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ENVIRONMENTAL SYSTEMS AND SOCIETIES
STANDARD LEVEL
PAPER 1

Candidate session number

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Friday 4 November 2011 (afternoon)

1 hour

Examination code

8	8	1	1	–	6	3	0	1

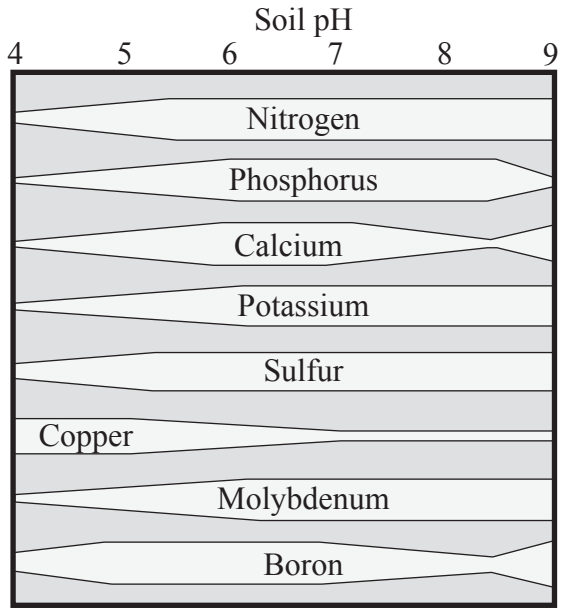
INSTRUCTIONS TO CANDIDATES

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all questions.
- Write your answers in the boxes provided.

0116

1. Figure 1 below shows the effect of soil pH on plant nutrient availability. The thickness of the band indicates the relative availability of each plant nutrient at various pH levels in a soil.

Figure 1



[Source: http://extension.missouri.edu/p/MG4. Used with permission]

(a) Predict the effect of acid deposition on potassium and copper availability to plants from this soil. *[2]*

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(This question continues on the following page)

(Question 1 continued)

(b) The population and activity of nitrogen-fixing bacteria is decreased in acid soils. Suggest **three** possible consequences of a decrease in the activity of nitrogen-fixing bacteria on the ecosystem. *[3]*

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(c) Outline **one** pollution management strategy that might reduce the impact of acid deposition in soils. *[2]*

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2. The single-celled organism *Plasmodium* spends part of its life cycle living in mosquitoes and another part of its life cycle living in humans where it causes the disease malaria.

(a) State the name of the type of interaction between *Plasmodium* and its human host. *[1]*

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(b) For humans, malaria can be a density-dependent limiting factor. Outline the concept of density-dependent limiting factors. *[2]*

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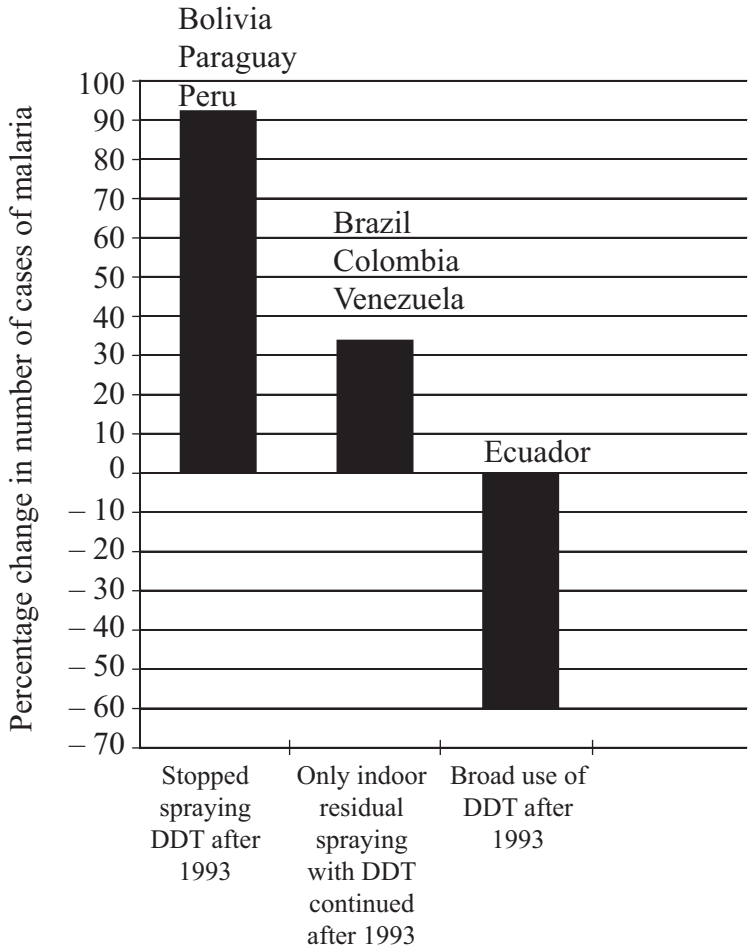
(Question 2 continued)

Some mosquitoes may carry *Plasmodium*, so they are considered to be a disease vector. One controversial strategy for the control of malaria is to use the pesticide DDT (*dichlorodiphenyltrichloroethane*) to kill the mosquito.

