INTERNATIONAL BACCALAUREATE
BACCALAURÉAT INTERNATIONAL
BACHILLERATO INTERNACIONAL

N00/460/S(2)

**ENVIRONMENTAL SYSTEMS**
**STANDARD LEVEL**
**PAPER 2**

Name

Number

Wednesday 15 November 2000 (afternoon)

1 hour

INSTRUCTIONS TO CANDIDATES

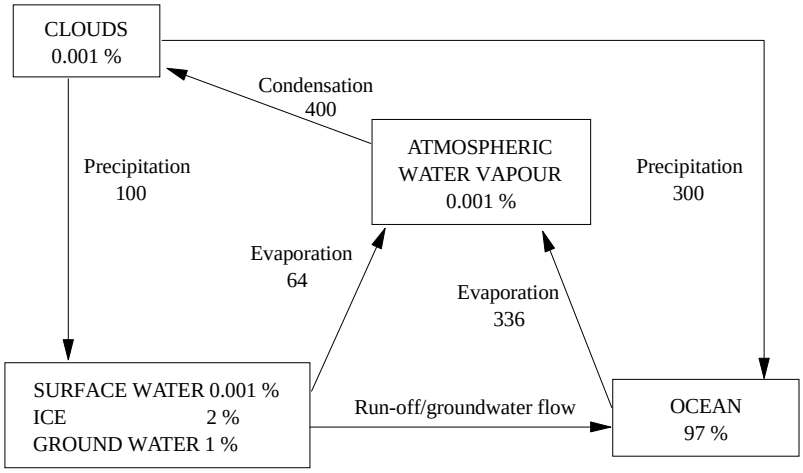
- Write your candidate name and number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: Answer Section A in the spaces provided.
- Section B: Answer one question from Section B. You may use the lined pages at the end of this paper or continue your answers 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 diagram below shows storages (in percentage of total water) and flows in the global water cycle. The rates of flow are given in $10^{15}$ kg $yr^{-1}$.




(a) (i) What is the source of energy which drives the water cycle? . . . . . *[1]*

(ii) In which of the processes given in the diagram does this energy enter the cycle? *[1]*

. . . . . .

(b) (i) What percentage of all precipitation falls directly into the oceans? *[1]*

. . . . . .

. . . . . .

(ii) What percentage of all evaporated water comes from the oceans? *[1]*

. . . . . .

. . . . . .

*(This question continues on the following page)*

*(Question 1 continued)*

(c) (i) Assuming the cycle is in steady state, what mass of water flows into the oceans through run-off and groundwater flow per year? *[2]*

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. . . . . .

(ii) Explain why this figure might increase in the future, as a result of burning fossil fuels. *[3]*

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(d) Name a storage of water in the biosphere that is not shown in the diagram, and explain how water is transferred in and out of this storage. *[3]*

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*(This question continues on the following page)*

*(Question 1 continued)*

(e) (i) State briefly **one** way in which one of the other flows in the diagram might change if evaporation rates were to increase. *[1]*

. . . . . .

. . . . . .

(ii) Describe how **two** changes in the flows shown on the diagram could lead to a fall in global temperatures and reduce global warming. *[4]*

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. . . . . .

(iii) Name the type of feedback involved in this reduction in global warming. *[1]*

. . . . . .

(f) Identify each of the different processes referred to on the diagram as either transfer or transformation processes. *[2]*

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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.** The following table provides information relating to the world human population and grain production for the years 1960 and 1997:

| **Year** | **1960** | **1997** |
|---|---|---|
| **World population ($\times 10^9$)** | 3.04 | 5.85 |
| **Area for grain production ($\times 10^6$ ha)** | 616 | 621 |
| **Total grain production ($\times 10^9$ kg)** | 823 | 1884 |

(a) Using the data in the table above, show how both the available area and actual grain production have changed **relative** to the world population. *[6]*

(b) (i) Describe the change in grain production per unit area, between 1960 and 1997. *[1]*

(ii) Using **four** examples of agricultural strategies that may have accounted for such a change in production per unit area, discuss the extent to which they may, and may not, lead to increasing the carrying capacity of the planet for the human population. *[10]*

*Expression of ideas [3]*

**3.** (a) Draw a labelled diagram showing major patterns of atmospheric circulation to include low-altitude prevailing winds and convection cells. Identify on the diagram the general distribution of tundra, deserts and tropical rainforests. *[6]*

(b) Explain how the processes involved in the Hadley cell redistribute energy in the atmosphere. *[5]*

(c) Explain how the Hadley cell influences
(i) the distribution of productivity, and
(ii) biodiversity. *[6]*

*Expression of ideas [3]*

**4.** (a) Draw and fully label an energy flow diagram for a food chain of named species up to, and including, the secondary consumer level. Include on the diagram a storage of decomposers. *[5]*

(b) With reference to your diagram, explain how the first and second law of thermodynamics are relevant to the energy flow throughout the food chain. *[5]*

(c) Identify **one** internal factor and **one** external factor that might have a role in regulating the population size of one of the named species in your food chain. Explain the relevance of negative feedback to these regulation processes. *[7]*

*Expression of ideas* *[3]*

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