



22116014



**BIOLOGY**  
**HIGHER LEVEL**  
**PAPER 2**

Wednesday 18 May 2011 (afternoon)

2 hours 15 minutes

Candidate session number

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Examination code

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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 questions.
- Section B: answer two questions.
- Write your answers in the boxes provided.

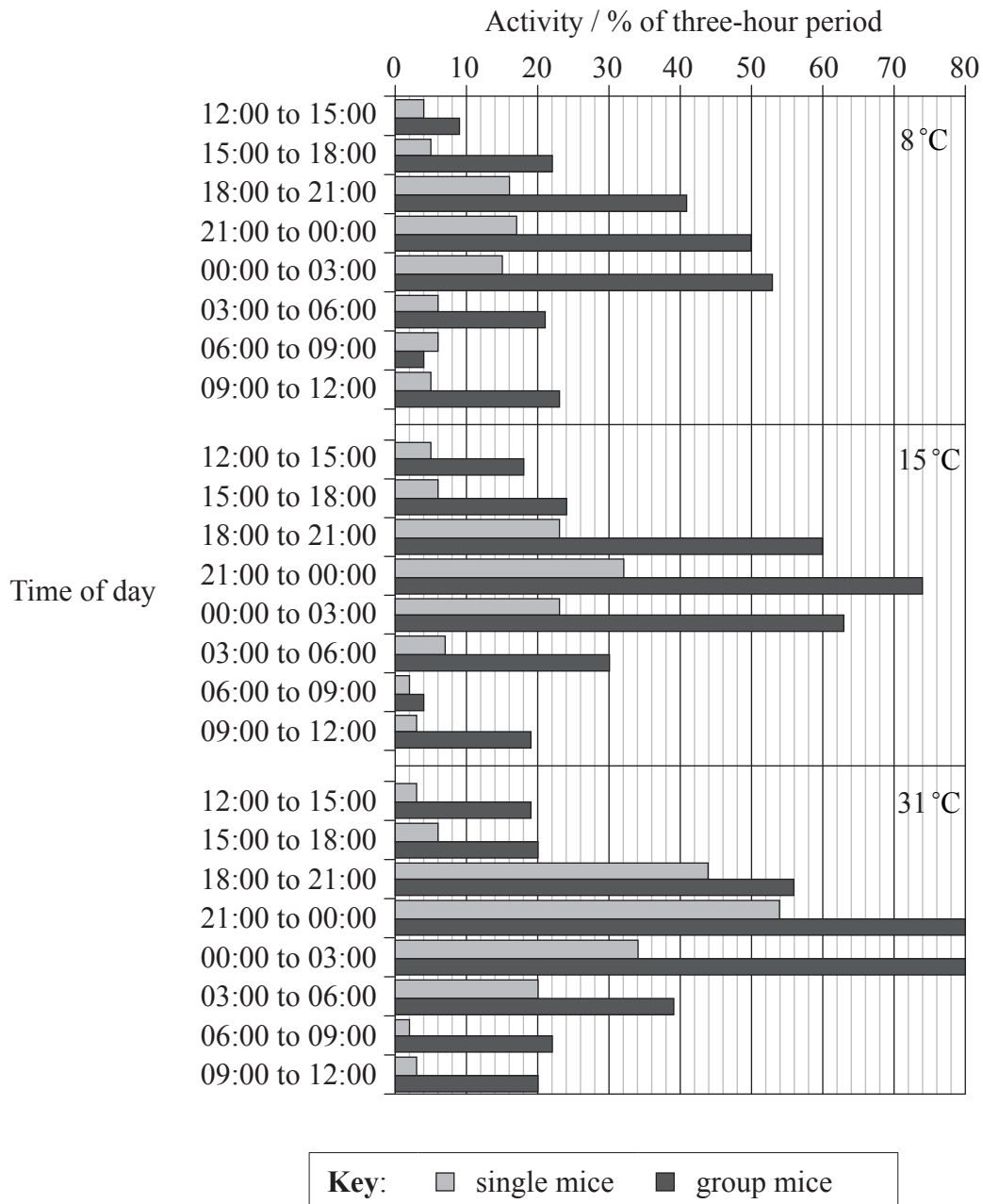


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**SECTION A**

Answer **all** questions. Write your answers in the boxes provided.