Figure 2 below shows the relationship between DDT use in Latin American countries and percentage change in the number of cases of malaria.

Figure 2



Roberts DR, Laughlin LL, Hsheih P and Legters LJ. "DDT, Global Strategies, and a Malaria Control Crisis in South America". Journal: *Emerg Infect Dis.* 1997, Sep, Vol. 3, No. 3. Figure 7. Available from http://wwwnc.cdc.gov/eid/article/3/3/97-0305.htm

(c) (i) Identify **four** countries on the graph where DDT is still in use. *[1]*

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(Question 2 continued)

(ii) The World Health Organization (WHO) has categorized DDT as a persistent organic pollutant (POP). The Stockholm Convention on Persistent Organic Pollutants is an international treaty that aims to eliminate or restrict the production and use of POPs. Within the Convention is the following provision:

WHO recommends only indoor residual spraying (spraying only on the inside walls of buildings) of DDT for disease vector control.

With reference to Figure 2, evaluate this provision. *[3]*

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(iii) Suggest why an ecocentrist position might be opposed to indoor residual spraying. *[2]*

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(Question 2 continued)

(iv) Rachel Carson's book *Silent Spring* drew attention to the environmental impact of DDT on top carnivores. Explain the vulnerability of top carnivores to non-biodegradable toxins, such as DDT, entering food chains. *[2]*

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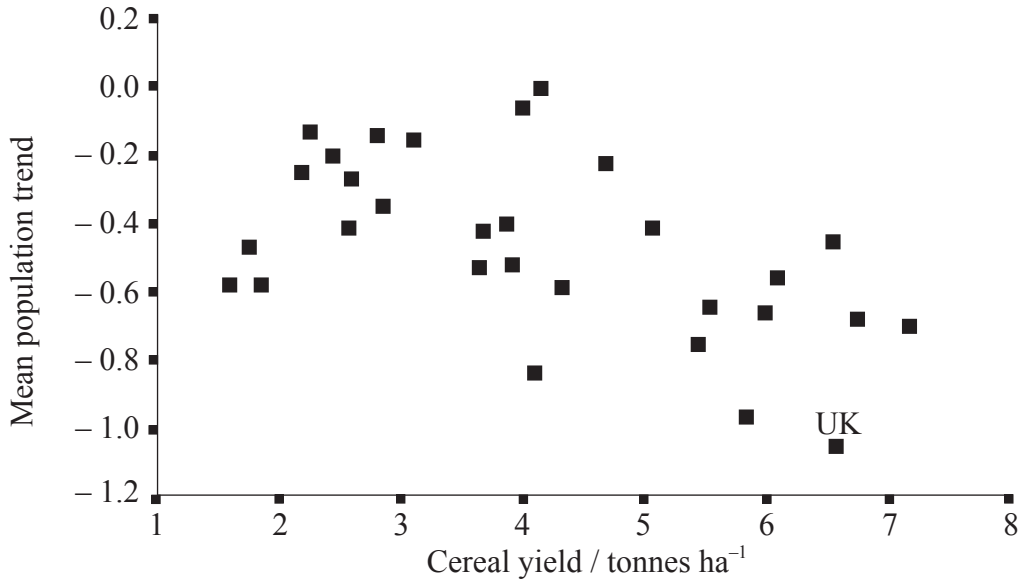
3. Many birds such as the Corn Bunting (*Miliaria calandra*), the Grey Partridge (*Perdix perdix*), the Linnet (*Carduelis cannabina*) and the Yellowhammer (*Emberiza citrinella*) occupy niches around farmland. They can serve as indicator species. Farmland birds use the combined natural and agricultural habitats to nest and feed. In agricultural areas, permanent grassland, hedgerows, tree lines, wetlands and ponds provide habitat diversity and resources. Crops provide food sources such as seeds, and host other food sources such as insects and other animals.

Figure 3 below shows the changes in farmland bird populations in a number of European countries over twenty years and the cereal yield in each of those countries in 1993. The British Royal Society for the Protection of Birds has argued that there is a correlation between intensive agriculture practices and bird populations.

Figure 3



Donald *et al*. 268 (1462): 25. "Agricultural intensification and the collapse of Europe's farmland bird populations". Fig. 4. Journal: *Proceedings of the Royal Society B: Biological Sciences*. © 2001. Used with permission.

(a) With reference to Figure 3, determine the cereal yield in the UK in 1993. *[1]*

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(Question 3 continued)

(b) List **two** inputs that are necessary to achieve high cereal yields. *[2]*

1. . . . . .

