

Surname					Other Names				
Centre Number					Candidate Number				
Candidate Signature									

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General Certificate of Education  
 January 2004  
 Advanced Subsidiary Examination



**ENVIRONMENTAL SCIENCE**  
**Unit 3 The Biosphere**

**ESC3**

Friday 9 January 2004 Afternoon Session

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

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

Time allowed: 1 hour

**Instructions**

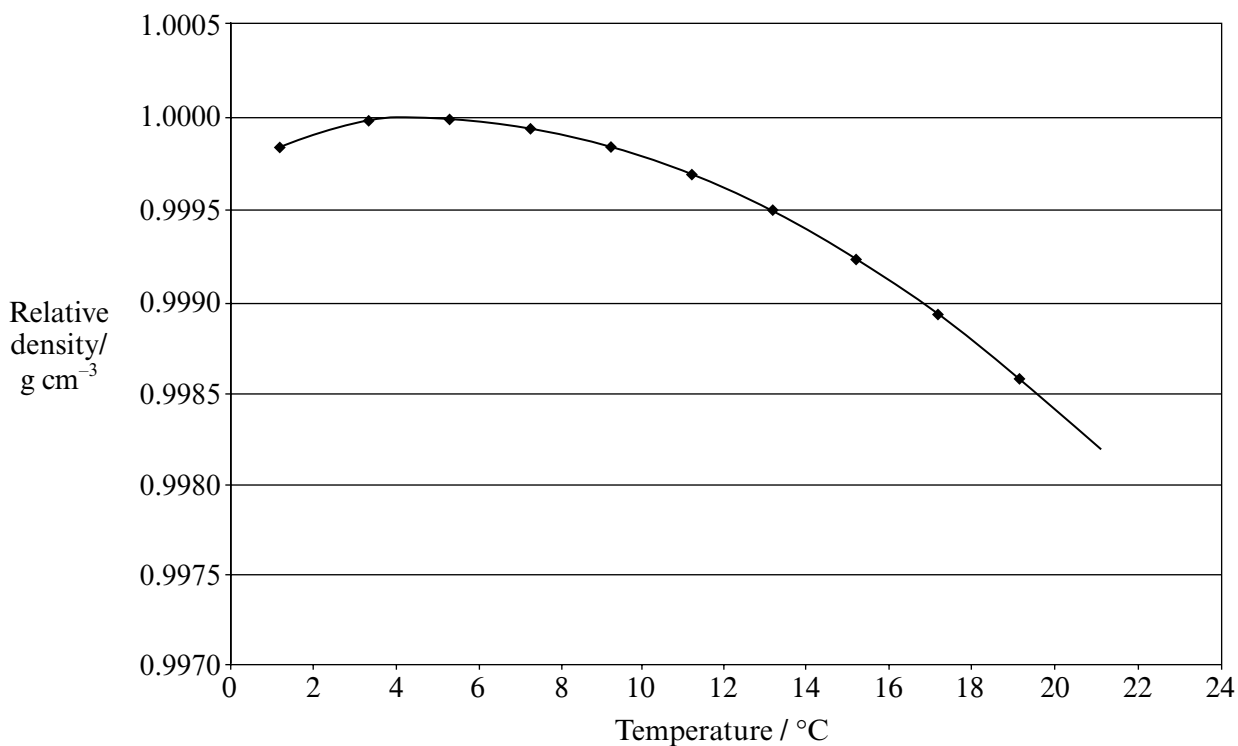
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer all questions in the spaces provided. All working must be shown.
- Do all rough work in this book. Cross through any work you do not want marked.

**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 Water has many special properties which support life on Earth. The graph shows the relationship between water density and temperature.



