS

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