



22116017

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

Wednesday 18 May 2011 (afternoon)

1 hour 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 one question.
- Write your answers in the boxes provided.

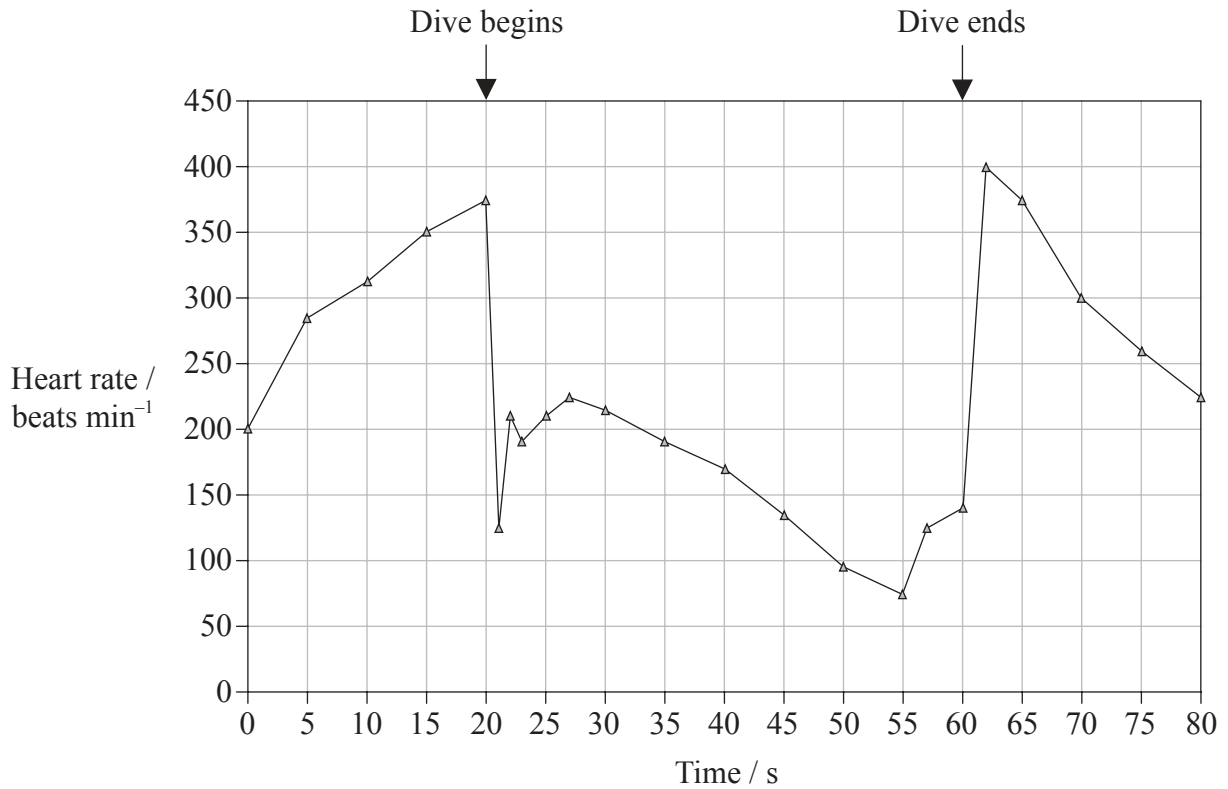


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SECTION A

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

1. Tufted ducks (*Aythya fuligula*) are found in lakes and lagoons throughout Europe. They eat molluscs, insects and plants, sometimes from the surface but mostly by diving under the water. The graph shows how the heart rate of a tufted duck changes when diving under the water.



R. Stephenson, P. J. Butler and A. J. Woakes, "Diving behaviour and heart rate in tufted ducks (*Aythya fuligula*)", J Exp Biol (1986) 126:341-359. Reproduced with permission.

- (a) State the length of time the tufted duck was under the water. [1]

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*(Question 1 continued)*

- (b) Outline the changes in the heart rate during the dive. [2]

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- (c) Suggest, with a reason, the type of respiration used by the tufted duck during the dive. [1]