1. Investigators carried out experiments to find the relationship between the energy used by mice (the metabolic rate) and their activity. They found that the amount of time mice are active depends on the time of day, whether they are single or in groups and on the temperature of their surroundings. The bar chart below shows the percentage of time mice were active during three-hour periods at three different temperatures.



L. E. Mount and J. V. Willmott (1967) Journal of Physiology, 190, pages 371–380. Published by Wiley-Blackwell. Used with permission.

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*(Question 1 continued)*

- (a) Calculate how many minutes the group mice are active between 21:00 and 00:00 at 8°C. [1]

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- (b) Outline the relationship between activity and temperature from 21:00 to 03:00 in all of the mice. [1]

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- (c) Animals which are active at night are nocturnal. Suggest **one** advantage for mice being nocturnal. [1]

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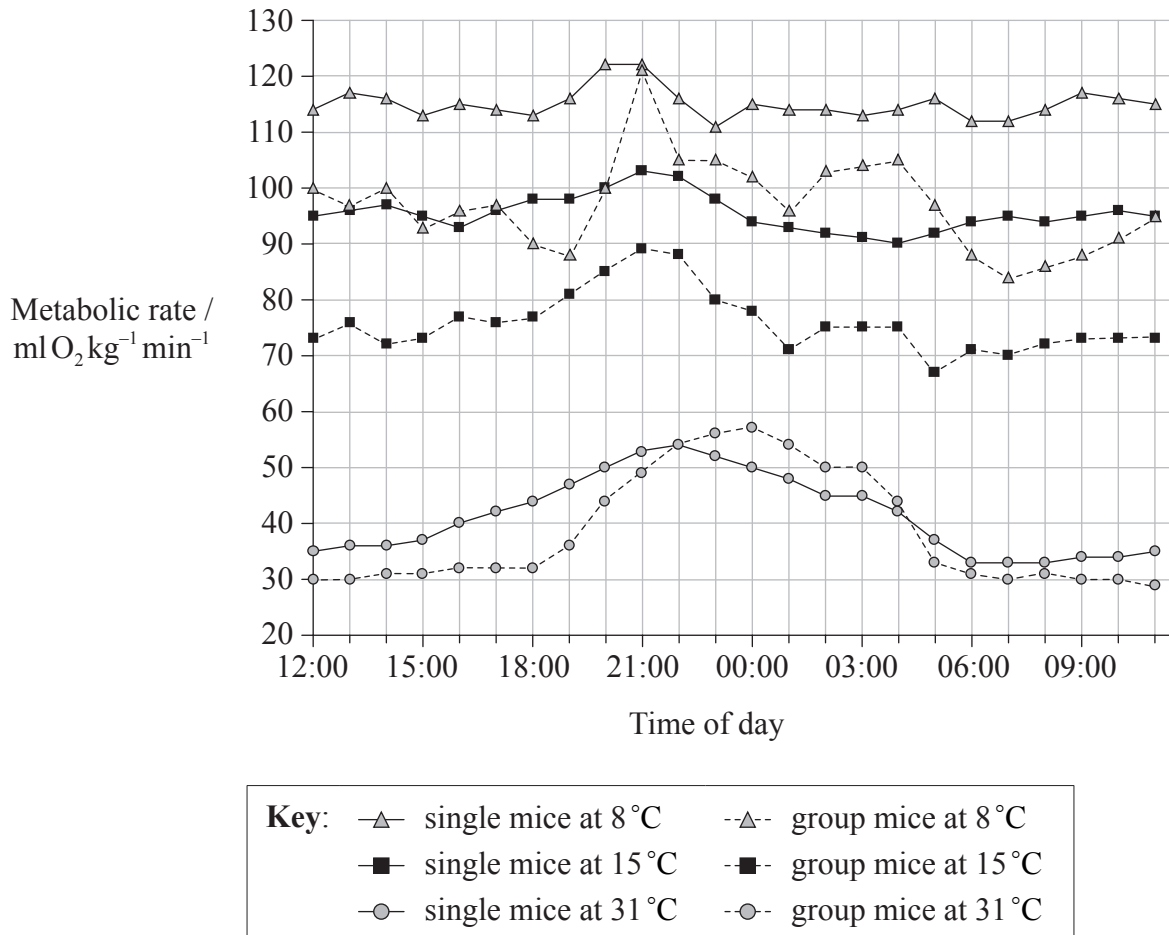
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(Question 1 continued)

The investigators also found that the metabolic rate of the mice changed at different times of the day. Mice were kept at one of the three constant temperatures for 24 hours and their oxygen consumption was measured. The graph below shows the results for single mice and the mean values for group mice.



