Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

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General Certificate of Education
June 2006
Advanced Level Examination

AQA
ASSESSMENT and QUALIFICATIONS ALLIANCE

ENVIRONMENTAL SCIENCE **ESC4**
Unit 4 Biotic Resource Management

Tuesday 27 June 2006 1.30 pm to 3.00 pm

You will need no other materials.
You may use a calculator.

Time allowed: 1 hour 30 minutes

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 marked.

Information

- The maximum mark for this paper is 70.
- 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.
- This unit assesses your understanding of the relationship between the different aspects of Environmental Science.

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

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

1 Complete the table by putting ticks to indicate whether the statements are true **or** false.

Statement	True	False
The main aim of the Countryside Stewardship Scheme has been to reduce over-production by farmers		
Vegetative propagation is a useful way of maintaining genetic uniformity		
Increasing the organic matter content of soils can increase fertility and reduce soil erosion		
The deep ocean is usually more productive than shallow areas		
Afforesting catchments may reduce flooding but may also reduce the volume of available water		

(5 marks)

5

2 (a) What is meant by the term domestication?

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(1 mark)

(b) The diagram shows a breeding programme involving wheat. Complete the diagram to show the desired outcome.

Parents:	**Parent 1** **High yield,** **low disease resistance**	×	**Parent 2** **Low yield,** **high disease resistance**

Offspring: .....

(1 mark)

(c) Explain why it is important to conserve old varieties of apple trees.

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(3 marks)

(d) (i) Outline the technique of embryo transplantation.

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(3 marks)

(ii) What are the advantages to farmers of this technique?

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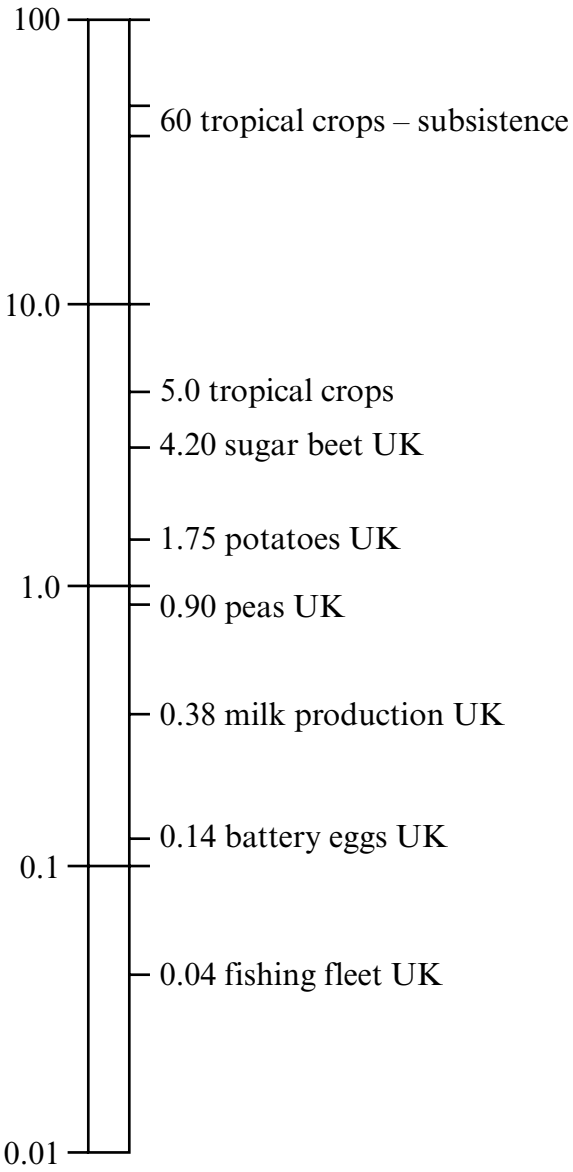
(2 marks)

3 The diagram shows energy ratios for some food crops and agricultural systems. The energy ratio is given by:

$$\frac{\text{Energy Output}}{\text{Energy Input}}$$



(a) Suggest an explanation for the *energy ratio* of:

(i) UK milk production;

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(1 mark)

(ii) subsistence farming.

