**5** The endocrine system and the nervous system both coordinate responses in mammals.

**(a)** Complete Table 5.1 to show the features of three cell-signalling molecules of the endocrine system: antidiuretic hormone (ADH), glucagon and insulin.

Use a tick (✓) if the molecule has the feature and a cross (✗) if the molecule does **not** have the feature.

Put a tick (✓) or a cross (✗) in every box.

**Table 5.1**

| feature | ADH | glucagon | insulin |
|---|---|---|---|
| binds to receptors on cell surface membranes | | | |
| results in molecules moving from cells into the blood | | | |
| is secreted as a result of detection by osmoreceptors | | | |

[3]

**(b)** The endocrine system has a slower transmission speed than the nervous system.

Describe **other** ways in which the endocrine system and the nervous system differ.

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..... [4]





**(c)** The endocrine system and the nervous system can affect muscle function.

Fig. 5.1 shows a transmission electron micrograph of a longitudinal section of striated muscle tissue that is in a relaxed state.

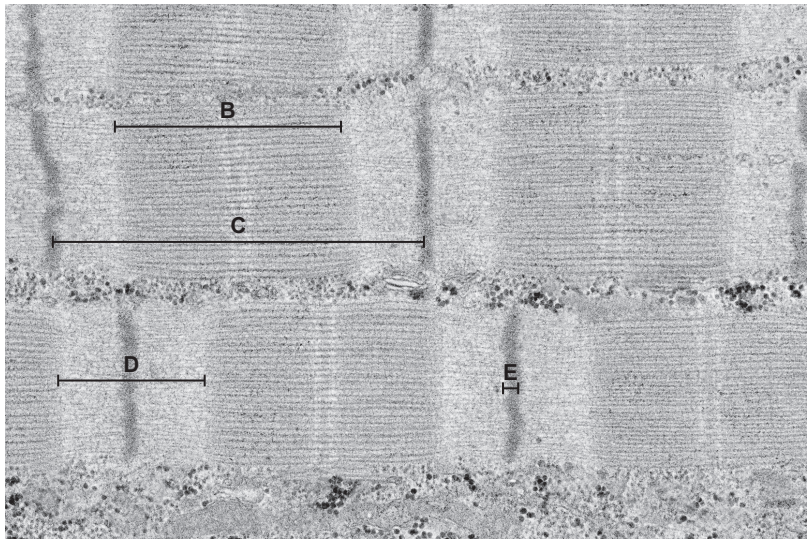


**Fig. 5.1**

**(i)** State the letter on Fig. 5.1 that indicates the length of a sarcomere.

..... [1]

**(ii)** State the letter on Fig. 5.1 that indicates a region where actin and myosin overlap.

..... [1]

**(iii)** Describe **and** explain how the region labelled **D** on Fig. 5.1 changes during muscle contraction.

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..... [4]

**10** **(a)** Nerve impulses can be transmitted along a myelinated motor neurone to a neuromuscular junction at fast speeds of up to $100\,m\,s^{-1}$.

Outline how a transmission speed of $100\,m\,s^{-1}$ is achieved by the neurone.

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..... [3]

**(b)** When a nerve impulse reaches the neuromuscular junction, acetylcholine is released and diffuses to the sarcolemma.

Describe how the release of acetylcholine can result in the binding of calcium ions to troponin in the sarcomere.

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..... [4]





**(c)** Muscle contraction can be affected by a low blood glucose concentration.

Suggest how a low blood glucose concentration would affect the functioning of the sarcomere.

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..... [3]

[Total: 10]

**1** **(a)** Fig. 1.1 is a diagram of a sensory neurone.

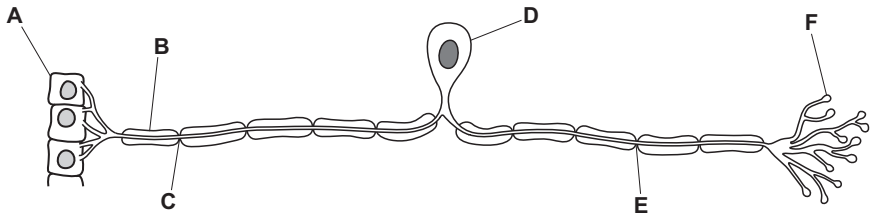


**Fig. 1.1**

Use the letters **A**–**F** in Fig. 1.1 to identify:

a receptor cell .....

an area where dendron membrane depolarisation occurs .....

a structure that forms a synapse with an intermediate neurone .....

a structure that allows rapid transmission of impulses .....

[4]

**(b)** Opioid drugs can bind to opioid receptors in the presynaptic membrane of a cholinergic synapse.

Fig. 1.2 is a diagram of a presynaptic membrane with an opioid receptor.

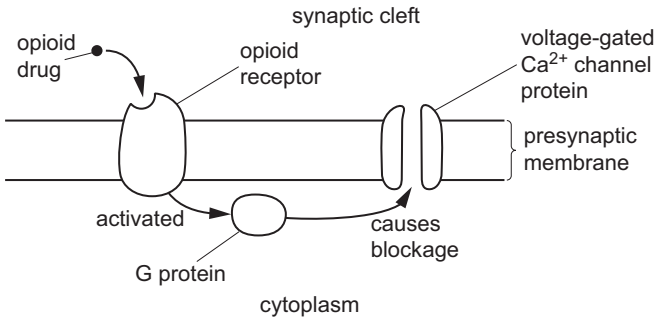


**Fig. 1.2**





Opioid drugs have an effect on the normal events that occur at a cholinergic synapse.

Suggest **and** explain the effect that an opioid drug will have on the normal events that occur at a cholinergic synapse.

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..... [4]

[Total: 8]

**10** During the course of an action potential, the potential difference across a neurone membrane changes.

Table 10.1 shows the potential difference across the neurone membrane at three sequential time points, **X**, **Y** and **Z**, just before and during an action potential.

**Table 10.1**

| time point | potential difference / mV |
|---|---|
| **X** | –70 |
| **Y** | +40 |
| **Z** | –90 |

**(a)** Describe the events that cause each of the potential differences at points **X**, **Y** and **Z**.

..... [7]





**(b)** Suggest how one action potential causes an action potential in an adjacent section of the axon of an unmyelinated neurone.

..... [2]

**(c)** Vertebrate animals generally have a myelin sheath around the axons of motor neurones.

Explain why the presence of a myelin sheath around a motor neurone axon is an advantage.

..... [3]

[Total: 12]