IB DIPLOMA PROGRAMME
PROGRAMME DU DIPLÔME DU BI
PROGRAMA DEL DIPLOMA DEL BI

N03/460/S(3)

ENVIRONMENTAL SYSTEMS
STANDARD LEVEL
PAPER 3

Candidate number

Monday 17 November 2003 (morning)

1 hour

INSTRUCTIONS TO CANDIDATES

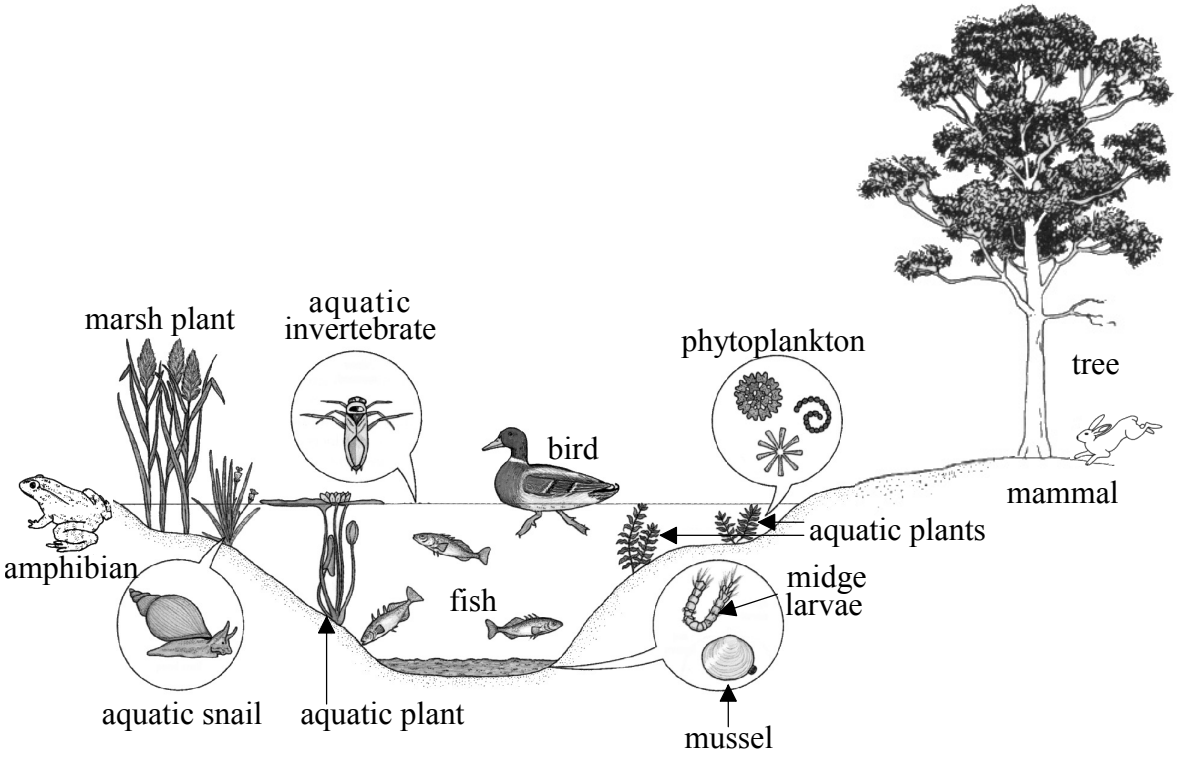
- Write your candidate number in the box above.
- Do not open this examination paper until instructed to do so.
- Answer all the questions from Option A and all the questions from either Option B, Option C or Option D in the spaces provided.
- You may continue your answers on answer sheets. Write your candidate 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 letters of the Options 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

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

A1. (a) Examine the diagram below. It is not intended to represent any particular ecosystem and the organisms are not shown to the same scale. Choose **one** of the organisms shown in the diagram.

Write its name here . . . . . .