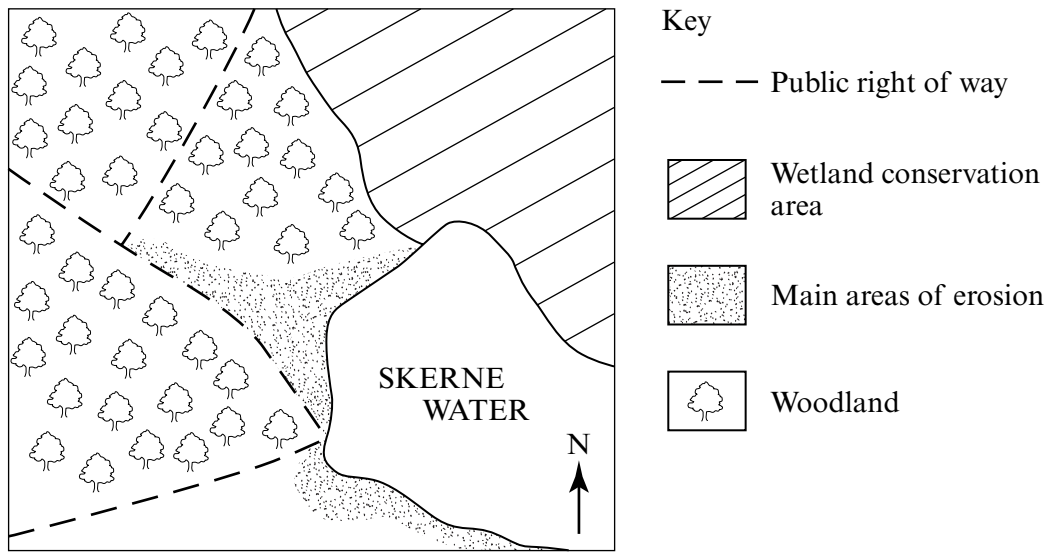
- (a) Describe the relationship shown by the graph.

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

- (b) Explain how the change in water density protects aquatic animals when temperatures fall below 4 °C.

.....  
 .....  
 .....  
 .....  
 (2 marks)

2 Middleham in the north east of England is privately owned land that has been designated as a Site of Special Scientific Interest (SSSI). The diagram shows part of the SSSI.



(a) What is the criterion for designating a site as a SSSI?

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

(b) At Middleham, over a period of time, the open water may develop into a wetland area and then into a woodland community. Name this process.

.....  
 (1 mark)

(c) Fenced off areas of erosion are now regenerating naturally. Name this process.

Process .....

(1 mark)

TURN OVER FOR THE NEXT QUESTION

Turn over ►

3 The increase in human population is having a detrimental impact on the environment.

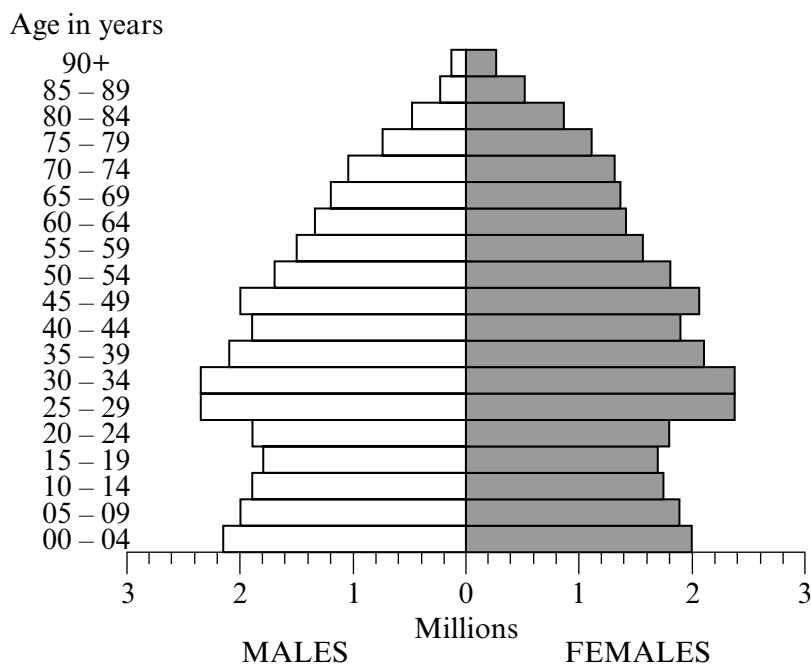
(a) (i) State the difference between population size and population density.

.....  
 .....  
 (2 marks)

(ii) Describe two ways in which governments have attempted to regulate human population.

1. ....  
 .....  
 2. ....  
 .....  
 (2 marks)

(b) The diagram shows a predicted age-sex pyramid for the UK in 2010.



(i) Using the pyramid, estimate the number of males aged 0-14 in 2010.

..... million  
 (1 mark)

(ii) Estimate the number of people born between 1966 and 1970 who would be alive in 2010.

..... million  
 (1 mark)

(iii) Outline how the shape of the pyramid in 2010 may have major economic implications for the UK in the future.

.....  
.....  
.....  
.....  
.....  
.....

