

Biology
Standard level
Paper 2

Monday 1 May 2017 (afternoon)

Candidate session number

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1 hour 15 minutes

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.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is **[50 marks]**.



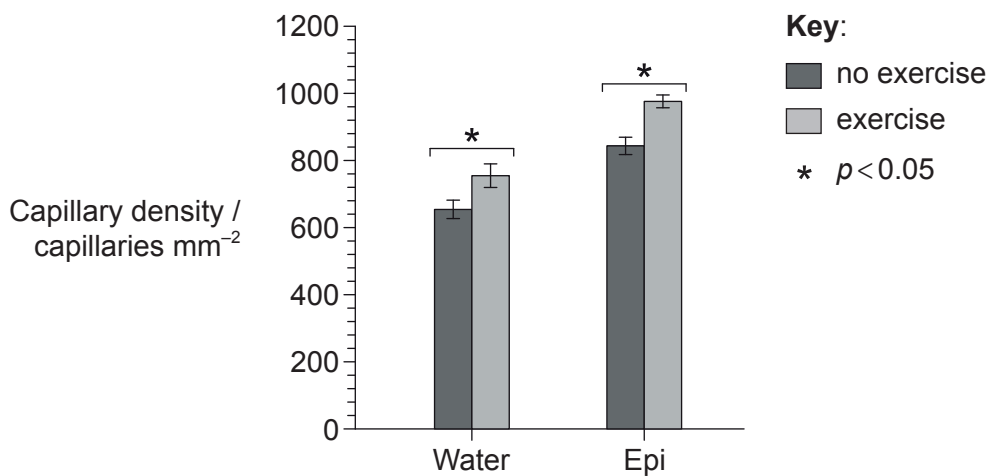
Section A

Answer **all** questions. Answers must be written within the answer boxes provided.

- Consumption of dark chocolate has been shown to have health benefits. A study was undertaken to see the effects of epicatechin (Epi), a substance in dark chocolate, on the aerobic capacity of leg muscles of mice.

A group of adult mice was used to measure the effects of a low dose of Epi given over 15 days. The mice were divided into four groups and given either water or Epi and were either kept idle (no exercise) or made to exercise on a treadmill.

After 15 days, the results were analysed. The blood capillary density in leg muscle was measured under the light microscope.



[Source: adapted from L Nogueira, *et al.*, (2011), *The Journal of Physiology*, **589** (part 18), Wiley, pages 4615–4631]

- State the significance of the statement: $p < 0.05$. [1]

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- Outline the trends in capillary density in the results of this experiment. [2]

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(Question 1 continued)

(b) Describe how increased capillary density could affect the aerobic capacity of muscle. [2]

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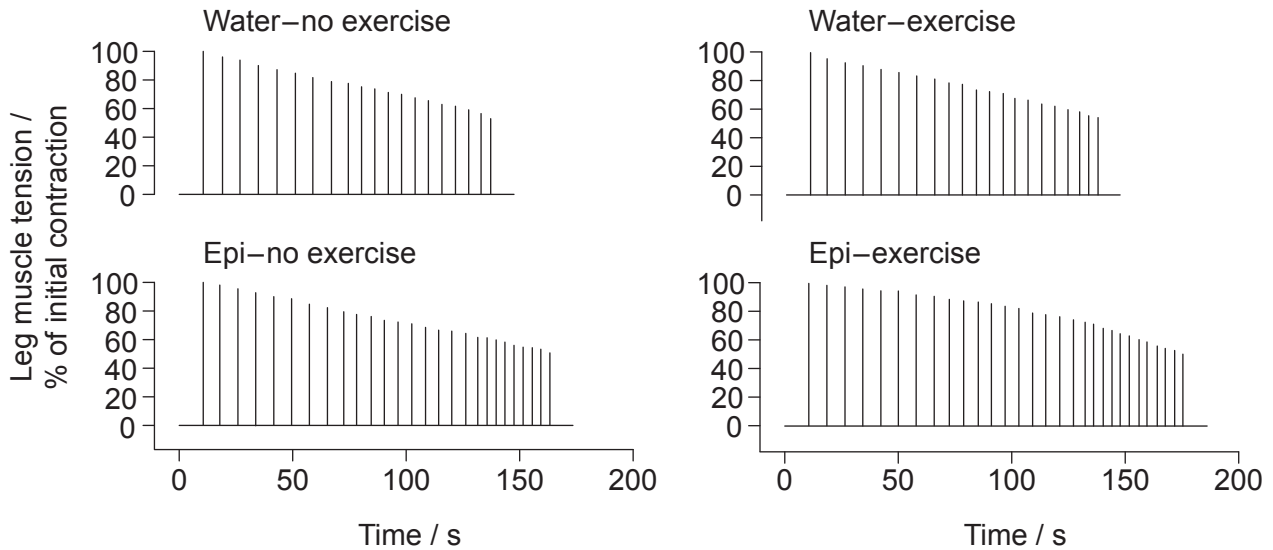


