



22076011

BIOLOGY
STANDARD LEVEL
PAPER 2

Monday 14 May 2007 (afternoon)

1 hour 15 minutes

Candidate session number

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INSTRUCTIONS TO CANDIDATES

- Write your session number in the boxes 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 one question from Section B. Write your answers on answer sheets. Write your session 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.



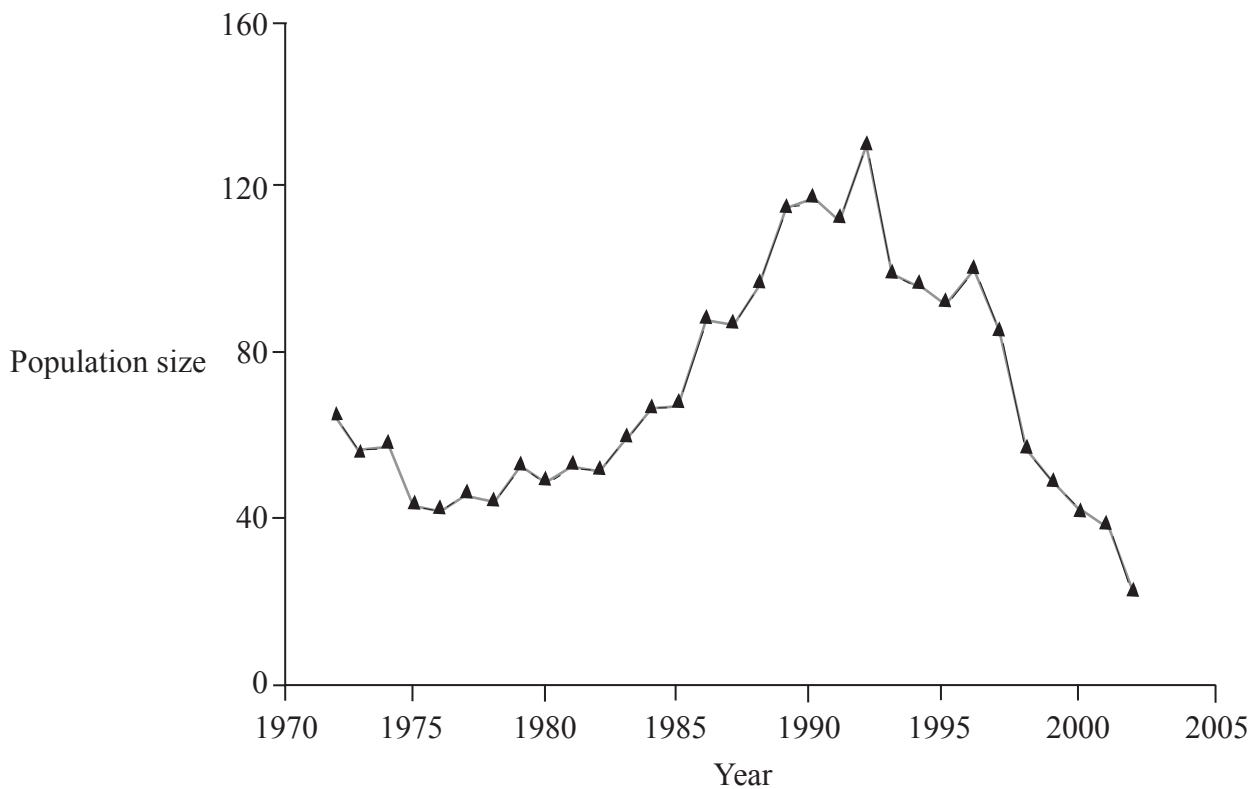
SECTION A

Answer **all** the questions in the spaces provided.

- 1. A population of bighorn sheep (*Ovis canadensis*) on Ram Mountain in Alberta, Canada, has been monitored since the 1970s. Hunters can buy a licence to shoot male bighorn sheep on the mountain. The large horns of this species are very attractive to hunters, who display them as hunting trophies.

