6.5 Neurones & Synapses

Mark Schemes

Course	DP IB Biology
Section	6. Human Physiology
Topic	6.5 Neurones & Synapses
Difficulty	Medium

To be used by all students preparing for DP IB Biology HL
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1

The correct answer is **C** because voltage gated sodium channels are opened during the depolarisation of the neurone. This only occurs if the threshold potential is exceeded which is then followed by a very sharp rise in the membrane potential.

A is incorrect as this is the resting potential of the neurone.

B is incorrect as there is only a gradual rise in membrane potential which precedes the threshold potential being reached.

D is incorrect as this is the peak of the action potential.

2

The correct answer is **A** because the depolarisation of the membrane causes voltage gated potassium channels to open, which allows potassium ions to flow down their electrochemical gradient out of the cell to repolarise the membrane towards the resting potential.

B is incorrect as depolarisation is due to the opening of voltage gated sodium channels in the membrane.

C is incorrect as hyperpolarisation is due to the slow closing of potassium channels.

D is incorrect as release of neurotransmitters is triggered by the opening of calcium channels in the presynaptic neurone.

3

The correct answer is **B** because increasing reuptake would remove some of the excess serotonin and dopamine causing the condition which would help to alleviate symptoms.

A is incorrect as this would increase the influx of calcium ions during depolarisation increasing the amount of neurotransmitter released.

C is incorrect as this enzyme would break down the neurotransmitter acetylcholine but not dopamine or serotonin. Different neurotransmitters require specific enzymes to break them down.

D is incorrect as this would prevent an action potential being generated in the postsynaptic neurone but not remove the excess serotonin and dopamine present.

4

The correct answer is **B**.

A, **C** and **D** are incorrect as;

Statement I is correct as electrical impulses jump between the small, uninsulated sections of the myelin sheath known as the nodes of Ranvier in a process known as saltatory conduction.

Statement II is correct as Schwann cells wrap around the axon forming the myelin sheath.

Statement III is incorrect as the myelin sheath acts as an electrical **insulator** preventing electrical impulses from passing through.

5

The correct answer is **C**.

X marks the repolarisation of the neurone. During repolarisation the sodium channels close and the potassium channels open allowing the membrane potential to decrease from +40mV to -70mV.

6

The correct answer is **D** because structure A shows the **dendrites** which are short branched nerve fibres which connect to many other neurones forming a network for easy communication

A is incorrect as the cell body contains most of the cellular structures including the nucleus.

B is incorrect as the myelin sheath acts as an electrical insulator preventing electrical impulses from passing through.

C is incorrect as the axon is an elongated nerve fibre responsible for carrying impulses long distances between receptors and the spinal cord.

7

The correct answer is **A** because three sodium ions are pumped out of the axon whilst two potassium ions are pumped into the axon. This causes the inside of the axon to be negatively charged in comparison to the outside generating the negative resting membrane potential.

B and **D** are incorrect because the ions move by diffusion in these processes as they are moving down a concentration gradient.

C is incorrect because the sodium and potassium ions move in the opposite directions when the resting potential is generated.

8

The correct answer is **D**

A, B and C are incorrect as at resting potential the sodium/potassium pump is active, pumping sodium ions out of the axon leading to a low sodium concentration inside the neurone. The same pump also moves potassium ions into the neurone leading to a high potassium concentration inside the neurone. There is a low membrane permeability for sodium as the voltage gated sodium channels are closed at resting potential.

9

The correct answer is **D** because the neurotransmitter diffuses across the synaptic cleft and not across a membrane therefore not requiring a membrane protein.

A is incorrect as active transport of sodium ions out of the axon is carried out by the sodium-potassium pump which is a membrane protein.

B is incorrect as during depolarisation voltage gated sodium channels open allowing movement of sodium ions into the axon.

C is incorrect as binding of the neurotransmitter to the postsynaptic neurone triggers opening of associated sodium ion channels.

10

The correct answer is **C**.

A, **B** and **D** are incorrect as pesticides contain Neonicotinoid compounds which can block synaptic transmission at cholinergic synapses in insects by binding to acetylcholine receptors.