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ENVIRONMENTAL SYSTEMS
STANDARD LEVEL
PAPER 3

Thursday 15 May 2008 (morning)

1 hour

Candidate session number

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INSTRUCTIONS TO CANDIDATES

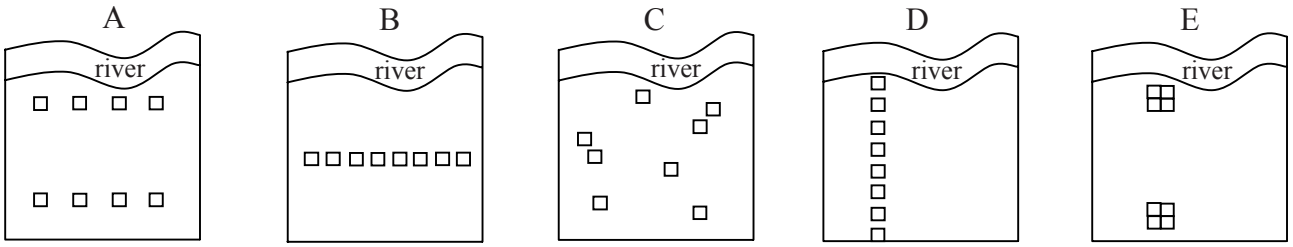
- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all the questions from Option A and all the questions from either Option B, Option C or Option D in the spaces provided.
- You may continue your answers on answer sheets. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.
- At the end of the examination, indicate the letter of the Option answered in the candidate box on your cover sheet and indicate the number of answer sheets used in the appropriate box on your cover sheet.

0114

Option A — Analysing Ecosystems

The compulsory question below relates to the detailed study of ecosystems.

A1. The following diagrams indicate possible arrangements of quadrats that might be placed in order to investigate plant communities near to a river:



(a) Identify and explain which arrangement would be the best for

(i) testing a hypothesis that the abundance of a particular species depends on their distance from a water source. *[2]*

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(ii) estimating the population size of a given species in the area shown. *[2]*

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(iii) comparing the species diversity in communities close to this length of the river with those further away. *[2]*

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(This question continues on the following page)

(Question A1 continued)

(b) In estimating the abundance of a plant species, these quadrats could be used to measure either *percentage frequency* or *percentage cover*.

(i) Describe the data that would need to be collected for each of these measurements. *[2]*

percentage frequency: . . . . . .

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percentage cover: . . . . . .

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(ii) State **one** advantage and **one** disadvantage of using percentage frequency rather than percentage cover as an estimate of abundance. *[2]*

advantage: . . . . . .

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disadvantage: . . . . . .

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(This question continues on the following page)

(Question A continued)

A2. A hypothesis states that increasing temperatures in an ecosystem will lead to an increase in the gross and net productivity of biomass in a consumer species in the ecosystem.

(a) (i) Suggest what practical procedures and calculations could be used to test this hypothesis on a population of this consumer species kept under laboratory conditions. *[6]*

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(ii) Suggest **two** assumptions that need to be made in drawing conclusions from these procedures in order to test the initial hypothesis. *[2]*

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(iii) Explain how dry weight measurements may differ from a true value of biomass. *[2]*

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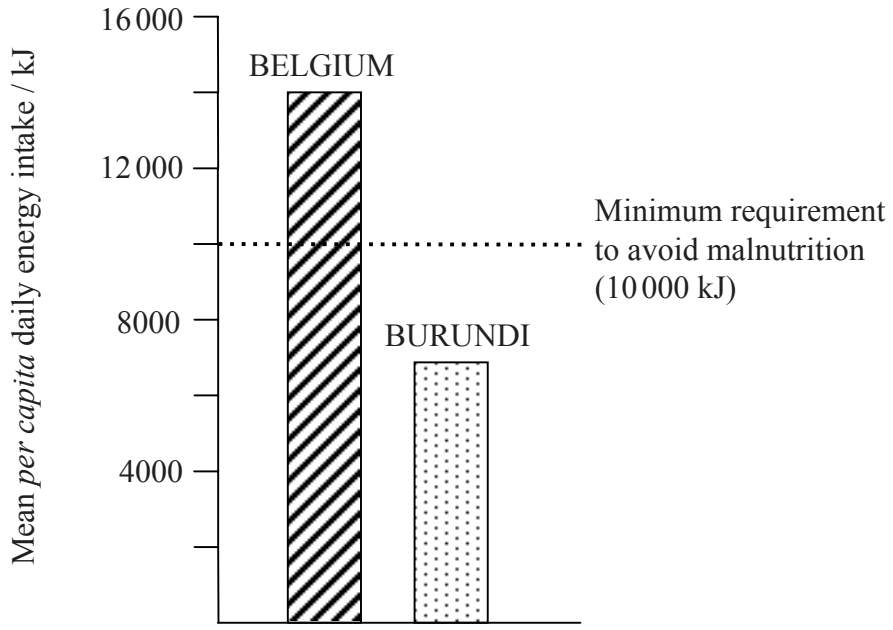
Option B — Impacts of Resource Exploitation

B1. The following bar chart shows the mean *per capita* daily energy intake (energy content of food consumed per individual) for two similarly sized countries. Belgium is a more economically developed country in western Europe, and Burundi is a less economically developed country in tropical Africa.



