

Grey Matter -3

Name: _____

Class: _____

Date: _____

Time:

Total Marks Available:

Total Marks Archived:

Level: Edexcel A level Biology

Subject: Biology

Exam Board: Pearson Edexcel Level 3 GCE AS and A level Biology A (Salters-Nuffield) and also

Pearsons Edexcel AS and A Level Biology B (9BI0) - Is however suitable for use by AS and A

level Biology Students of other Boards

Topic: Grey Matter -3

Type: Mark Scheme

To be used by all students preparing for Edexcel AS and A level Biology A and Biology B - Students of other Boards may also find this useful

Mark Scheme

Q1.



EXAM PAPERS PRACTICE



EXAM PAPERS PRACTICE

Question Number	Answer	Mark																							
(a)	<table border="1"> <thead> <tr> <th rowspan="2">Feature</th> <th colspan="3">Type of neurone</th> </tr> <tr> <th>Sensory</th> <th>Relay</th> <th>Motor</th> </tr> </thead> <tbody> <tr> <td>Found only in the central nervous system</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/> ;</td> </tr> <tr> <td>Cell terminates at the effector</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/> ;</td> </tr> <tr> <td>Pre-synaptic membrane not found in the central nervous system</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/> ;</td> </tr> <tr> <td>Impulse stimulated by the receptor</td> <td><input type="checkbox"/> ;</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> </tbody> </table>	Feature	Type of neurone			Sensory	Relay	Motor	Found only in the central nervous system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> ;	Cell terminates at the effector	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> ;	Pre-synaptic membrane not found in the central nervous system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> ;	Impulse stimulated by the receptor	<input type="checkbox"/> ;	<input type="checkbox"/>	<input type="checkbox"/>	(4)
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Question Number	Answer	Additional guidance	Mark
(b)(i)	hydrolysis / eq ;		(1)

Question Number	Answer	Additional guidance	Mark
(b)(ii)	<ol style="list-style-type: none"> 1. supplies energy to allow opsin and retinal to combine ; 2. to (re)form rhodopsin ; 3. use in the transport of ions e.g. to allow Na⁺ to be pumped out of cell ; 		(2)



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Question Number	Answer	Additional guidance	Mark
(b)(iii)	<ol style="list-style-type: none">1. reference to actin and myosin interacting ;2. ATP binds to myosin head causing {bond / cross-bridge / eq} between actin and myosin to break / eq ;3. ATP {breaks / hydrolyses} into ADP and P_i {releasing energy that is stored in myosin head / causing myosin head to reset / eq} ;4. myosin head binds to actin / {bond / cross-bridge forms} between actin and myosin / eq ;5. P_i is released from myosin head / eq ;6. energy in myosin head causes it to move / eq ;7. idea that actin slides along ;8. ADP is released at this time / eq ;9. role of ATP in transport of calcium ions back into sarcoplasmic reticulum / eq ;		(5)



EXAM PAPERS PRACTICE

Q2.

Question Number	Answer	Additional Guidance	Mark
(i)	<p>An explanation that makes reference to three of the following:</p> <ul style="list-style-type: none">• nicotine similar in shape to acetylcholine (1)• increases permeability of membrane to sodium ions / changes shape of { receptors / channel proteins } (1)• nicotine causes the depolarisation of the post-synaptic membrane (1)• depolarisation reaches threshold level (1)	<p>ALLOW { sodium ion / Na⁺ } channels open</p> <p>ALLOW sodium ions { diffuse / move down concentration gradient } into the neurone</p>	(3)

Question Number	Answer	Additional Guidance	Mark
(ii)	<p>An answer that makes reference to the following:</p> <ul style="list-style-type: none">• (calcium ions cause) vesicles (containing noradrenaline) to fuse with { cell (surface) membrane / presynaptic membrane } (1)	<p>ALLOW (calcium ions cause) vesicles to release noradrenaline through exocytosis</p>	(1)



EXAM PAPERS PRACTICE

Q3.

Question Number	Answer	Additional Comments	Mark
(a)	<ol style="list-style-type: none"> only (alpha) 1-4 glycosidic bonds in amylose / (alpha) 1-6 only found in amylopectin ; only amylopectin has side branches / only amylose is {coiled / eq} ; Amylopectin is a {larger / eq} molecule than amylose ; 	1. ACCEPT 1-6 and 1-4 in amylopectin	(2)

Question Number	Answer	Additional Comments	Mark
(b)	<ol style="list-style-type: none"> Different individuals in the {colony / eq} take on specific {roles / jobs / eq} ; Example given e.g. queen produces offspring ; 	1. Accept division of labour 2. Accept dominance by queen, {few of the males / kings} involved in breeding	(2)

Question Number	Answer	Additional Comments	Mark
(c) (i)	Idea that body temperature of animal mimics the ambient temperature ;	Accept body temp follows environmental temperature	(1)

