



**BIOLOGY**  
**STANDARD LEVEL**  
**PAPER 2**

Friday 2 November 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

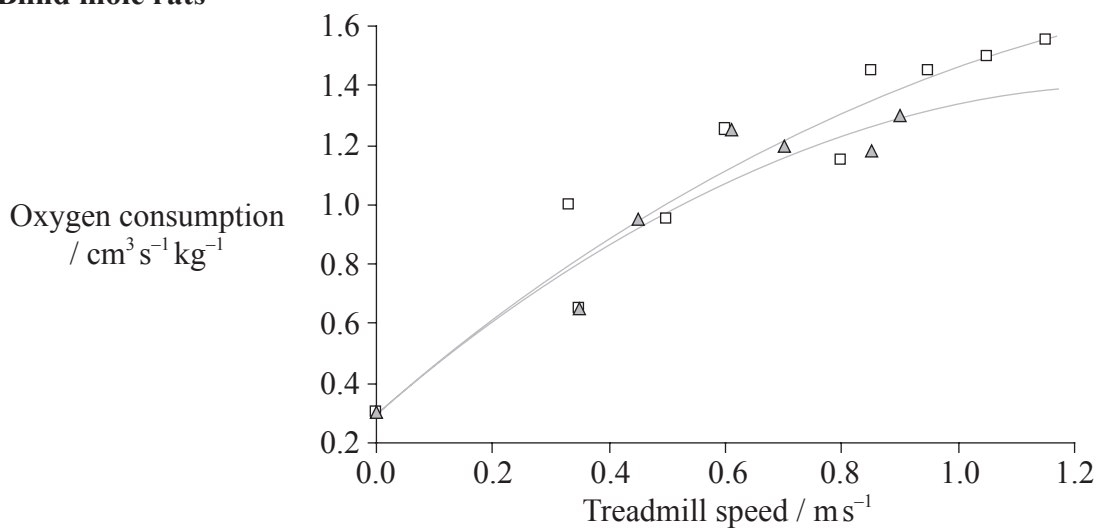
Answer **all** the questions in the spaces provided.

1. Blind mole rats (*Spalax ehrenberghi*) are adapted to live in underground burrows with very low oxygen conditions. Scientists compared blind mole rats and white rats in order to determine whether these adaptations are due to changes in their ventilation system.

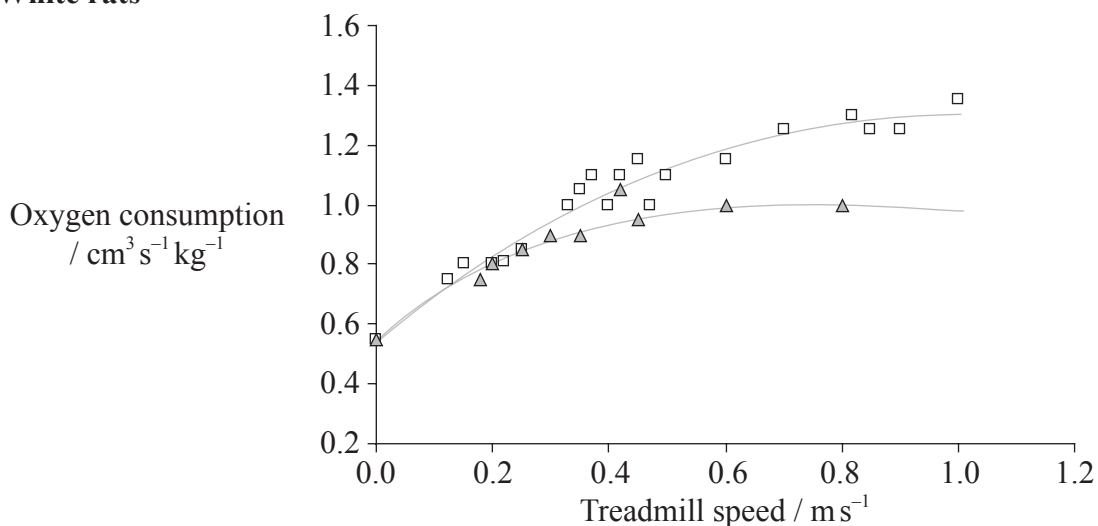
Both types of rat were placed on a treadmill and the amount of oxygen consumed was measured at different speeds. This study was done under normal oxygen conditions and under low oxygen conditions. The results are shown in the scatter graph below.

Key: □ normal oxygen    △ low oxygen

**Blind mole rats**



**White rats**



[Source: *Proceedings of the National Academy of Sciences*, vol. 94, issue 5, March 4 1997, "Working underground: Respiratory adaptations in the blind mole rat", Hans R. Widmer, Hans Hoppeler, Eviatar Nevo, C. Richard Taylor and Ewald R. Weibel, pages 2062-7, Fig.1. Copyright 1997 National Academy of Sciences, USA.]

