

Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 Some mammalian hormones are synthesised from amino acids.

(a) (i) Put a cross ☒ in the box next to the structure where translation of messenger RNA and protein synthesis take place. (1)

- A** Golgi apparatus
- B** lysosome
- C** rough endoplasmic reticulum
- D** smooth endoplasmic reticulum

(ii) Put a cross ☒ in the box next to the structure where modification of proteins to form glycoproteins takes place. (1)

- A** Golgi apparatus
- B** lysosome
- C** nucleolus
- D** ribosome

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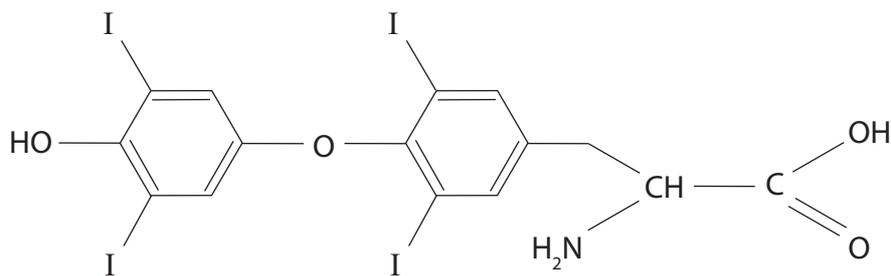


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(b) The diagram below shows the structure of thyroxine, a hormone involved in the regulation of respiration in cells. Thyroxine is synthesised from two amino acids and iodine.



(i) Draw a circle round the carboxyl group. (1)

(ii) Thyroxine increases the body's sensitivity to hormones such as adrenaline.
Thyroxine can also inhibit nerve impulses.

Compare the mechanisms used in hormonal and nervous coordination in mammals.

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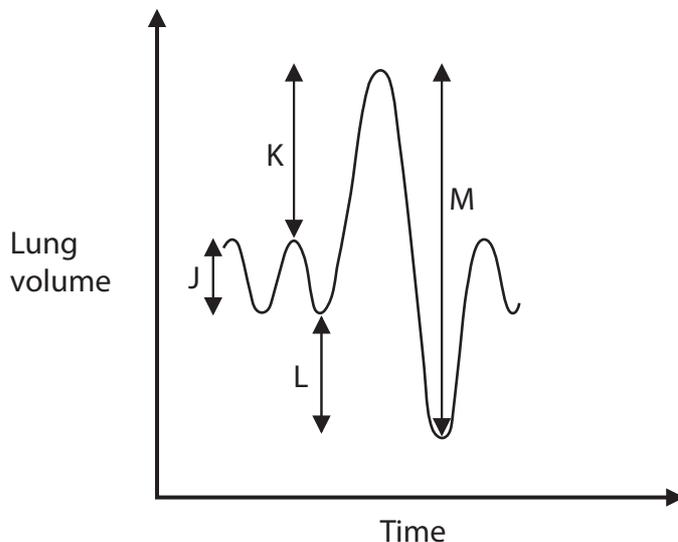
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2 Spirometry is a technique used to investigate lung function.

(a) The diagram below shows part of a spirometer trace of a person at rest and when breathing in and out as fully as possible.



(i) Put a cross ☒ in the box next to the letter that shows the tidal volume.

(1)

- A J
- B K
- C L
- D M

(ii) The minute volume is the volume of air breathed in or out by a person in one minute.

Put a cross ☒ in the box next to the minute volume of a person with a tidal volume of 450 cm^3 and a breathing rate of 18 breaths per minute.

(1)

- A $8.1 \text{ dm}^3 \text{ min}^{-1}$
- B $16.2 \text{ dm}^3 \text{ min}^{-1}$
- C $25.0 \text{ dm}^3 \text{ min}^{-1}$
- D $810.0 \text{ dm}^3 \text{ min}^{-1}$



(iii) Explain how you would use a spirometer trace to find the breathing rate of a person.

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(b) The effect of exercise on the breathing of a person was investigated.

The tidal volume and breathing rate of a person were measured at rest and then immediately after cycling for two minutes at increasing speeds.

The table below shows the results of this investigation.