[Source: Adapted from Adds, J *et al. The Organism and the Environment*, 2nd edition (1997), page 81]

For the **organism** you have chosen, describe and evaluate a method for estimating its abundance. *[5]*

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(This question continues on the following page)

(Question A1 continued)

(b) Explain why it might be important to know the abundance of the species of organisms in an ecosystem in assessing that ecosystem's diversity. *[2]*

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(c) State how you would attempt to identify an organism with which you were unfamiliar. *[2]*

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(This question continues on the following page)

(Question A1 continued)

(d) (i) Name and briefly describe an ecosystem of which you have made a special study. *[1]*

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(ii) Describe **one** human activity that might influence your chosen ecosystem. *[1]*

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(iii) State **one** abiotic factor that might be changed by this human activity. *[1]*

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(iv) Explain how this human activity might change the abiotic factor. *[2]*

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(v) Outline how you would measure changes in this abiotic factor. *[2]*

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(This question continues on the following page)

(Question A1 continued)

(e) (i) Explain, with an example, what is meant by the term *environmental gradient*. *[2]*

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(ii) Explain how you would measure the changes in the species diversity of an ecosystem along an environmental gradient. *[2]*

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Option B – Impacts of Resource Exploitation

B1. The table below provides data on the ecological footprints of several countries.

Country	Total area / km^2	Population	Footprint / hectares per head of population	Total footprint of population / km^2
Australia	7 700 000	18 000 000	10.0	1 800 000
China	11 000 000	1 200 000 000	1.5	18 000 000
Singapore	580	3 000 000	6.2	200 000

[Source of data: *Commonwealth of Australia*, Department of Environment Sport and Territories, 1996, and other sources]

(a) (i) Explain the term *ecological footprint*. *[2]*

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(ii) Compare the ecological footprints of the countries in the table, and explain the differences between them. *[5]*

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(This question continues on the following page)

(Question B1 continued)

(b) A government is considering the building of a new power station to meet the country's rising demand for energy. The choice at present lies between an oil-fired power station and a nuclear power station. State **one** advantage and **one** disadvantage of each. *[2]*

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(c) State **two** other strategies, besides the building of a nuclear or oil-fired power station, that might be adopted to help meet the energy needs of the people of the country. State an advantage for each of the strategies you suggest. *[2]*

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(This question continues on the following page)

(Question B1 continued)

(d) (i) Describe the characteristics of a **named** food production system, listing its inputs and outputs. *[4]*

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(ii) Outline **one** impact that the system in (d)(i) has on its environment. *[2]*

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(e) Suggest, giving reasons, **three** changes in the world food production system that may occur in the next 50 years. *[3]*

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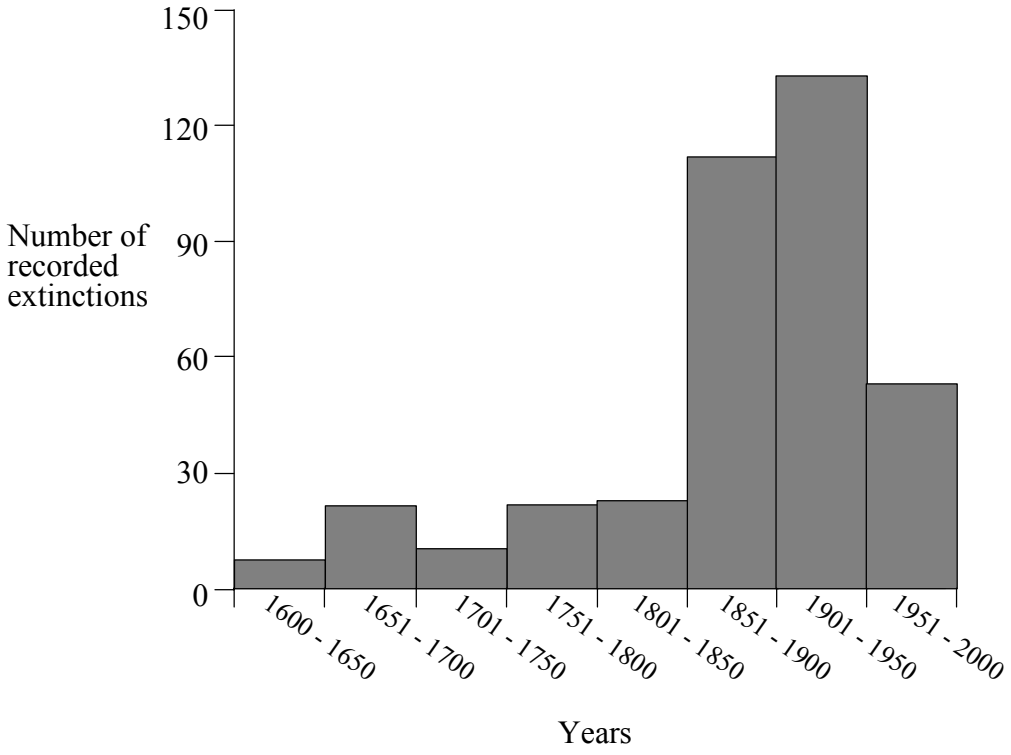
Option C – Conservation and Biodiversity

C1. The graph below, shows the number of animal species that have become extinct in each 50 year period since 1600.



