

Topic 8 Biology

Booklet 1 of 3

Revision Questions

**Nervous Transmission
& Synapses**

MARK SCHEME

Question Number	Correct Answer	Mark
2(a)	1. depolarisation of adjacent {membrane / eq} / eq ; 2. changes PD across membrane / eq ; 3. opens sodium {gates / eq} ; 4. sodium ions move into (the neurone) ;	max (2)

Question Number	Correct Answer	Mark									
2(b)	<table border="1"> <thead> <tr> <th>Position on diagram</th><th>Permeable to sodium ions</th><th>Permeable to potassium ions</th></tr> </thead> <tbody> <tr> <td>A</td><td><input checked="" type="checkbox"/></td><td>;</td></tr> <tr> <td>D</td><td></td><td><input checked="" type="checkbox"/> ;</td></tr> </tbody> </table>	Position on diagram	Permeable to sodium ions	Permeable to potassium ions	A	<input checked="" type="checkbox"/>	;	D		<input checked="" type="checkbox"/> ;	(2)
Position on diagram	Permeable to sodium ions	Permeable to potassium ions									
A	<input checked="" type="checkbox"/>	;									
D		<input checked="" type="checkbox"/> ;									

Question Number	Correct Answer	Mark
2(c)	1. correct {reference to / description of} diffusion gradient (of potassium ions) ; 2. correct {reference to / description of} electrochemical gradient ; 3. increased permeability (of membrane) to potassium ions / eq ; 4. reference to potassium {gates / eq} open / eq ; 5. reference to sodium {gates / eq} closed / eq ;	max (3)

June 2010

Question Number	Correct Answer	Mark
2(d)	<ol style="list-style-type: none"> 1. PD less negative / eq 2. idea that the membrane remains permeable to potassium ions ; 3. potassium ions {move because of charge difference / eq} ; 4. into {nerve cell / neurone / axon / eq} ; 5. idea that potassium ion is removing a positive charge (from the outside) ; 6. idea that equilibrium is established e.g. diffusion gradient balanced by potential difference ; 	<p>max (3)</p>

June 2010

Question Number	Answer	Mark
1(a)	D ;	(1)

Question Number	Answer	Mark
1(a)	B ;	(1)

Question Number	Answer	Mark
1(a)	C ;	(1)

Question Number	Answer	Mark
1(a)	A ;	(1)

Question Number	Answer	Mark
1(b)	<ol style="list-style-type: none"> 1. reference to (electrical) insulation / eq ; 2. reference to depolarisation at nodes ; 3. impulse jumps from node to node / eq ; 4. saltatory conduction ; 5. reference to faster conduction ; 	(4)

Question Number	Answer	Mark
1(c)	<ol style="list-style-type: none">1. idea that phospholipid restricts ion movement / eq ;2. proteins span the membrane / eq ;3. idea that sodium potassium pump moves ions / eq ;4. (protein) {gates / channels} allow {diffusion / movement} of ions / eq ;	(3)

Question Number	Answer	Mark										
6	<table><tr><th>Statement</th><th>Tick (✓) or cross (x)</th></tr><tr><td>Cause cell depolarisation</td><td>x</td></tr><tr><td>Affected by all wavelengths of light</td><td>x</td></tr><tr><td>Involved in plant growth and development</td><td>✓</td></tr><tr><td>Affected by darkness</td><td>✓</td></tr></table> <p>1 for each correct row.</p>	Statement	Tick (✓) or cross (x)	Cause cell depolarisation	x	Affected by all wavelengths of light	x	Involved in plant growth and development	✓	Affected by darkness	✓	(4)
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Cause cell depolarisation	x											
Affected by all wavelengths of light	x											
Involved in plant growth and development	✓											
Affected by darkness	✓											

Question Number	Answer	Mark
1(a)(i)	100 (mV) ;	(1)