L. E. Mount and J. V. Willmott (1967) *Journal of Physiology*, 190, pages 371–380. Published by Wiley-Blackwell. Used with permission.

(d) State the relationship between temperature and metabolic rate. [1]

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*(Question 1 continued)*

- (e) Compare the results for the single mice at 15°C with those for the group mice at 15°C. [2]

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- (f) Suggest **one** reason why the results differ for single mice and group mice. [1]

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.....

- (g) Explain why oxygen consumption is used as a measure of metabolic rate. [2]

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*(Question 1 continued)*

- (h) Using the data from both graphs, evaluate the hypothesis that increased activity causes an increase in metabolic rate in mice. [2]

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- (i) The reactions of respiration take place in the mitochondria of the mice cells as shown in the following micrograph.

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*(Question 1 continued)*

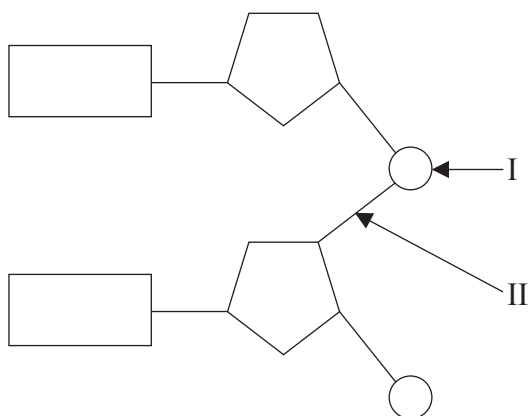
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Turn over

2. The diagram below shows two nucleotides linked together to form a dinucleotide.



(a) (i) Identify the chemical group labelled I. [1]

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(ii) State the type of bond labelled II. [1]

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(b) Distinguish between the sense and antisense strands of DNA during transcription. [1]

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*(Question 2 continued)*

(c) Compare the DNA found in prokaryotic cells and eukaryotic cells.

[2]

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3. (a) Define the term *excretion*.

[1]

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(b) Explain the process of ultrafiltration.

[2]

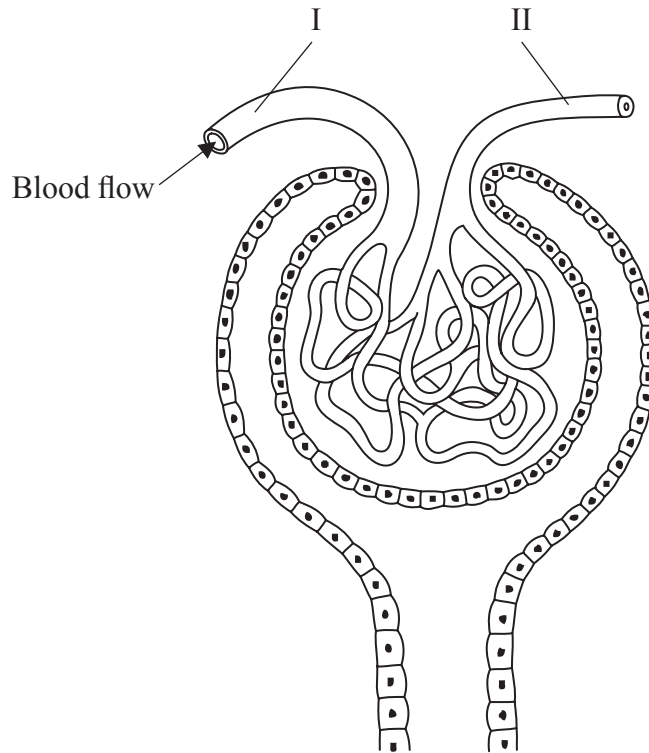
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(Question 3 continued)

- (c) The diagram below shows part of the human kidney. The arrow shows the direction of blood flow.



