

Surname						Other Names					
Centre Number						Candidate Number					
Candidate Signature											

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General Certificate of Education
 June 2003
 Advanced Subsidiary Examination



ENVIRONMENTAL SCIENCE
Unit 3 The Biosphere

ESC3

Wednesday 4 June 2003 Afternoon Session

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

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

Time allowed: 1 hour

Instructions

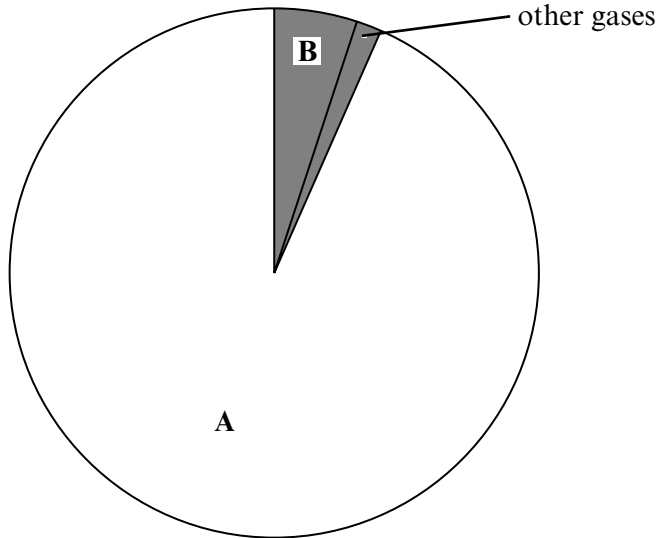
- ∞ Use blue or black ink or ball-point pen.
- ∞ Fill in the boxes at the top of this page.
- ∞ Answer **all** questions in the spaces provided. All working must be shown.
- ∞ Do all rough work in this book. Cross through any work you do not want marked.

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.

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

1 The diagram shows the components of the Earth's primitive atmosphere before life evolved.



(a) Suggest the **two** gases represented by slices **A** and **B**.

- 1.
 - 2.
- (1 mark)*

(b) The Earth's present day atmosphere contains approximately 21% oxygen. Explain how the presence of life on Earth may have brought about the change.

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(2 marks)

2 The populations of many species, such as the snow leopard, have been declining in the wild.

(a) Suggest **one** reason why snow leopard numbers have been declining in the wild.

.....
.....

(1 mark)

(b) The graph shows the origins of the population of captive snow leopards.

□
□

The graph, from 'A Primer for Conservation: Sinauer Assoc.' by
R.B. Primack (Macmillan, 1995), is not reproduced here due to □
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The full copy of this paper can be obtained by ordering ESC3□
from AQA Publications Tel: 0161 953 1170□

(i) Suggest why animals bred in zoos may not be used to repopulate the wild.

.....
.....

(1 mark)

(ii) Why is it important that a proportion of the captive population be born in the wild?

.....
.....

(1 mark)

(c) Give **one** advantage and **one** disadvantage of botanic gardens over nature reserves for plant conservation.