Most horn growth takes place between the second and the fourth year of life in male bighorn sheep. They use their horns for fighting other males during the breeding season to try to defend groups of females and then mate with them. Younger males below the age of 6 are rarely able to compete with older males and so have fewer offspring.

The graph below shows the size of the bighorn sheep population on Ram Mountain.



[Source: Coltman *et al.*, (2003), *Nature*, **426**, page 655–658]

- (a) Outline the trends in the population of bighorn sheep on Ram Mountain. [2]

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(Question 1 continued)

The length of a male's horns is strongly influenced by its genes. It is therefore possible to predict the length of the horns of the future offspring of a male. An index of predicted horn length for the future offspring of each male on Ram Mountain has been calculated. Negative values indicate offspring with smaller horns than the mean of the population. Positive values indicate horns larger than the mean of the population.

- (b) Suggest **one** type of factor apart from genes, that could affect the length of a male's horns. *[1]*

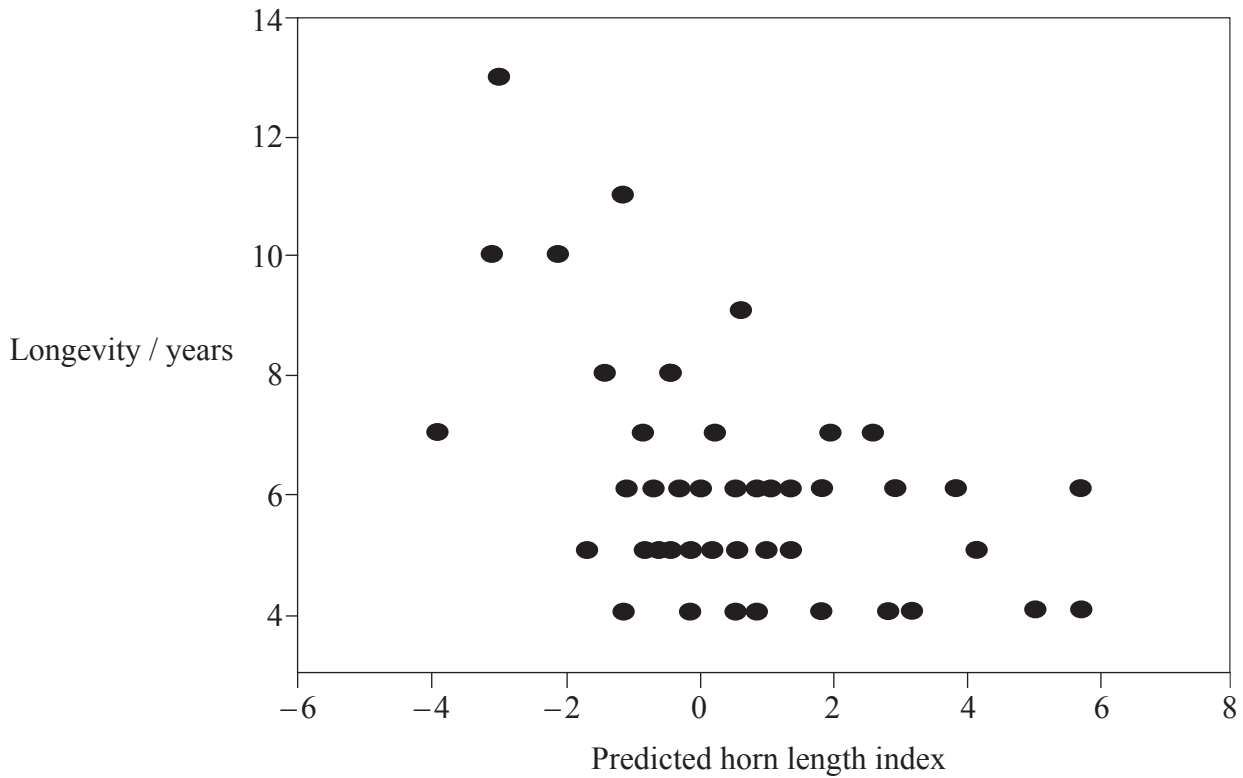
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(Question 1 continued)

The scattergraph below shows the relationship between the age to which a male lived (longevity) and the predicted horn length index of the male.