Question Number	Answer	Mark																												
1(a)(ii)	<table><tr><th>Description</th><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th><th>F</th></tr><tr><td>Stage when the concentration of positive ions is greatest inside the axon</td><td></td><td></td><td><input checked="" type="checkbox"/></td><td></td><td></td><td></td></tr><tr><td>Stage when hyperpolarisation first occurs</td><td></td><td></td><td></td><td></td><td><input checked="" type="checkbox"/></td><td></td></tr><tr><td>Site showing the resting potential</td><td><input checked="" type="checkbox"/></td><td></td><td></td><td></td><td></td><td></td></tr></table>	Description	A	B	C	D	E	F	Stage when the concentration of positive ions is greatest inside the axon			<input checked="" type="checkbox"/>				Stage when hyperpolarisation first occurs					<input checked="" type="checkbox"/>		Site showing the resting potential	<input checked="" type="checkbox"/>						(3)
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Question Number	Answer	Mark
1*(b)	<p>QWC – Spelling of technical terms (<i>shown in italics</i>) must be correct and the answer must be organised in a logical sequence</p> <ol style="list-style-type: none"> 1. diffuses across {gap /eq} ; 2. binds to (receptors on) post-synaptic membrane / eq ; 3. idea of gated-channels opening or Na^+ travels through post-synaptic membrane ; 4. causing a depolarisation / eq ; 5. (if sufficient present) an action potential is set up in {post-synaptic membrane/adjacent cell / eq} ; 6. details such as temporal or spatial summation ; 7. idea that allows coordination / one way flow of information ; 8. idea that it allows integration in post-synaptic cell ; 9. neurotransmitter broken down (by enzyme) / eq ; 10. so that do not get {prolonged /eq} action potential in post-synaptic membrane / make receptors available again ; 11. credit reference to fate of products e.g. reabsorbed through pre-synaptic membrane OR to be re-synthesised into neurotransmitter substance ; 	(5)

Question Number	Answer	Additional guidance	Mark
5(a)	A - cell body ; B - axon ;		(2)

Question Number	Answer	Additional guidance	Mark
5(b)(i)	<ol style="list-style-type: none"> 1. increasing Eugenol concentration increases percentage inhibition / positive correlation ; 2. description of non linear correlation ; 3. credit correct manipulation of the data e.g. between 0.1 and 1.0 mmol dm³ percentage inhibition to increase by 55% ; 	ACCEPT 2 – e.g. greatest increase in inhibition is between eugenol concentration of 0.2 and 0.4 mmol dm ⁻³	(2)

Question Number	Answer	Additional guidance	Mark
*5(b)(ii)	<p>QWC – Spelling of technical terms (<i>shown in italics</i>) must be correct and the answer must be organised in a logical sequence)</p> <ol style="list-style-type: none"> 1. {reduced / eq} Ca^{2+} enters { <i>presynaptic membrane</i> / into <i>sensory neurone</i> } ; 2. due to Ca^{2+} channel not opening / decreased sensitivity of <i>membrane</i> to Ca^{2+} ; 3. fewer <i>vesicles</i> {move towards / fuse} with <i>presynaptic membrane</i> ; 4. less <i>neurotransmitter</i> {released into / less diffuses across} {<i>synaptic gap</i> / eq} ; 5. less <i>neurotransmitter</i> binds to receptors on {<i>post-synaptic membrane</i> / adjacent neurone} ; 6. idea of reduced depolarisation / less Na^+ or cation channels open ; 7. idea of { threshold intensity / <i>action potential</i> / <i>impulse</i> } less likely to occur ; 8. idea of pain not being sensed as impulse {stopped before entering CNS / leaving the <i>sensory neurone</i>} ; 	<p>ACCEPT 1 – into <i>synaptic knob</i> / pre-synaptic neurone</p> <p>ACCEPT 4 (& 5) - named neurotransmitter example</p> <p>ACCEPT 7 - not reached as alternative to less likely to be reached</p>	(6)

Question Number	Answer	Mark
1(a)(i)	A ; cerebrum	(1)

Question Number	Answer	Mark
1(a)(ii)	C ; hypothalamus	(1)

Question Number	Answer	Additional Guidance	Mark												
1(b)(i)	<table border="1"> <thead> <tr> <th>Stage</th><th>Voltage-gated K⁺ channel open</th><th>Voltage-gated K⁺ channel closed</th><th>Voltage-gated Na⁺ channel closed</th></tr> </thead> <tbody> <tr> <td>Depolarisation</td><td></td><td>✓</td><td></td></tr> <tr> <td>Repolarisation</td><td>✓</td><td></td><td>✓</td></tr> </tbody> </table>	Stage	Voltage-gated K ⁺ channel open	Voltage-gated K ⁺ channel closed	Voltage-gated Na ⁺ channel closed	Depolarisation		✓		Repolarisation	✓		✓	3 columns correct = 2 marks 2 columns correct = 1 mark	(2)
Stage	Voltage-gated K ⁺ channel open	Voltage-gated K ⁺ channel closed	Voltage-gated Na ⁺ channel closed												
Depolarisation		✓													
Repolarisation	✓		✓												

Question Number	Answer	Mark
1(b)(ii)	A ;	(1)