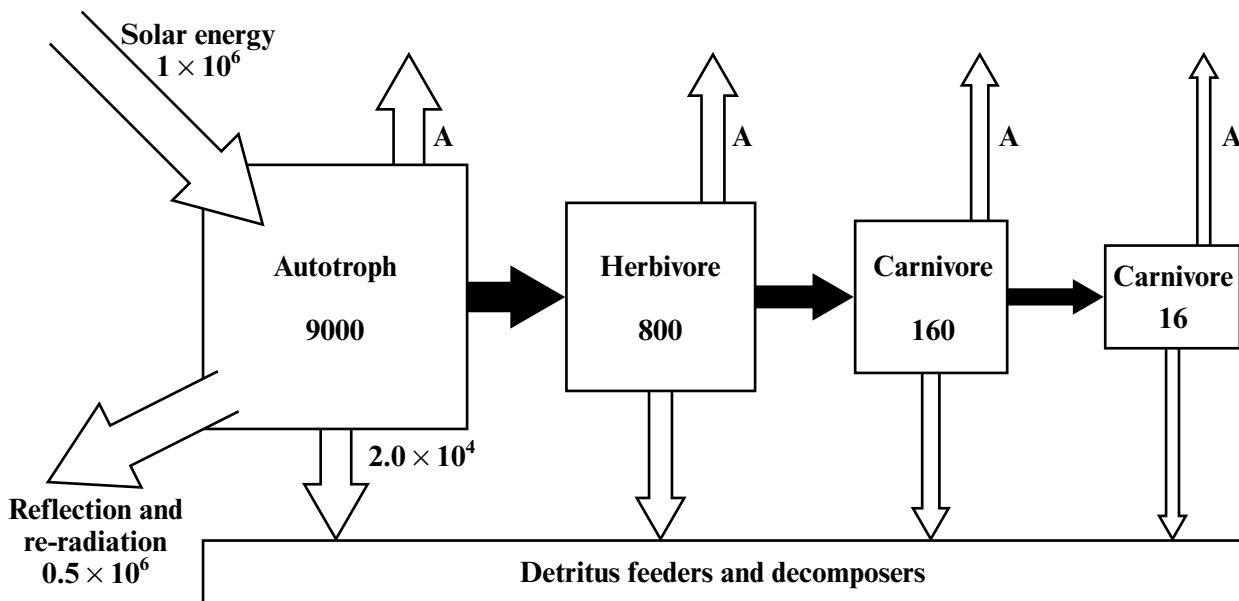
Advantage

Disadvantage

(2 marks)

Turn over ►

3 The diagram shows energy flow in an ecosystem. The Gross Primary Production is 0.5×10^6 units.



(a) State which process is represented by arrow A.

.....
(1 mark)

(b) Calculate the percentage of *Gross Primary Productivity* lost to process A. Show your working.

Answer
(2 marks)

(c) Explain what is meant by Net Primary Productivity.

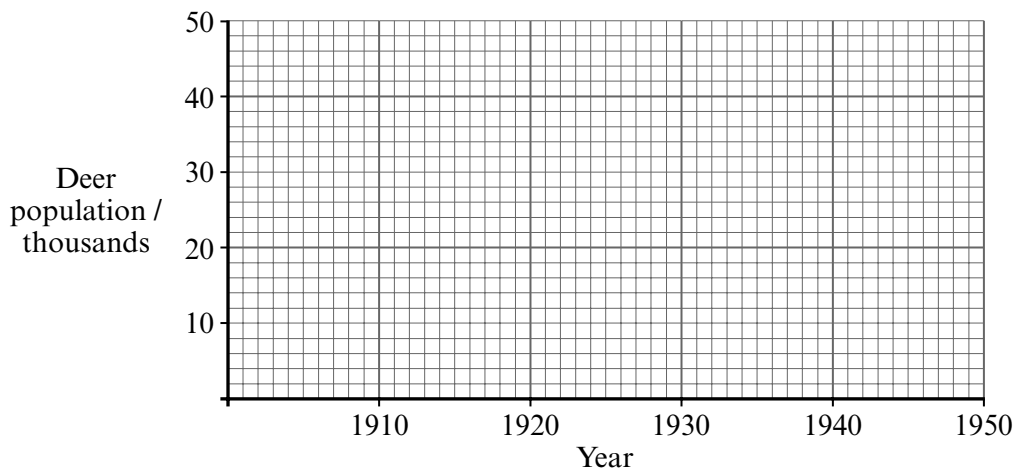
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(1 mark)

(d) Calculate the efficiency of the secondary consumer trophic level. Show your working.

Answer
(1 mark)

4 Early conservation work often failed because ecosystems were not fully understood. In 1910, an area of the USA was declared a wildlife refuge for 3000 deer. The area had a carrying capacity of 20 000 deer. Predators were exterminated. By 1920, there were 50 000 deer but by 1950, only 8000 deer remained.

(a) (i) Construct a graph to show the change in deer population over time.



(1 mark)

(ii) Explain what is meant by the *carrying capacity* of an area.

.....
.....

