

Surname						Other Names					
Centre Number						Candidate Number					
Candidate Signature											

Leave blank

General Certificate of Education
 June 2004
 Advanced Subsidiary Examination



ENVIRONMENTAL SCIENCE
Unit 3 The Biosphere

ESC3

Thursday 10 June 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			
8			
Total (Column 1)	→		
Total (Column 2)	→		
TOTAL			
Examiner's Initials			

Time allowed: 1 hour

Instructions

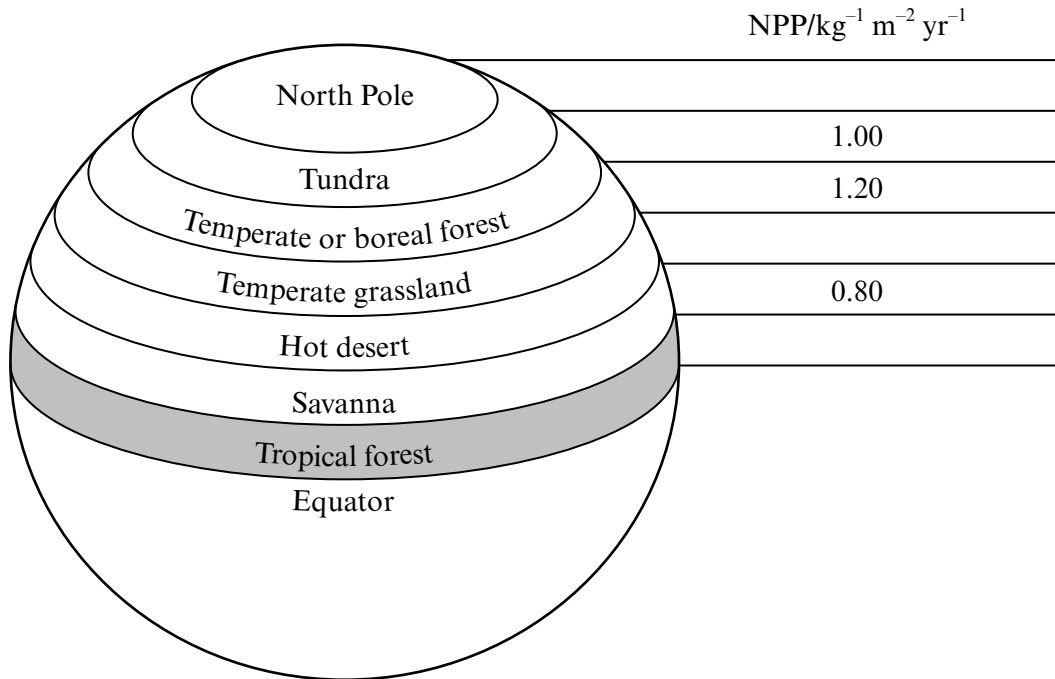
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided. All working must be shown.
- Do all rough work in this book. Cross through any work you do not want marked.

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 distribution of biomes on land with their mean Net Primary Productivity (NPP).



(a) (i) Complete the table by putting the following values for NPP into the correct boxes.

2.20

0.03

0.90

(1 mark)

(ii) Outline how a named abiotic factor may reduce NPP.

.....

.....

.....

.....

(2 marks)

(b) Explain what is meant by the term *biome*.

.....

.....

.....

.....

(2 marks)

2 The different wavelengths of light penetrating to different depths in water have a significant impact on aquatic ecosystems.

(a) The diagram shows the depth of penetration of different wavelengths of light.

*The diagram is not reproduced here due to third-party copyright restraints.
Printed copies of this paper can be obtained by ordering ESC3 from
AQA Publications. Tel: 0161 953 1170*

Use the information in the diagram to state which colours of light aquatic plants use at depths below 100m.

.....
.....

(1 mark)

(b) Outline the role of light in photosynthesis.

