IBO

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

ENVIRONMENTAL SYSTEMS
STANDARD LEVEL
PAPER 2

Name

Number

Thursday 9 May 2002 (afternoon)

1 hour

INSTRUCTIONS TO CANDIDATES

- Write your name and candidate 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. Write 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 2	/20	/20	/20
SECTION B	. . . .	/20	/20	/20
NUMBER OF CONTINUATION BOOKLETS USED	. . . .	TOTAL /40	TOTAL /40	TOTAL /40

SECTION A

*Both questions must be attempted by **all** candidates in the spaces provided.*

1. The table below gives data for the number of pheasants (a bird the size of a chicken) on a small island off the northwest coast of the USA in the years following its introduction. The island is too far from the coast for birds to reach it without assistance. Pheasants eat seeds and insects.

Year	Number of pheasants recorded
1937 spring	8
1937 autumn (fall)	40
1938 spring	30
1938 autumn (fall)	100
1939 spring	81
1939 autumn (fall)	426
1940 spring	282
1940 autumn (fall)	844
1941 spring	705
1941 autumn (fall)	1540
1942 spring	1325
1942 autumn (fall)	1898

[Source: D Lack, *The Natural Regulation of Animal Numbers*, Oxford University Press, 1954]

(a) The percentage increase between spring and autumn (fall) in 1937 was 400 % and in 1939 it was 426 %. Calculate the percentage increase between spring and autumn (fall) in 1941. Show your working.   *[3]*

. . . .

. . . .

. . . .

. . . .

. . . .

(b) Is there evidence that the population was approaching its carrying capacity by 1942? Explain your answer.   *[2]*

. . . .

. . . .

. . . .

. . . .

. . . .
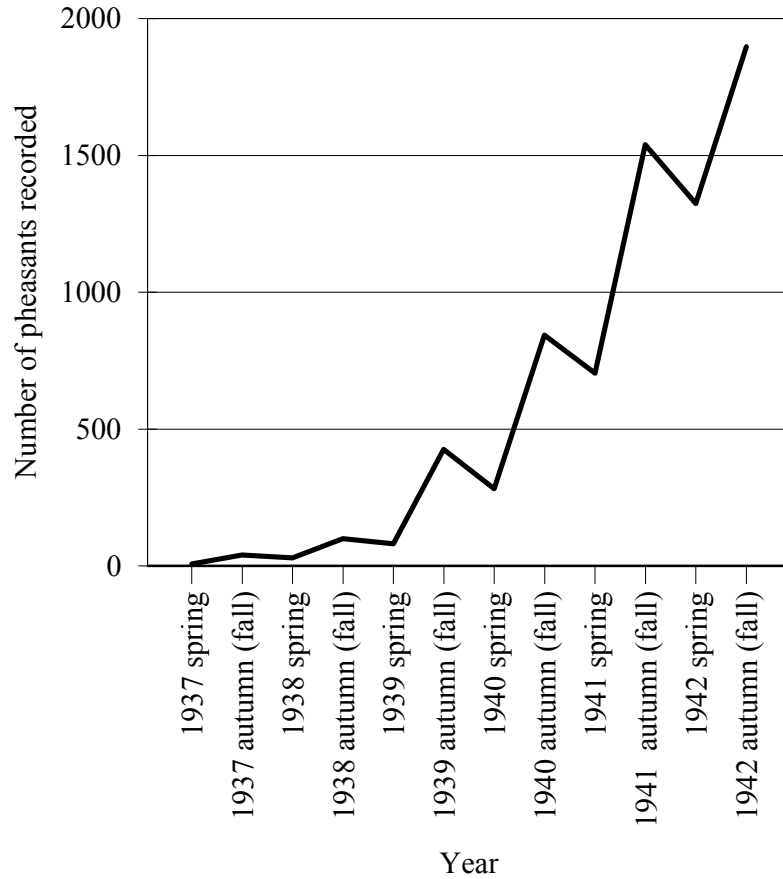
(This question continues on the following page)

(Question 1 continued)

The data is plotted on the graph below.

(c)   Describe and explain the shape of the curve.   *[5]*

. . . .

. . . .

. . . .

. . . .

. . . .

. . . .

. . . .

. . . .

. . . .

. . . .