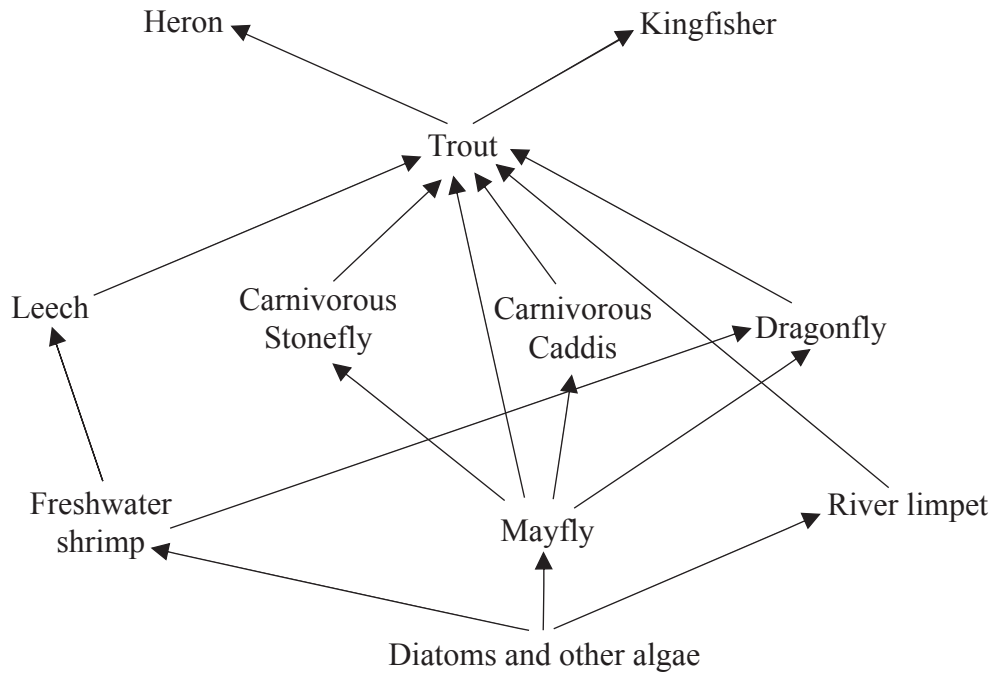
Compare the composition of the fluids found in the regions labelled I and II by giving **one** difference and **one** similarity.

[2]

Difference: .....
.....
Similarity: .....
.....



4. The food web below shows some of the feeding relationships found between the organisms living in or near a river in England.



- (a) Identify an organism in the food web that is

(i) an autotroph.

[1]

.....

(ii) both a secondary and tertiary consumer.

[1]

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*(This question continues on the following page)*



*(Question 4 continued)*

(b) Explain how the flow of energy in the food web differs from the movement of nutrients. [2]

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(c) Discuss reasons why the levels of a pyramid of energy differ in size. [2]

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**SECTION B**

Answer **two** questions. Up to two additional marks are available for the construction of your answers. Write your answers in the boxes provided.

- 5. (a) Outline the effect of temperature and substrate concentration on the activity of enzymes. [4]
- (b) Distinguish between competitive and non-competitive enzyme inhibition of chemical reactions, giving an example of each. [5]
- (c) Explain the light-independent reactions of photosynthesis. [9]
  
- 6. (a) Outline the various stages of the cell cycle. [4]
- (b) Describe the differences in the structures of dicotyledonous plants and monocotyledonous plants. [5]
- (c) Define the term *transpiration* and explain the factors that can affect transpiration in a typical terrestrial plant. [9]
  
- 7. (a) Describe the causes of Down syndrome. [5]
- (b) Describe how human skin colour is determined genetically. [5]
- (c) Explain the causes of sickle-cell anemia. [8]
  
- 8. (a) Outline the role of the skin in temperature regulation. [5]
- (b) Outline the role of hormones in the process of birth in humans. [4]
- (c) Explain the principles of vaccination. [9]

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