[Source: Adapted from Sacquet, A. (2002) *World Atlas of Sustainable Development*. Anthem Press London]

(a) The population of Belgium is 10.4 million and the population of Burundi is 6.4 million. Calculate the total annual energy consumed above the minimum requirement by the population of Belgium, and the total below the minimum requirement by the population of Burundi. *[2]*

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(b) Explain how the difference in energy intake of these two populations will affect the comparative size of their ecological footprints. *[2]*

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(This question continues on the following page)

(Question B1 continued)

(c) Other factors that affect ecological footprint are listed below. Explain how they are likely to differ in their effect on the footprint of each of these two countries. *[6]*

Methods of food production . . . . . .

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CO_2 emissions. . . . . .

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CO_2 absorption . . . . . .

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(d) In 1969 it was estimated that the energy intake of 37% of the world population fell below the minimum requirement, and in 1999 this estimate had dropped to 17% of the world population. Identify **two** strategies that may have led to this change and explain how they may have contributed to it. *[4]*

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(This question continues on the following page)

(Question B continued)

B2. The efficiency of aquatic and terrestrial food production systems can be compared by finding the proportion of incoming solar energy eventually harvested as food in a given area.

Identify **three** factors that will influence this efficiency, and explain how the effect of each is likely to differ in the two systems. *[6]*

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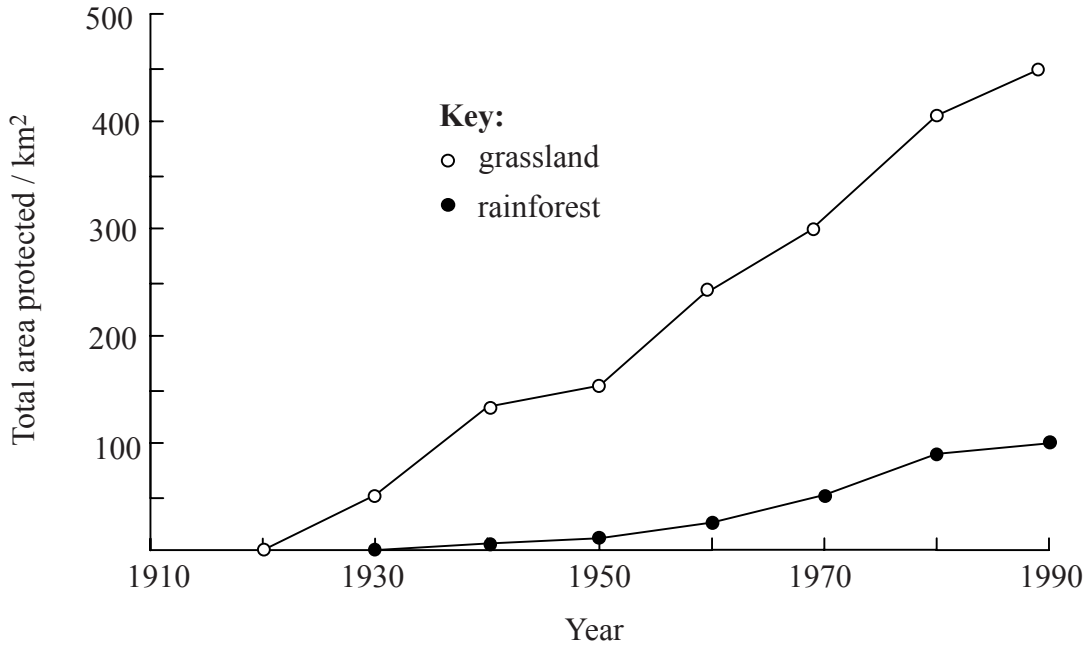
Option C — Conservation and Biodiversity

C1. (a) The following graph shows the increase in total area of two types of protected habitats in a region of Africa between 1910 and 1990.