Question Number	Answer	Additional Comments	Mark
(c) (ii)	<ol style="list-style-type: none"> Lack of insulating layer: Idea that does not impede transfer of heat energy / allows exchange of heat energy more easily ; A marked reduction in sweat glands: Idea that they do not need to cool down OR less water lost ; 	1. Accept enables heat transfer between environment and NMR	(2)

Question Number	Answer	Additional Comments	Mark
(d)	<ol style="list-style-type: none"> (Cancer causing) gene identified / eq ; Gene {cut / isolated / eq} from DNA / eq ; Using a {restriction / eq} enzyme / eq ; Gene in {vector / named vector} ; Mechanism for getting {gene/vector} into host cells (of mice) / eq ; 	1. Accept screen for the gene 2. Accept extracted 3. Accept correctly named restriction enzyme e.g. EcoR1 4. Accept Named <u>egs</u> – retrovirus, virus, liposome, plasmid, bacteria 5. Accept reference to (micro)injection, <u>microprojectiles</u> , electroporation, gene gun, inhaler, transduction	(3)



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Question Number	Answer	Additional Comments	Mark
* (e)	<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. {<i>neurone</i> (cell) surface membrane exposed / no <i>myelination</i> / eq} at nodes of <i>Ranvier</i> ; 2. Nodes are the site of clusters of {<i>sodium-gated channel proteins</i> / <i>potassium channels</i>} ; 3. Which {open / close} when <i>impulse</i> arrives / eq ; 4. Allowing <i>depolarisation</i> at nodes / eq ; 5. idea that <i>myelin</i>/eq acts as an (electrical) <i>insulator</i> (on <i>neurone</i> surface between nodes) ; 6. reference to <i>Schwann</i> cell ; 7. idea that <i>impulse/depolarisation</i> 'jumps' to next node ; 8. Reference to this being <i>saltatory conduction</i> ; 9. idea that this happens between the <i>myelin</i> layers of the <i>Schwann</i> cell ; 	<p>QWC emphasis on spelling</p> <p>3. Accept influx of sodium ions</p>	(5)

Question Number	Answer	Additional Comments	Mark
(f)	<ol style="list-style-type: none"> 1. idea of heart working less efficiently ; 2. idea of less oxygen absorbed at lungs / eq ; 3. less blood pumped to brain ; 4. concentration gradient (for oxygen) at brain reduced / eq ; 5. less oxygen in blood (in brain) diffuses into brain tissue / eq ; 6. idea of less oxygen in brain tissue due to continual (aerobic) respiration ; 		(3)

Question Number	Answer	Additional Comments	Mark
(g)	<p><i>gonadotrophin</i>-releasing (hormone) stimulates <i>gonadotrophin</i> release / <i>gonadotrophin</i> stimulates ovulation / testosterone stimulates {sperm production / (male) secondary sexual characteristics / other named example} ;</p>		(1)



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Question Number	Answer	Additional Comments	Mark
(h)	1. Idea of effect on mitochondria ; 2. (therefore) reduced {energy / ATP / eq} for flagellum movement ;	1. Accept less efficient / fewer / none 2. Accept tail for flagellum	(2)

Question Number	Answer	Additional Comments	Mark
(i)	1. idea that fat is an energy store ; 2. reduces dependence on external food source / eq ; 3. enables disperser to travel / eq ; 4. (metabolic) water is released (on oxidation) / eq ; 5. acts as a thermal insulator / eq ;	Accept energy-rich	(3)

Question Number	Answer	Additional Comments	Mark
(j)	1. idea that unfamiliar males are likely to be genetically different ; 2. idea that this is outbreeding ; 3. idea that this increases genetic diversity ;	3. Accept producing offspring that are genetically different	(2)

Question Number	Answer	Additional Comments	Mark
(k)	the order of the {bases / genes and non-coding sequences / eq} in the DNA (of the naked mole rats) is found / eq ;	Accept exons and introns Ignore genes unqualified	(1)



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Question Number	Answer	Additional Comments	Mark
(1)	<p>Paired responses:</p> <ol style="list-style-type: none">1. reduced sensitivity to chemical pain / disconnection of 'pain nerves' ;2. Idea of pain relief e.g. dealing with post traumatic pain, post surgical pain, joint pain after a knee operation ;3. haemoglobin has higher affinity for oxygen ;4. Idea of dealing with reduced oxygen situations such as due to a heart attack or stroke ;5. Naked mole rat {incisors / eq } grow through skin (of lip) without damage ;6. Idea of better prosthesis e.g. new {coatings / permanent seal} at {skin / bone / metal} interface, soft tissue not damaged, avoid infection ;7. High protein stability / does not (easily) lose 3D shape ;8. (so) reduced effect of oxidative {damage / stress} / reduced effect of oxygen-containing free radicals / live healthily into old age ;9. Cell overcrowding early warning gene / ref. to two tiered contact inhibition / presence of gene p16 ;10. Idea of cancer prevention e.g. cancer resistance, future cancer therapy ;11. Naked mole rat neurones display immature {characteristics / physiological properties} / brain cells that cope with {low oxygen / hypoxia} ;12. To treat people with temporary loss of oxygen to brain e.g. heart attack, stroke, drowning / to prevent permanent brain damage ;13. High levels of oxytocin receptors in {brain / nucleus accumbens};14. Idea of links to autism ;15. Naked mole rats do not experience menopause ;16. Ref to osteoporosis {treatment / prevention} (without side effects) ;17. circadian rhythms / sleep patterns of naked mole rats ;18. Idea that may help with sleep disorders ;	<p>9. Accept anticancer mechanism</p>	

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Q4.

