

Mark Scheme (Results)

Summer 2013

GCE Biology (6BI05) Paper 01R

Unit 5: Energy, Exercise and
Coordination

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question Number	Answer	Mark																													
1(a)	<table><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><tr><td>Nearest the pupil of the eye</td><td>☐</td><td>☐</td><td>☐</td><td>☒</td></tr><tr><td>Containing the photosensitive pigment</td><td>☒</td><td>☐</td><td>☐</td><td>☐</td></tr><tr><td>Has the pre-synaptic membrane</td><td>☐</td><td>☐</td><td>☐</td><td>☒</td></tr><tr><td></td><td></td><td></td><td></td><td></td></tr></table>	Description	Area of the rod cell				A	B	C	D	Nearest the pupil of the eye	☐	☐	☐	☒	Containing the photosensitive pigment	☒	☐	☐	☐	Has the pre-synaptic membrane	☐	☐	☐	☒						(3)
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Question Number	Answer	Additional Comments	Mark
1(b) (i)	- 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 ;	ACCEPT 3 - cis to trans retinal ACCEPT 6 - decreases permeability (of membrane) to {sodium ions /Na⁺}, channels close ;	(4)

Question Number	Answer	Additional Comments	Mark
1(b) (ii)	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 ;	ACCEPT 4 - for depolarisation- threshold level not achieved	(2)

Question Number	Answer	Additional Comments	Mark
2(a)	1. identification of location / eq ; 2. size of tumour / eq ; 3. type of tumour / eq ; 4. reference to {blood vessels / eq} ; 5. idea of monitoring treatment or growth of tumour ;		(2)

Question Number	Answer	Additional Comments	Mark
2(b) (i)	Two from gender, age, physiological state, {BMI/eq}, not dieting, previous chocolate intake ;		(1)

Question Number	Answer	Additional Comments	Mark
2(b) (ii)	1. idea that fMRI can allow brain activity to be seen in real time ; 2. idea that fMRI uses {radio waves / magnetic field} ; 3. increase supply of oxygenated blood in active areas / eq ; 4. that {reflects/does not absorb} fMRI signals / eq ; 5. idea of seen as a white area ; 6. idea of comparison with and without chocolate ;	ACCEPT 1 - observe whilst eating chocolate ACCEPT 4 - less signal absorbed ACCEPT 5 - area lights up or is a different colour	(3)

Question Number	Answer	Additional Comments	Mark
2(b)(iii)	Two from Think, learn, feel emotions, personality, ability to see, memory ;;	ACCEPT - speech, decision making, problem solving intelligence, controls voluntary behaviour, forming associations (combining information from rest of cortex)	(2)

Question Number	Answer	Additional Comments	Mark
3(a)	1. idea of a different enzyme for each step ; 2. (which) converts one intermediate into the next e.g. enzyme 1 converts DHAP to 2-PG / eq ; 3. idea that this product becomes the substrate of the next {stage/enzyme} ; 4. idea of specificity ; 5. {controls/regulates/ eq} the conversion / eq ; 6. {speeds up / catalyses} the conversion / eq ; 7. by lowering the activation energy / eq ; 8. idea that pyruvate only produced if all enzymes active ;	ACCEPT 1 - 3 enzymes are involved ACCEPT 2 - correctly named enzyme ACCEPT 4 - description of specificity	(4)

Question Number	Answer	Additional Comments	Mark
3(b)(i)	1. direction of electron movement described / eq ; 2. reference to oxidation / reduction ; 3. idea of releasing energy ; 4. idea that this is used to pump the {H⁺ / hydrogen ions/protons} ; 5. from the matrix / into the space between the inner and outer mitochondrial membrane ;	ACCEPT 1 - electron picked up from carrier A or passed on to carrier C	(3)

Question Number	Answer	Additional Comments	Mark
3(b)(ii)	1. structure X is { stalked particle / ATP synthase / eq} ; Any two of the following: 2. reference to {H⁺ flows through {structure X / eq} / chemiosmosis} / eq ; 3. down electrochemical gradient / eq ; 4. (sufficient) energy is {released / eq} to ; 5. allow {ADP + Pi to join / ATP to form} ;	ACCEPT 1 - ATPase ACCEPT 3 - down H⁺ concentration gradient ACCEPT 5 - phosphorylation of ADP	(3)

Question Number	Answer			Additional Comments	Mark
3(c)	Situation	Movement of coloured liquid			
		towards A	towards B	does not move	
	Syringe plunger pulled upwards	☒	☐	☐	
	Syringe plunger not moved	☒	☐	☐	
	Potassium hydroxide is replaced with water and syringe plunger not moved	☐	☐	☒	
					(3)

Question Number	Answer	Additional Comments	Mark
4(a)(i)	Actin = 14 (%) ; Myosin = 10 (%) ;		(2)

Question Number	Answer	Additional Comments	Mark
4(a)(ii)	1. {Ca ²⁺ / eq} bind to troponin ; 2. troponin molecules {changes shape / moves / eq} ; 3. idea that this displaces tropomyosin ;		(2)

Question Number	Answer	Additional Comments	Mark
4(a)(iii)	{right / R} atrium ;		(1)

Question Number	Answer	Additional Comments	Mark
4(b)(i)	The higher the concentration of troponin T in the blood, the higher the mean number of days in hospital / eq ;	ACCEPT - the longer the stay in hospital ACCEPT - the higher the concentration of troponin T in the blood, the more severe the CVD is	(1)

