IB DIPLOMA PROGRAMME
PROGRAMME DU DIPLÔME DU BI
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N04/4/ENVSY/SP3/ENG/TZ0/XX

88046412

ENVIRONMENTAL SYSTEMS
STANDARD LEVEL
PAPER 3

School code

Candidate code

Thursday 11 November 2004 (morning)

1 hour

INSTRUCTIONS TO CANDIDATES

- Write your school code and candidate code 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 school code and candidate code 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.

Option A – Analysing Ecosystems

A1. (a) (i) Name and briefly describe an ecosystem you have studied. *[1]*

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(ii) State **two** abiotic factors significant in the ecosystem. *[1]*

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(iii) Outline and evaluate a method to measure **one** of the selected abiotic factors. *[3]*

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(b) Name an organism found in the ecosystem specified above. Describe and evaluate a method for estimating its abundance. *[4]*

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(This question continues on the following page)

(Question A1 continued)

Two areas of forest each contain 50 trees. The species composition of the two areas is as follows.

	Area A	**Area B**
Eucalyptus	42	25
Casurina	8	25

(c) Simpson's diversity index can be calculated by applying the formula below,

$$D = \frac{N(N-1)}{\sum n(n-1)}$$

where: N = total number of organisms of all species,

n = number of organisms of a particular species.

(i) Calculate Simpson's diversity index for area B (showing your working). *[2]*

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(ii) Simpson's diversity index for area A is 1.38. Suggest a reason for the difference between the values for these two areas. *[1]*

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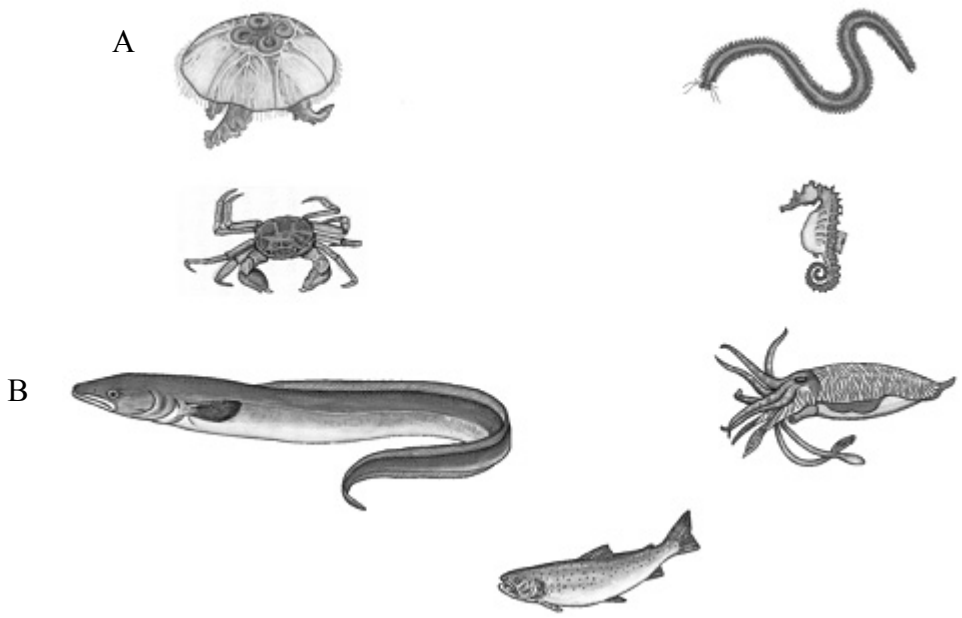
A2. The organisms shown below were found in a European estuary.



(Not drawn to scale)

[Source: modified from J Adds *et al.*, (1997), *The Organisms and the Environment*, Nelson, page 158]

(a) Suggest **three** visible characteristics of the organisms shown in the diagram which could be used to construct part of a key to identify them. *[3]*

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(b) If you actually collected organisms A and B from the estuary, suggest **two** other characteristics which might help you to identify them. *[2]*

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(c) State **one** limitation of using a key to identify an organism. *[1]*

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(This question continues on the following page)

(Question A2 continued)

(d) Outline **two** practical problems that you might have when trying to estimate the biomass of the population of any organism living in an estuarine ecosystem. *[2]*

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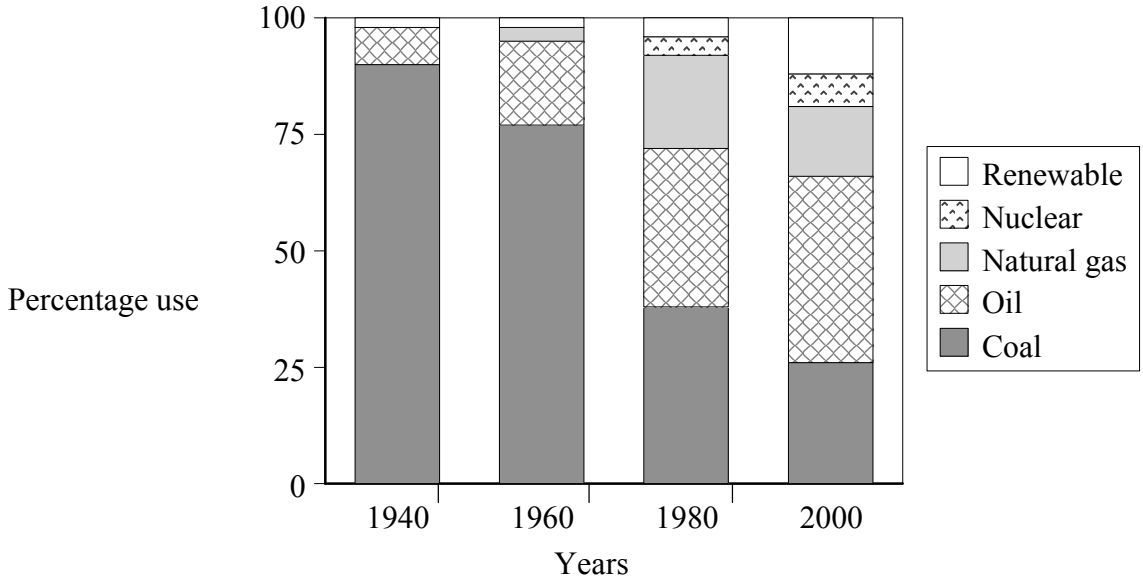
Option B – Impacts of Resource Exploitation