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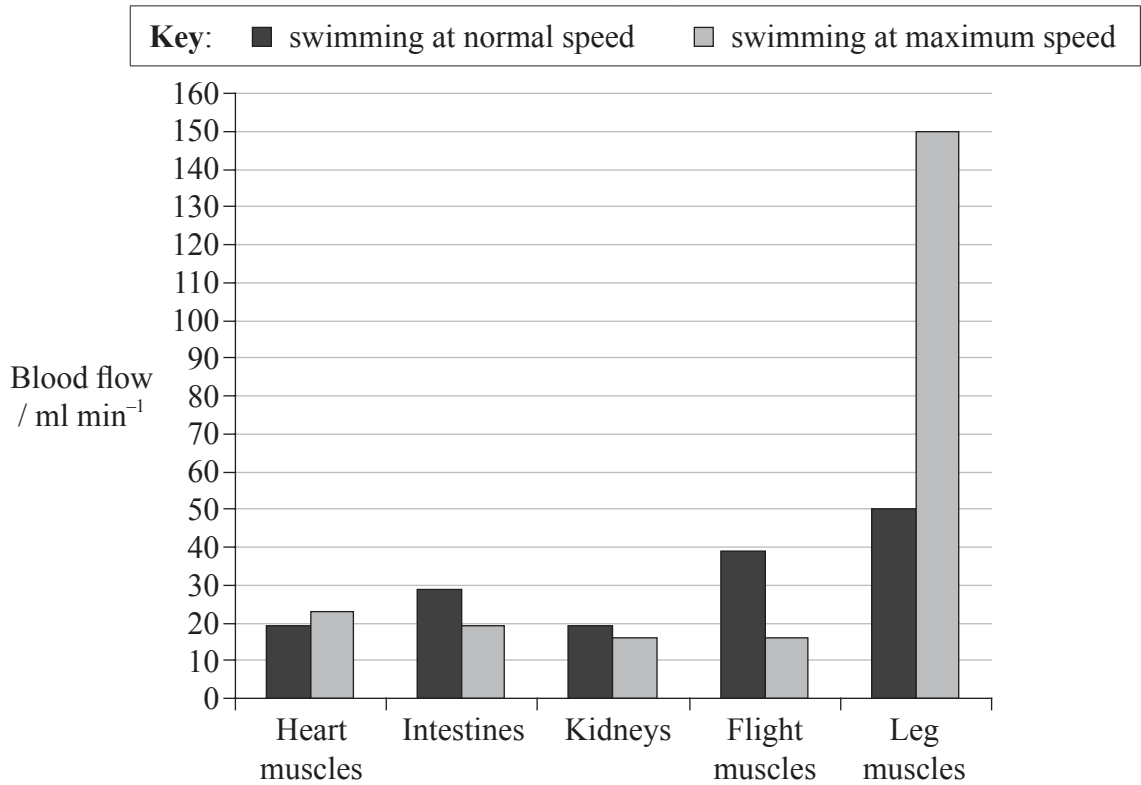
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(Question 1 continued)

When swimming on the surface, the blood supply to different parts of the body of the tufted duck varies according to whether it is swimming at normal speed or maximum speed.



Butler, P.J., Turner, D.L., Al-Wassia, A. & Bevan, R.M. 1988. Regional distribution of blood flow during swimming in the tufted duck (*Aythya fuligula*). *J. exp. Biol.* 135, 461-472. Reproduced with permission.

- (d) Calculate the percentage increase in blood flow to the leg muscles when the tufted duck changes from swimming at normal speed to swimming at maximum speed. [1]

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*(Question 1 continued)*

- (e) Compare the blood flow to the heart muscles with the blood flow to the flight muscles when changing from swimming at normal speed to swimming at maximum speed. [2]

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- (f) Explain the changes in blood flow that occur when swimming at maximum speed. [2]

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- (g) Predict, with reference to both graphs, what would happen to the blood flow to the heart muscles when the tufted duck is diving. [2]

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*(Question 1 continued)*

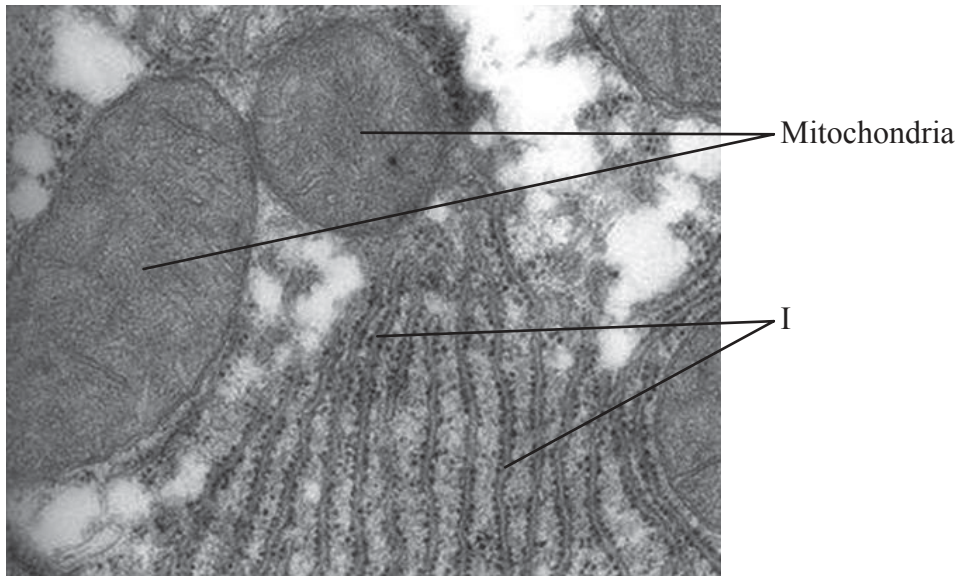
(h) State the hormone that affects heart rate.

[1]

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2. The electron micrograph below shows the ultrastructure of part of an animal cell.



Reproduced with the kind permission of the Electron Microscopy Facility, Trinity College, Hartford, Connecticut, USA, and Professor Daniel G. Blackburn.