(c) State the most frequent longevity (the mode). [1]

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(d) (i) Outline the relationship between longevity and the predicted horn length index of the males. [1]

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(ii) Suggest a reason for the relationship. [1]

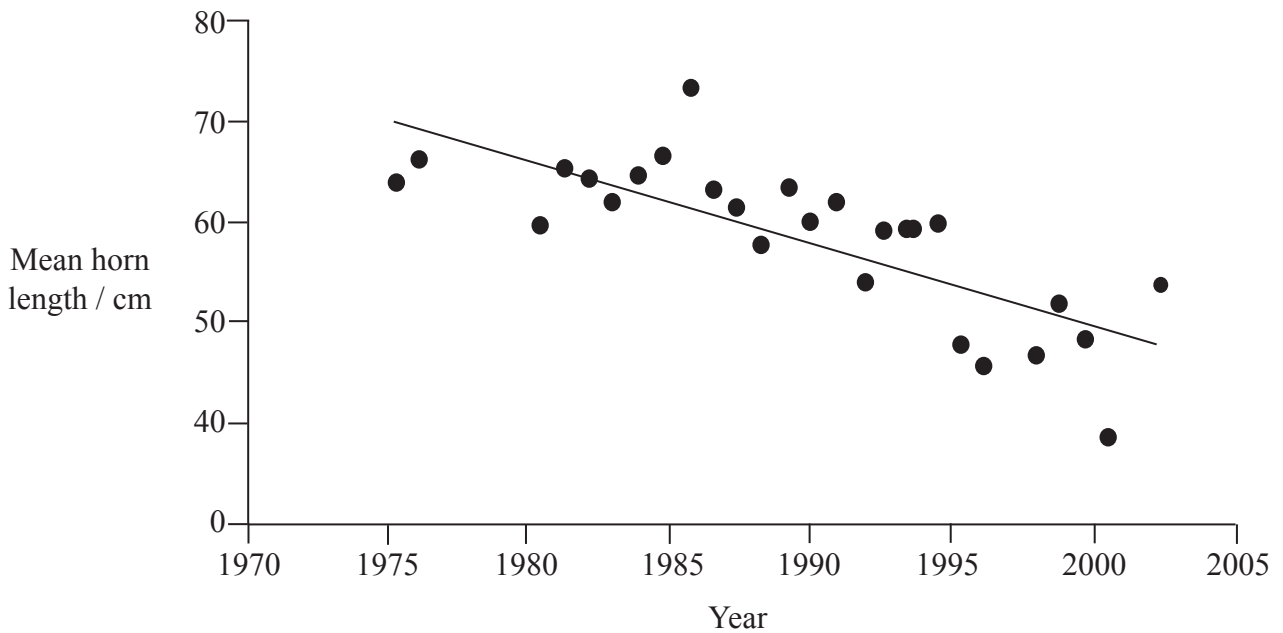
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(Question 1 continued)

The graph below shows the mean horn length of males on Ram Mountain, between 1975 and 2002.



(e) Explain the change in horn length shown in the graph in terms of the longevity of the males, the number of offspring that they produce and your understanding of the process of evolution. [3]

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(f) Suggest how the change in the size of horns could be reversed. [1]

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2. To maintain the internal environment of the body (*homeostasis*), humans use the excretory system and some other organ systems. Two other systems are needed to control the process of homeostasis.

(a) State the names of the **two** other organ systems that are used to control homeostasis. [2]

I.

II.

(b) Define the term *excretion*. [2]

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(c) The kidney produces urine, which consists of water with substances dissolved in it. State **two** substances that are dissolved in the urine of a healthy person. [2]

I.