Question number	Answer	Additional guidance	Mark
	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none">• (give) {a precursor of dopamine / L-dopa} which can cross the blood brain barrier (1)• L-dopa is converted into dopamine (in the brain) (1) <p>OR</p> <ul style="list-style-type: none">• (give) a {drug that stops the breakdown of dopamine / MAO inhibitor} (1)• that can cross the blood brain barrier (1)	<p>ALLOW</p> <ul style="list-style-type: none">• use of {electrode / deep brain stimulation}• to stimulate basal ganglia to produce dopamine	(2)

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Q5.

Question Number	Answer	Mark
(a)(i)	B (between 12 and 15 hours) ;	(1)

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



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Question Number	Answer	Additional Guidance	Mark
(a)(iii)	any two of the following standardised: water / eq mineral ion concentrations / eq light intensity / eq wavelength of light CO ₂ concentration, temperature pH soil type ;	ACCEPT named mineral ion	(2)

Question Number	Answer	Additional Guidance	Mark
(a)(iv)	idea of using shorter time intervals e.g. 1 hour intervals ;	ACCEPT a description e.g. repeat with 12 hours of light, 13 hours, etc	(1)

Question Number	Answer	Additional Guidance	Mark
(b)	any one from: temperature water availability the {wavelength / quality} of light intensity of light {edaphic / named edaphic} factor ;		(1)

Question Number	Answer	Additional Guidance	Mark
(c)(i)	outer segment / internal membranes / inner membranes / vesicles ;		(1)



Question Number	Answer			Mark	
(c)(ii)	Statement				
	Description	Opsin binds to the rod cell membrane	Rhodopsin bleaches		ATP used
	Rhodopsin responding to light	✓	✓		✗
	Rhodopsin being reformed	✗	✗		✓
Any two correct for 1 mark ;				(3)	

Q6.

Question Number	Acceptable Answer	Additional Guidance	Mark
	An explanation that makes reference to three of the following: <ul style="list-style-type: none"> • positive phototropism (1) • IAA diffuses away from light source (1) • IAA accumulates in { cells / tissues } furthest from light (1) • IAA stimulates cell elongation causing growth towards light (1) 		(3)



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Q7.

Question Number	Answer	Mark
(i)	<p>The only correct answer is D – phytochrome change is P_R to P_{FR} and speed of change is rapid</p> <p>A is incorrect because phytochrome does not change from P_{FR} to P_R in light and the process is rapid</p> <p>B is incorrect because phytochrome does not change from P_{FR} to P_R in light</p> <p>C is incorrect because the conversion is not slow</p>	(1)

Question Number	Answer	Mark
(ii)	<p>The only correct answer is B – a photosensitive pigment</p> <p>A is incorrect because phytochrome is not a form of opsin</p> <p>C is incorrect because phytochrome is not an isomer of retinal</p> <p>D is incorrect because not a type of cytochrome</p>	(1)

Question Number	Answer	Additional Guidance	Mark
(iii)	<p>An answer that makes reference to one of the following:</p> <ul style="list-style-type: none">(seed) germination / flowering (1)	<p>ALLOW chlorophyll synthesis / leaf development / stops growth e.g. falling leaves</p>	(1)



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Q8.



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Question Number	Answer	Mark
(a)	(leave it) in the dark / eq ;	(1)

Question Number	Answer	Mark
(b)(i)	<ol style="list-style-type: none">1. mass higher in A (compared with B) for both studies ;2. the difference is less in repeat study ;3. comparative manipulation of data e.g. 13g decrease for A to B for original and 5 g for repeat ;4. mass lower in repeats (of both A and B) / eq ;	(3)

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Question Number	Answer	Mark
(b)(ii)	<ol style="list-style-type: none">1. { increase / eq } in stem length ;2. correct manipulation of the data e.g. by 23cm / 18.4% ;3. reference to {taller / faster growing / eq} seedling ;4. to receive {more light / higher red light / eq} / to maximize photosynthesis / eq ;5. idea of allows {active phytochrome / eq} to be made ;	(3)

Question Number	Answer	Mark
(b)(iii)	<ol style="list-style-type: none">1. less red light {increases / eq} mean stem length / more far red light increases stem length / eq ;2. the (significant) difference in mean stem length is not due to {chance / eq} / eq ;3. the mean length for repeat was close to the original ;4. suggesting it is likely to be reliable ;	(3)



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Q9.



