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

M04/715/S(1)+

ECOSYSTEMS AND SOCIETIES
STANDARD LEVEL
PAPER 1

Candidate number

Tuesday 11 May 2004 (afternoon)

1 hour 15 minutes

INSTRUCTIONS TO CANDIDATES

- Write your candidate number in the box above.
- Do not open this examination paper until instructed to do so.
- Answer all of the questions 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 using the tag provided.
- At the end of the examination, indicate the number of answer sheets used in the appropriate box on your cover sheet.

1. (a) (i) Outline the concept of an ecological footprint as applied to a country. *[1]*

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(ii) The table below shows the breakdown of the ecological footprint (in hectares) for an average Canadian.

	Energy	**Built Environment**	**Agricultural Land**	**Forest**	**Total**
Food	0.4	0.0	0.9	0.0	1.3
Housing	0.5	0.1	0.0	1.0	1.6
Transport	1.0	0.1	0.0	0.0	1.1
Consumer goods	0.6	0.0	0.2	0.2	1.0
Resources in services	0.4	0.0	0.0	0.0	0.4
Total	2.9	0.2	1.1	1.2	5.4

[Source : *Sustainable Consumption and Production* , www.iisd.ca/linkages/consume/mwfoot.html]

Calculate the percentage of the ecological footprint required for the combined total of agricultural land and forest. *[1]*

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(iii) Peru, a less economically developed country (LEDC), has an energy component of 16.0 % within its ecological footprint, whereas Canada has an energy component of 53.7 %. Suggest reasons for this difference. *[2]*

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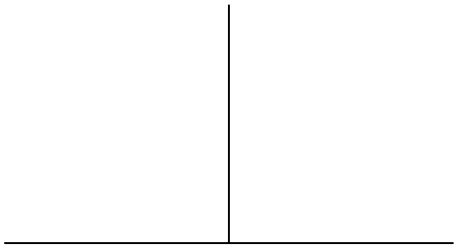
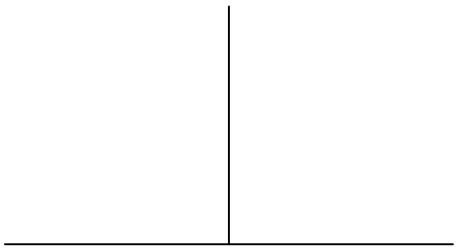
(Question 1 continued)

(b) Draw the outline of an age/sex pyramid for

(i) a less economically developed country (LEDC). *[1]*



(ii) a more economically developed country (MEDC). *[1]*



(c) (i) State **two** factors that may reduce birth rate. *[1]*

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(ii) State **two** factors that may reduce death rate. *[1]*

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(iii) Outline the difference between LEDCs and MEDCs in terms of dietary composition and explain what impact this has on ecological footprint size. *[3]*

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2. (a) Distinguish between the terms *renewable*, *replenishable* and *non-renewable natural capital*, giving an example of each. *[3]*

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(b) Define the term *sustainability*. *[1]*

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(c) Explain, using an example, how the status of a resource may change over time. *[3]*

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(Question 2 continued)

(d) The table below gives data for recruitment and growth, and harvesting of salmon (*Salmo salar*) over a ten year period.

