

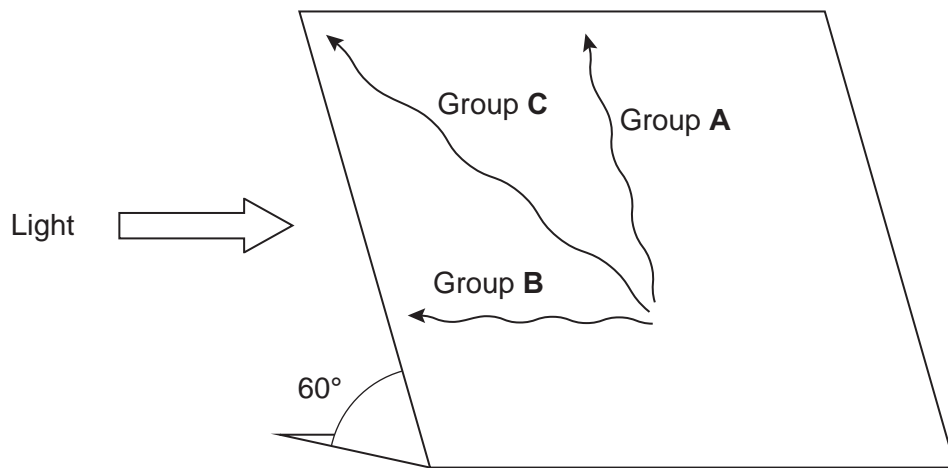
Answer **all** questions in the spaces provided.

- 1** Termites are insects. Some species live in colonies in the soil. Although most termites are wingless, winged termites are sometimes produced. The winged termites fly from the soil, mate and start new colonies.

A scientist studied the behaviour of winged termites. He divided these termites into three groups.

- Group **A** had their eyes covered.
- Group **B** had their antennae removed.
- Group **C** was the control group.

He put individual winged termites on a sloping board that was illuminated from one side. The diagram shows the direction of movement of a typical termite from each of the three groups.



- 1 (a) (i)** What type of behaviour was shown by the termite from group **B**?

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(1 mark)

- 1 (a) (ii)** Give the evidence for your answer.

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(1 mark)

- 1 (b)** Explain what the results from group **A** suggest about the factors controlling the behaviour of winged termites.

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(3 marks)

(Extra space).....

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- 1 (c)** Suggest **one** advantage to the termites from group **C** of the behaviour shown in the investigation.

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(2 marks)

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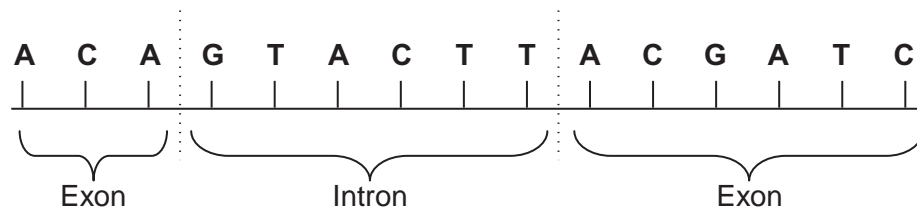
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ANSWER IN THE SPACES PROVIDED**

- 2 (a)** Complete the table to show the differences between DNA, mRNA and tRNA.

Type of nucleic acid	Hydrogen bonds present (✓) or not present (✗)	Number of polynucleotide strands in molecule
DNA		
mRNA		
tRNA		

(2 marks)

- 2 (b)** The diagram shows the bases on one strand of a piece of DNA.



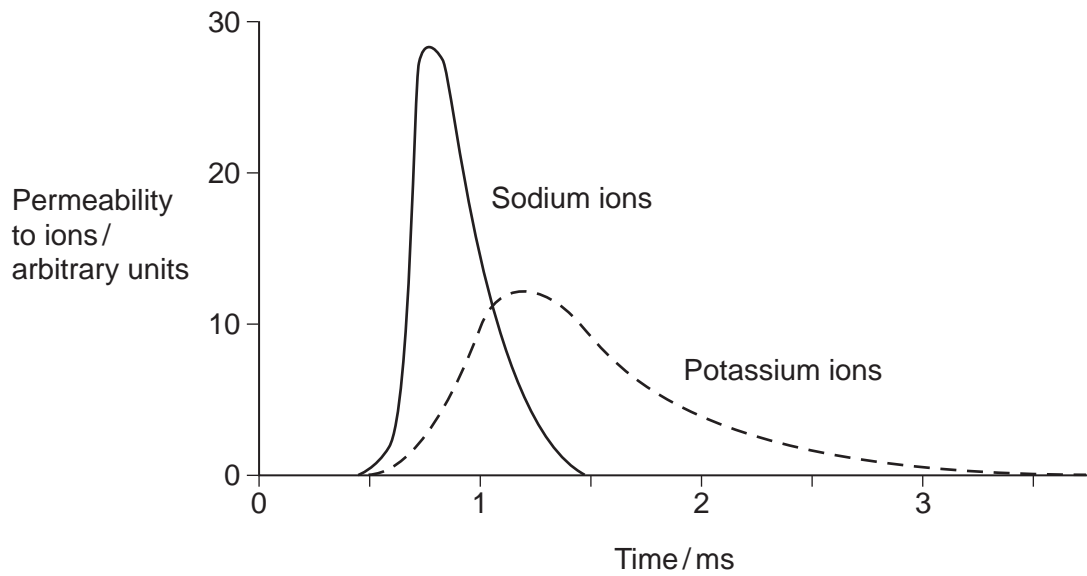
- 2 (b) (i)** In the space below, give the sequence of bases on the pre-mRNA transcribed from this strand.