Cycling speed / km hour ⁻¹	Tidal volume / cm ³	Breathing rate / breaths min ⁻¹
0 (rest)	600	12
10	1800	14
15	2300	17
20	2650	20
25	3000	27

(i) Using the data in the table, describe the effect of exercise on tidal volume.

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(ii) Using the results of this investigation, explain the effect of exercise on the depth and rate of breathing.

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(Total for Question 2 = 11 marks)



- 3 The photograph below shows a camel. Camels are large mammals adapted to a desert environment.



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- (a) A desert environment has a wide temperature range. A camel maintains a nearly constant body temperature by the process of negative feedback.

Explain what is meant by the term **negative feedback**.

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- (b) The table below shows the daily heat loss from a camel that had been given water to drink and the daily heat loss from a camel that had not been given water to drink.

Camel	Daily heat loss / kJ
given water to drink	20 920
not given water to drink	8 368

Using the data in the table, calculate the percentage increase in the heat loss of the camel given water to drink.

Show your working.

(2)

Answer%



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*(c) Temperatures in the desert may rise above 50°C.

Suggest how the camel is able to maintain an internal body temperature within a range of 38°C to 40°C.

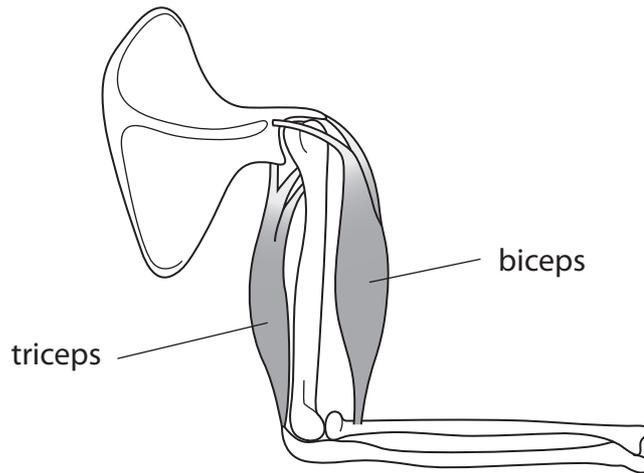
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Area with horizontal dotted lines for writing the answer.

(Total for Question 3 = 10 marks)



4 The diagram below shows two muscles in the human arm, the biceps and the triceps.



(a) Explain how extension of the lower arm is brought about.

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(b) Muscles contain structural proteins.

Put a cross in the box next to the row in the table that shows two structural proteins involved in muscle contraction.

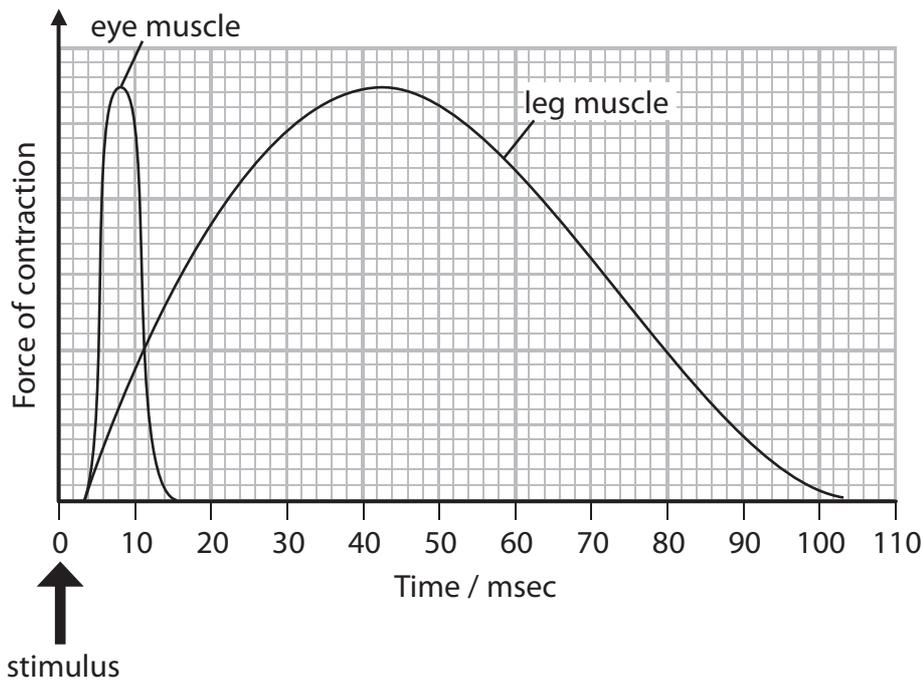
(1)