(1 mark)

(b) Explain why the population fell below the carrying capacity.

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(3 marks)

(c) Suggest a way in which the programme could have been managed more successfully.

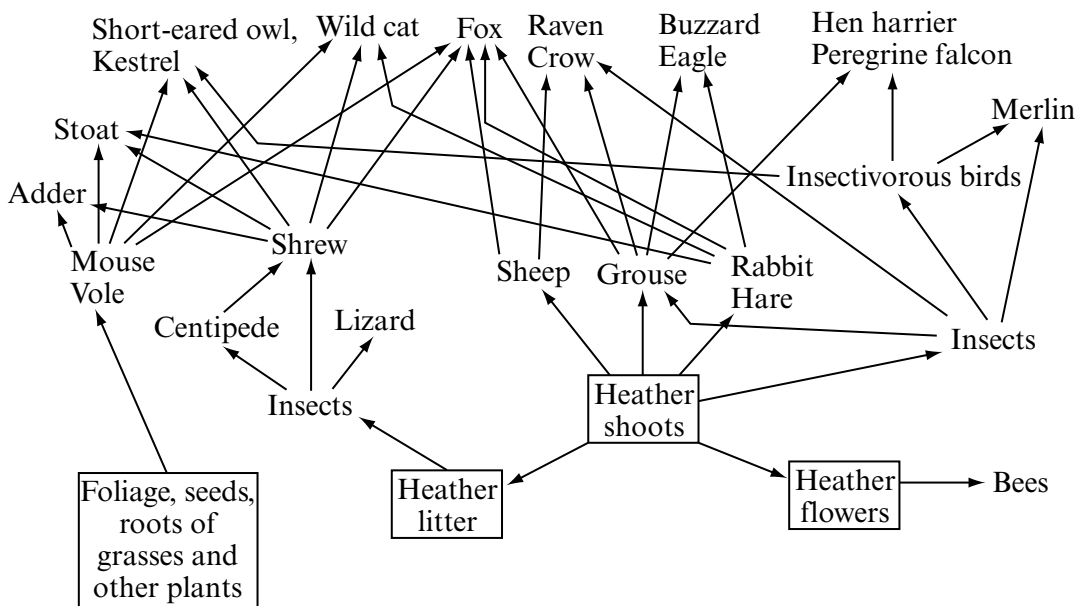
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(1 mark)



Turn over ►

5 Wild cats are rare in the wild but may be found on heathland. The diagram shows a heathland food web.



Source: adapted from A. KIDD, *Managing Ecosystems* (Hodder and Stoughton) 1999

(a) Using evidence from the food web, outline **two** changes which might occur if the wild cat became extinct.

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2.
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(4 marks)

(b) Suggest how the food web could be used to argue **for** and **against** fox hunting.

For

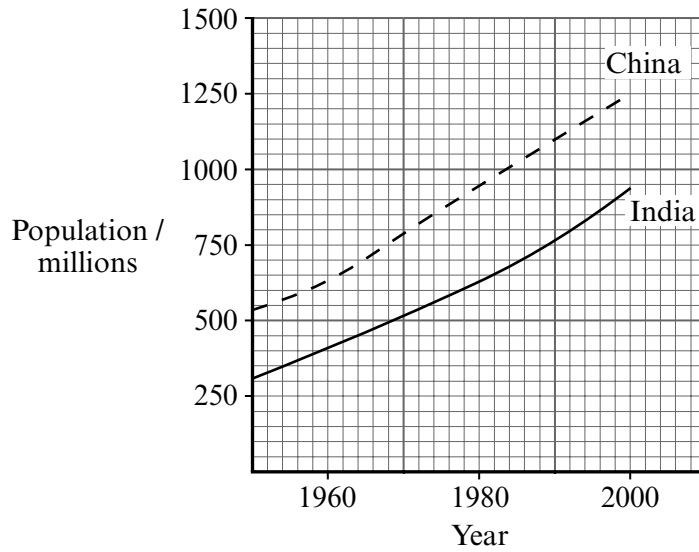
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Against

.....

