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

M04/715/S(2)+

**ECOSYSTEMS AND SOCIETIES**
**STANDARD LEVEL**
**PAPER 2**

Candidate number

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Wednesday 12 May 2004 (morning)

1 hour 45 minutes

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INSTRUCTIONS TO CANDIDATES

- Write your candidate number in the box above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all of Section A in the spaces provided.
- Section B: answer two questions from Section B. Write 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 numbers of the questions answered in the candidate box on your cover sheet and indicate the number of sheets used in the appropriate box on your cover sheet.

## SECTION A

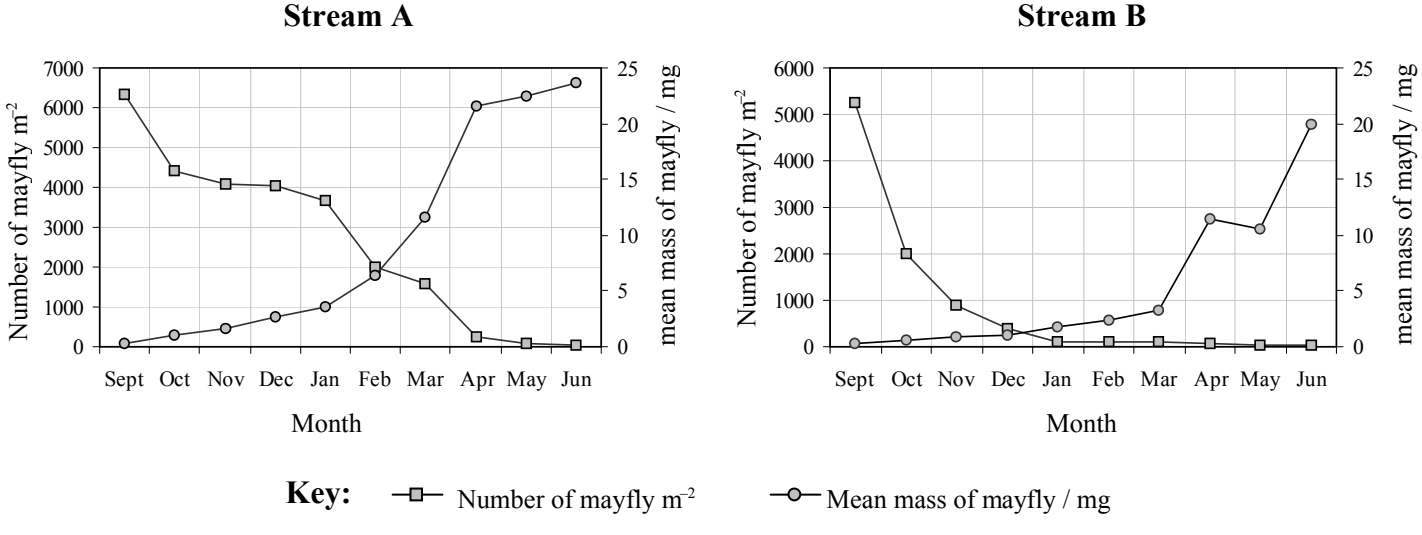
*Answer this question in the spaces provided.*

**1.** Figures 1 and 2 show population data for the mayfly (*Ephemerellal subvaria*) in two similar streams, A and B, in Minnesota, USA. Data were collected on population size (number of mayfly $m^{-2}$) and mean mass of mayfly between September 1970 and June 1971.

**Figure 1**: Population dynamics of mayfly in streams A and B

| | Stream A | | | Stream B | | |
|---|---|---|---|---|---|---|
| **Month** | **Number of mayfly $m^{-2}$** | **Mean biomass / g $m^{-2}$** | **Mean mass of mayfly / mg** | **Number of mayfly $m^{-2}$** | **Mean biomass / g $m^{-2}$** | **Mean mass of mayfly / mg** |
| September | 6350 | 1.4 | 0.2 | 5251 | 1.2 | 0.2 |
| October | 4432 | 4.6 | 1.0 | 2001 | 1.3 | 0.6 |
| November | 4082 | 6.6 | 1.6 | 905 | 0.7 | 0.8 |
| December | 4053 | 10.8 | 2.6 | 400 | 0.4 | 1.1 |
| January | 3660 | 13.0 | 3.5 | 123 | 0.2 | 1.7 |
| February | 2007 | 12.8 | 6.3 | 99 | 0.2 | 2.4 |
| March | 1587 | 18.4 | 11.6 | 98 | 0.3 | 3.2 |
| April | 230 | 4.9 | 21.5 | 80 | 0.9 | 11.4 |
| May | 84 | 1.8 | 22.4 | 34 | 0.3 | 10.6 |
| June | 44 | 1.0 | 23.6 | 24 | 0.4 | 20.0 |

**Figure 2**: Population size and mean mass plotted against time for mayfly in streams A and B
*(Both graphs plotted using the data above)*




[Source: Adapted from Waters and Crawford, *Limnology and Oceanography*, (1973), **18**, pages 286-296]

*(This question continues on the following page)*

*(Question 1 continued)*

(a) (i) Using the data in Figures 1 and 2, describe the relationship between population size and mean mass for mayfly in stream A. *[2]*

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(ii) Outline **two** differences in the populations of stream A and stream B during the study period. *[2]*

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(iii) Calculate the percentage change in the population of mayfly in stream A from September to June. *[1]*

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(b) (i) Define the term *biomass*. *[1]*