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

(2 marks)

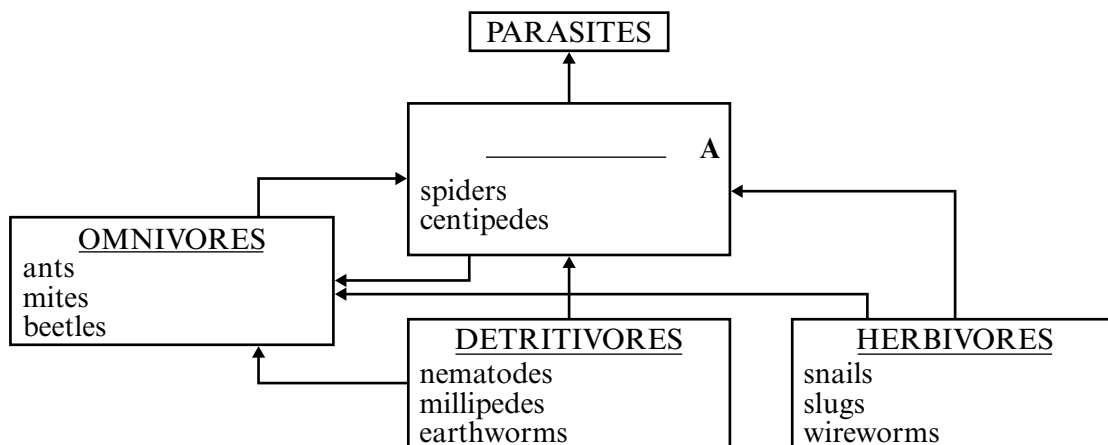
(c) Explain how the warm water released by power stations into the sea may affect the rate of photosynthesis.

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

(2 marks)

Turn over ►

3 (a) The diagram shows a soil food web.



(i) Complete the diagram of a soil food web by adding a label to box A. (1 mark)

(ii) What do the arrows in the diagram represent?

.....

(1 mark)

(b) The table shows the assimilation efficiency of organisms in relation to the mass of food consumed and the mass of faeces produced.

Organism	Mass of food consumed/g	Mass of faeces produced/g	Assimilation efficiency/%
Woodlouse	1.90	1.60	
Earthworm	0.89	0.88	1.14
Cow	3053	1907	60.09

(i) Use the information in the table to calculate the assimilation efficiency of a woodlouse. Show your working.

$$\text{Assimilation Efficiency}/\% = \frac{\mathbf{F} - \mathbf{M}}{\mathbf{M}} \times 100$$

where **F** = food consumed
M = faeces produced

Answer%
(2 marks)

(ii) Explain why many herbivores, such as rabbits and cattle, have a high assimilation efficiency.

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

(2 marks)

$\frac{1}{6}$

4 Many species of animals in captivity at the Cotswold Wildlife Park are endangered in the wild. Almost all the mammal species bred at the park were part of a worldwide captive breeding programme.

(a) Suggest reasons why few of these mammals will ever be released into the wild.

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

(3 marks)

(b) Explain why captive breeding organisations worldwide keep a computer record or 'stud book' of the mating partners of the animals on their programme.

