C2.2 Neural signalling

What the Cell · DP Biology · worksheet · statements C2.2.1–7

Name _____ **Date** _____ **Total** _____ / 49

About 50 minutes, or one section at a time. A calculator is allowed. The number of marks shows how many separate points to make. Look at the bold command term: "state" needs a brief answer, while "explain" needs reasons.

Section A: Recall

9 marks

1 **Distinguish** between a dendrite and an axon. C2.2.1 **[2]**

2 **State** the typical resting potential of a neuron. C2.2.2 **[1]**

3 **State** the number of sodium ions and of potassium ions moved by one cycle of the pump, and the direction of each. C2.2.2 **[2]**

4 **Identify** one neurotransmitter, and one type of synapse where it is used. C2.2.7 **[2]**

5 **State** the type of cell that forms the myelin sheath in peripheral nerves. C2.2.4 **[1]**

6 **State** the ion that enters the synaptic knob when the presynaptic membrane depolarizes. C2.2.6 **[1]**

Section B: Understanding

16 marks

7 **Outline** why a signal can pass in only one direction across a typical synapse. C2.2.5 **[2]**

8 **Explain** how a resting potential is generated and maintained. C2.2.2 **[4]**

9 **Explain** why a nerve impulse is described as electrical. C2.2.3 **[2]**

10 **Describe** how a neurotransmitter is released from a presynaptic membrane. C2.2.6 **[3]**

11 **Explain** how the binding of acetylcholine generates an excitatory postsynaptic potential. C2.2.7 **[4]**

12 **State** why a neuron uses ATP even when it is not transmitting an impulse. C2.2.2 **[1]**

Section C: Working with data

16 marks

Values are rounded or invented for practice, based on realistic patterns.

13 C2.2.4

The table shows typical conduction speeds in five types of nerve fibre.

Fibre	Diameter / μm	Myelinated	Speed / m s^{-1}
Squid giant axon	500	no	25
Cockroach giant axon	50	no	10
Human small fibre	1	no	1
Cat motor fibre	5	yes	30
Human motor fibre	20	yes	120

a **Calculate** how many times faster the squid giant axon conducts than the human small fibre. **[1]**

b **Describe** the effect of diameter on speed in non-myelinated fibres. **[1]**

c **Compare** the cat motor fibre with the cockroach giant axon. **[2]**

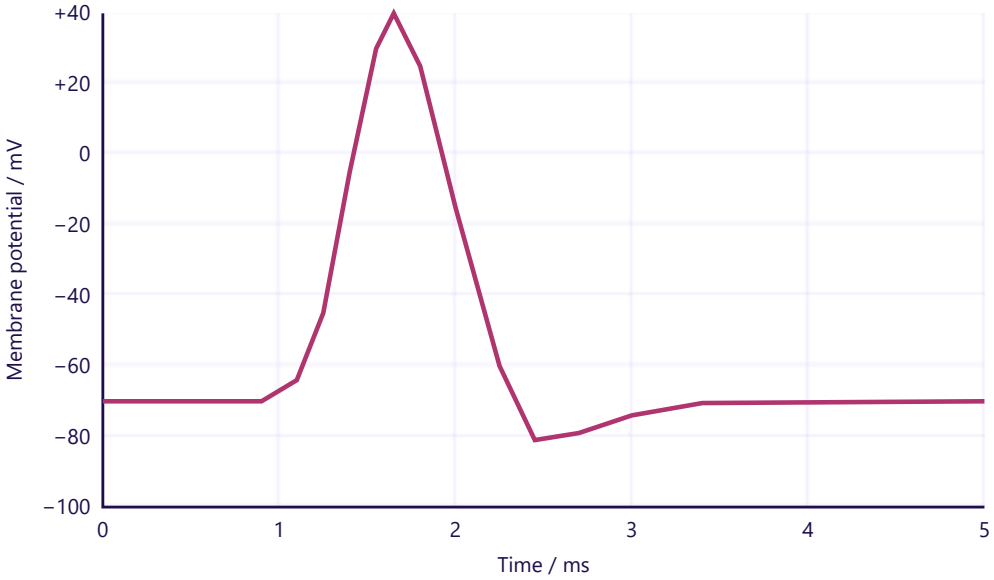
d **Explain** why a wider fibre conducts faster. **[2]**

e **Explain** why myelin increases conduction speed. **[2]**

f **Suggest** an advantage to a squid of having giant axons controlling its escape response. **[2]**

14 C2.2.2, C2.2.3

The graph shows the membrane potential at one point on an axon as an impulse passes.



a **State** the resting potential shown. **[1]**

b **Calculate** the change in membrane potential from rest to the peak. **[1]**

c **Identify** the ion whose movement causes the rising part of the curve, and its direction. **[1]**

d **Identify** the ion whose movement causes the falling part of the curve, and its direction. **[1]**

e A second electrode, 60 mm further along the axon, recorded the same peak 3 ms later. **[2]**
Calculate the conduction speed in m s^{-1}.

Section D: Longer answers

8 marks

15 **Describe** how a signal passes across a cholinergic synapse, from the arrival of an action potential to the removal of the neurotransmitter. C2.2.5–7 **[8]**