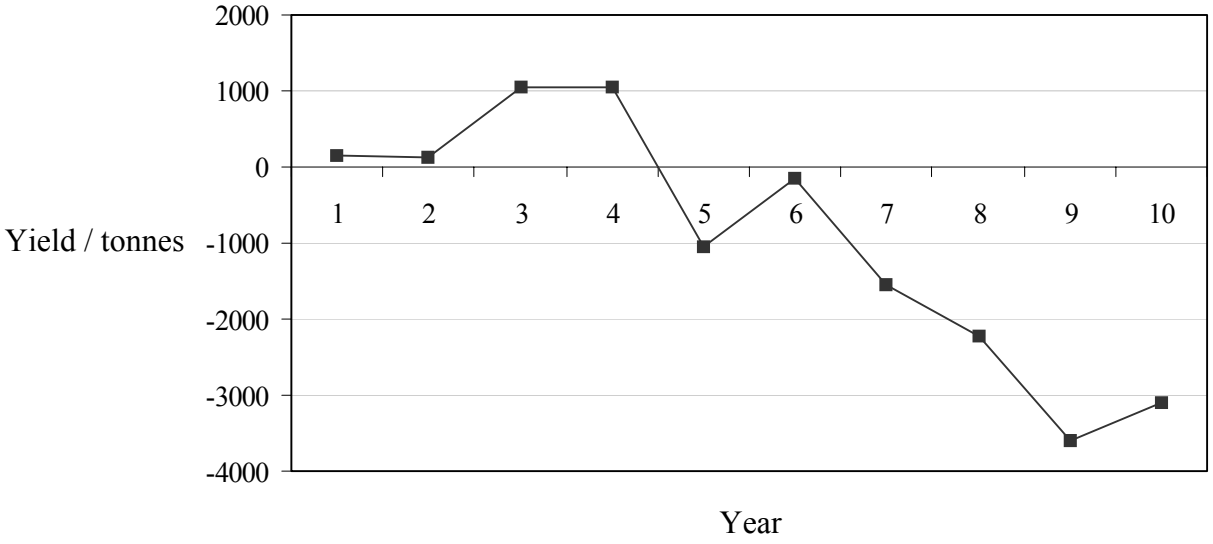
Year	Recruitment and growth / tonnes	Harvesting / tonnes	Yield / tonnes
1	23400	23250	150
2	23425	23300	?
3	24450	23400	1050
4	24560	23500	1060
5	22345	23400	–1055
6	24356	?	– 144
7	23450	25000	–1500
8	22900	25125	–2225
9	21000	24600	–3600
10	21210	24300	–3090

(i) Calculate the missing values for year 2 and year 6. *[1]*

Year 2 . . . . . .

Year 6 . . . . . .

The yield data from the table above is shown in the following graph.



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(Question 2 continued)

(ii) Identify the year in which harvesting first becomes unsustainable. *[1]*

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(iii) Predict what will happen if the apparent trend shown in the graph continues. *[1]*

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(iv) Outline **two** factors that cause humans to use resources unsustainably. *[2]*

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3. (a) (i) State the first law of thermodynamics. *[1]*

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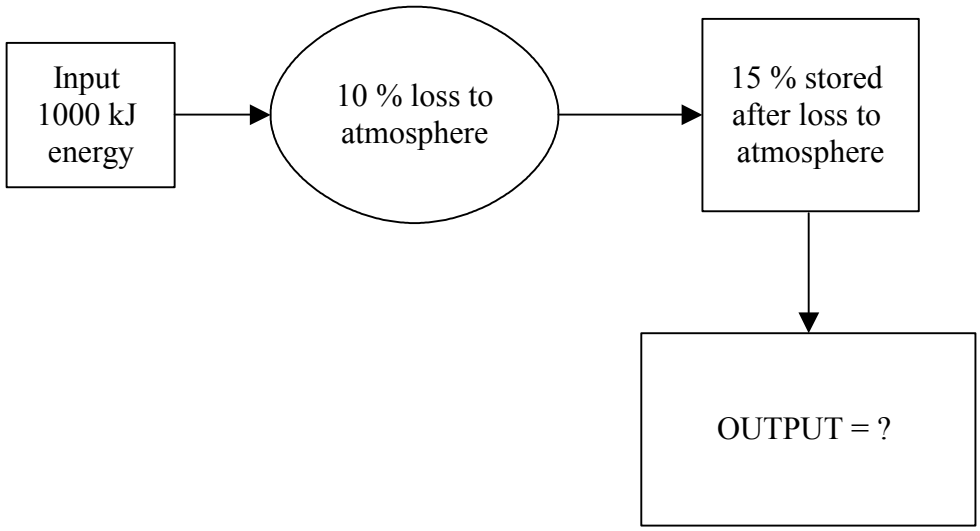
(ii) Calculate the amount of energy output in the model below. *[2]*