<input type="checkbox"/> A	actin	myoglobin
<input type="checkbox"/> B	actin	myosin
<input type="checkbox"/> C	myosin	myoglobin
<input type="checkbox"/> D	sarcomere	tropomyosin



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(c) The graph below shows the force of contraction of two muscles after a stimulus.



(i) Using the information in the graph, compare the response of these two muscles to a stimulus.

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(ii) Eye muscles contain a higher proportion of fast twitch fibres to slow twitch fibres than leg muscles.

Complete the table below to give **three** differences between fast twitch and slow twitch muscle fibres.

(3)

Fast twitch muscle fibres	Slow twitch muscle fibres

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(d) Some athletes use drugs to enhance the performance of their muscles.

Suggest **two** reasons why the use of such drugs should be banned.

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(Total for Question 4 = 10 marks)



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5 Neurones conduct impulses and synapses allow for the transmission of nerve impulses from one neurone to another.

(a) Put a cross in the box next to the words to complete each of the following statements.

(i) When an axon membrane is depolarised and the membrane potential rises from -70 mV to $+40\text{ mV}$,

(1)

- A potassium channels open and potassium ions move into the axon
- B potassium channels open and potassium ions move out of the axon
- C sodium channels open and sodium ions move into the axon
- D sodium channels open and sodium ions move out of the axon

(ii) The sodium-potassium pump in the axon membrane actively transports

(1)

- A potassium ions into the axon and sodium ions out of the axon
- B potassium ions out of the axon and sodium ions into the axon
- C sodium ions and potassium ions into the axon
- D sodium ions and potassium ions out of the axon

(b) Explain how calcium ions are involved in synaptic transmission.

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(c) Suggest **two** reasons why impulses travel in only one direction across a synapse.

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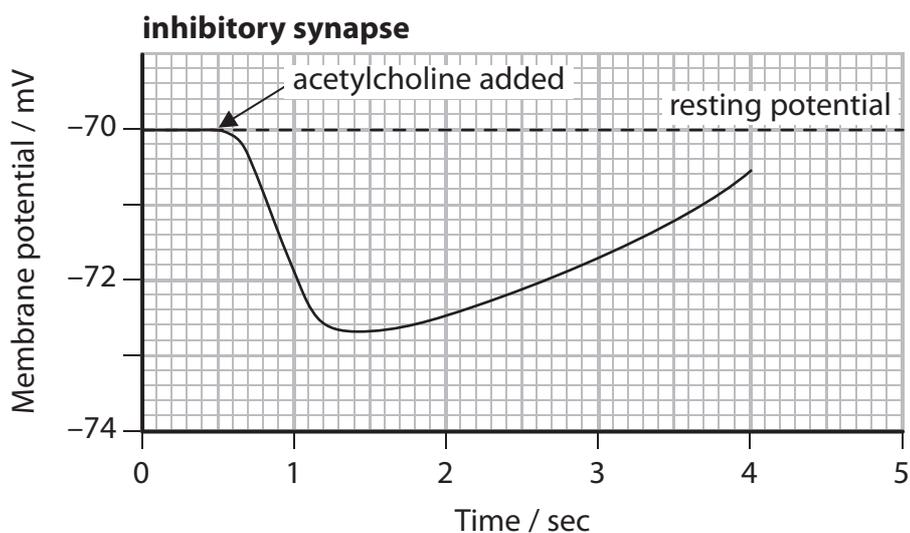
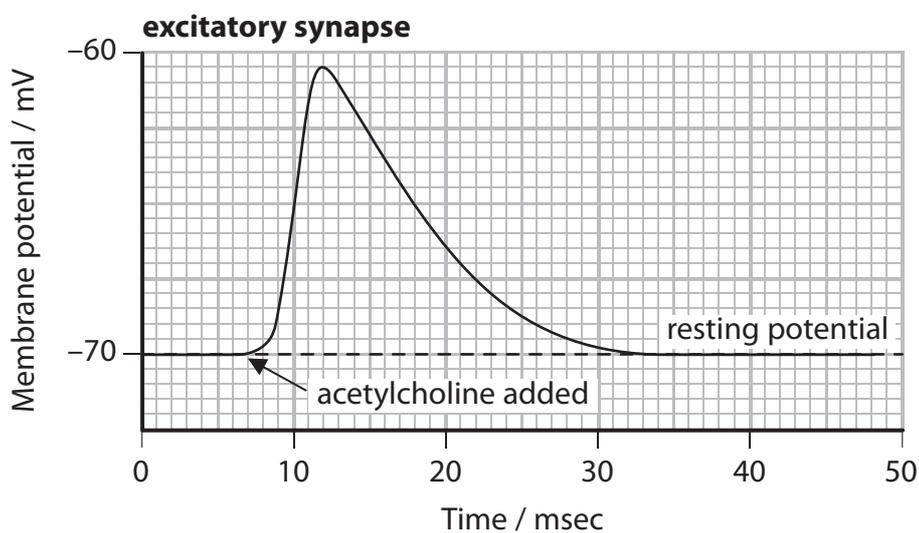
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(d) The graphs below show the effect of acetylcholine on the membrane potential of the postsynaptic cell in an excitatory synapse and in an inhibitory synapse.



