

Surname						Other Names					
Centre Number						Candidate Number					
Candidate Signature											

For Examiner's Use

General Certificate of Education
 June 2007
 Advanced Subsidiary Examination



ENVIRONMENTAL SCIENCE
Unit 3 The Biosphere

ESC3

Thursday 7 June 2007 1.30 pm to 2.30 pm

<p>You will need no other materials: You may use a calculator.</p>
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For Examiner's Use			
Question	Mark	Question	Mark
1		5	
2		6	
3			
4			
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.
- Answer the questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The maximum mark for this paper is 60.
- The marks for questions are shown in brackets.
- You are reminded of the need for good English, clear presentation and appropriate use of specialist vocabulary. Question 6 should be answered in continuous prose. Quality of Written Communication will be assessed in this answer.

There are no questions printed on this page

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

1 The following methods can be used in fieldwork to sample populations of organisms.

- A Kick sampling
- B Tüllgren funnel
- C Mark-release-recapture (Lincoln Index)
- D Pitfall trap
- E Belt transect
- F Random quadrat sampling
- G Abundance scale
- H Light trap
- I Direct observation

Complete the table to give the letter of an appropriate technique to use in each case. The first one has been done as an example.

	Letter
Estimating the population of snails in a hedgerow	C
Sampling bottom dwelling freshwater invertebrates in a stream	
Sampling night-flying moths	
Comparing populations of daisies in two lawns with different weed-control treatments	
Collecting invertebrates in a soil or leaf litter sample	
Investigating the zonation of seaweeds down a rocky shore.	

(5 marks)

5

- 2 (a) Scientists carried out a survey of some upland streams in different parts of the UK.

Some of the results are shown in the table.

Stream	pH of stream water	Number of animal species	Number of plant species
1	4.0	5	4
2	7.1	22	19
3	4.4	11	6
4	6.5	20	13
5	5.7	16	9

- (i) Describe the relationship between the pH of the streams and the number of animal species.

.....

 (1 mark)

- (ii) Suggest why stream 2 has the greatest number of plant species.

.....

 (1 mark)

- (iii) Which stream would you expect to be the least stable ecosystem?

Explain your answer.

Stream

Explanation

.....

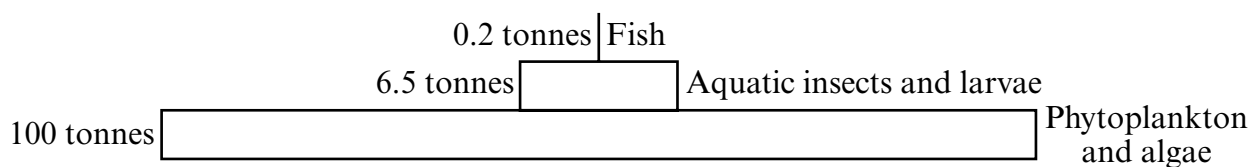
 (3 marks)

(iv) Outline a method which could be used to measure accurately the pH of the stream water.

.....
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(2 marks)

(b) The diagram shows a pyramid of biomass for one of the streams.



Explain why the biomass of fish is only 0.2 tonnes whereas the biomass of phytoplankton and algae is 100 tonnes.