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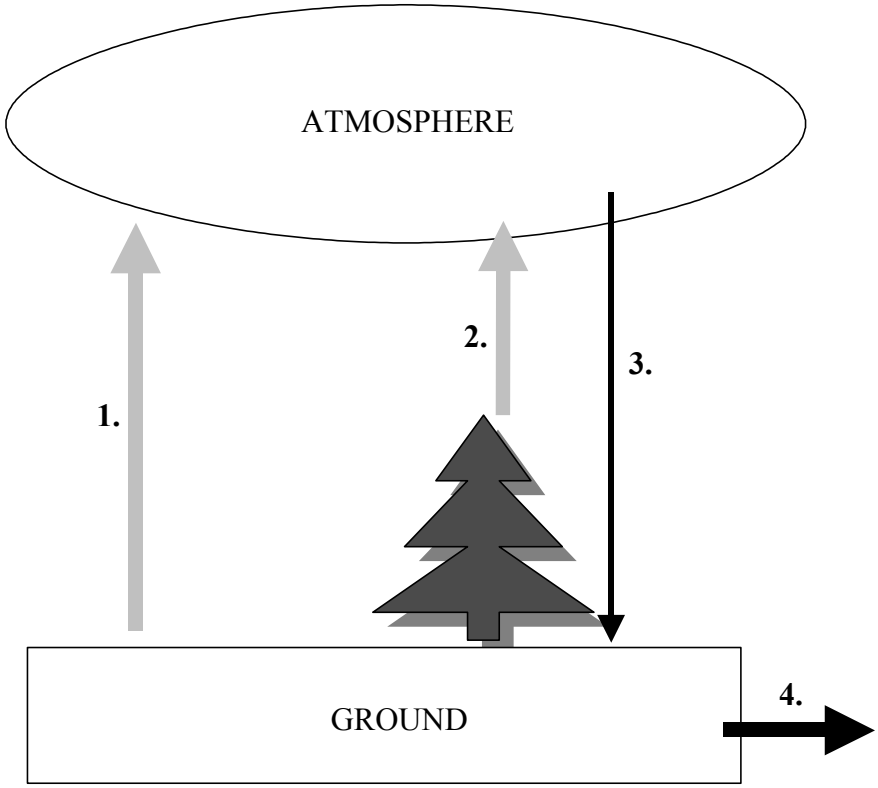
(Question 3 continued)

(b) The diagram below represents a simplified hydrological cycle.



(i) Identify the processes corresponding to the arrows labelled 1 to 4 in the diagram. *[2]*

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(ii) Suggest **one** weakness in the model above. *[1]*

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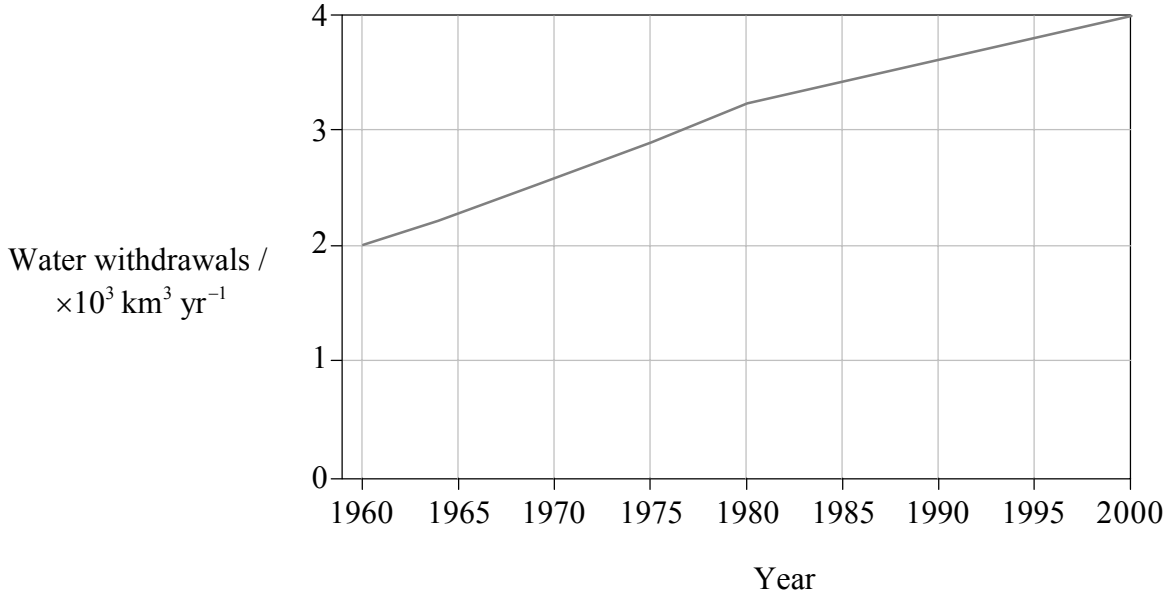
(Question 3 continued)