20EP03

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(Question 1 continued)

Leg muscle tension was measured over time during a treadmill exercise in all four groups. The muscle is considered to reach a point of fatigue when there is a decrease in tension to 50% of the initial tension.



[Source: adapted from L Nogueira, *et al.*, (2011), *The Journal of Physiology*, **589** (part 18), Wiley, pages 4615–4631]

(c) (i) State the time when the point of fatigue occurred in the Epi-exercise group. [1]

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(ii) Compare and contrast the results for the water-no exercise group and the Epi-no exercise group. [3]

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(Question 1 continued)

(d) Discuss the effect of exercise on the results of the experiment.

[2]

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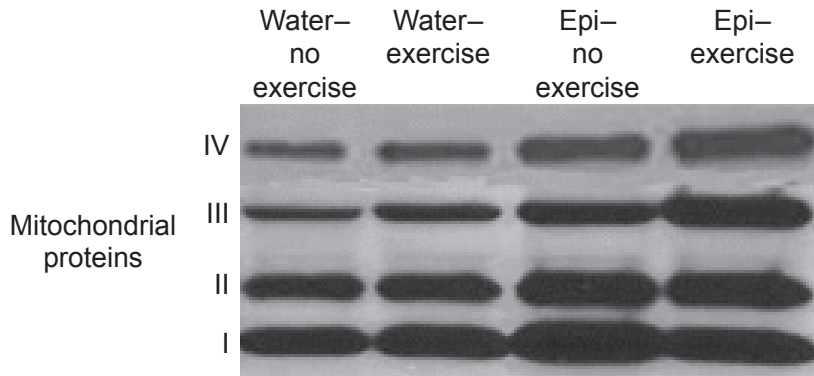


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(Question 1 continued)

The scientists tested the expression of four different mitochondrial proteins. The protein samples were taken from leg muscles. The technique that was used to quantify the amount of protein expressed was Western blotting. In this procedure the thickness of the band is an indicator of the amount of protein.



[Source: adapted from L Nogueira, *et al.*, (2011), *The Journal of Physiology*, **589** (part 18), Wiley, pages 4615–4631]

(e) Analyse the effect of exercise on the presence of the mitochondrial proteins in the leg muscle.

[2]

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(f) Mitochondria are essential for aerobic respiration. Suggest **one** possible role of the proteins that were studied.

[1]

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(Question 1 continued)

The scientists concluded that Epi significantly increased aerobic capacity in leg muscle.

- (g) Evaluate the strength of the evidence provided by all of the data for dark chocolate improving the aerobic capacity of athletes.

[3]

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Answers written on this page
will not be marked.



2. (a) Glands are organs that secrete and release particular chemical substances. Melatonin is an important hormone secreted in the pineal gland in the brain. Describe its role in mammals.

[2]

