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General Certificate of Education
January 2005
Advanced Subsidiary Examination

AQA

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

ENVIRONMENTAL SCIENCE   ESC3
Unit 3   The Biosphere

Tuesday 11 January 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			
3			
4			
5			
6			
Total (Column 1)			
Total (Column 2)			
TOTAL			
Examiner's Initials			

ESC3

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

1 Early evolution on primitive Earth included heterotrophs feeding on organic chemicals in the oceans and autotrophs from which the first food chains were established.

(a) Complete the table.

Term	Definition
Heterotroph	....
Autotroph	....
Food chain	....

(3 marks)

(b) Describe **two** advantages for life on Earth of the evolution of photosynthesising organisms.

1. ....

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2. ....

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(2 marks)

5

2 (a) The graph shows the exponential growth of the human population over the last 2000 years.
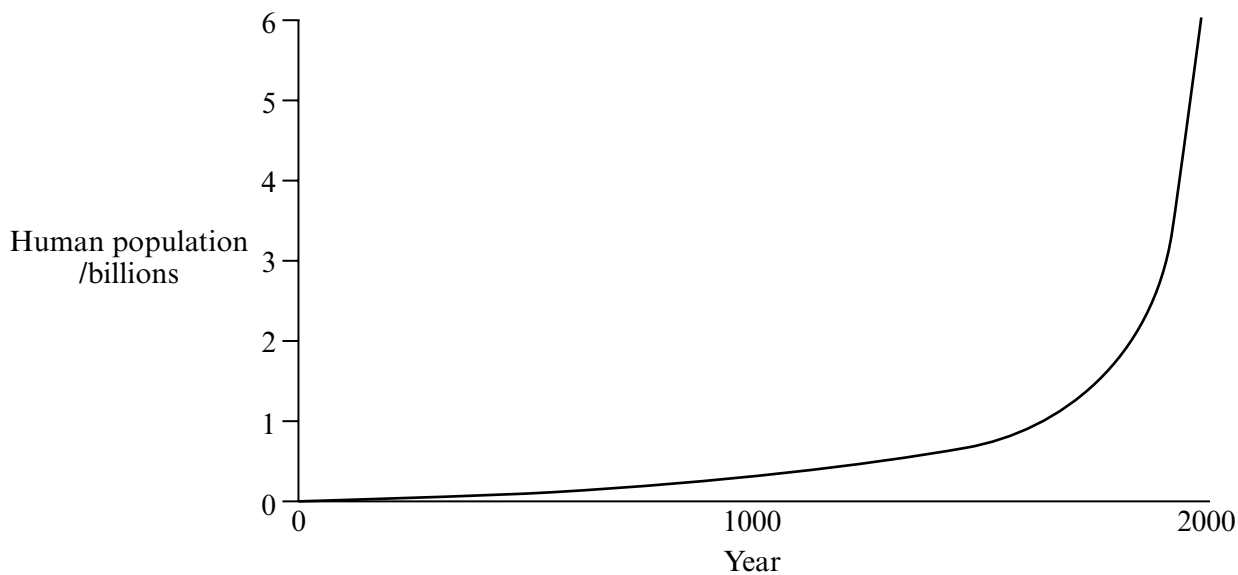
(i) Explain what is meant by *exponential growth*.

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(1 mark)

(ii) Suggest **four** factors that have enabled the human population to expand rapidly during the last 300 years.

1. ....

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2. ....

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3. ....

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4. ....

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(4 marks)