The graph below shows the estimated world water withdrawals from 1960 to 2000.



[Source: J Loh (editor), *The Living Planet Report 2000*, (2002), WWF]

(iii) Calculate the percentage increase in world water withdrawals from 1960 to 2000. *[2]*

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(iv) Suggest **three** reasons for the increase in water withdrawals during the period 1960 to 2000. *[3]*

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4. (a) (i) Outline the process of eutrophication. *[2]*

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(ii) State **one** method of preventing eutrophication. *[1]*

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(iii) State **one** method of dealing with eutrophication after it has occurred. *[1]*

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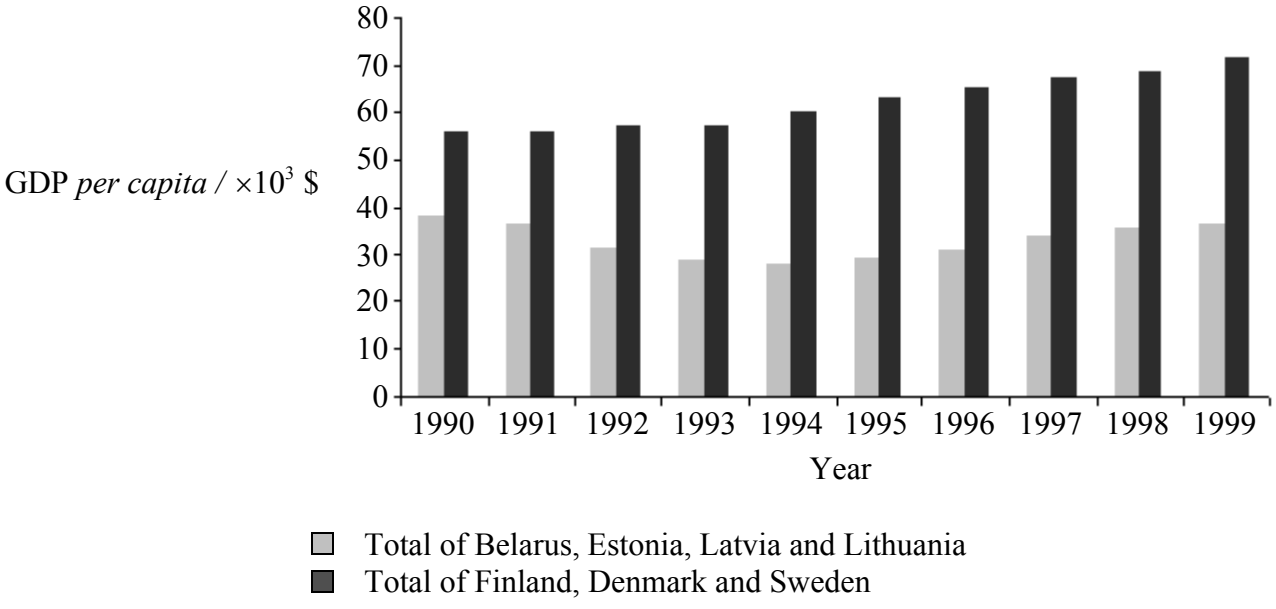
The following graphs show the gross domestic product (GDP) and the phosphate fertilizer use for countries bordering the Baltic Sea. (GDP is the market value of all goods and services produced in a year. It is used as an indicator of the size of an economy.)