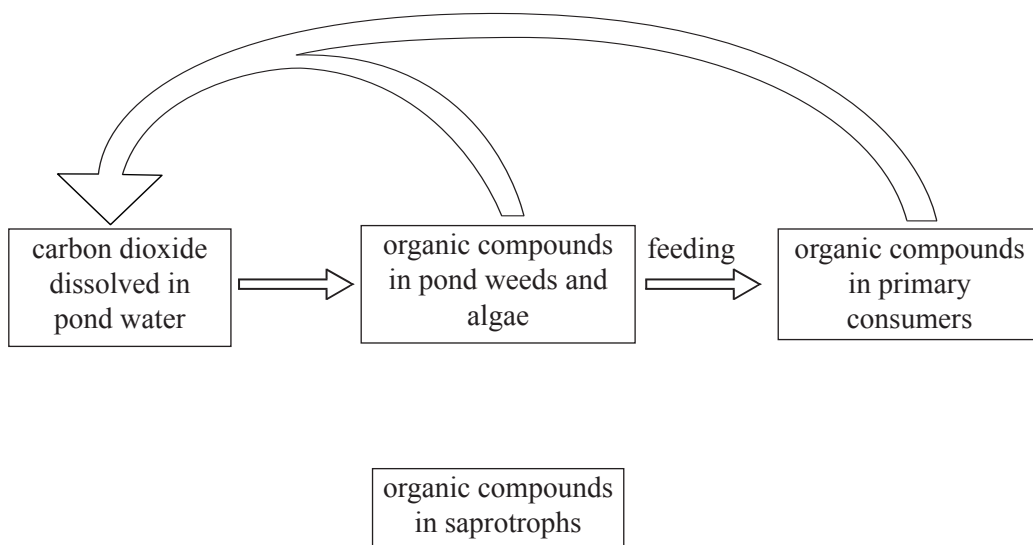
II.

(d) The kidneys may produce a larger volume of urine on one day than on the next day. Suggest reasons for variation in the volume of urine produced per day. [3]

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3. The diagram below is part of a carbon cycle diagram for an ecosystem in a pond.



(a) State the names of the processes that

(i) convert carbon dioxide into organic compounds in pond weeds and algae. [1]

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(ii) convert organic compounds in pond weeds, algae and primary consumers into carbon dioxide. [1]

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(b) (i) Draw arrows on the diagram above to show how the saprotrophs obtain carbon. [1]

(ii) Explain the role of saprotrophs in recycling carbon. [2]

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(c) Draw a box on the diagram in an appropriate position, labelled organic compounds in secondary consumers. Draw arrows to show the links between secondary consumers and other parts of the carbon cycle. [2]

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(Question 3 continued)

There has been a significant increase in the concentration of carbon dioxide in the Earth's atmosphere during the last fifty years.

(d) (i) Suggest **two** reasons for this increase in atmospheric carbon dioxide concentration. [2]

- 1.
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- 2.
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(ii) Suggest **one** effect of an increase in carbon dioxide concentration on organisms in a pond. Include in your answer the reason for the effect and the type of organisms that are affected. [2]

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SECTION B

Answer **one** question. Up to two additional marks are available for the construction of your answer. Write your answers on the answer sheets provided. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.

4. (a) Louis Pasteur discovered that diseases can be caused by infection with one specific type of bacterium. Describe how humans can become infected with a **named** bacterium and the effects that it has on the body. [6]
- (b) List types of organism, apart from bacteria, that can cause disease in humans. [4]
- (c) Explain how antibodies are produced in response to infection in humans. [8]
5. (a) Before cell division in unicellular and multicellular organisms, the nucleus must divide to produce two genetically identical nuclei. Explain the events that occur in cells that result in the production of genetically identical nuclei. [8]
- (b) Cell division in unicellular organisms can increase the population size. Outline reasons for the population of a unicellular organism not increasing, despite reproduction by cell division. [6]
- (c) Suggest why cell division is necessary in multicellular organisms. [4]
6. (a) Draw and label a simple diagram to show how DNA is constructed from sugars, phosphates and bases. [6]
- (b) Define the terms *gene* and *gene mutation*. [4]
- (c) Genetic modification involves the transfer of DNA from one species to another. Discuss the potential benefits and possible harmful effects of one example of genetic modification in a **named** organism. [8]
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