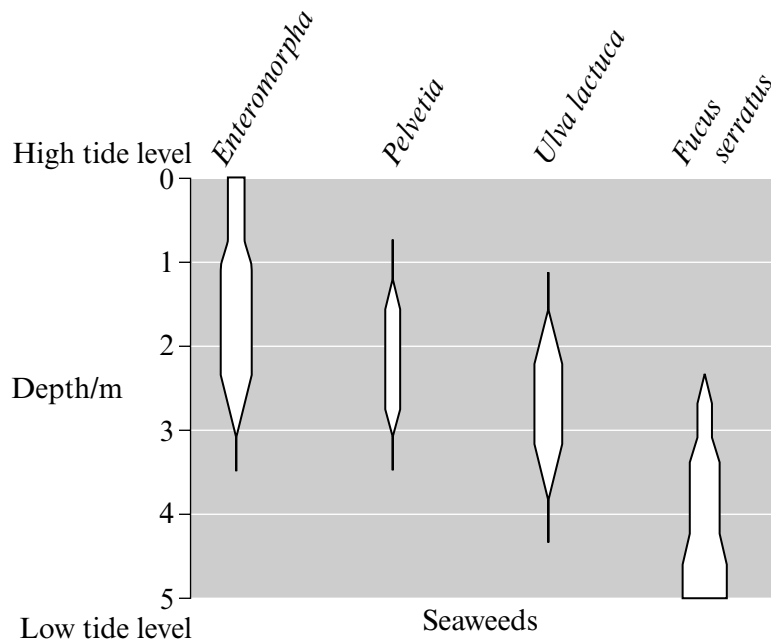
.....
.....
.....
.....
.....
.....

(3 marks)

$\frac{1}{6}$

Turn over ►

5 In ecosystems, species distribution may be controlled by many factors. The diagram shows the distribution of **four** species of seaweeds on a rocky shore. The width of the column shows species frequency.



(a) Explain why the diagram shows the zonation of seaweeds and not evidence of succession.

.....

 (2 marks)

(b) Give the main abiotic factor which controls seaweed distribution on a rocky shore.

.....

 (1 mark)

(c) Describe a suitable method to gather the data shown in the diagram.

.....

.....

.....

.....

.....

.....

(5 marks)

$\frac{\quad}{8}$

TURN OVER FOR THE NEXT QUESTION

Turn over ►

6 Populations in the wild do not remain constant in size but fluctuate about the carrying capacity.

(a) Explain what is meant by *carrying capacity*.

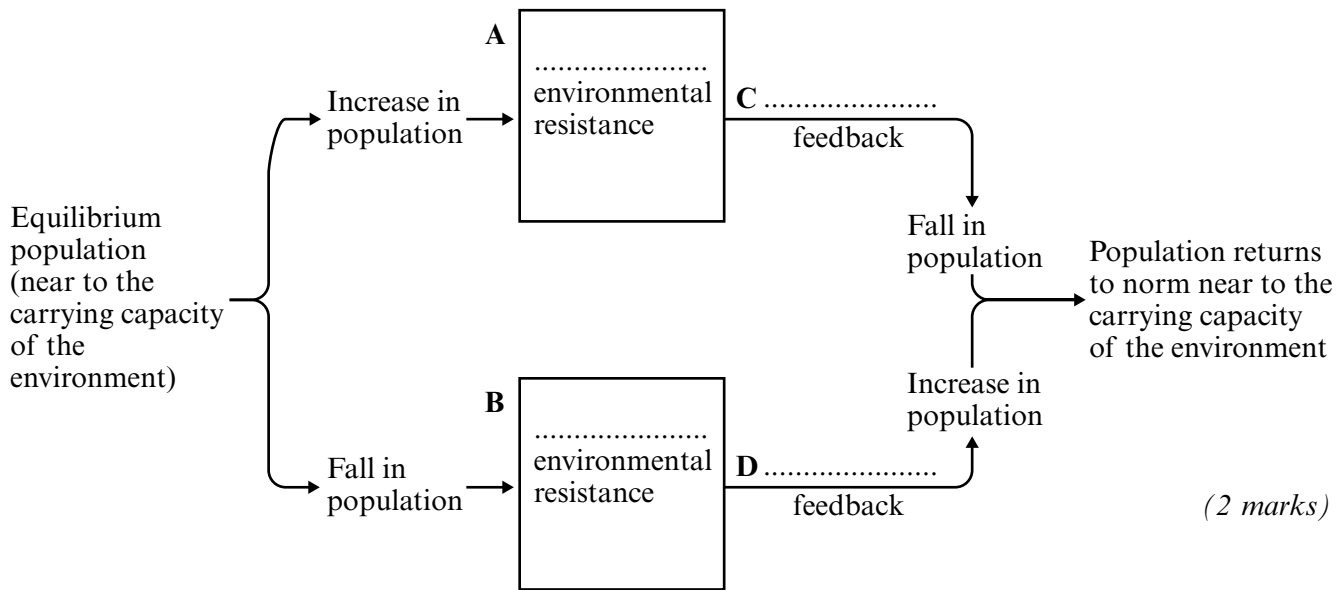
.....
.....