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Question Number	Acceptable Answer	Additional Guidance	Mark
(a)	<ul style="list-style-type: none">• $2.03 - 1.53 = 0.5 \div 2.03 \times 100$ (1)• $= 24.63\%$ (1)		(2)

Question Number	Acceptable Answer	Additional Guidance	Mark
(b)	<p>An explanation that makes reference to three of the following:</p> <ul style="list-style-type: none">• moving shadow and touch are perceived as presence of {danger / predator} (1)• response to touch is greater than to shadow because touch perceived as {more dangerous/ closeness of predator} (1)• response in tube is greater than response out of tube because tube provides physical surface to assist {contraction/ withdrawal} (1)• worm has receptors and those for light generate less response than those for touch (1)• when out of tube, a shadow stimulus affects all of a worm but a touch stimulus affects part of a worm (1)		(3)



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Question Number	Acceptable Answer	Additional Guidance	Mark
(c)(i)	An answer that makes reference to the following: <ul style="list-style-type: none">• prevents wasting energy (1)• allows maximum feeding effort (1)		(2)

Question Number	Acceptable Answer	Additional Guidance	Mark
(c)(ii)	An explanation that makes reference to the following: <ul style="list-style-type: none">• there is less response because there is less depolarisation of the post-synaptic membrane (1)• because there are fewer calcium ions entering the pre synaptic membrane so fewer vesicles fuse with the presynaptic cell membrane (1)• so less neurotransmitter diffuses across the synaptic cleft (1)• therefore less binding to the receptors on the post- synaptic membrane so fewer sodium channels open (1)• resulting in no {action potential / impulse} in the post- synaptic neurone leading to no withdrawal response (1)	Allow description of sodium ion movement	(5)



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Q10.

Question number	Answer	Additional guidance	Mark
	<p>A description that makes reference to four of the following:</p> <ul style="list-style-type: none">• (isolate) the gene for the cytokine (from human DNA) (1)• use a bacterial plasmid (as a vector) (1)• cut the human DNA and the plasmid using the same restriction enzyme (1)• splice the gene and plasmid together using (DNA) ligase (1)• put the (modified) plasmids into bacterial cells (1)	<p>e.g. use a restriction enzyme to cut the DNA and the plasmid</p> <p>ALLOW 'join' for 'splice'</p> <p>ALLOW produce lots of bacteria (with the plasmid / expressing the cytokine gene)</p>	<p>(4)</p>



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Q11.



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Question Number	Acceptable Answer	Additional guidance	Mark
(a)(i)	49 182 000 x 0.05 (1) 2 459 100 (1)	Correct answer gains full marks	(2)

Question Number	Acceptable Answer	Additional guidance	Mark
(a)(ii)	An explanation that makes reference to the following: <ul style="list-style-type: none">• can dilate bronchioles /airways (1)• therefore allowing more oxygen into lungs /alveoli (1)		(2)

Question Number	Acceptable Answer	Additional guidance	Mark
(a)(iii)	An explanation that makes reference to the following: <ul style="list-style-type: none">• sympathetic neurotransmitters are released at the SAN (1)• therefore if beta-2 agonists are present the SAN will increase its rate of stimulation (1)• so impulses will spread faster and more often over the atria (1)• therefore the heart muscle will contract more often which increases the heart rate (1)		(4)

Question Number	Acceptable Answer	Additional guidance	Mark
(b)	An explanation that makes reference to four of the following: <ul style="list-style-type: none">• HGH binds to receptor in cell surface membrane (1)• activation of messenger molecule in cytoplasm (1)• reference to protein kinase cascade (1)• transcription factor produced (1)• gene for IGF-1 switched on (1)		(4)



EXAM PAPERS PRACTICE

Question Number	Acceptable Answer	Additional guidance	Mark
(c)	An explanation that makes reference to the following: <ul style="list-style-type: none">• occur naturally / would have some present in body (1)• therefore difficult to detect additional HGH (1)		(2)

Question Number	Acceptable Answer	Additional guidance	Mark
(d)	An explanation that makes reference to the following: <ul style="list-style-type: none">• no need for blood transfusion (1) plus any one from: <ul style="list-style-type: none">• therefore no risk of rejection / agglutination/ delay in {tissue/blood} typing (1)• they supply the oxygen requirements for the body (1)		(2)

Question Number	Acceptable Answer	Additional guidance	Mark
(e)	An explanation that makes reference to four of the following: <ul style="list-style-type: none">• reference to {sodium ion channels / voltage gated sodium ion channels} (1)• binding blocks movement of sodium ions into neurone (1)• membrane is not depolarised (1)• action potential is not generated (1)• no impulses conducted to brain (1)	Accept more sophisticated answers that refer to the effect on calcium ion movement	(4)



