INTERNATIONAL BACCALAUREATE
BACCALAURÉAT INTERNATIONAL
BACHILLERATO INTERNACIONAL

ENVIRONMENTAL SYSTEMS
STANDARD LEVEL
PAPER 2

Thursday 11 May 2000 (afternoon)

1 hour

Name

Number

INSTRUCTIONS TO CANDIDATES

- Write your candidate name and number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: Answer Section A in the spaces provided.
- Section B: Answer one question from Section B. You may use the lined pages at the end of this paper or continue your answers in a continuation answer booklet, and indicate the number of booklets used in the box below. Write your name and candidate number on the front cover of the continuation answer booklets, and attach them to this question paper using the tag provided.
- At the end of the examination, indicate the number of the Section B question answered in the box below.

QUESTIONS ANSWERED		EXAMINER	TEAM LEADER	IBCA
SECTION A	1	/20	/20	/20
SECTION B	. . . .	/20	/20	/20
NUMBER OF CONTINUATION BOOKLETS USED	. . . .	TOTAL /40	TOTAL /40	TOTAL /40

SECTION A

This question must be attempted by ***all*** *candidates in the spaces provided.*

1. The table below shows annual production and respiration in kcal m^{-2} $year^{-1}$ in five ecosystems.

Ecosystem	**A**	**B**	**C**	**D**	**E**
Gross Primary Productivity (GPP)	24 400	12 200	11 500	20 800	45 000
Autotrophic Respiration (AR)	9200	4700	6400	12 000	32 000
Net Primary Productivity (NPP)					
Heterotrophic Respiration (HR)	800	4600	3000	6800	13 000
Net Community Productivity (NCP)	14 400	2900	2100	2000	0

Net Community Productivity (NCP) = Net Primary Productivity (NPP) + Secondary Productivity (SP)

Ecosystems:

A = Alfalfa grass field
B = young pine plantation
C = medium aged oak-pine forest
D = large river
E = mature tropical rainforest

[Adapted from Odum, E. P. (1975) *Fundamentals in Ecology*, Saunders & Co.]

(a) (i) Define the term *community* in ecology. *[1]*

. . . .

. . . .

(ii) Identify the ecosystem above which is likely to have the greatest species diversity. Give a reason for your answer. *[2]*

Ecosystem . . . .

Reason . . . .

. . . .

. . . .

(This question continues on the following page)

(Question 1 continued)

(b) State **three** abiotic factors that affect primary productivity in the ecosystems above. *[1]*

. . . .

. . . .

(c) For ecosystem A

(i) Calculate the net primary productivity (NPP) and fill in the table. *[1]*

(ii) Calculate the efficiency of conversion of GPP to NCP. Show your working. *[2]*

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(iii) Explain why ecosystem A has the highest NCP. *[2]*

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(iv) Explain why ecosystem E has the highest GPP but zero NCP. *[2]*

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(This question continues on the following page)

(Question 1 continued)

(d) State and explain the impact that:

(i) a significant increase in the use of chlorofluorocarbons (CFCs) might have on the GPP of these ecosystems. *[3]*

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(ii) continuous acid deposition might have on the NPP in ecosystem B. *[3]*

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(iii) a 25 % decrease in the area of ecosystem E might have on global temperatures. *[3]*

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SECTION B

Answer ***one*** *question. You may use the lined pages at the end of this paper or continue your answers in a continuation answer booklet. Write your name and candidate number on the front cover of the continuation answer booklets, and attach them to this question paper using the tag provided.*

Each essay question is marked out of a total of 20 marks of which 3 are for the expression and development of ideas as follows:

0 No expression of relevant ideas.
1 Expression and development of relevant ideas is limited.
2 Ideas are relevant, satisfactorily expressed and reasonably well developed.
3 Ideas are relevant, very well expressed and well developed.

2. A recent census indicated that India's population of 855 million might double in 35 years unless the growth rate is soon lowered sharply. This increase would completely cancel out India's recent social and economic development.

It is said that educating women is the single most important step governments can take to improve the health of their citizens and their economies. There are an estimated 600 million illiterate women in the world. They outnumber illiterate men by nearly two to one.

[Data from WWF bulletin, *Population and Resources*, 1996.]

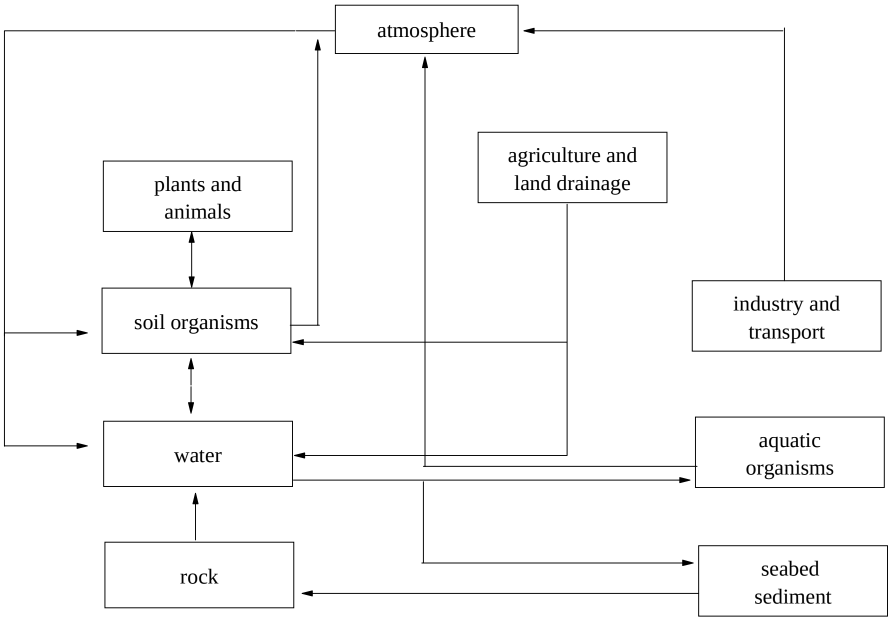
(a) Define *natural capital* and discuss the implications of the information above for its exploitation. *[6]*