QUESTION 2 CONTINUES ON THE NEXT PAGE

Turn over ▶

(b)   The graph shows the changes in life expectancy in the UK since 1841.
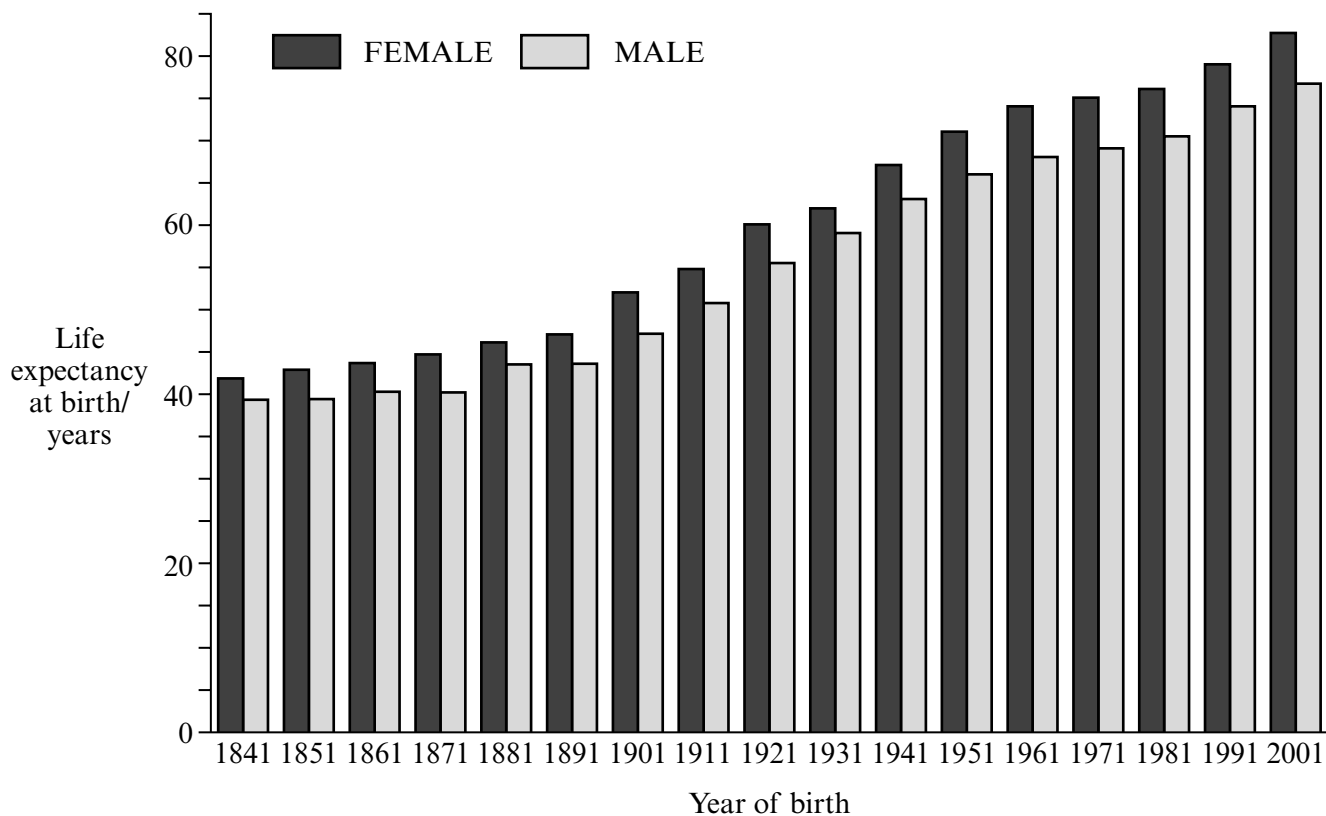
(i)   Identify **three** major trends shown in the graph.

1. ....

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2. ....

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3. ....

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(3 marks)

(ii)   Suggest **one** economic and **one** environmental consequence for the UK of the continuation of the present trend in life expectancy.

Economic ....

....

Environmental ....

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(2 marks)

10

NO QUESTIONS APPEAR ON THIS PAGE

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

3 (a) The diagram shows a vertical section through an area of tropical rain forest in Brazil.
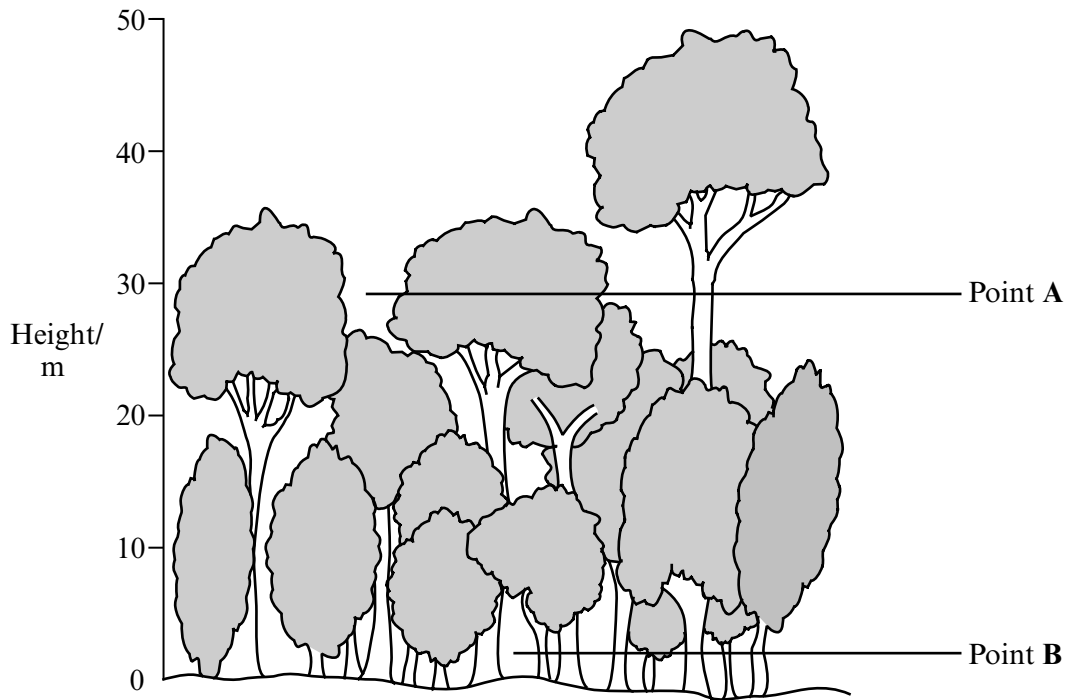
Suggest why:

(i) the concentration of carbon dioxide over a 24 hour period is greater at point **B** than at point **A**;

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(2 marks)

(ii) there is little vegetation at ground level in a tropical rain forest.

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(1 mark)

(b) Cutting down tropical rain forests will reduce the diversity of animals. Suggest why this may lead to a reduction in plant species diversity.

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(2 marks)

(c) The table shows the mean annual Net Primary Productivity (NPP) for a tropical rain forest ecosystem compared with a temperate grassland ecosystem.

Ecosystem	Mean annual NPP/kg m^{-2} yr^{-1}
Tropical rain forest	2.20
Temperate grassland	0.60

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

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(1 mark)

(ii) Explain why the Net Primary Productivity of tropical rain forests is much higher than that of temperate grassland.

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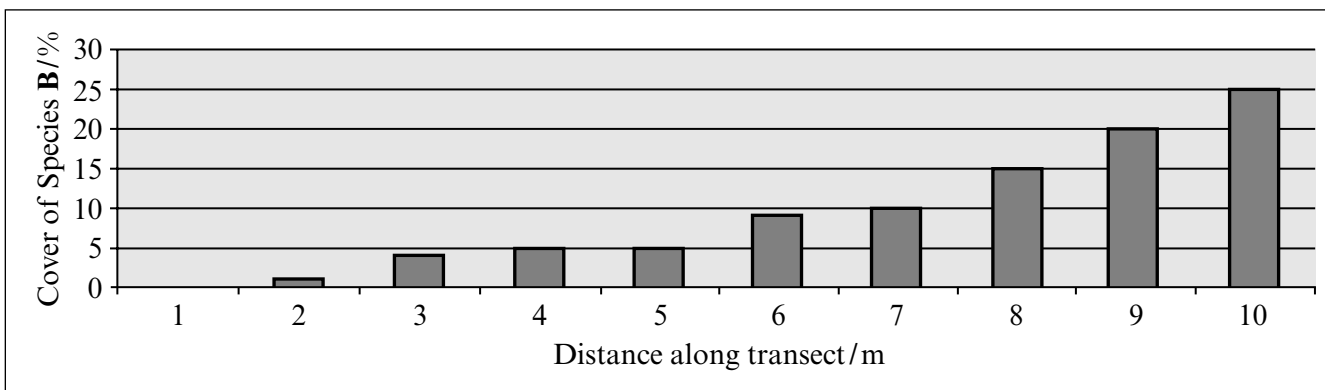
(4 marks)

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Turn over ▶

4 A student used a belt transect to investigate the distribution of two plant species down a slope. In each quadrat, the student recorded the percentage cover of each species and used these results to calculate the species frequency.