(2 marks)

- 2 (b) (ii)** In the space below, give the sequence of bases on the mRNA produced by splicing this piece of pre-mRNA.

(1 mark)

- 3** During an action potential, the permeability of the cell-surface membrane of an axon changes. The graph shows changes in permeability of the membrane to sodium ions (Na^+) and to potassium ions (K^+) during a single action potential.



- 3 (a)** Explain the shape of the curve for sodium ions between 0.5 ms and 0.7 ms.

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(3 marks)

(Extra space).....

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- 3 (b)** During an action potential, the membrane potential rises to +40 mV and then falls. Use information from the graph to explain the fall in membrane potential.

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(3 marks)

(Extra space).....

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- 3 (c)** After exercise, some ATP is used to re-establish the resting potential in axons. Explain how the resting potential is re-established..

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(2 marks)

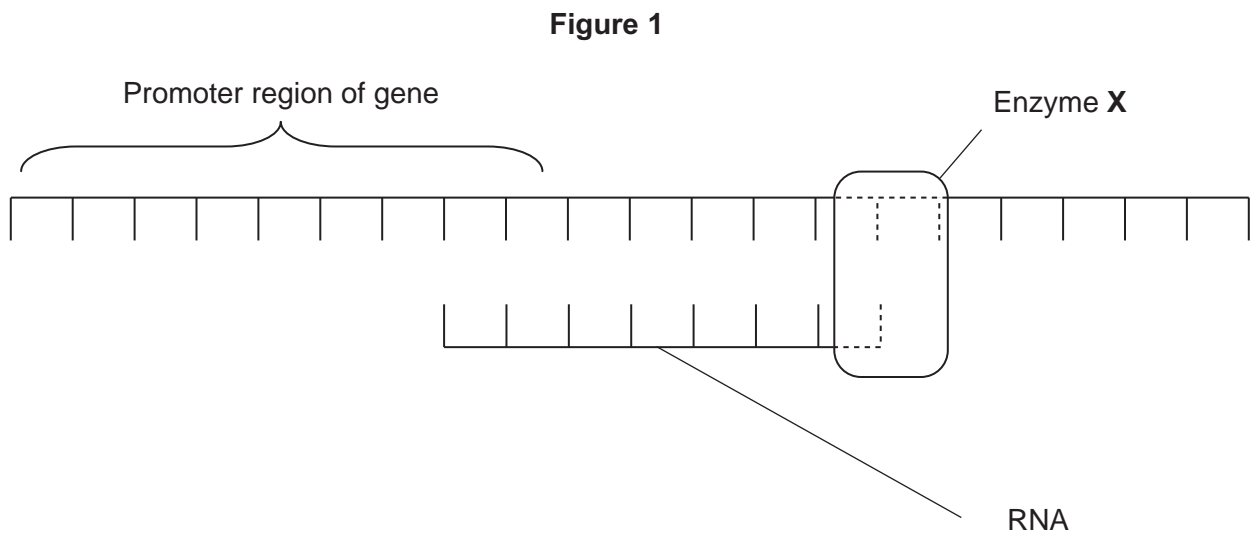
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Question 4: N/A

- 5 **Figure 1** shows part of a gene that is being transcribed.



- 5 (a) Name enzyme X.

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(1 mark)

- 5 (b) (i) Oestrogen is a hormone that affects transcription. It forms a complex with a receptor in the cytoplasm of target cells. Explain how an activated oestrogen receptor affects the target cell.

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(2 marks)

- 5 (b) (ii) Oestrogen only affects target cells. Explain why oestrogen does not affect other cells in the body.