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(1 mark)

(b) Outline how ocean fishing may be made more sustainable.

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(4 marks)

(c) Explain:

(i) the benefit to agricultural production systems of shortening food chains;

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(2 marks)

(ii) why organic farming is not as energy subsidised as non-organic farming.

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(2 marks)

10

4 The table summarises some of the characteristics of wild and plantation-grown teak. Teak is a valuable timber species used to make high-value furniture. In 2002, 70 % of the teak harvested in the wild was exported to richer countries. Plantations are seen as one way of helping to slow tropical forest destruction.

	Wild	**Plantation**
Growing time / years	Up to 200	20–80
Species mix	Usually hundreds of different species per hectare	Usually a monoculture
Resistance to fungal and beetle attack	High	Low

(a) Suggest why plantation-grown teak is ready for harvest faster than wild-grown teak.

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(1 mark)

(b) Using the information in the table and your own knowledge of production systems, outline how teak plantations may:

(i) conserve tropical biodiversity;

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(2 marks)

(ii) reduce tropical biodiversity.

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(3 marks)

(c) Suggest how:

(i) genetic engineering may help to improve the quality of plantation teak;

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(2 marks)

(ii) a boycott of teak in richer countries may result in cures being developed faster for diseases that are currently incurable.

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(2 marks)

10

Turn over for the next question

5 Read the following passage on the population:resource balance.

Land degradation has contributed to the decline of a number of ancient civilizations and it may now threaten our own. Such degradation, in the form of soil erosion and salinisation, results from the increased intensification of farming, itself a result of increasing population. A study of sedimentation in Mexican lakes found that episodes of major soil erosion coincided with dense farming populations. Depopulation after the Spanish conquest resulted in less sedimentation.

Intensification usually leads to reduced fallow periods. Native forms of agriculture often left the land to recover for 5–10 years before re-cultivation. This reduced soil erosion by providing cover, replenishing organic matter levels and by cycling soil nutrients between deep and surface soil layers. When farmers returned, the rejuvenated soil had gained the carbon-rich humus and nutrients needed for another crop cycle.

Unfortunately, population is now increasing faster than food production and some scientists argue that countries with less than 0.07 hectares of arable land per person cannot feed their populations without the unsustainable use of artificial fertilisers. The most successful traditional cultivation systems, such as those of eastern Asia, were able to feed a mainly vegetarian diet to about 12 persons per hectare of farmland. This involved a closed system that maintained soil fertility by mixing crops and recycling crop, animal and human wastes and provided 0.08 hectares of arable land for each person. Others argue that, if meat consumption continues to increase in poorer countries, the minimum amount of land needed per capita (per person) will be much greater.

Both the number of people and the proportion of the population experiencing a shortage of arable land are increasing. Between 1960 and 2000, the number of people living in arable land-scarce countries more than tripled from 97 million to 292 million. Ironically, many of these countries became more dependent on imports of basic foodstuffs, whilst increasing the proportion of their land used for growing cash crops for export.

(a) Explain why increasing population densities may lead to:

(i) sedimentation (lines 3–6);

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(3 marks)

(ii) salinisation (lines 3–6).

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(3 marks)

(b) Explain how, in fallow areas, nutrients may be cycled between deep and surface soil layers (line 11).

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(3 marks)

(c) Explain why:

(i) the use of artificial fertilisers is unsustainable (lines 16–17);

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(2 marks)

Question 5 continues on the next page

(ii) the minimum amount of land needed per capita (per person) will increase if more people eat meat (lines 22–23).

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(2 marks)

(d) Suggest why some countries have changed from the production of basic foodstuffs to growing cash crops (lines 28–29).

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(2 marks)

15

6 Write an essay on **one** of the following topics. Credit will be given for your understanding of the relationship between different areas of the subject, also for the organisation and presentation of the essay and use of grammar, punctuation and spelling.

EITHER (a) Discuss the scientific principles of organic farming. *(20 marks)*

OR (b) Discuss the environmental and economic importance of forests. *(20 marks)*

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(20 marks)

END OF QUESTIONS

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