(a) Identify the structure labelled I. [1]

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(b) Explain briefly how materials produced in the structure labelled I are transported to the plasma membrane. [2]

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*(Question 2 continued)*

(c) Outline the function of the mitochondria in the cell.

[2]

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(d) Suggest why the two labelled mitochondria are different shapes in the micrograph.

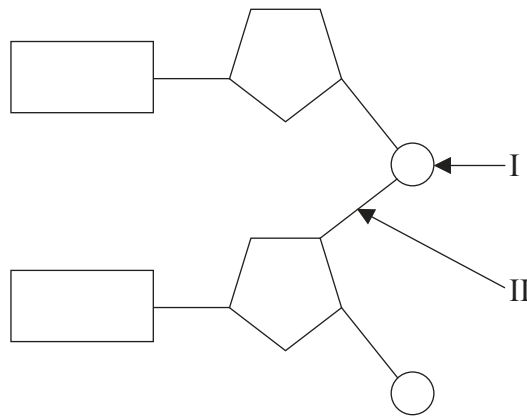
[1]

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3. 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) Explain the role of polymerase in DNA replication. [2]

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*(Question 3 continued)*

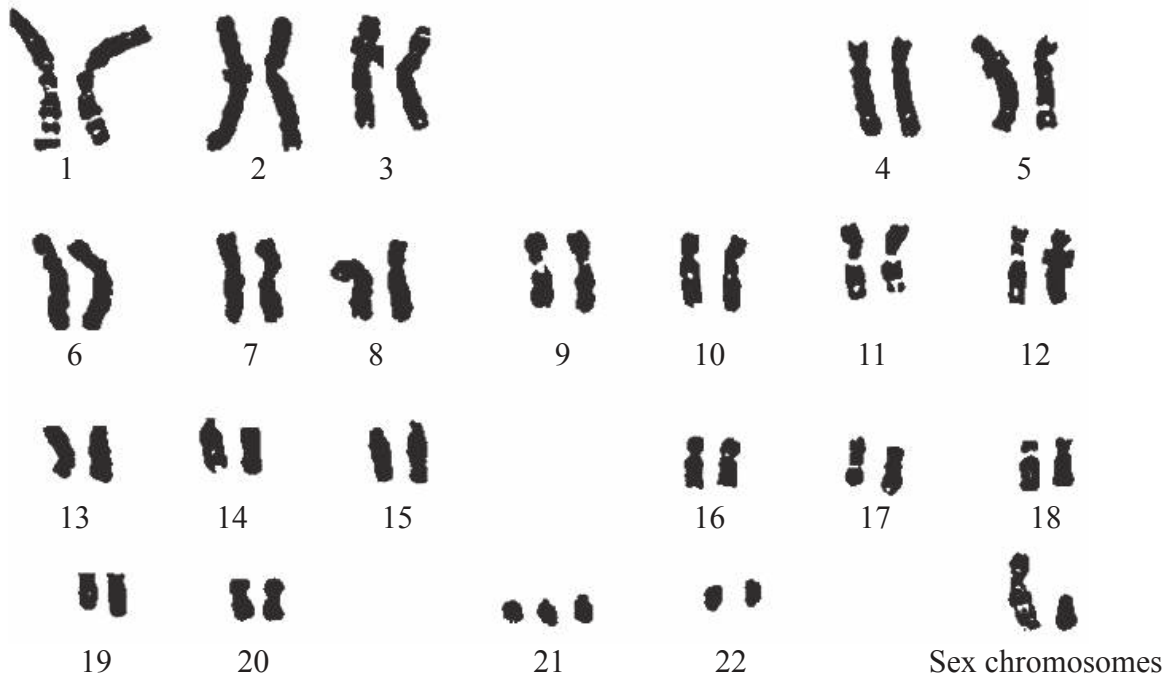
(c) Compare the DNA found in prokaryotic cells and eukaryotic cells.

[2]

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4. The karyotype below shows the chromosomes from a person with Down syndrome.



U.S. Department of Energy Human Genome Program (genomics.energy.gov, genomicscience.energy.gov)

(a) State the evidence provided by the karyotype that shows this person has Down syndrome. [1]

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(b) Outline how Down syndrome occurs due to meiosis. [2]

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*(Question 4 continued)*

- (c) Determine, giving a reason, the sex of the person in the karyotype. [1]

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- (d) Explain briefly why males are more likely to inherit colour blindness than females. [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 in the boxes provided.

- 5. (a) Describe what is meant by a food chain using an example with **four named** organisms. [4]
- (b) Outline how global warming may affect arctic ecosystems. [5]
- (c) Explain how natural selection can lead to evolution using antibiotic resistance in bacteria as an example. [9]
  
- 6. (a) Outline the cause and transmission of AIDS. [5]
- (b) Describe how phagocytic leucocytes may act as a defence against disease. [4]
- (c) Explain the principle of homeostasis with reference to the control of body temperature. [9]
  
- 7. (a) Outline condensation and hydrolysis reactions using a different example for each. [5]
- (b) Outline the effect of temperature and substrate concentration on the activity of enzymes. [4]
- (c) Explain methods by which the rate of photosynthesis can be measured, including conditions that affect the rate. [9]

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