Question Number	Answer	Additional Guidance	Mark
1(b)(iii)	<p>In sensory neurone:</p> <ol style="list-style-type: none"> 1. dendron longer; 2. dendron myellinated ; 3. axon shorter ; 4. {cell body / eq} {not at the end / towards the middle / to the side / eq } ; 5. reference to no {motor end plate / eq} ; 	<p>ALLOW converse for motor neurone</p> <p>4. ACCEPT centron / nucleus for cell body</p>	(3)

Question Number	Answer	Additional Guidance	Mark
5(a)(i)	<ol style="list-style-type: none"> 1. idea that potassium (ion) gradient is greater than sodium (ion) gradient ; 2. Credit correct comparative manipulation of the data ; 3. idea of concentration gradients act in different directions / eq ; 	<p>1 ACCEPT steeper, higher for greater</p> <p>2 ACCEPT e.g (K⁺ gradient is greater than gradient for Na⁺) by 10 mmol dm⁻³, ratio e.g. 1:10 and 30:1</p>	(2)

Question Number	Answer	Additional Guidance	Mark
5(a)(ii)	<p>1. idea that proteins act as channels ;</p> <p>Repolarising:</p> <p>2. (most voltage-dependent) { sodium / Na^+ } { channels / eq } closed ;</p> <p>3. sodium ions cannot (continue to) enter { neurone / cytoplasm / eq } ;</p> <p>Resetting after hyperpolarisation:</p> <p>4. (voltage-dependent) { potassium / K^+ } { channels / eq } close ;</p> <p>5. sodium-potassium pump imports (two) potassium ions and exports (three) sodium ions / eq ;</p>	<p>IGNORE: descriptions of depolarisation/action potentials</p> <p>1 ACCEPT gates for channels</p>	(4)

Question Number	Answer	Additional Guidance	Mark
5(b)	1. idea that Ca^{2+} enters synaptic bouton ; 2. vesicles containing neurotransmitter / eq ; 3. { move towards / fuse with presynaptic membrane / eq } / reference to exocytosis (of neurotransmitter) ;	1 ACCEPT for 1: knob, button, presynaptic neurone for bouton, through presynaptic membrane 3 ACCEPT neurotransmitter released into synaptic {gap / cleft} IGNORE: vesicles being released	(3)

Question Number	Answer	Mark
4(a)(i)	<p>4(a)(i). The only correct answer is C</p> <p><i>A is not correct because motor neurones transmit impulses away from the CNS</i></p> <p><i>B is not correct because relay and sensory neurones have a cell body</i></p> <p><i>D is not correct because relay neurones have very short axons</i></p>	(1)

Question Number	Answer	Mark
4(a)(ii)	<p>4(a)(ii). The only correct answer is B</p> <p><i>A is not correct because amylose is a polysaccharide</i></p> <p><i>C is not correct because myosin is a protein found in muscle filaments</i></p> <p><i>D is not correct because a thylakoid is a structure found in chloroplasts</i></p>	(1)

Question Number	Answer	Mark
4(a)(iii)	<p>4(a)(iii). The only correct answer is A</p> <p><i>B is not correct because the resting potential of all neurones is -70 mV</i></p> <p><i>C is not correct because in a diagram an inhibitory synapse would be shown as a junction between two neurones</i></p> <p><i>D is not correct because the thickness of the cell membrane is not reduced at nodes of Ranvier</i></p>	(1)

Question Number	Answer	Additional Guidance	Mark
4(a)(iv)	1. {action potential / impulse / eq }causes influx of Ca^{2+} / eq ; 2. vesicles fuse with pre-synaptic membrane / eq Or reference to exocytosis ; 3. idea that a neurotransmitter released and attaches to receptors (on cell T) ;	1. ACCEPT Ca^{2+} channels open 3. ACCEPT causes an action potential (in cell T)	(3)

Question Number	Answer	Additional Guidance	Mark
4(b)(i)	1. $(4.7 - 2.3) \div 4.7$ or $2.4 \div 4.7$; 2. multiplied by 100 = 51(%) ;	Correct answer with no working gains full marks ACCEPT: 51 , 51.06, 51.1(%) and correct ecf answers	(2)

Question Number	Answer	Additional Guidance	Mark
4(b)(ii)	1. pupil size is smaller in older people (in low light conditions) / eq ; 2. the radial fibres in the iris contract less in older people (compared with younger people) ;	1. ACCEPT reverse argument 2. ACCEPT increased contraction of circular fibres in older people	(2)

Total for Question 4 = 10 MARKS