(2 marks)



4 Text extract from: **Environmental Biology**, Routledge 1997 pg 67 – not reproduced here, due to third-party copyright constraints.

(a) Question 4(a) not reproduced here, due to third-party copyright constraints.

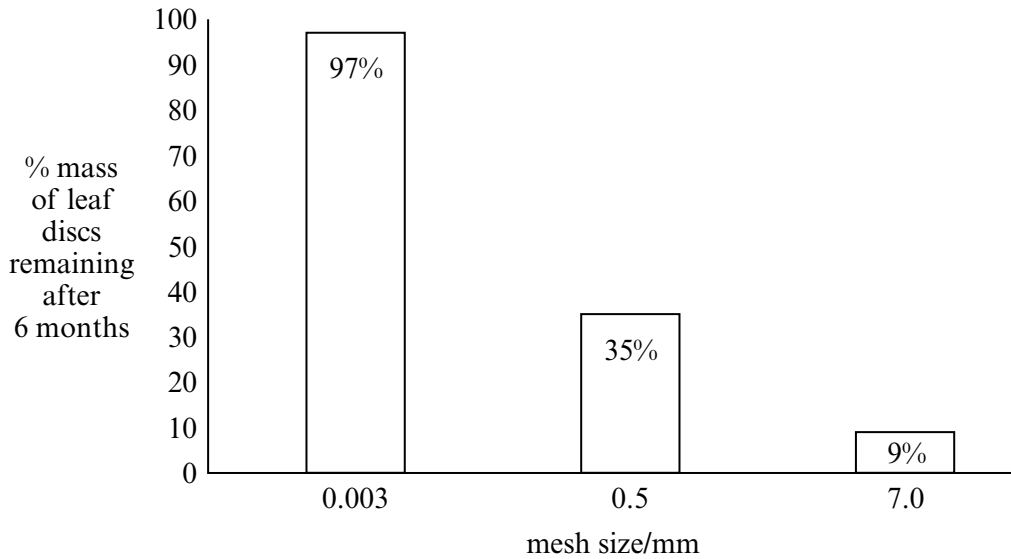
(2 marks)

QUESTION 4 CONTINUES ON THE NEXT PAGE

Turn over ►

- (b) An experiment was carried out to investigate the role of detritivores in the soil. Twelve mesh bags, of three different mesh sizes, were filled with leaf discs and buried underground.

The graph shows the percentage mass of leaf discs remaining after six months.



- (i) Suggest four examples of good scientific practice that would have been used by the researcher collecting these data.

- 1. ....
- 2. ....
- 3. ....
- 4. ....

(4 marks)

- (ii) Use the data to explain the role of detritivores and decomposers in the soil.

- .....
- .....
- .....
- .....
- .....
- .....
- .....
- .....
- .....
- .....

(4 marks)

5 Aston Rowant, in Oxfordshire, is designated as a National Nature Reserve (NNR).

(a) State one organisation which manages NNR's and outline one purpose of an NNR.

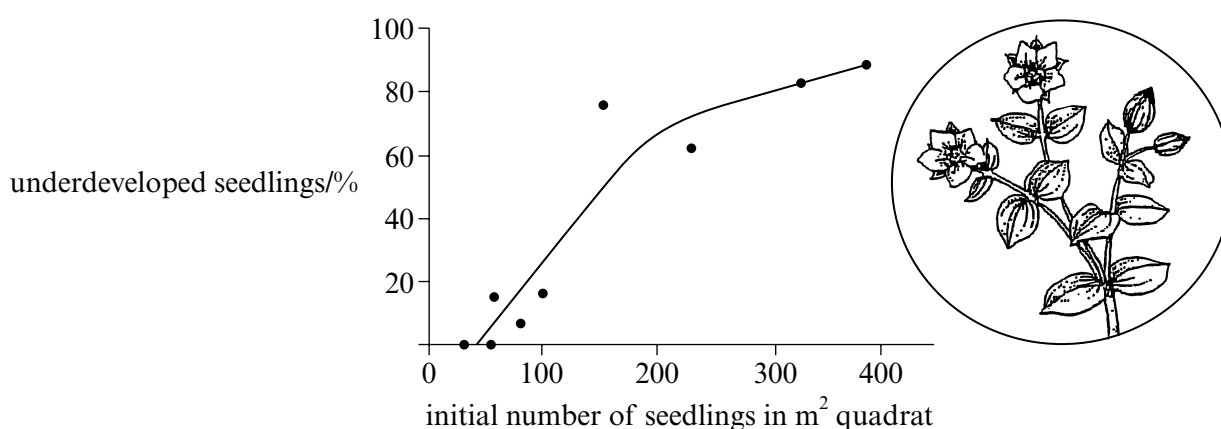
Organisation .....