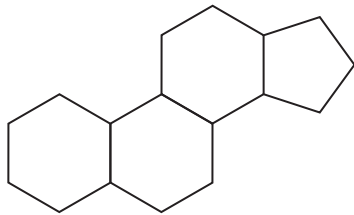
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(1 mark)

- 5 (c)** Some breast tumours are stimulated to grow by oestrogen. Tamoxifen is used to treat these breast tumours. In the liver, tamoxifen is converted into an active substance called endoxifen.

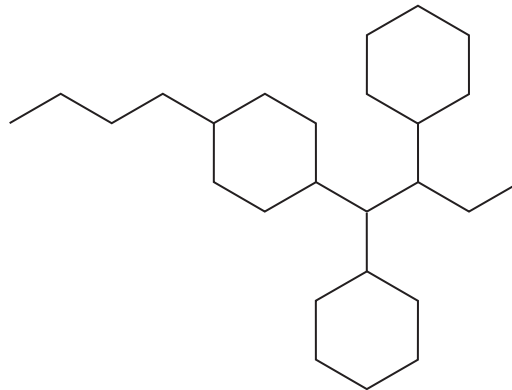
Figure 2 shows a molecule of oestrogen and a molecule of endoxifen.

Figure 2

Oestrogen



Endoxifen



Use **Figure 2** to suggest how endoxifen reduces the growth rate of these breast tumours.

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(2 marks)

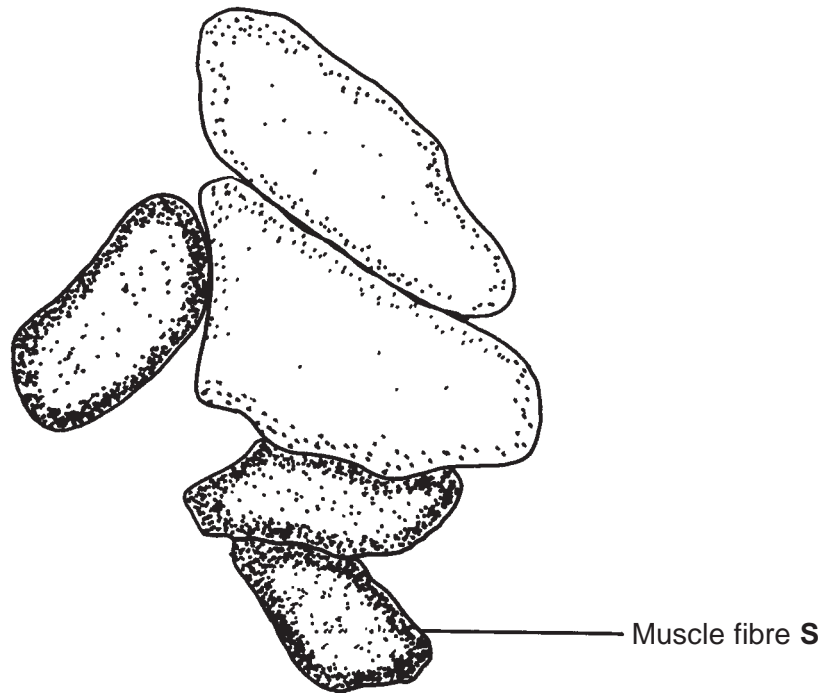
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Question 6: N/A

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- 7 The drawing is a tracing of a cross-section through skeletal muscle tissue. This muscle contains fast muscle fibres and slow muscle fibres. The section has been stained to show the distribution of the enzyme succinate dehydrogenase. This enzyme is found in mitochondria.



- 7 (a) (i) Succinate dehydrogenase catalyses one of the reactions in the Krebs cycle. What is the evidence from the drawing that muscle fibre S is a slow muscle fibre? Explain your answer.

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(2 marks)

- 7 (a) (ii) Use evidence from the diagram to describe the distribution of mitochondria inside the slow muscle fibres. Explain the importance of this distribution.

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(3 marks)

(Extra space).....

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- 7 (b) (i) You could use an optical microscope and a slide of stained muscle tissue to find the diameter of one of the muscle fibres. Explain how.

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(2 marks)

- 7 (b) (ii) A student found the mean diameter for the slow muscle fibres in a section. Give **two** precautions that she should have taken when sampling the fibres. Give a reason for each precaution.