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Question Number	Acceptable Answer	Additional guidance	Mark
(f)	An explanation that makes reference to two of the following: <ul style="list-style-type: none">• (they) increase the removal of {water/salts} from blood (1)• (removal of water) lowers blood volume and therefore pressure (1)• (removal of salt) lowers uptake of water into blood (by osmosis from tissue fluid) and therefore blood pressure (1)		(2)

Question Number	Acceptable Answer	Additional guidance	Mark
(g)	An explanation that makes reference to the following: <ul style="list-style-type: none">• normal ratio is 1:1 (1)• taking testosterone and epitestosterone in equal measures maintains this ratio (1)• therefore it is not possible to detect cheats (1)		(3)

Question Number	Acceptable Answer	Additional guidance	Mark
(h)	An explanation that makes reference to the following: <ul style="list-style-type: none">• drug E has been retained in the gas phase longer (1)• because it has {greater solubility / smaller mass} (1)	Accept more sophisticated answers related to charge	(2)



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Question Number	Acceptable Answer	Additional guidance	Mark
(i)	<p>An explanation that makes reference to two of the following:</p> <ul style="list-style-type: none">• longitudinal monitoring / to be followed over time (1)• therefore can identify individual differences in naturally occurring drug concentrations (1)• therefore can see pattern or link to competition / injury / look for changes (1)		(2)

Question Number	Acceptable Answer	Additional guidance	Mark
(j)	<p>An answer that makes reference to the following:</p> <ul style="list-style-type: none">• the absolutist's view would be that they should never be used (1) <p>plus any one from:</p> <ul style="list-style-type: none">• because of the damage to the body by the side effects (1)• athletes should compete using their innate {anatomical / physiological} abilities / fair competition should be promoted (1) <p>and</p> <ul style="list-style-type: none">• the rationalist's view would be that their use is acceptable if there is a justifiable outcome (1) <p>Plus any one from:</p> <ul style="list-style-type: none">• because it is a personal choice (1)• because it could help to overcome the inequalities in {training / medical support} (1)		(4)



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Q12.

Question Number	Acceptable Answer	Additional Guidance	Mark
	C		(1)

Q13.

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

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

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

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

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

Question Number	Answer	Additional guidance	Mark
(b)	1. Ideas of (muscles) work antagonistically ; 2. circular muscle relaxes ; 3. radial muscle contracts;	ACCEPT 2 stretched	(2)



EXAM PAPERS PRACTICE

Q14.

Question Number	Answer	Additional guidance	Mark
	<p>An answer that makes reference to the following:</p> <ul style="list-style-type: none"> transfer of antibiotic-resistance gene to other microorganisms (1) a reason associated with health (1) 	e.g. pathogenic bacteria developing resistance to antibiotics	(2)

Q15.

Question Number	Answer	Mark																								
(a)	<table border="1"> <thead> <tr> <th rowspan="2">Description</th> <th colspan="4">Area of the rod cell</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> <th>D</th> </tr> </thead> <tbody> <tr> <td>Nearest the pupil of the eye</td> <td><input checked="" type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td>Containing the photosensitive pigment</td> <td><input checked="" type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td>Has the pre-synaptic membrane</td> <td><input checked="" type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> </tr> </tbody> </table>	Description	Area of the rod cell				A	B	C	D	Nearest the pupil of the eye	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Containing the photosensitive pigment	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Has the pre-synaptic membrane	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Comp (3)
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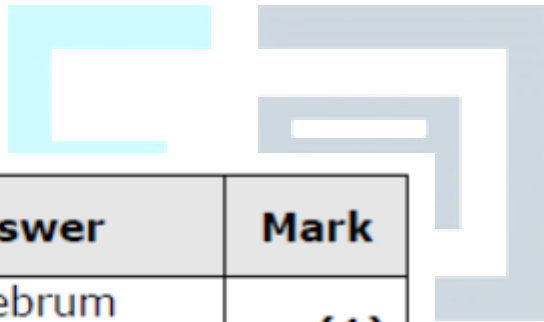
Question Number	Answer	Additional Comments	Mark
(b) (i)	<ol style="list-style-type: none"> reference to light intensity required / eq ; light {absorbed / eq} by rhodopsin / eq ; rhodopsin changes shape / eq ; rhodopsin is converted to retinal AND opsin / eq ; opsin binds with cell surface membrane / eq ; idea of fewer {sodium ions /Na⁺} enter rod cell ; idea of sodium ions pumped out of rod cell ; hyperpolarisation occurs (leading to change in voltage) / eq ; 	<ol style="list-style-type: none"> Ignore hits Accept Cis to Trans retinal Ignore bleaching Accept decreases permeability (of membrane) to {sodium ions /Na⁺}, channels close ; 	(4)



EXAM PAPERS PRACTICE

Question Number	Answer	Additional Comments	Mark
(b) (ii)	<ol style="list-style-type: none">1. idea of not enough {rhodopsin is converted /opsin binds to membrane} ;2. (so) change in voltage is insufficient / eq ;3. idea of { neurotransmitter / glutamate} still released (from rod cell) ;4. idea that depolarisation in bipolar neurone insufficient ;5. idea of bipolar neurone already depolarised ;	4. Accept for depolarisation- {threshold level, generator potential , EPSP} not achieved	(2)

Q16.