Purpose .....

.....

(2 marks)

(b) The thyme leaved sandwort, *Arenaria serpyllifolia*, is an annual which thrives at Aston Rowant.



Source: T. J. KING, *Selected Topics in Ecology* (Nelson) 1984

(i) Describe and explain the data shown in this graph.

Description .....

.....

Explanation .....

.....

.....

.....

(3 marks)

(ii) The death rate of seedlings increases during the summer. Suggest how this may have been caused by a:

density dependent factor; .....

.....

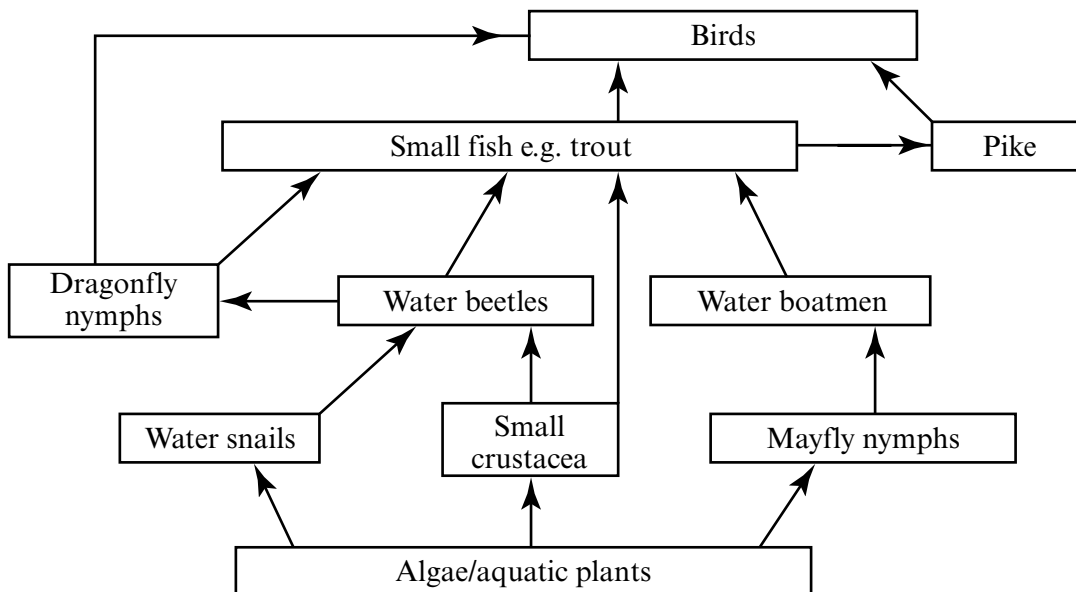
density independent factor. ....

.....

(2 marks)

Turn over ►

6 (a) The diagram shows a food web from a river.



With reference to the diagram, explain the short term impact of a drop in mayfly numbers on the population of:

(i) algae; .....

.....

..... (2 marks)

(ii) water snails; .....

.....

..... (2 marks)

(iii) trout. ....

.....

..... (2 marks)

(b) The table shows the results of a freshwater invertebrate survey of a Dorset river in 1990.

Invertebrate group (common names)	Number of individuals
Caddis fly larvae	13
Freshwater shrimp	22
Mayfly larvae	18
Water hoglouse	23



(i) Outline a suitable method to collect these data.

.....

.....

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.....

.....

(4 marks)

(ii) Give one limitation of this method.

.....

.....

(1 mark)

(iii) Use the data from the table to calculate the index of diversity (D) for the river 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 = sum of

Answer .....

(3 marks)

Turn over ►

7 The southern white rhino, a sub species of the African white rhino is now classified as critically endangered. Their horns are still used to make ceremonial dagger handles. The future of the rhino depends on the development and operation of effective conservation strategies.

(a) CITES is a conservation strategy that makes international trade in the products of endangered living species illegal. Suggest why CITES has led to increased poaching of the rhino.

.....  
.....  
.....  
.....

*(2 marks)*

(b) There are only 25 southern white rhino in the wild. Explain the significance for their survival of such a small population.

.....  
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.....  
.....  
.....  
.....  
.....

*(3 marks)*