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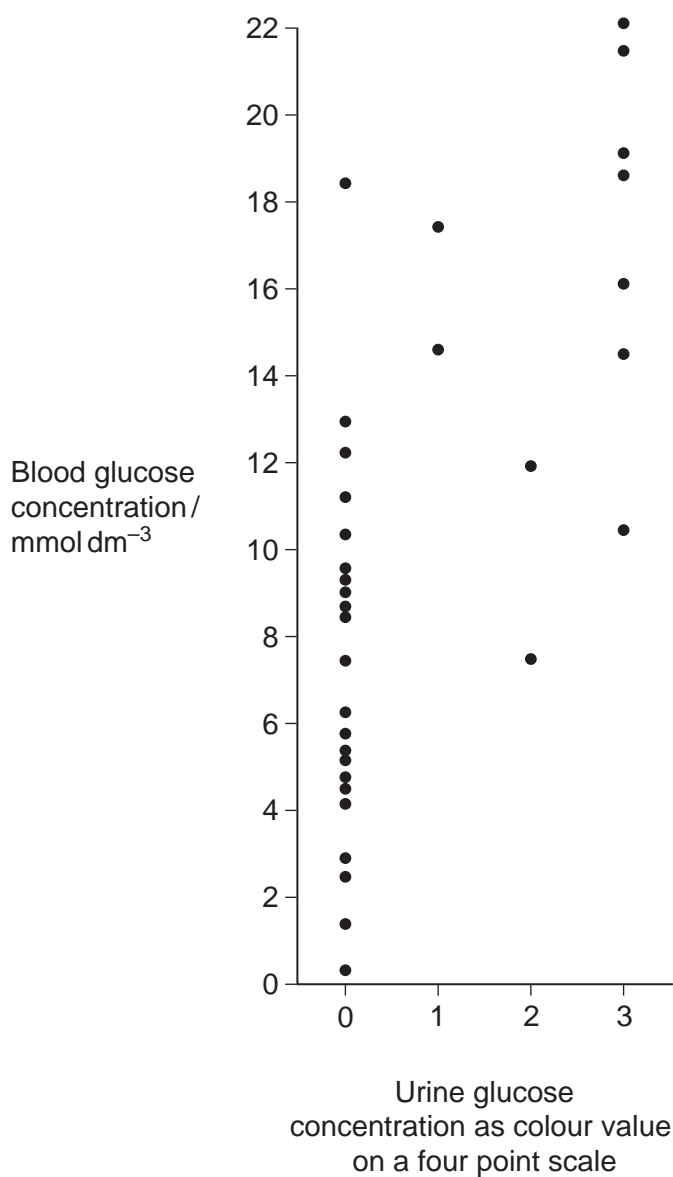
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(2 marks)

- 8 (a)** Technicians in a hospital laboratory tested urine and blood samples from a girl with diabetes at intervals over a one-year period. Each time the technicians tested her urine, they also measured her blood glucose concentration. Their results are shown in the graph.



- 8 (a) (i)** The girl who took part in this investigation was being successfully treated with insulin. The graph shows that on some occasions, the concentration of glucose in her blood was very high. Suggest why.

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(2 marks)

- 8 (a) (ii)** Use the graph to evaluate the use of the urine test as a measure of blood glucose concentration.

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(3 marks)

(Extra space).....

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- 8 (b)** Diabetic people who do not control their blood glucose concentration may become unconscious and go into a coma. A doctor may inject a diabetic person who is in a coma with glucagon. Explain how the glucagon would affect the person's blood glucose concentration.

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(2 marks)

- 9 (a) The biochemical pathway of aerobic respiration involves a number of different steps. Name **one** step in which carbon dioxide is produced.

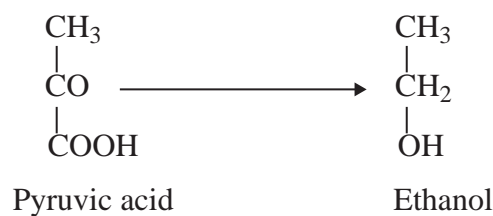
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(1 mark)

In an investigation, scientists transferred slices of apple from air to anaerobic conditions in pure nitrogen gas. They measured the rate of carbon dioxide production.

- (b) The scientists kept the temperature constant throughout the investigation. Explain how a decrease in temperature would affect the rate of carbon dioxide production.

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(2 marks)

- (c) When the apple slices were transferred to nitrogen, the following biochemical pathway took place.



Use this pathway to explain the part played by reduced NAD when the apple slices were transferred to nitrogen.

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(2 marks)

- (d) The rate of carbon dioxide production was higher when the apple slices were in nitrogen than when they were in the air. Explain why.

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(3 marks)

(Extra space)

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- 10 (a) In the light-dependent reaction of photosynthesis, light energy generates ATP.
Describe how.

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(5 marks)

(Extra space)

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- [illegible]

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- (c) Explain how the intensive rearing of domestic livestock increases net productivity.

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(4 marks)

(Extra space)

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END OF QUESTIONS