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

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

PRACTICE



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Q17.

Question Number	Answer	Additional Guidance	Mark
(a)	<ol style="list-style-type: none">1. involves prophase, metaphase, anaphase and telophase ;2. idea that produces two nuclei ;3. idea that these are genetically identical to original ;	<ol style="list-style-type: none">1. NOT if cytokinesis or interphase included as part of mitosis2. ACCEPT produces two cells	(2)

Question Number	Answer	Additional Guidance	Mark
(b)	<ol style="list-style-type: none">1. (SAN) is myogenic / description given ;2. electrical activity from SAN causes atria to contract / eq ;3. idea that activity of SAN can be changed by nerve impulses e.g. controlled by medulla ;4. credit detail of nervous control e.g. more impulses from accelerator increases heart rate ;		(3)



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Question Number	Answer	Additional Guidance	Mark
(c)	<ol style="list-style-type: none">1. idea that lactase gene {activated / transcribed} ;2. (synthesis of) lactase / eq ;3. hydrolysis of lactose / glycosidic bonds broken ;4. to produce glucose AND galactose ;		(3)

Question Number	Answer	Additional Guidance	Mark
(d)	<ol style="list-style-type: none">1. idea that a better model than guinea pigs or mice ;2. idea of animal rights ;3. easy to culture / eq ;4. (HeLa cells) susceptible to disease / HPV / eq ;	<ol style="list-style-type: none">1. ACCEPT reference to only HeLa {cells / DNA} are human3. ACCEPT cheaper (as continual supply)	(2)



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Question Number	Answer	Additional Guidance	Mark
*(e)	<p>(QWC – spelling of technical terms must be correct and the answer must be organised in a logical sequence)</p> <ol style="list-style-type: none">1. idea that {motor neurone / cell body / nucleus} is destroyed ;2. depolarisation does not occur in the neurone / (insufficient so) no action potential set up in the neurone ;3. detail of (depolarisation / action potential) not occurring in neurone e.g. idea Na^+ does not diffuse into neurone ;4. {neurotransmitter / named neurotransmitter} not {released / produced / eq} at junction with muscle / eq ;5. detail of lack of neurotransmitter release e.g. vesicles (containing neurotransmitter) do not {move / fuse} with {presynaptic membrane /	<p>QWC emphasis is clarity of expression</p> <ol style="list-style-type: none">1. ACCEPT idea of damage to myelin sheath / Schwann cells3. ACCEPT Na^+ / cation channels {non-functional / eq}4. ACCEPT {neurotransmitter / named neurotransmitter} not {released / produced / eq} at {motor neurone presynaptic membrane / motor end plate}	



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	<p>eq} / eq ;</p> <p>6. Ca²⁺ not released into muscle cytoplasm ;</p> <p>7. Ca²⁺ not released from sarcoplasmic reticulum ;</p> <p>8. no Ca²⁺ to {activate / eq} troponin ;</p> <p>9. idea that muscle does not contract ;</p>	<p>6. ACCEPT Ca²⁺ not released into sarcoplasm</p>	<p>(6)</p>
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Question Number	Answer	Additional Guidance	Mark
<p>(f)</p>	<p>1. contains bases / eq ;</p> <p>2. contain phosphate (groups) ;</p> <p>3. have a pentose sugar ;</p> <p>4. reference to phosphodiester bonds ;</p> <p>5. idea of discrete strands ;</p>	<p>1. ACCEPT both have (4) bases / nucleotides</p> <p>3. ACCEPT 5C sugar</p> <p>5. ACCEPT linear</p>	<p>(3)</p>



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Question Number	Answer	Additional Guidance	Mark
(g)	<p>1. smooth shown as dominant / wrinkled shown as recessive e.g. use of upper and lower case ;</p> <p>Parental generation:</p> <p>2. both types shown as homozygous ;</p> <p>F1:</p> <p>3. all shown as heterozygous ;</p> <p>F2:</p> <p>4. genetic diagram to show that 75% are smooth / 25% are wrinkled ;</p>	<p>4. Diagram should show genotypes</p>	(4)

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Question Number	Answer	Additional Guidance	Mark
(h)	<ol style="list-style-type: none">all the {DNA / eq} found in {a human / the human species / eq} ;idea of genes {on different chromosomes / different positions on same chromosome} ;	<ol style="list-style-type: none">ACCEPT population for species	(2)