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(c) Outline the relationship between changes in farmland bird populations and cereal yield. *[2]*

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(d) Suggest **three** causes of changes in farmland bird populations. *[3]*

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(Question 3 continued)

(e) Outline the concept of an indicator species. *[2]*

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(f) The Corn Bunting, the Grey Partridge, the Linnet and the Yellowhammer are all birds with Red List conservation status. Other than reduction in population size, list **two** factors which are used to determine a species' Red List conservation status. *[2]*

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will not be marked.

4. Figure 4 below shows the effect of temperature and precipitation on nutrient storage and flow for several biomes. Circles represent storage compartments and arrows represent flows. The size of the circle is proportional to the amount of nutrient stored and the width of the arrows is proportional to the rate of nutrient flow.

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(a) Outline the changes in the size of the store of nutrients in the biomass compartment with increasing temperature and precipitation. *[2]*

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(Question 4 continued)

(b) Explain whether the process indicated by the arrow connecting the litter compartment and the soil compartment is a transfer **or** a transformation process. *[3]*

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(c) Identify the biome where the soil compartment represents the largest store of nutrients. *[1]*

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(d) The enhanced greenhouse effect is predicted to lead to climate changes such as increased precipitation in some areas and decreased precipitation in other areas. Using Figure 4, predict the effect on **nutrient cycling** of increased precipitation over many years in a region that is currently a steppe. *[3]*

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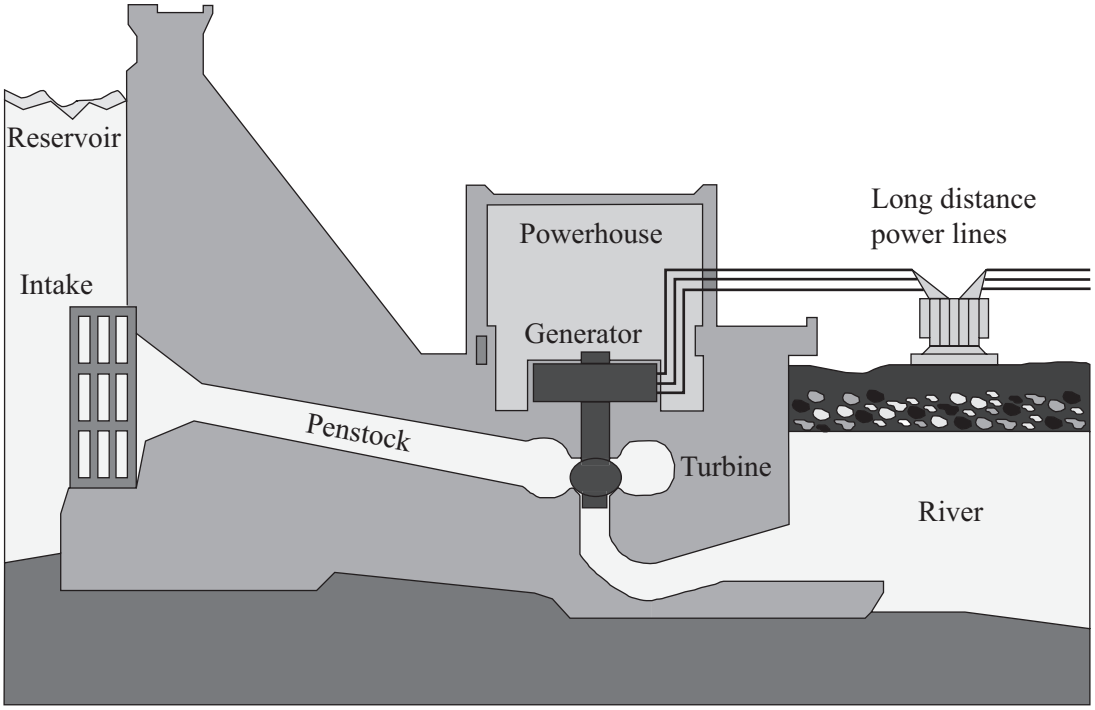
5. Energy from the Sun powers the water cycle. This energy can be harnessed by blocking the flow of rivers with dams. The controlled release of water through the dam transfers energy for the generation of hydroelectricity.

Figure 5 Hydroelectric dam



[Source: http://en.wikipedia.org/wiki/File:Hydroelectric_dam.svg. Author: Tomia.]

(a) State whether the water used for the generation of hydroelectricity is a renewable, replenishable **or** non-renewable resource. *[1]*

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(b) Other than the production of hydroelectricity, identify **one** form of natural income that might be derived from the damming of rivers. *[1]*

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(Question 5 continued)

(c) Outline **one** way in which a hydroelectric dam might contribute to the ecological footprint of a country. *[1]*

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(d) When a new dam is proposed, an environmental impact assessment (EIA) will often be commissioned. Describe the stages of an EIA. *[3]*

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