The diagram shows the results of the investigation.
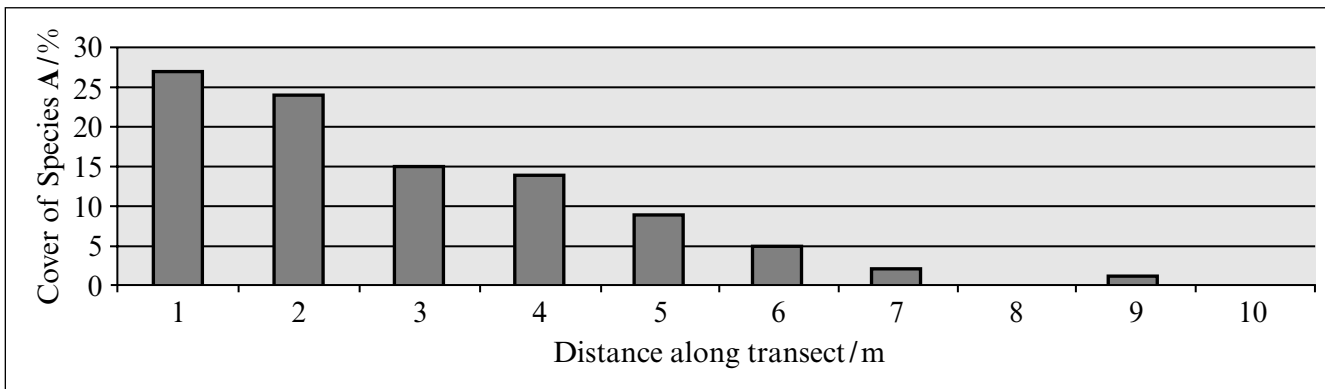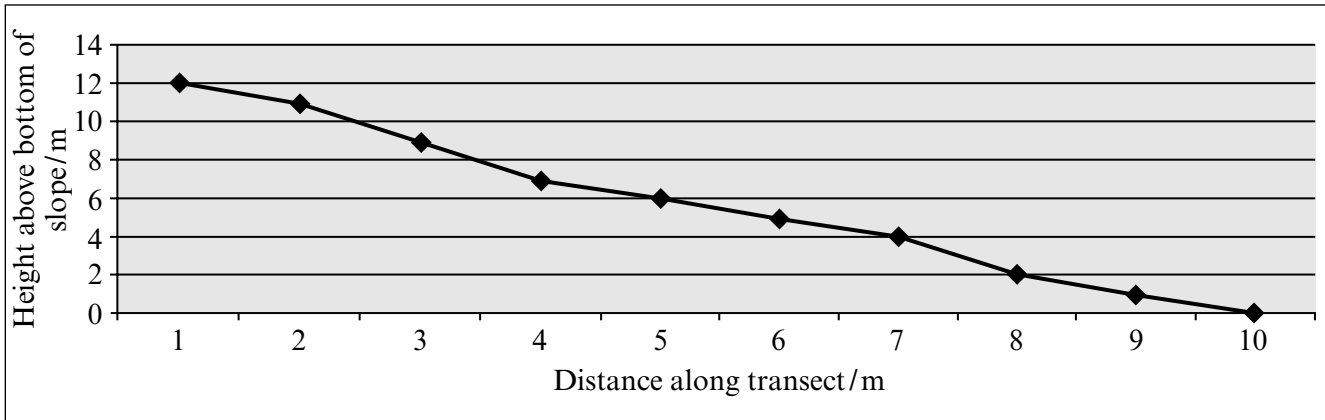
(a)   Calculate:

   (i)   the species frequency of Species **A**;

   Show your working.

Answer ....

(2 marks)

   (ii)   the mean percentage cover of Species **B**.

   Show your working.

Answer ....

(2 marks)

(b)   Suggest **one** advantage and **one** disadvantage of recording the percentage cover of the vegetation compared with counting the number of plants present in each quadrat.

   Advantage ....

   ....

   Disadvantage ....

   ....

(2 marks)

(c)   (i)   A factor possibly affecting the distribution of these two species is light intensity. Explain how light intensity is measured.

   ....

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(2 marks)

QUESTION 4 CONTINUES ON THE NEXT PAGE

Turn over ▶

(ii) Suggest **two** other factors influencing the distribution of Species **A** and **B**.

1. ....

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2. ....

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(2 marks)

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NO QUESTIONS APPEAR ON THIS PAGE

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

5 Airfields are open, man-made environments which support a large number of wildlife species.

The diagram shows the human activity and management of an airfield.

Diagram not reproduced here, due to third-party copyright constraints.

(a) The graphs show the species abundance in long grass compared with short grass from 1960–2000.

The graphs have not been reproduced here due to third-party copyright constraints.

(i) Describe the trends in the abundance of plant and animal species shown in the graphs.

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(2 marks)

(ii) Suggest reasons to explain these trends.

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(4 marks)

QUESTION 5 CONTINUES ON THE NEXT PAGE

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(b) The table shows the species diversity calculated using Simpson's Diversity Index for the areas of long grass and short grass.

	Diversity Index
Long grass	5.3
Short grass	2.6

(i) Explain the ecological significance of a high species diversity.

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(2 marks)

(ii) Suggest why it is often difficult to collect the data for calculating an index of diversity for grass species.

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(2 marks)

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6 The golden lion tamarin (*Leontopithecus rosalia*) is a small monkey living in coastal tropical rain forests in Brazil. Loss of habitat led to it becoming an endangered species. Following successful captive breeding, it is now being reintroduced into the wild.

(a) Explain what is meant by *endangered species*.

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(1 mark)

(b) Suggest why:

(i) some species do not breed successfully in captivity;

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(2 marks)

(ii) it is often difficult to reintroduce captive bred animals into the wild.

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(2 marks)

(c) With reference to suitable examples, describe methods, other than captive breeding, for conserving plant and animal species.

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QUESTION 6 CONTINUES ON THE NEXT PAGE

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(10 marks)

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END OF QUESTIONS