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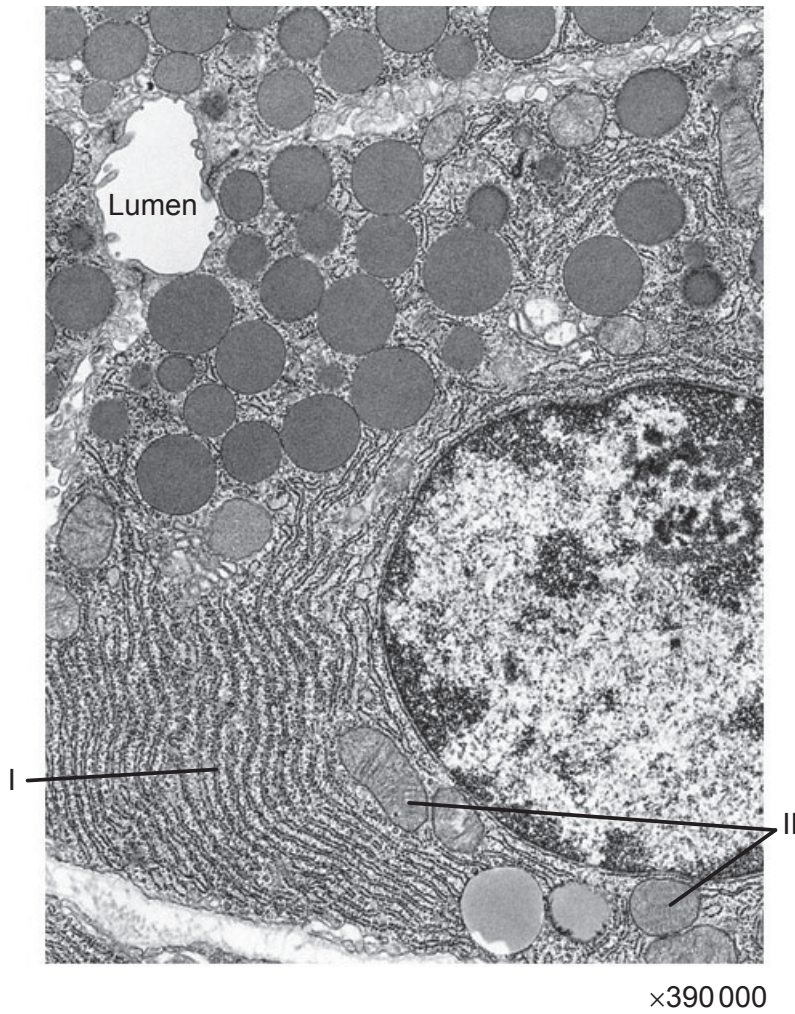
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(Question 2 continued)

- (b) The electron micrograph shows the structures in an exocrine gland cell of the pancreas.



[Source: Meschner AL, *Junqueira's Basic Histology: Text and Atlas*, 12th edition. Copyright McGrawHill Education.]

- (i) State the principal product of this cell.

[1]

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(Question 2 continued)

- (ii) Using the table, identify the organelles labelled I and II on the electron micrograph with their principal role. [2]

Organelle	Name	Principal role
I		
II		

3. (a) Outline the use of human embryonic stem cells (hESC) to treat Stargardt's disease. [2]

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- (b) The most common form of Stargardt's disease is known to be autosomal recessive. Using a Punnett grid, deduce the probability of a child inheriting Stargardt's disease, if both of the parents are carriers of the disease but do not have the disease themselves. [3]



4. (a) Mutations are the ultimate source of genetic variation and are essential to evolution.

(i) State **one** type of environmental factor that may increase the mutation rate of a gene. [1]

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(ii) Identify **one** type of gene mutation. [1]

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(Question 4 continued)

(b) Lice are wingless insects that belong to the phylum arthropoda.

(i) State **two** characteristics that identify lice as members of the arthropoda. [2]

1.
2.

(ii) Some lice live in human hair and feed on blood. Shampoos that kill lice have been available for many years but some lice are now resistant to those shampoos. Two possible hypotheses are:

Hypothesis A	Hypothesis B
Resistant strains of lice were present in the population. Non-resistant lice died with increased use of anti-lice shampoo and resistant lice survived to reproduce.	Exposure to anti-lice shampoo caused mutations for resistance to the shampoo and this resistance is passed on to offspring.

Discuss which hypothesis is a better explanation of the theory of evolution by natural selection. [3]

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Section B

Answer **one** question. Up to one additional mark is available for the construction of your answer. Answers must be written within the answer boxes provided.

5. (a) Draw a molecular diagram of an amino acid to show its general structure. [3]
- (b) Outline the role of ribosomes in translation. [4]
- (c) Some blood proteins are involved in defence against infectious disease. Explain the roles of **named** types of blood proteins in different defence mechanisms. [8]
6. (a) Describe the structure and function of starch in plants. [3]
- (b) Outline the production of carbohydrates in photosynthesis. [4]
- (c) Discuss the processes in the carbon cycle that affect concentrations of carbon dioxide and methane in the atmosphere and the consequences for climate change. [8]



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20EP15

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20EP18

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20EP19

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