(2 marks)

6 The graph shows population growth in two of the most populated countries of the world, 1950–2000.



(a) Outline **two** environmental implications for these countries if their population trend continues.

1.
-
2.
-

(2 marks)

(b) (i) Suggest how an economic factor could be used to reduce population growth.

.....
.....

(1 mark)

(ii) Suggest **one** other way to reduce population growth.

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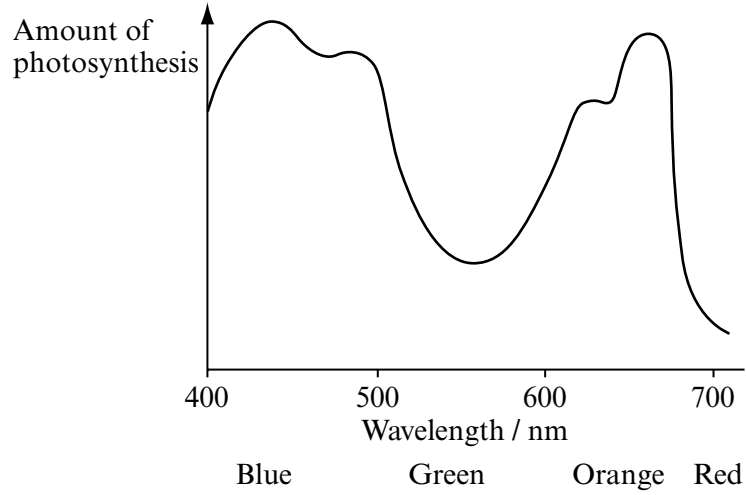
(1 mark)



Turn over ►

7 A student wanted to investigate the effect of muddy water in a stream on the rate of photosynthesis.

(a) The diagram shows the action spectrum.



Use the action spectrum to state and explain which colours of light are most used for photosynthesis.

Colours

Explanation

.....

.....

(2 marks)

- (b) The student could not investigate the rate of photosynthesis safely in the stream. Describe an experiment that could be carried out in a laboratory, using the pond weed *Elodea*, to investigate the effect of muddy water on the rate of photosynthesis. You may use a diagram.

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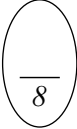
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(6 marks)

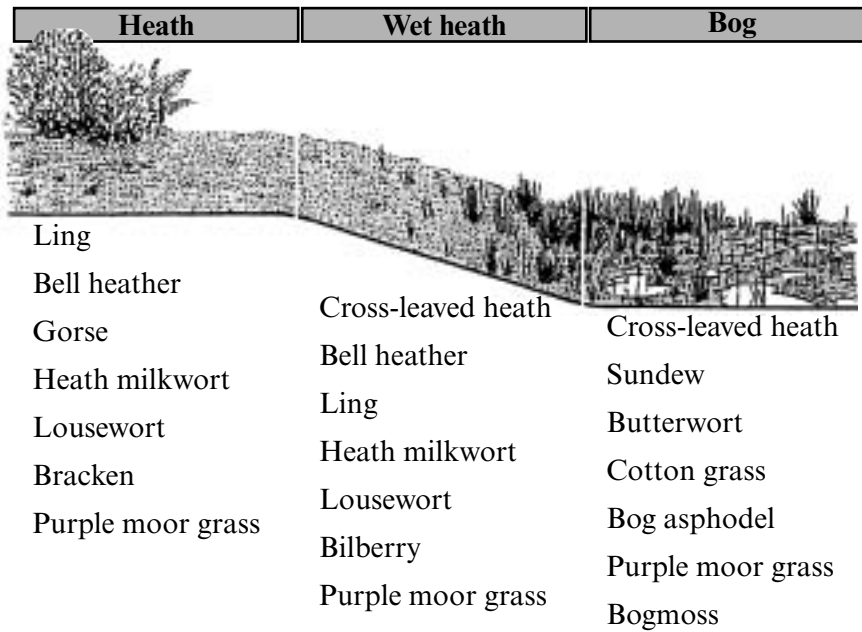
SPACE FOR DIAGRAM IF REQUIRED



TURN OVER FOR THE NEXT QUESTION

Turn over ►

8 The diagram shows the zonation of plants on a moorland. Common names are used.



Source: adapted from W. H. DOWDESWELL, *Ecology-Principles and Practice* (Heinemann) 1984

- (a) Give **one** abiotic and **one** biotic factor that would influence the distribution of plant species in this ecosystem.