(This question continues on the following page)



*(Question 1 continued)*

- (a) Compare the oxygen consumption of blind mole rats and white rats when the treadmill is not moving. [1]

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- (b) Compare the effect of increasing the treadmill speed on the oxygen consumption in both types of rats under normal oxygen conditions. [3]

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- (c) Evaluate the effect of reducing the amount of oxygen available on both types of rat. [2]

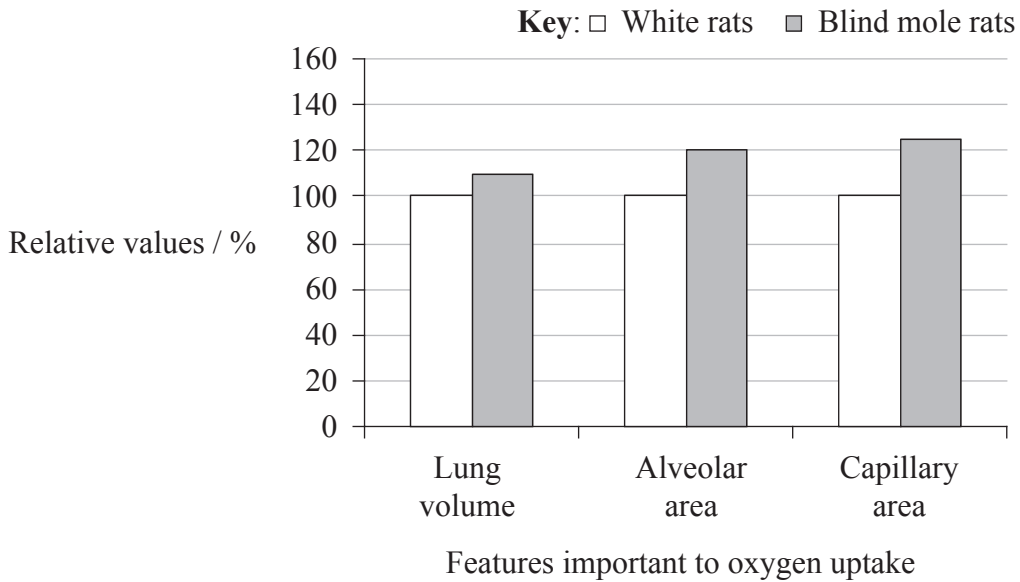
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(Question 1 continued)

The lungs of both types of rats were studied and the features important to oxygen uptake were compared. The results are shown in the bar chart below.



[Source: *Proceedings of the National Academy of Sciences*, vol. 94, issue 5, March 4 1997, "Working underground: Respiratory adaptations in the blind mole rat", Hans R. Widmer, Hans Hoppeler, Eviatar Nevo, C. Richard Taylor and Ewald R. Weibel, pages 2062-7, Fig.4. Copyright 1997 National Academy of Sciences, USA.]

(d) Using your knowledge of gaseous exchange in lungs, explain how these adaptations would help the blind mole rats to survive in underground burrows. [3]

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(e) Suggest how natural selection played an important part in the adaptations of blind mole rats. [3]

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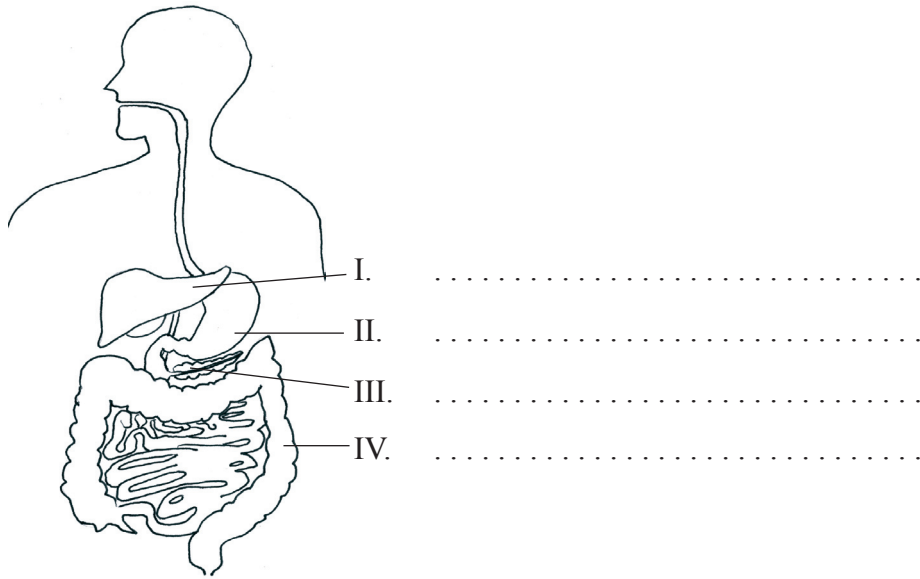
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2. (a) Identify the parts of the human digestive system indicated below. [2]



(b) In the space below draw the structure of an amino acid. [2]

(c) The enzyme pepsin, involved in protein digestion in the stomach, requires an acid pH to work properly. Explain the effect of pH on enzyme activity. [2]

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*(Question 2 continued)*

- (d) Explain how **three** structures of the villus are related to the role of the villus in absorption. [3]