B1. The figure below shows the changes in the percentage use of various sources of energy in a developed country between 1940 and 2000.



[Source: D Waugh (1995), *Geography – An Integrated Approach*, Nelson, page 491]

(a) Describe the changes in the use of the sources of energy in the country between 1940 and 2000. *[2]*

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(b) List **two** advantages and **two** disadvantages of using solar power to produce electricity.

(i) Advantages *[1]*

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(ii) Disadvantages *[1]*

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(This question continues on the following page)

(Question B1 continued)

(c) Describe the inputs and outputs of materials for a named commercial farming system, in **either** a terrestrial **or** an aquatic environment. *[4]*

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B2. The table below shows total world and *per capita* grain production for certain years between 1950 and 2000.

Year	World Grain Production / 10^6 tons	*Per Capita* Grain Production / kg person^{-1}
1950	600	250
1960	750	275
1970	1000	290
1980	1400	330
1990	1600	320
2000	1800	290

[Source: data from US Department of Agriculture and Worldwatch Institute, 2001]

(a) Calculate the percentage **increase** in world grain production and *per capita* production between 1950 and 2000.

(i) world grain production: . . . . . *[1]*

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(ii) *per capita* grain production: . . . . . *[1]*

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(b) Describe and explain the data for *per capita* grain production shown in the table. *[4]*

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(Question B2 continued)

(c) Suggest **one** advantage and **one** disadvantage of meat production.

(i) Advantage *[1]*

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(ii) Disadvantage *[1]*

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(d) (i) Define the term *ecological footprint*. *[1]*

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(ii) Suggest the likely difference between the ecological footprint of a city in a developed country and the ecological footprint of a population of the same size in a developing country. Explain your answer. *[3]*

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Option C – Conservation and Biodiversity

C1. The table below shows estimates of the world's bird species.

Total known bird species	9 600
Bird species declining in number	6 500
Bird species threatened with extinction	1 100

[Source: data from The World Conservation Union, *Red List of Threatened Animals*, 1996]

(a) State **two** factors that can lead to the loss of diversity in birds. *[1]*

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(b) Discuss any possible sources of inaccuracy in these data. *[2]*

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(c) Outline problems for the conservation of bird species that migrate over very long distances. *[2]*

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C2. (a) Define the term *habitat diversity*. *[1]*

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(b) Outline the range of habitat diversity in a **named** protected area you have studied. *[2]*

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(c) Explain how the habitat diversity in the environment you named in C2 (b) might influence the area's species diversity. *[4]*

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C3. (a) It has been suggested that "extinction is a natural process therefore we should not worry about the loss of biodiversity". Give **two** reasons why you **either** agree **or** disagree with this statement. *[2]*

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(b) List **two** advantages and **two** disadvantages of the role of captive breeding programs and zoos in the conservation of endangered species.

(i) Advantages *[2]*

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(ii) Disadvantages *[2]*

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(c) Evaluate the strengths and weaknesses of the Convention on International Trade in Endangered Species (CITES). *[2]*

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Option D – Pollution Management

D1. The data in the table below are for three toxic metals that reach the North Sea in Western Europe. The units are tonnes yr^{-1}.

Sources	Mercury	Lead	Zinc
Rivers	21	1 000	7 500
Atmosphere	15	6 000	8 000
Direct discharges	22	700	9 600

[Source: A Mas and J Azcue, (1993), *Metales en Sistemas Biológicos*, PPU, page 190]

(a) (i) Determine which metals represent the largest and the smallest inputs into the North Sea. *[1]*

Largest: . . . . . .

Smallest: . . . . . .

(ii) Calculate the percentage of lead that reaches the North Sea from the atmosphere. *[1]*

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(b) Suggest pollution management strategies that could be used for industrial pollutants such as the metals listed in the table above. *[3]*

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(c) State **one** example of a non-point source of pollution. *[1]*

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D2. A high percentage of the world's lakes are classified as eutrophic.

(a) Describe the major characteristics of a eutrophic lake. *[3]*

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(b) State **two** strategies that might be used for clean up and restoration of a eutrophic lake. *[2]*

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(c) Outline an indirect method that could be used to measure pollution. *[2]*

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D3. The graph below shows the *per capita* waste generation rate for different household sizes.

[Source: modified from Rhyner *et al.* (1995), *Waste Management and Resource Recovery*, CRC Press, page 30]

(a) Describe and explain the data shown in the graph. *[3]*

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(b) Outline **four** strategies which could reduce the problem of solid waste in your local area. *[4]*

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