(b) Discuss **four** reasons why educating women might reduce the birth rate in India. *[8]*

(c) Explain, with examples, how national policies could affect human population growth. *[3]*

Expression of ideas *[3]*

3. Below is a diagram of the nitrogen cycle.



Each year about 175 million tonnes of nitrogen are biologically fixed and about 40 million tonnes of nitrogen are produced artificially.

(a) Explain the roles of the biotic phases in this cycle. *[7]*

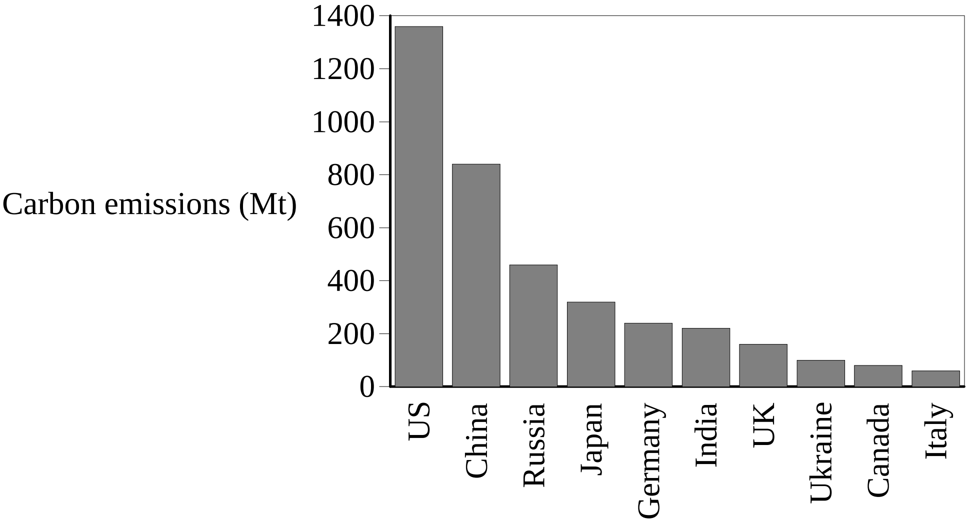
(b) What is the role of energy in this cycle? *[3]*

(c) What effects have human activities had on the nitrogen cycle? *[7]*

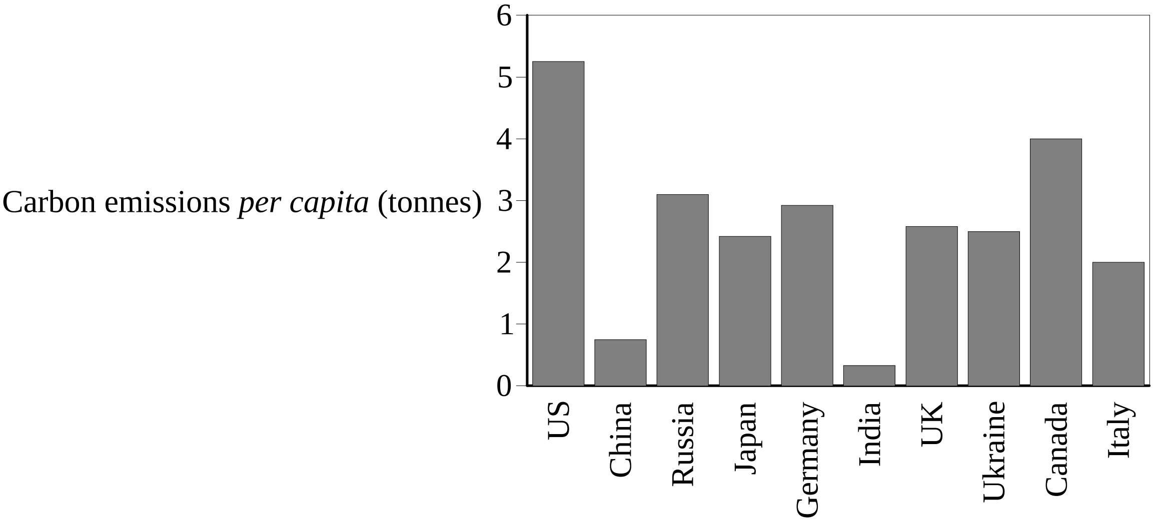
Expression of ideas *[3]*

4. The graphs below show the top ten countries in terms of total carbon emissions and emissions *per capita*.

Graph A: Total carbon emissions from fossil fuel burning for the top ten emitting countries, in million tonnes (Mt).



Graph B: Total carbon emissions (tonnes) *per capita* for the top ten emitting countries.



[Source: Brown, L. R. *et al*, *State of the World*, 1996, Earthscan.]

(a) Comment on the significance of these data. *[8]*

(b) Describe the international agreements that aim to reduce the amount of carbon emissions. *[4]*

(c) What technologies and what policies might reduce the amount of carbon emissions? *[5]*

Expression of ideas *[3]*