



22096017



BIOLOGY
STANDARD LEVEL
PAPER 2

Wednesday 6 May 2009 (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.



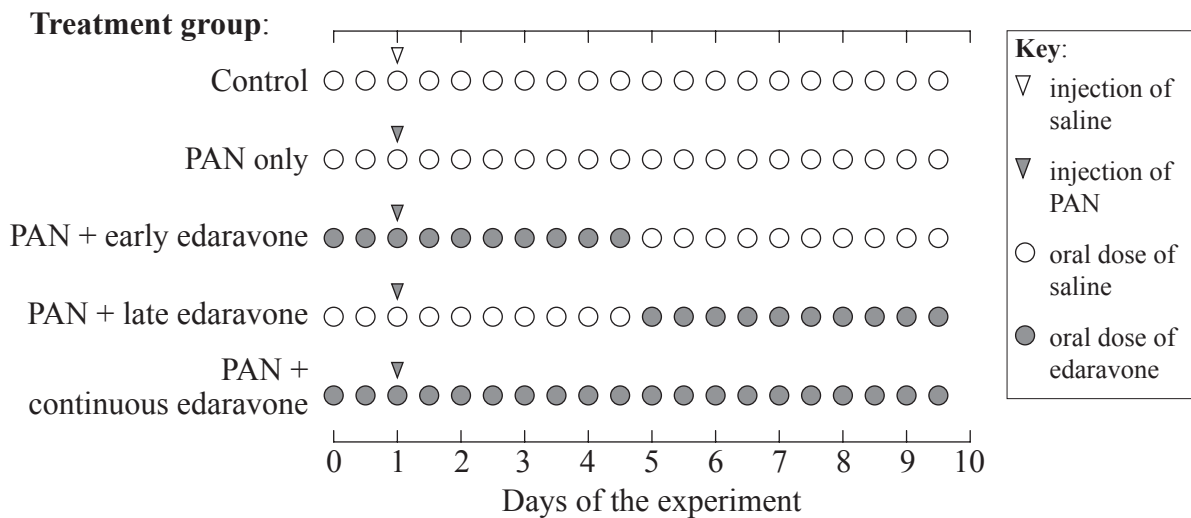
22096017



SECTION A

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

1. Medical scientists investigated the development of nephrotic syndrome, a kidney disease that results in the abnormal presence of protein in the urine. This symptom of the disease can also be caused by injecting puromycin aminonucleoside (PAN) into rats. The drug edaravone, a proposed treatment for the disease, was studied. The experimental timetable for the different treatment groups is summarized below. Edaravone was given by mouth (oral dose). Saline is a solution with the same concentration of solutes as blood plasma.



[Source: H. Matsumura, A. Ashida, K. Hirano, H. Nakakura and H. Tamai, "Protective effect of radical scavenger edaravone against puromycin nephrosis", *Clinical Nephrology*, Vol. 66, no. 6/2006, pp. 405-410. Reprinted with permission.]

- (a) State when PAN was injected into the rats. [1]

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- (b) Outline the treatment given to the control group. [2]

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- (c) Distinguish between the treatment received by the PAN only group and the PAN + early edaravone group. [1]

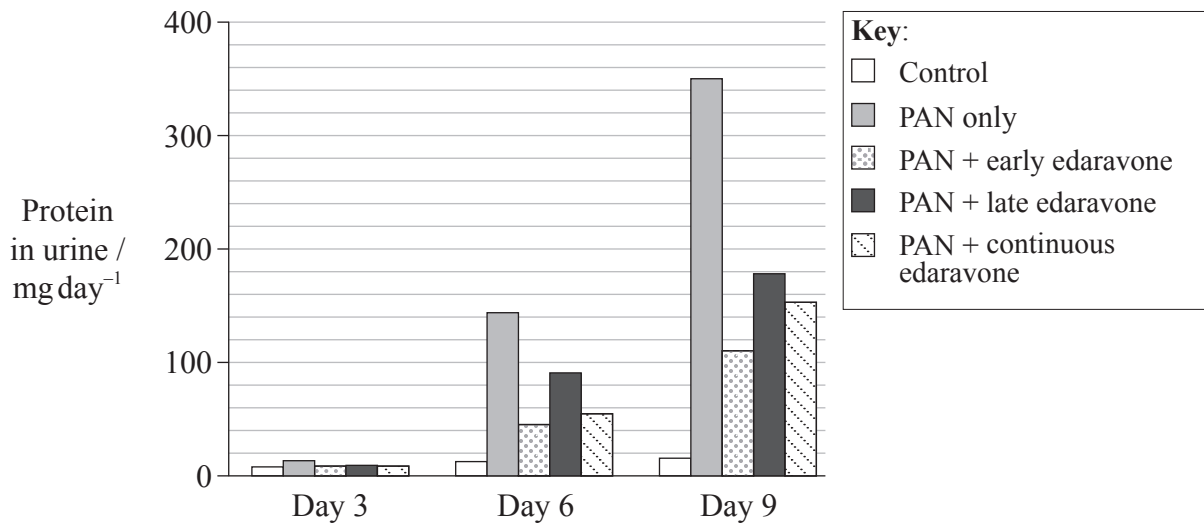
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(This question continues on the following page)



(Question 1 continued)

The graph below shows the levels of protein found in the urine of the rats on day 3, day 6 and day 9 of the experiment.



[Source: H. Matsumura, A. Ashida, K. Hirano, H. Nakakura and H. Tamai, "Protective effect of radical scavenger edaravone against puromycin nephrosis", *Clinical Nephrology*, Vol. 66, no. 6/2006, pp. 405-410. Reprinted with permission.]

(d) State the increase in protein in the urine of rats treated with PAN only between day 6 and day 9. [1]

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(e) Compare the levels of protein during the experiment in the urine of rats treated using PAN only with those treated using PAN + early edaravone. [3]

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(f) Evaluate whether the results support the hypothesis that a continuous dose of edaravone is better than the same drug administered over shorter periods. [3]

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2. (a) State the property of stem cells that makes them useful in medical treatment. [1]

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(b) Explain how multicellular organisms develop specialized tissues. [2]

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(c) Outline some of the outcomes of the sequencing of the human genome. [3]

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3. (a) Explain how materials are moved across membranes of cells by active transport. [2]

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(b) Explain the effects of pH on enzyme catalysed reactions. [3]

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(c) Distinguish between the process of anaerobic respiration in yeast and humans. [2]

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4. (a) Define the terms *species*, *population* and *community*. [3]

Species:

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Population:

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Community:

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- (b) Explain the shape of the pyramids of energy that are constructed by ecologists to represent energy flow in an ecosystem. [3]

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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) Draw a labelled diagram of the heart showing the chambers, associated blood vessels and valves. [4]
- (b) Describe the relationship between the structure and function of blood vessels. [6]
- (c) Explain the mechanisms involved in the ventilation of the lungs. [8]
6. (a) Draw a labelled diagram of the adult female reproductive system. [4]
- (b) Describe how natural selection leads to evolution. [6]
- (c) Explain the consequences of altering a DNA base in the genome of an organism. [8]
7. (a) Draw a labelled diagram showing the ultrastructure of a typical prokaryote. [4]
- (b) Outline how **three** different environmental conditions can affect the rate of photosynthesis in plants. [6]
- (c) Explain how the emission of gases, both naturally and through human activity, can alter the surface temperature of the Earth. [8]
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