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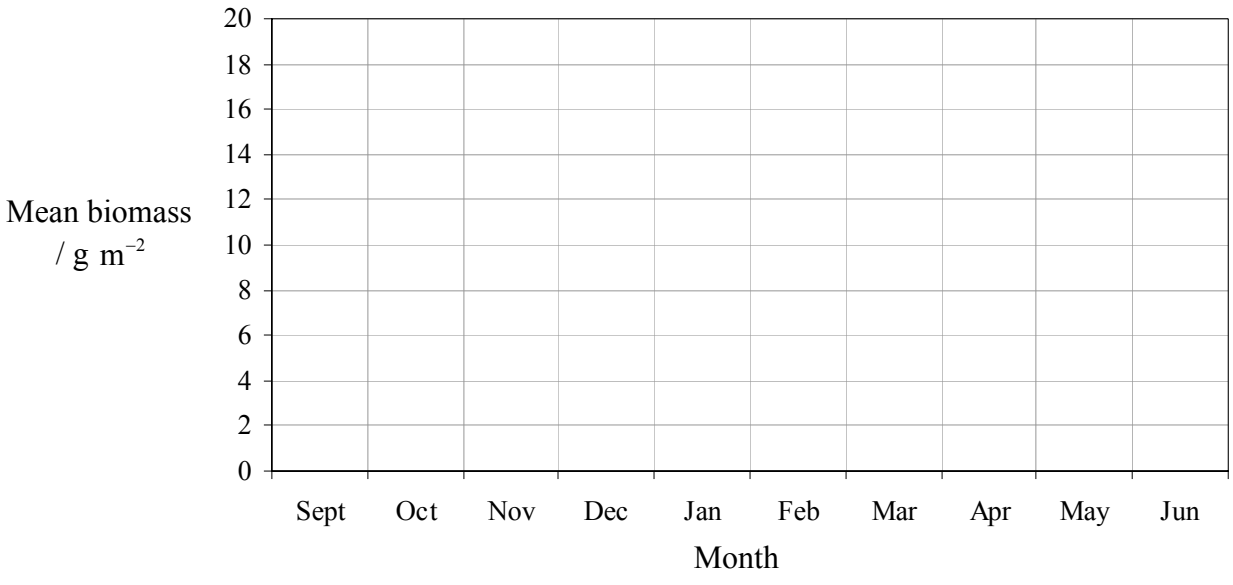
(ii) Sketch below the values for mean biomass against time for stream A and stream B. (The data is available in Figure 1.) Label your graph lines. *[2]*




*(This question continues on the following page)*

*(Question 1 continued)*

(c) (i) Suggest a reason for the difference in population dynamics of mayfly in the two streams. Explain your answer. *[2]*

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(ii) Mayfly occupy an important niche at the lower end of the food chain. Predict, giving reasons, the impact of mayfly population change between September and June in stream B on other organisms within the stream. *[2]*

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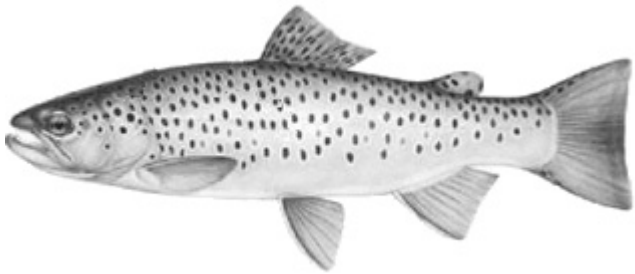
(d) (i) Scientists wish to assess the abundance of a brown trout (*Salmo trutta*) population within a chalk stream using the Lincoln index. Describe a possible method for this. *[3]*



Brown trout

[Source: Alberta Government - Sustainable Resource Development, Fish and Wildlife
www.gov.ab.ca/srd/fw/fishing/FishID/brown_t.html]

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(ii) It is suspected that a number of abiotic factors may influence the biology of the chalk stream. Outline **three** abiotic factors that may be important in the stream. *[3]*

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(iii) Both mayfly and brown trout are *r*-strategists. Outline what this means. *[2]*

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## SECTION B

*Answer **two** questions. Write your answers on the answer sheets provided. Write your candidate number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.*

*Each question is marked out of a total of 20 marks of which 3 are allocated to 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) Outline the factors that make some organisms less prone to extinction and the factors that make others more prone to extinction. Use named examples to support your answer. *[5]*

(b) List **three** Red Data Book categories and explain the criteria used to assess a species' conservation status. Illustrate your answer with named examples. *[6]*

(c) Justify your personal viewpoint on the best strategy for conserving a named protected area. *[6]*

*Expression of ideas [3]*

**3.** (a) Describe the role of greenhouse gases in maintaining mean global temperature. *[4]*

(b) Discuss the impact of global warming. Consider the potential effect on biomes, global agriculture and human society. *[7]*

(c) Predictive models of climate change may give very different results. Explain this statement with reference to the limitations of models and the contrasting arguments about global warming. *[6]*

*Expression of ideas [3]*

**4.** (a) Define the term *soil* and outline the **three** principle stages in soil development. *[4]*

(b) Describe the process of soil degradation and explain the direct and indirect consequences to the environment. *[7]*

(c) Explain, using a named farming system, how

(i) a technocentric approach can aid soil conservation. *[3]*

(ii) an ecocentric approach can aid soil conservation. *[3]*

*Expression of ideas* *[3]*

**5.** (a) Compare **two** different food production systems. Your answer should be based on named examples. Consider resource inputs, resource outputs and technology. *[6]*

(b) Outline the impact of the two systems identified in (a) on the surrounding environment. *[5]*

(c) (i) Suggest reasons why human food resource needs will change over the next 100 years and how this change may be achieved. *[4]*

(ii) Outline what impact a changing demand for food resources may have on the environment. *[2]*

*Expression of ideas* *[3]*