Question Number	Answer	Additional Guidance	Mark
(i)	<ol style="list-style-type: none">product (of p53 gene) {stops / eq} development of tumour cells / eq <p>OR</p> <ol style="list-style-type: none">product (of p53 gene) {stops / regulates} progression {of cell cycle / towards mitosis} ;acts as an inhibitor of {transcription / protein synthesis / eq} / eq ;idea that {DNA / eq} repair ;idea that leads to apoptosis ;	<ol style="list-style-type: none">ACCEPT product stops tumour cells growing / dividing <ol style="list-style-type: none">ACCEPT product keeps it in {interphase / named mitotic stage} / product interferes with mitosis progress	(2)



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Question Number	Answer	Additional Guidance	Mark
(j)	<ol style="list-style-type: none">1. protein / glycoprotein ;2. reference to this being CD4 ;3. found on cell (surface) membrane / eq ;4. that acts as a {receptor / named receptor} for HIV / eq ;	4. ACCEPT receptor for gp120	(2)

Question Number	Answer	Mark
(k)	200 (nucleotides) ;	(1)

Q18.

Question Number	Answer	Additional guidance	Mark
(a)	<ol style="list-style-type: none">1. chromosomes / eq (continue to) condense ;2. nuclear envelope breaks down ;3. spindles (fibres) form ;4. nucleolus breaks down / eq ;		(3)



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Question Number	Answer	Additional guidance	Mark
(b)	<ol style="list-style-type: none">1. (pH sensitive cells) detect a change in blood pH / eq ;2. these are in the {carotid body / carotid artery / aortic body / aorta / medulla } ;3. alter impulse rate to brain / eq ;4. reference to cardiac centre ;5. in medulla ;6. change impulse rate of SAN ;		(4)

Question Number	Answer	Additional guidance	Mark
(c)	<ol style="list-style-type: none">1. idea that reproduce rapidly / {robust / hardy} so many can be formed rapidly ;2. easy to culture / eq ;3. (HeLa cells) susceptible to disease / HPV / eq ;4. genome known / eq ;5. idea that they have no Hayflick limit ;	<ol style="list-style-type: none">2. ACCEPT cheaper (as continual supply)3. ACCEPT other named disease4 ACCEPT reference to (HeLa) cells are human	(3)



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Question Number	Answer	Additional guidance	Mark
* (d)	<p>(QWC – spelling of technical terms must be correct and the answer must be organised in a logical sequence)</p> <ol style="list-style-type: none">1. phospholipid bilayer ;2. idea of its hydrophobic properties inhibit movement of ions across membrane ;3. Na⁺ gated channel present ;4. to allow Na⁺ to enter during depolarisation / to open when local currents occur ;5. K⁺ channels ;6. to allow K⁺ to diffuse ;7. sodium-potassium pump / eq ;8. to {export Na⁺/ import K⁺} ;9. role of pump in neurone membrane ;10.idea that only parts of the membrane may be involved e.g. nodes of Ranvier ;	<p>QWC emphasis is logical sequence</p> <p>10. ACCEPT salutatory condition ;</p>	(6)



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Question Number	Answer	Additional guidance	Mark
(e)	<ol style="list-style-type: none">1. idea of double stranded only in HeLa ;2. idea of too many H bonds in HeLa / {complementary bases / base pairs} ;3. thymine only found in HeLa genetic material / uracil only in poliovirus ;4. sugar present in HeLa is deoxyribose / ribose in poliovirus / eq ;		(3)

Question Number	Answer	Additional guidance	Mark
(f)	<ol style="list-style-type: none">1. brown shown as dominant / white shown as recessive e.g. use of upper and lower case; <p>Parental generation:</p> <ol style="list-style-type: none">2. both types shown as homozygous ; <p>F1:</p> <ol style="list-style-type: none">3. all shown as heterozygous ;		



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	F2: 4. genetic diagram to show that 75% are brown / 25% are white ;	4. Diagram should show genotypes	(4)
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Question Number	Answer	Additional guidance	Mark
(g)	<ol style="list-style-type: none">allow continual division (of hybrid) ;idea of continual production of (monoclonal) antibodies ;	<ol style="list-style-type: none">ACCEPT division is rapid / eq;	(2)

Question Number	Answer	Additional guidance	Mark
(h)	<ol style="list-style-type: none">modification of {genome / DNA / eq} ;reference to the addition of {genetic material / eq} from another {organism / species / eq} / eq ;		(2)



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Question Number	Answer	Mark
(i)	D (2^{50}) ;	(1)

Question Number	Answer	Additional guidance	Mark
(j)	Any two for 1 mark: Carbon / hydrogen / oxygen / nitrogen ; ;	ACCEPT as chemical symbols	(2)

Q19.

Question number	Answer	Mark
	<p>The only correct answer is B – habituation</p> <p><i>A is not correct because co- ordination is a general term not restricted to changes given</i></p> <p><i>C is not correct because inhibition does not describe a change in response</i></p> <p><i>D is not correct because it is not a term with meaning in the context of change of response</i></p>	(1)



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Q20.