Using the information in the graphs, compare the effect of acetylcholine at these two synapses.

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(Total for Question 5 = 10 marks)



P 5 1 8 6 1 A 0 1 5 2 4

6 Plants and animals detect and respond to environmental cues, such as light.

(a) (i) Name the visual pigment present in rod cells.

(1)

(ii) Put a cross in the box next to the words to complete the following statement.

(1)

When a rod cell responds to light,

- A cation channels close and the rod cell becomes depolarised
- B cation channels close and the rod cell becomes hyperpolarised
- C cation channels open and the rod cell becomes depolarised
- D cation channels open and the rod cell becomes hyperpolarised

(b) Explain the role of auxin (IAA) in phototropism.

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(c) The level of uric acid in the blood stream is considered to affect the chance of developing Parkinson's disease (paragraph 10).

(i) Sketch a graph in the space below to show this relationship.

(2)

(ii) Describe how scientists could obtain data to verify this relationship.

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(d) Dr. Braak's hypothesis 'stimulated much discussion and debate among researchers' (paragraph 13).

Suggest how these researchers learnt of Dr. Braak's hypothesis.

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(e) The motor problems of patients with Parkinson’s disease can be controlled with medication.

A side effect of some of these medications is that nonmotor symptoms of Parkinson’s disease can become more serious. Many of these nonmotor symptoms can respond to treatment (paragraph 17).

Explain how scientists could determine if a treatment reduced the side effects of these medications.

(3)

Dotted lines for writing the answer to question (e).

(f) Drugs that are being developed to treat patients with Parkinson’s disease have been tested on animals.

Some of these drugs, that looked promising when tested on animals, turned out to be ineffective in treating patients with Parkinson’s disease (paragraph 20).

Suggest why some drugs look promising when tested on animals but are ineffective in treating patients with Parkinson’s disease.

(2)

Dotted lines for writing the answer to question (f).



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(g) Rotigotine is a drug administered to patients using a skin patch (paragraph 22).

Suggest **two** advantages of administering drugs to patients using skin patches.

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(h) The loss of dopaminergic neurones in the substantia nigra results in a change in the balance of excitatory and inhibitory pathways of the brain (paragraph 24).

Explain why the loss of dopaminergic neurones results in a change in the balance of these pathways.

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(i) Explain why adeno-associated virus type 2 is 'particularly efficient in carrying the genetic material to the neurons affected in Parkinson's disease' (paragraph 27).

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(Total for Question 7 = 30 marks)

TOTAL FOR PAPER = 90 MARKS



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