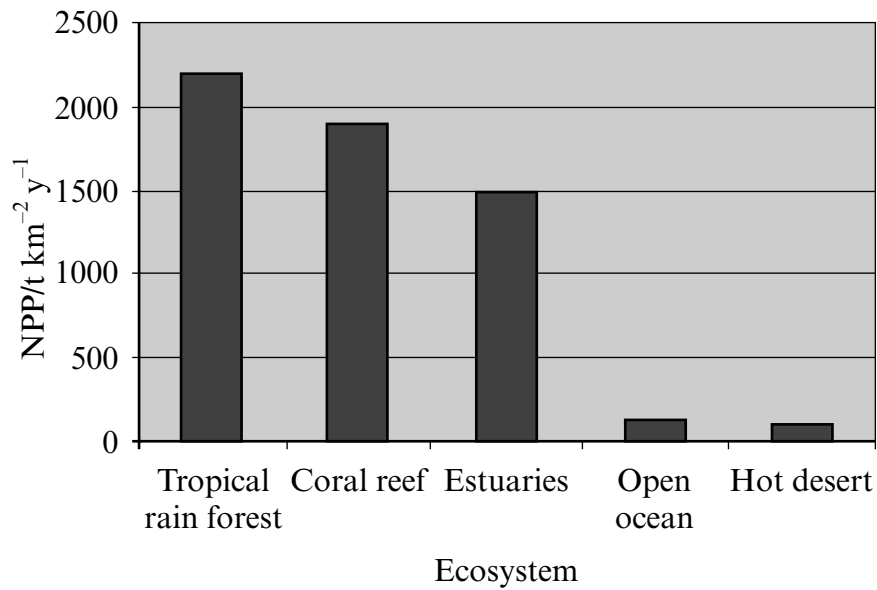
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(3 marks)

10

Turn over for the next question

3 The graph shows the Net Primary Productivity (NPP) of selected ecosystems.



(a) Explain what is meant by *Net Primary Productivity* (NPP).

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

(b) Suggest an explanation for the high NPP values of:

(i) tropical rain forest

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

(ii) estuaries.

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

(c) Explain why, despite their low value, the NPP of oceans is significant on a global scale.

.....
.....

(1 mark)

(d) Describe how a named biotic factor may reduce the primary productivity of an ecosystem.

Biotic factor

.....
.....

(2 marks)

(e) Suggest **two** ways in which tourism may affect coral reefs.

1

.....

2

.....

(2 marks)

10

Turn over for the next question

- 4 About 10 000 years ago the glaciers that had covered much of Britain began melting and retreating. The table shows the changes in vegetation over time in the glaciated valleys.

Approximate time from retreat of glacier / years	Vegetation
0–4	Bare rock with lichens
5	Mosses and short grasses
25	Taller grasses and hardy flowering plants
100–200	Dense growth of shrubs
300–500	Shrubs and small trees such as birch
2000	Developing mixed forest
5000–10 000	Mature forest

- (a) (i) What name is given to this type of vegetation change?

.....
(1 mark)

- (ii) Give **one** other example of a situation where vegetation change occurs in a previously unvegetated area.

.....
(1 mark)

- (b) What term can be used to describe:

- (i) the plants establishing in years 0–4

.....
(1 mark)

- (ii) the community that is developing between 5000 and 10 000 years?

.....
(1 mark)

(c) Explain how these changes in vegetation have taken place.

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(4 marks)

(d) Under what circumstances would you expect further changes in the species composition of the mature forest to occur?

Explain your answer.

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.....
.....

(2 marks)