Question Number	Answer				Additional Guidance	Mark
(i)	Stage	Voltage-gated K⁺ channel open	Voltage-gated K⁺ channel closed	Voltage-gated Na⁺ channel closed	3 columns correct = 2 marks 2 columns correct = 1 mark	
	Depolarisation		✓			
	Repolarisation	✓		✓		
						(2)

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

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Q21.



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Question Number	Answer	Additional Guidance	Mark
*	<p>(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)</p> <p>1. identify a gene that {provokes an effective immune response / codes for {antigen / eq} / inhibits <i>T. gondii</i> entering {brain/muscle}}</p>	QWC with emphasis on clarity of expression	



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	cells} ;		
	2. gene removed using a {restriction enzyme / endonuclease} ;		
	3. {same / this / eq} restriction enzyme used to open { <i>T. gondii</i> genome / eq} / eq ;	3. NOT plasmid cut open	
	4. sticky ends {formed / eq} ;		
	5. ligase used to bind gene / eq ;		
	6. by forming phosphodiester bonds / eq ;		
	7. idea of method of introducing gene into pathogen ;	7. IGNORE plasmid	
	8. idea that gene needs to be expressed e.g. protein synthesised ;	8. ACCEPT synthesises antigen	
	9. idea of this protein in provoking an immune response ;		
	10. detail of immune response ;		
			(6)



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Q22.

Question Number	Answer	Additional Guidance	Mark
	<ol style="list-style-type: none">1. idea of rats have rights;2. rats made {blind/ eq } ;3. 15 samples may not be sufficient for a reliable investigation / eq ;4. idea that rat retina may not behave like human retina (so investigation has no (potential) medical application) ;	<ol style="list-style-type: none">1. ACCEPT lack of consent given2. ACCEPT harmed, causes pain, requires killing rats4. ACCEPT tissue culture available	(2)

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Q23.

Question Number	Answer	Additional Guidance	Mark
	<ol style="list-style-type: none">1. idea that it binds to wasp venom so it {is removed from / can no longer bind to} receptor ;2. idea that breaks down wasp venom so it leaves receptor ;3. idea that wasp venom binds more readily to it than to the receptor ;4. idea of the nature of the compound e.g. enzyme ;		(2)

E



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Q24.

Question Number	Answer	Additional guidance	Mark
(i)	<p>A description that makes reference to the following:</p> <ul style="list-style-type: none">calcium ions enter presynaptic neurone so vesicles with neurotransmitter can {move towards / fuse with presynaptic membrane} (1)neurotransmitter molecules diffuse across the synapse (1)neurotransmitter to bind with receptors on postsynaptic membrane (on the brain cell) (1)sodium ions diffuse into {brain cell / post-synaptic cell} leading to {a depolarisation / an action potential } (1)	<p>ALLOW calcium ions enter presynaptic neurone leading to exocytosis of neurotransmitter from vesicles</p> <p>ALLOW named neurotransmitter such as acetylcholine, dopamine, noradrenaline</p> <p>ALLOW enter for diffuse</p>	(4)

Question Number	Answer	Mark
(ii)	<p>The only correct answer is B - U - This is the site in the brain where the image is interpreted</p> <p><i>A is not correct because T is not the site in the brain where the image is interpreted</i></p> <p><i>C is not correct because V is not the site in the brain where the image is interpreted</i></p> <p><i>D is not correct because W is not the site in the brain where the image is interpreted</i></p>	(1)



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Q25.

Question number	Answer	Additional guidance	Mark
(i)	An answer that makes reference to two of the following: <ul style="list-style-type: none">• frequency of light-off pulses (1)• duration of light-off pulse (1)• {wavelength / intensity} of light (1)	ALLOW interval between {pulses / turning lights off}	Expert (2)

Question number	Answer	Additional guidance	Mark
(ii)	An answer that makes reference to three of the following: <ul style="list-style-type: none">• (with reduced synapsin) habituation is not as complete / there was a greater percentage of maximum jump response (1)• (with reduced synapsin) habituation takes place more slowly / jump-response decreases more slowly (1)• appropriate {manipulation / comparative use of data} (1)	ALLOW converse for normal synapsin ALLOW higher jump-response / jumped more e.g. jump response decreases by (14-4) 10% more with normal synapsin / takes (305) 25 more light-off stimuli to get maximum response for reduced synapsin after 100 light stimuli 16% higher with reduced synapsin	Expert (3)



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Question number	Answer	Additional guidance	Mark
(iii)	<p>An explanation that makes reference to three of the following:</p> <ul style="list-style-type: none">• (reduced synapsin) increases the number of vesicles fusing with the presynaptic membrane (1)• (resulting in more) {exocytosis / release} of neurotransmitter (into the synapse) (1)• therefore, (more) action potentials generated in post synaptic membrane (1)• therefore the flies (continue to) respond to the light-off stimulus (1)	<p>ALLOW vesicles can continue to fuse</p> <p>ALLOW (more) depolarisation of post synaptic membrane</p>	<p>Expert</p> <p>(3)</p>

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