[Source: Adapted from Sayer, J., Harcourt, C. & Collin, N. (1992) *The Conservation Atlas of Tropical Forests, Africa*. Macmillan:London]

(i) Suggest **two** reasons why there might be a greater area of grassland protected than rainforest. *[2]*

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(ii) Calculate the percentage increase in protected area for each of the two habitats over the last twenty years shown on the graph. *[2]*

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(This question continues on the following page)

(Question C1 continued)

(iii) Suggest a possible reason for the difference between these percentage increases of protected area for the two habitats. *[1]*

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(iv) Explain the significance of the increase in protected rainforest to global biodiversity. *[2]*

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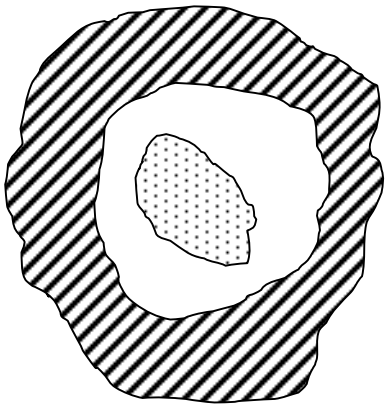
(This question continues on the following page)

(Question C1 continued)

(b) The diagram below represents the plan of a proposed nature reserve:



Key:

Transition zone: - Human settlements of limited size.

Buffer zone: - Scientific research.
- Eco-tourism.
- Sustainable exploitation by local residents.

Core zone: - No human activity.

Explain the benefits of each of these three zones for the purposes of conservation. *[4]*

Transition zone . . . . . .

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Buffer zone . . . . . .

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Core zone . . . . . .

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(This question continues on the following page)

(Question C continued)

C2. (a) The concept of biodiversity includes the diversity of species, habitats and genes. Identify which of these three, if increased, would be most likely to lead to an increase in the other two. Explain your answer. *[3]*

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(b) Describe the mechanisms that have naturally led to an increase in global species diversity in the past. *[4]*

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(c) Outline **one** relative advantage and **one** disadvantage of a conservation strategy focused on a single species compared with those focusing on whole ecosystems. *[2]*

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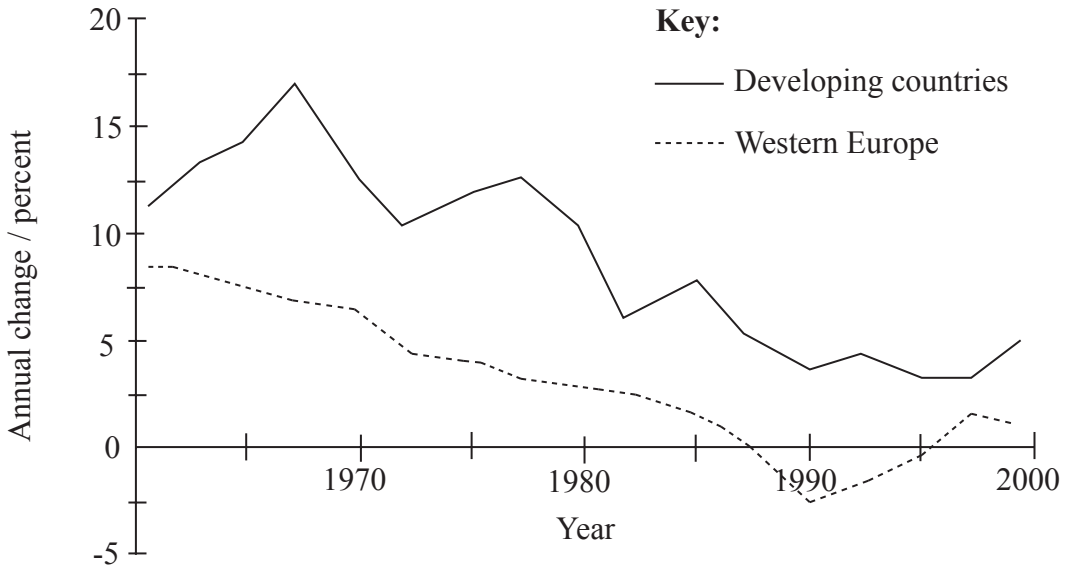
Option D — Pollution Management

D1. The following graph shows the annual percentage change in use of inorganic fertilizers in developing countries and western Europe between 1961 and 1999:



[Source: Adapted from *Mineral Fertiliser Use and the Environment* http://www.fertilizer.org/publish/pubenv/fertuse.htm]

(a) Compare the changes in fertilizer use in developing countries with those in western Europe, as shown by this data. *[2]*

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(b) If a typical developing country were using 40 000 tonnes of fertilizer in 1969, use the graph to estimate the quantity it might have used in 1970. *[2]*

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(This question continues on the following page)

(Question D1 continued)

(c) Explain how the use of inorganic fertilizers might be described as "pollution". *[2]*

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(d) Outline the processes and impacts of eutrophication in aquatic systems that may arise due to this use of inorganic fertilizers. *[6]*

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(e) State the meaning of the term BOD, and explain how it is likely to be affected by eutrophication. *[2]*

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(This question continues on the following page)

(Question D continued)

D2. The following diagram represents three stages of pollution:

(a) With reference to **named** pollutants, explain how a strategy of pollution management could be introduced at each of these **three** stages to reduce the impacts of pollution. *[3]*

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(b) Discuss a possible disadvantage of each of the three strategies of pollution management you described above. *[3]*

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