Graph A: GDP *per capita* between 1990 and 1999 for countries bordering the Baltic Sea



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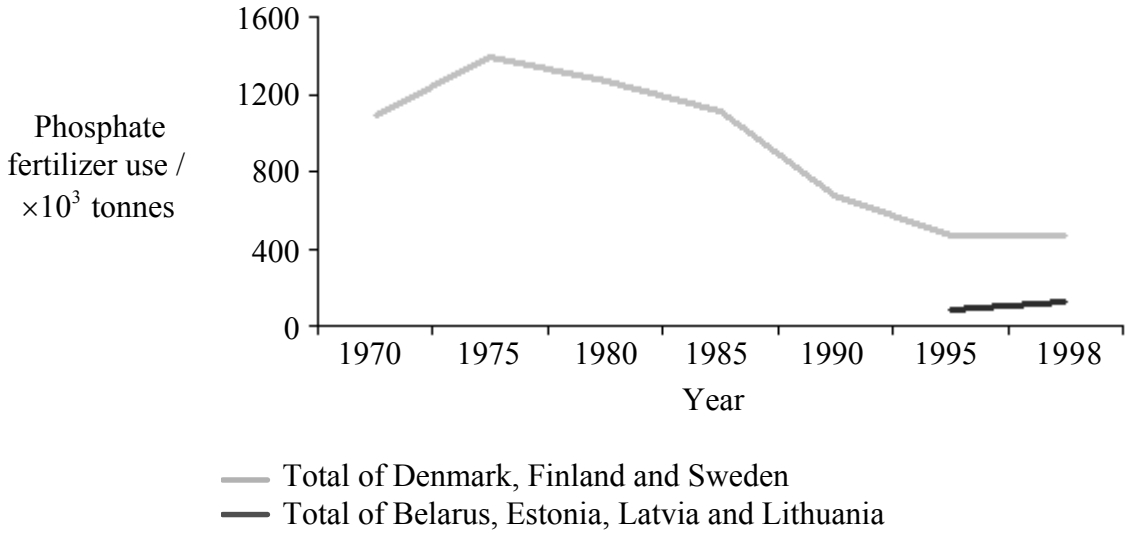
(Question 4 continued)

Graph B: Phosphate fertilizer use in countries bordering the Baltic Sea between 1970 and 1998



[Source: Adapted from *Eutrophication in the Baltic Sea*, Baltic on-line interactive geographical and environmental information service, www.grida.no/boing/drivingforces]

(iv) Suggest **two** strategies that may have been implemented to reduce use of phosphate fertilizers by Denmark, Finland and Sweden. *[2]*

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(v) Suggest why the use of phosphate fertilizers has increased in Belarus, Estonia, Latvia and Lithuania. *[2]*

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(Question 4 continued)

(b) Simpson's diversity index states that: $D = \frac{N(N-1)}{\sum n(n-1)}$

where N = the total number of individuals of all species found and n = the number of individuals of a particular species.

A garden pond contains the following organisms.

	Number of individuals
gold fish	24
carp	5
frogs	6
water boatmen	1500
water snail	1200
water flea	2500

(i) Using the Simpson diversity index formula above, calculate the diversity of this pond. *[3]*

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(ii) Run-off from an adjacent agricultural field has been entering the garden pond. Outline the possible impact on the pond's biota. *[2]*

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(c) (i) Suggest a method for recycling organic waste. *[1]*

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(Question 4 continued)

(ii) Explain why the method identified in (i) may be difficult to implement. *[2]*

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