[Source: Based on material in a scientific paper by F D M Smith and others 1993, *Biodiversity Assessment: A Guide to Good Practice*, London, HMSO, 1996]

(a) Describe and explain the changes in the extinction rate represented by the data in the graph. *[5]*

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(Question C1 continued)

(b) State **four** factors that might increase the likelihood of a species becoming extinct. *[2]*

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(c) Distinguish between the terms *endangered* and *extinct*. *[2]*

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(d) Name a species that has become extinct **since 1600**, and state **two** reasons for its becoming extinct. *[3]*

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(This question continues on the following page)

(Question C1 continued)

(e) (i) Name and briefly describe an area or ecosystem that has been protected to preserve its biodiversity. *[2]*

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(ii) Outline **three** measures that have been introduced to protect the organisms and ecosystem(s) in the area named in (e) (i) above, and evaluate their success. *[5]*

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(f) Distinguish between *genetic diversity* and *habitat diversity*. *[1]*

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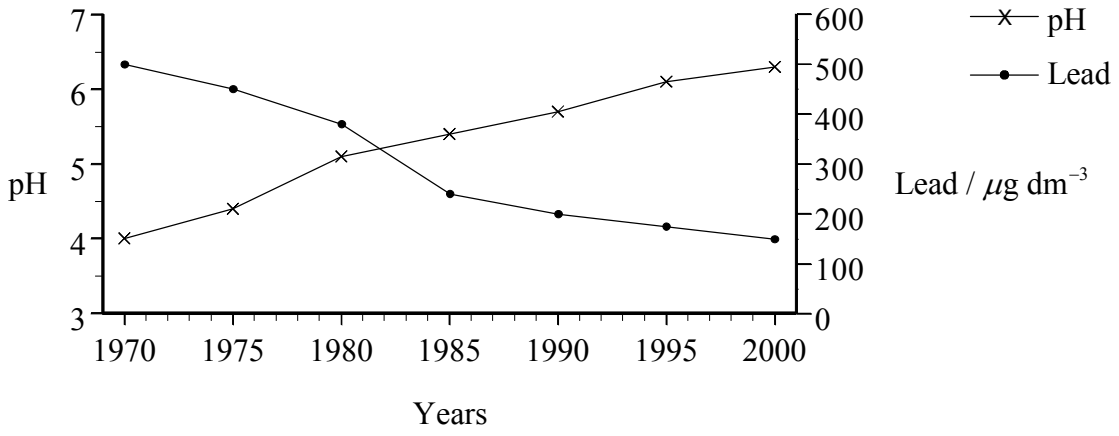
Option D – Pollution Management

D1. The graph below shows the pH and concentrations of lead (Pb) in the water of a lake for selected years between 1970 and 2000.



(a) Identify the year in which *[1]*

(i) the concentration of lead in the water was highest. . . . . .

(ii) the water was most acidic. . . . . .

(b) From the data in the graph, state whether the quality of the water in the lake has improved **or** deteriorated. Give a reason for your answer. *[1]*

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(c) Explain the changes shown by the graph. *[3]*

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(This question continues on the following page)

(Question D1 continued)

(d) Outline **one indirect** method of measuring the pollution levels in a lake. *[2]*

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(e) (i) Define the term *eutrophication*. *[1]*

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(ii) State **three** environmental effects of eutrophication. *[3]*

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(f) Describe a strategy for the cleaning up and restoration of a eutrophic lake. *[5]*

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(This question continues on the following page)

(Question D1 continued)

(g) State **two** advantages and **two** disadvantages of incineration as a method of disposal of domestic (municipal) waste.

(i) Advantages: *[2]*

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(ii) Disadvantages: *[2]*

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