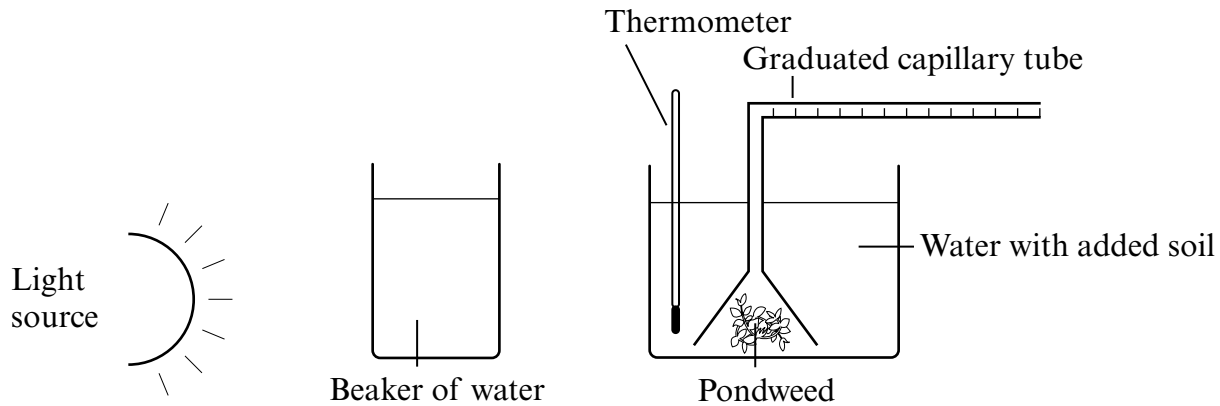
10

Turn over for the next question

5 As a result of poor farming practices, eroded soil was deposited in a small stream causing the water to become very cloudy.

A student decided to investigate the effect of this increased turbidity on the growth of water plants by measuring the rate of photosynthesis of pondweed in water with different quantities of soil added.

The diagram shows the equipment that the student used.



(a) (i) Explain the purpose of the beaker of water.

.....

 (1 mark)

(ii) What is the main gas that would be collected in the graduated capillary tube?

.....
 (1 mark)

(iii) Suggest **one** reason why the amount of gas collected would not represent the total amount produced by the pondweed.

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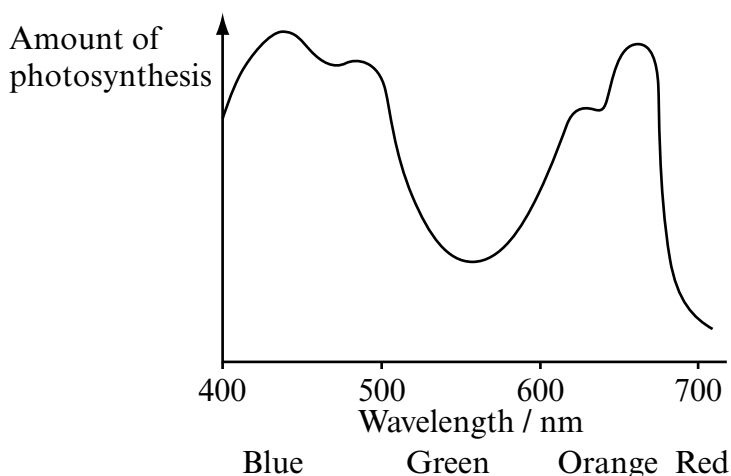
 (1 mark)

(b) State **three** precautions which the student should have taken to ensure a fair test.

- 1
- 2
- 3

(3 marks)

(c) The graph shows the effect of different colours of light on the rate of photosynthesis.



(i) Use the graph to state and explain which colours of light are most used for photosynthesis.

Colours

Explanation

(2 marks)

(ii) Suggest what happens to the light reaching the leaf that is not used for photosynthesis.

-
-
-
-

(2 marks)

- 6 (a) In order to study the effect of hedgerow management, the population of woodlice living in a hedgerow was estimated using the following method.
- Four pitfall traps were set up at 2 metre intervals and left for 24 hours.
 - The woodlice that had fallen into the traps were marked with quick-drying paint and released back into their habitat.
 - The next day the traps were checked again and the number of marked and unmarked woodlice were counted.

The results are shown in the table.

	Trap number			
	1	2	3	4
Number of woodlice marked and released	2	28	0	10
Number of marked woodlice in second catch	0	4	0	2
Number of unmarked woodlice in second catch	5	17	3	11

- (i) Use the formula to estimate the woodlouse population in the area.

Show your working.

$$\text{Population estimate} = \frac{n_1 \times n_2}{n_m}$$

where n_1 = number caught on the first occasion

n_2 = number caught on the second occasion

n_m = number of marked individuals in the second catch

Answer

(2 marks)

(ii) Suggest **three** reasons why it is not possible to make a reliable estimate of the woodlouse population size from these data.

1

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2

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3

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(3 marks)

(b) Discuss the roles of zoos and seed banks in the conservation of endangered species.

Quality of Written Communication will be assessed in this answer.

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