. . . .
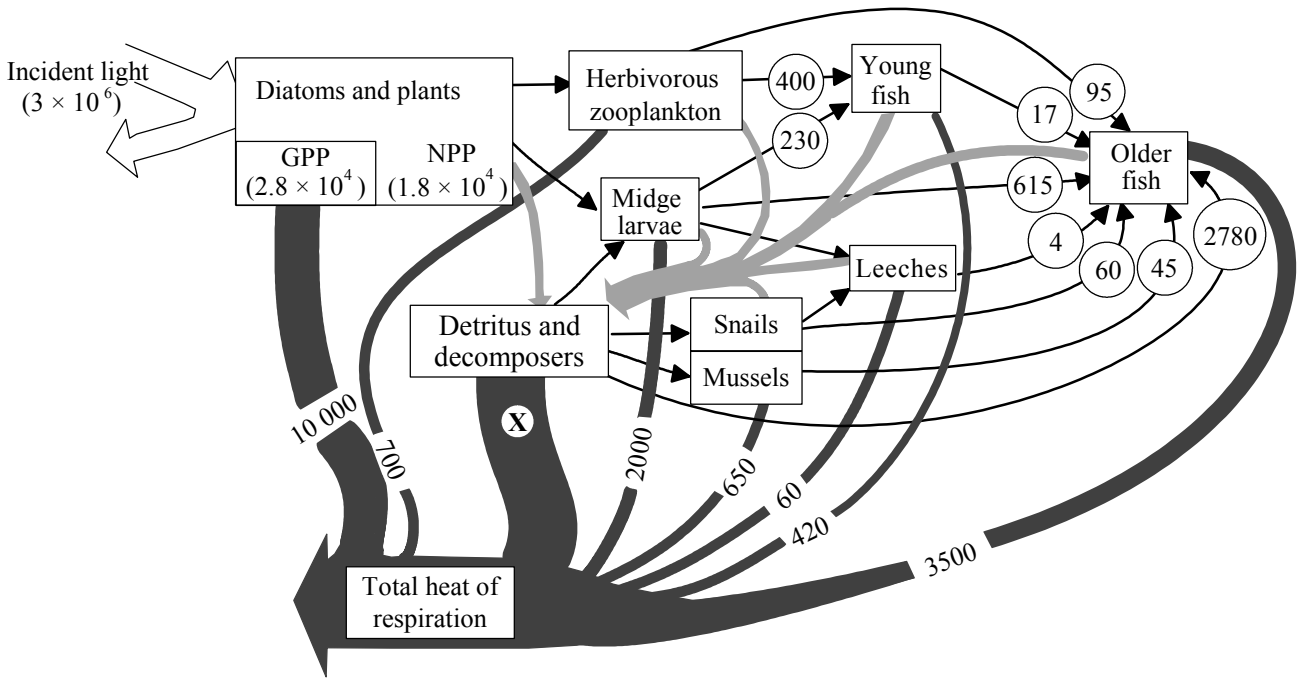
Turn over

2. The diagram below shows the energy flow in a river ecosystem in temperate latitudes. All energy values are kJ m^{-2} yr^{-1}.

[Source: Cadogan A & Best G, *Environment and Ecology*, Blackie & Son Ltd., 1992]

(a) Construct a complete food chain diagram of **four** trophic levels taken from this food web. *[2]*

(b) This ecosystem is in steady state equilibrium. What is meant by this statement? *[1]*

. . . .

. . . .

(This question continues on the following page)

(Question 2 continued)

(c) Given that the system is in steady state equilibrium, calculate the value of **X**. *[3]*

. . . .

. . . .

. . . .

. . . .

. . . .

(d) Calculate the sustainable yield of older fish. *[2]*

. . . .

. . . .

. . . .

. . . .

(e) Suggest a negative feedback mechanism within this ecosystem that may regulate the older fish population. *[2]*

. . . .

. . . .

. . . .

. . . .

SECTION B

*Answer **one** question. Write your answers in a continuation answer booklet. Write your name and candidate number on the front cover of the continuation answer booklet, and attach it 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.*

3. (a) Explain, with the aid of a diagram, the flows and the main storages in the hydrological cycle.   *[6]*

  (b) Describe and explain how the oceans and their currents play a role in the:

   (i)   planetary transfer of energy;
   (ii)   regulation of climate;
   (iii) distribution of global productivity.   *[11]*

Expression of ideas   *[3]*

4. Gilbert White in 1778 noted that every year eight pairs of swifts (an insect-eating bird that often nests in old buildings) nested in his village of Selborne in southern England. Recently it was found that a similar number of pairs were still nesting in the village over two hundred years later.

  (a) Explain, using named examples, why the numbers of some organisms remain constant.   *[9]*

  (b) Suggest what the effects might be on the number of swifts if the amount of insecticide used in the village was greatly increased.   *[4]*

  (c) State what other information would be needed to more accurately predict future changes in the number of nesting swifts.   *[4]*

Expression of ideas   *[3]*

5. (a) With the aid of labelled diagrams, describe and explain the movement of the plates of the earth's crust. *[12]*

(b) Explain, with examples, how this plate activity has influenced evolution and biodiversity. *[5]*

Expression of ideas *[3]*