Abiotic

.....

Biotic

.....

(2 marks)

- (b) (i) Explain why students studying changes in the moorland vegetation decided to use a belt transect.

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(2 marks)

- (ii) Give **one** advantage of belt transects over line transects.

.....

.....

(1 mark)

- (c) The table shows the results of a student's investigation on the population size of a moorland beetle.

Beetles originally marked	18
Beetles unmarked in second sample	16
Beetles marked in second sample	8

- (i) Give the name of this method of estimating population.

.....
(1 mark)

- (ii) Use the results to estimate the beetle population. Show your working.

The formula required is:

$$N = \frac{n^1 n^2}{n^m}$$

where

N = population estimate

n^1 = number of beetles originally marked

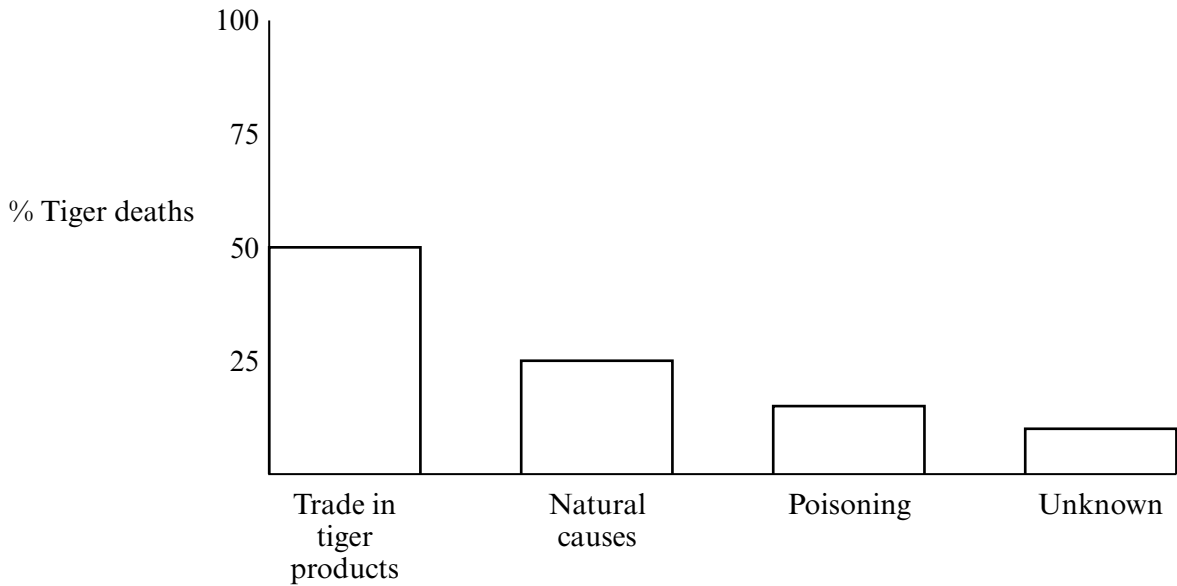
n^2 = number in recaptured sample

n^m = number already marked in recaptured sample

Answer
(2 marks)

Turn over ►

9 There are many causes of animal deaths in the wild. The graph shows some of the possible causes of tiger deaths.



(a) (i) Which world conservation agreement restricts trade in animal products?

.....
.....
(1 mark)

(ii) Suggest **two** methods by which the trade in animal products is restricted by this agreement.

1.
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2.
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(2 marks)

(iii) Suggest why such international agreements are difficult to enforce.

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(3 marks)

(b) Discuss the role of named designations of areas in protecting sites of ecological importance.

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(9 marks)

END OF QUESTIONS

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