(1 mark)

(b) The homeostatic control of a population is shown below. Complete the diagram showing:

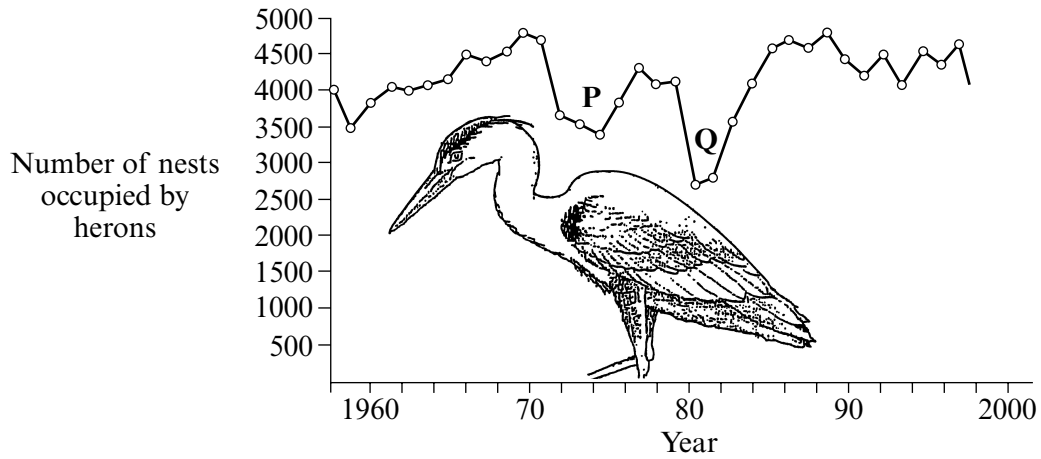
(i) the change in environmental resistance (A + B);

(ii) the type of feedback mechanism (C + D).



(2 marks)

(c) The graph shows the variation in the number of occupied heron nests over time.



Describe how a named abiotic factor may account for the rapid drop in the number of occupied nests at points P and Q on the graph.

.....

.....

.....

.....

(2 marks)

TURN OVER FOR THE NEXT QUESTION

Turn over ►

7 It is impossible to count every plant in a habitat so it is therefore necessary to sample the habitat. There are three ways in which sampling can be achieved: random, systematic and stratified sampling.

(a) (i) Describe how random sampling could be used to estimate the oak tree population of a woodland.

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

(4 marks)

(ii) Outline **one** problem of this method of sampling populations.

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

(2 marks)

(b) The stages of the mark-release-recapture method used to estimate mobile organisms are shown below.

1. capture a sample of the population
2. mark each individual and release
3. recapture organisms
4. note the number of marked organisms recaptured and release
5. calculate population using formula

(i) Outline **two** precautions to be taken to ensure the validity of this method.

1.
.....
2.
.....

(2 marks)

(ii) A *mark-release-recapture* investigation was carried out in Tile Woods.