Question Number	Answer	Additional Comments	Mark
4(b)(ii)	1. idea that the conclusion is valid ; 2. as there is no overlap between the range of data for each concentration of troponin T / eq ; 3. the validity (of the conclusion) becomes less the higher the concentration of troponin T / eq ; 4. (because) the data becomes less reliable at higher concentrations of troponin T / eq ; 5. idea that the range of data becomes greater ;		(2)

Question Number	Answer	Additional Comments	Mark
5(a) (i)	(terminal) dendrite ;		(1)

Question Number	Answer	Additional Comments	Mark
5(a) (ii)	B ;		(1)

Question Number	Answer	Additional Comments	Mark
5(b) (i)	1. Increasing eugenol concentration increase percentage inhibition / positive correlation ; 2. Description of non linear correlation ; 3. Credit correct manipulation of the data e.g. 0.8 mmol dm ⁻³ increase causes percentage inhibition to increase by {x 2.7 / eq} ;	ACCEPT 2 - greatest increase is between 0.2 & 0.4	(2)

Question Number	Answer	Additional Comments	Mark
5(b) (ii)	72.5 / 73.0 / 75 (%) ; ;	ACCEPT - for 1 mark (65 + 80) ÷ 2 or 145 ÷ 2 if answer incorrect	(2)

Question Number	Answer	Additional Comments	Mark
*5(c)	QWC – Spelling of technical terms (shown in <i>italics</i>) must be correct and the answer must be organised in a logical sequence 1. higher concentration of Na⁺ outside of neurone / eq ; 2. sodium ions move in causing a depolarisation / eq ; 3. eugenol may affect { Na⁺ / voltage-dependent } gates / eq ; 4. eugenol reduces influx of Na⁺ / eq ; 5. (so) depolarisation less likely to occur / eq ; 6. no impulse transmitted along neurone / eq ; 7. idea of no transmission to next neurone ; 8. idea of pain not being sensed as impulse stopped before entering CNS ;	ACCEPT 7 - no release of neurotransmitter	(6)

Question Number	Answer	Additional Comments	Mark
6(a) (i)	as a comparison / to show that IAA required for growth ;		(1)

Question Number	Answer	Additional Comments	Mark
6(a) (ii)	1. recorded {height / eq} of the shoots / eq ; 2. calculated difference in heights / eq ; 3. shoots with IAA are taller than control / eq ; 4. because IAA diffuse {down / out of agar / to zone of elongation} ; 5. causing cell elongation ; 6. details of cell elongation ; 7. idea of higher IAA concentration causes more growth ; 8. (due to) more cell elongation ;	ACCEPT - auxin as alternative to IAA throughout ACCEPT 4 - away from the light/agar block or goes into shoot	(5)

Question Number	Answer	Additional Comments	Mark
6(b)	1. Idea of IAA at cell surface membrane e.g. binds to receptors ; 2. idea of movement within cell e.g. secondary messengers, IAA moves to the nucleus ; 3. detail of interaction with transcription factor ; 4. idea of switching on gene ; 5. Activity at promoter region / eq ; 6. Allows formation of (m)RNA ; 7. Idea of translation produces protein ;	ACCEPT - auxin as alternative to IAA throughout ACCEPT 1 - IAA enters the cell ACCEPT 3 - e.g. binds to a transcription factor, activates transcription factor, forms transcription initiation complex, binds to or counters an inhibitor ACCEPT 4 - binds to promoter region ACCEPT 5 - RNA polymerase activity	(4)

Question Number	Answer	Additional Comments	Mark
7(a)	1. only (alpha) 1-4 glycosidic bonds in amylose / (alpha) 1-6 only found in amylopectin ; 2. only amylopectin has side branches / only amylose is {coiled / eq} ; 3. Amylopectin is a {larger / eq} molecule than amylose ;	ACCEPT 1 - 1-6 and 1-4 in amylopectin	(2)

Question Number	Answer	Additional Comments	Mark
7(b)	1. different individuals in the {colony / eq} take on specific {roles / jobs / eq} ; 2. example given e.g. queen produces offspring ;	ACCEPT 1 - division of labour ACCEPT 2 - dominance by queen, {few of the males / kings} involved in breeding	(2)

Question Number	Answer	Additional Comments	Mark
7(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
7(c) (ii)	1. Lack of insulating layer: idea that does not impede transfer of heat energy / allows exchange of heat energy more easily ; 2. A marked reduction in sweat glands: idea that they do not need to cool down OR less water lost ;	ACCEPT 1 - enables heat transfer between environment and naked mole rat	(2)

Question Number	Answer	Additional Comments	Mark
7(d)	1. (cancer causing) gene identified / eq ; 2. gene {cut / isolated / eq} from DNA / eq ; 3. using a {restriction / eq} enzyme / eq ; 4. gene in {vector / named vector} ; 5. mechanism for getting {gene/vector} into host cells (of mice) / eq ;	ACCEPT 4 – named examples including retrovirus, virus, liposome ACCEPT 5 - reference to (micro)injection, microprojectiles, electroporation, gene gun, inhaler	(2)

Question Number	Answer	Additional Comments	Mark
*7(e)	QWC – Spelling of technical terms (<i>shown in italics</i>) must be correct and the answer must be organised in a logical sequence 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 ;	ACCEPT 3 - influx of sodium ions	(5)

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

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

Question Number	Answer	Additional Comments	Mark
7(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 1 - energy-rich	(3)

Question Number	Answer	Additional Comments	Mark
7(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 ;	ACCEPT 3 - producing offspring that are genetically different	(2)

Question Number	Answer	Additional Comments	Mark
7(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	(1)

Question Number	Answer	Additional Comments	Mark
7(I)	Paired responses: 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 ;		

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