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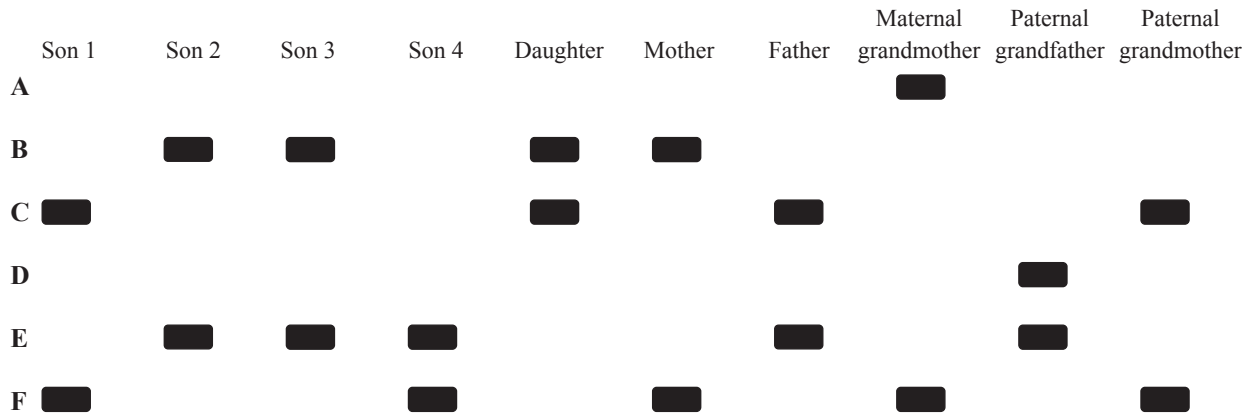
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3. The diagram below shows a DNA profiling of a family with five children. Segments of the DNA inherited by some members of the family are shown as two dark bands in each column. The DNA fragments are labelled A to F.



(a) State **two** properties of the fragmented pieces of DNA which allow them to be separated in gel electrophoresis. [1]

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(b) Determine which DNA fragment Son 2 inherited from his mother and which from his father. [1]

From his mother: .....

From his father: .....

(c) Identify the child that genetically most resembles one of the grandparents. [1]

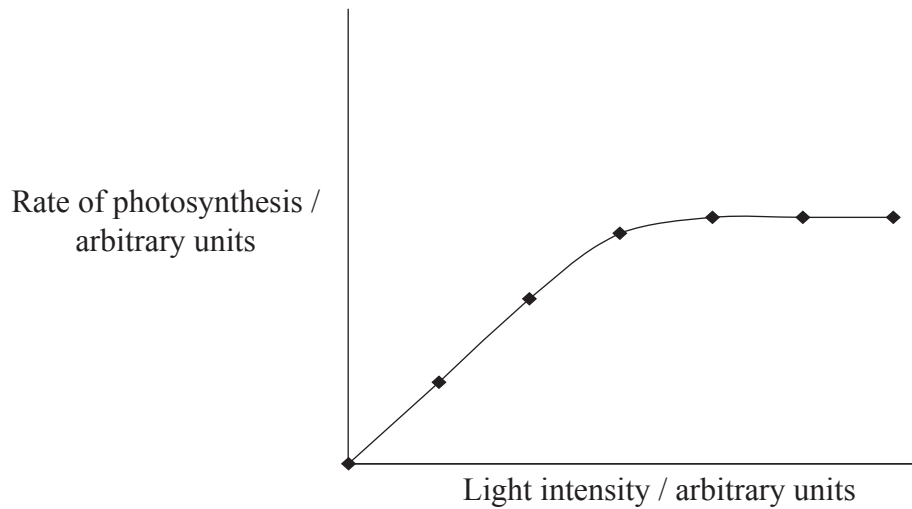
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(d) Apart from determining family relationships, outline **one** other application for DNA profiling. [1]

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4. The graph below shows the effect of light intensity on photosynthesis at 0.1 % carbon dioxide concentration.



- (a) On the graph above, draw the results obtained at 0.01 % carbon dioxide. [1]

- (b) Outline the fate of the oxygen and hydrogen which are produced in the photolysis of water during photosynthesis. [2]

Oxygen: .....

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Hydrogen: .....

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- (c) The energy produced in photosynthesis can enter a food chain. Explain how this energy can be lost before it reaches the last link in the chain. [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.

5. (a) Outline the advantages of using a light microscope instead of an electron microscope. [5]
- (b) Explain the importance of the surface area to volume ratio as a factor limiting cell size. [7]
- (c) Define the term *organelle* and state **one** function for each of these organelles: ribosome, golgi apparatus, mitochondrion, lysosome, rough endoplasmic reticulum. [6]
6. (a) Draw and label a diagram of the adult female reproductive system. [4]
- (b) Describe **one** method of contraception and discuss the advantages and disadvantages, including ethical issues, involved in using this type of method. [8]
- (c) Outline the process of birth and its hormonal control. [6]
7. (a) Compare the structure of DNA and RNA. [5]
- (b) Explain the replication of DNA. [8]
- (c) Describe the term genetic code and define what is meant by the terms *degenerate* and *universal*. [5]
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