Number of violet ground beetles originally marked (n_1)	8
Number of violet ground beetles in second sample (n_2)	11
Number of violet ground beetles marked in second sample (n_m)	3

Use the results to estimate the population of violet ground beetles in the woods. Show your working.

$$\text{Population} = \frac{n_1 \cdot n_2}{n_m}$$

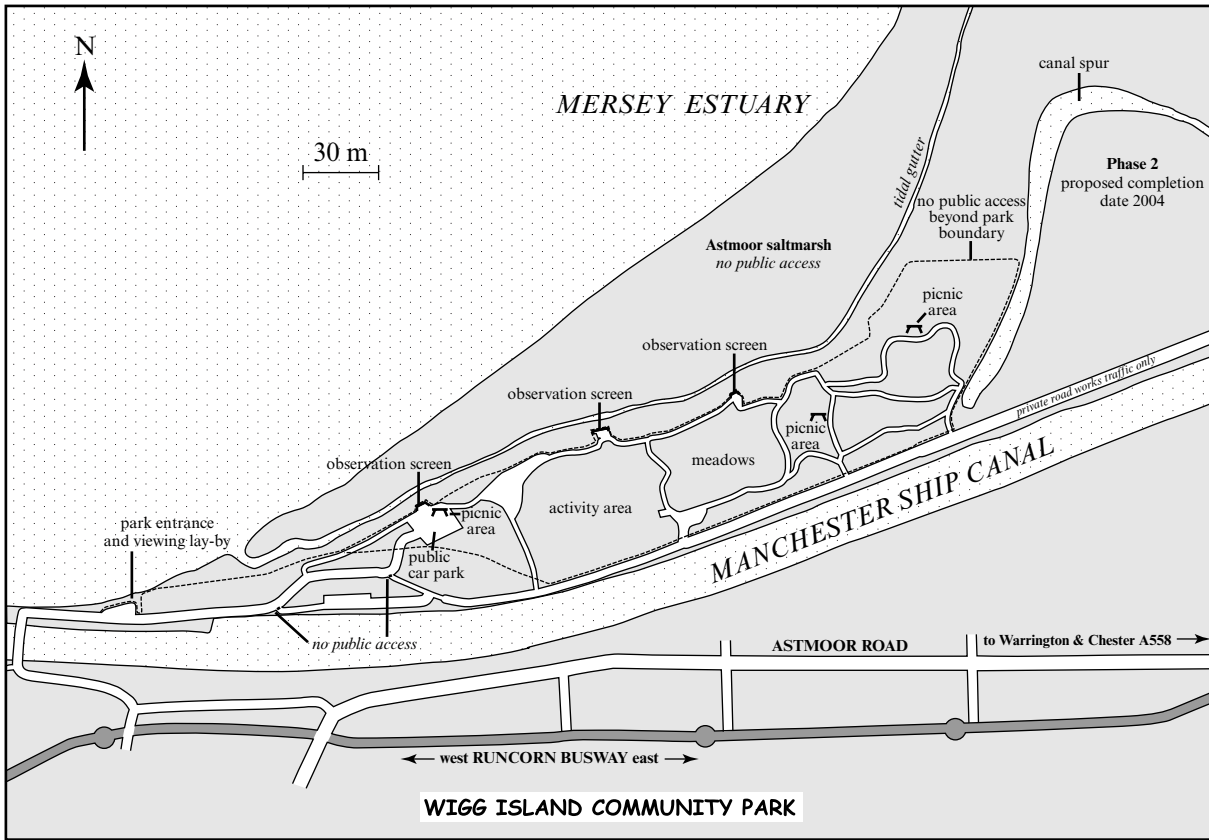
Answer

(2 marks)

10

Turn over ►

8 Until 1960, Wigg Island was the site of a chemical works. It has been reclaimed as a recreational park and may be given Special Area of Conservation status (SAC).



Source: adapted from "Wigg Island Community Park" Leaflet (Halton Borough Council)

(a) (i) Suggest **one** reason why this area may be awarded SAC status.

.....

 (1 mark)

(ii) Under what conditions can UK Governments overrule SAC status?

.....

 (1 mark)

(b) Describe **two** ways shown on the map by which the area has been managed to reduce the impact of visitors on the habitats of Wigg Island.

1.

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE