

# Mark Scheme (FINAL)

## January 2009

GCE

GCE Biology (6104/03)

## 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)	<p>A cortex / cerebrum / (left / right) cerebral hemisphere / cerebral cortex / eq;</p> <p>NOT cerebellum</p> <p>B hypothalamus / limbic system ;</p> <p>ACCEPT hyperthalamus</p>	(2)

Question Number	Answer	Mark
1(b)	<ol style="list-style-type: none"> <li>1. reference to {balance / posture / muscle tone} ;</li> <li>2. idea of {controls / coordinates} {skeletal / muscular / voluntary} movement ;</li> <li>3. reference to {modification of movement / fine movement / named example e.g. talking } ; [a learned, practiced or skilled movement]</li> </ol> <p>Comment: NOT general comments about sending impulses mp 2: not just “controls movement”</p>	max (2)

Question Number	Answer	Mark
2(a)(i)	W carbon dioxide / CO <sub>2</sub> ; X oxygen / O <sub>2</sub> / O / ½ O <sub>2</sub> ; Note: one mark deducted for each wrong answer up to a max of 2 marks deducted	(2)

Question Number	Answer	Mark
2(a)(ii)	G ; Note: no mark in presence of any other letters.	(1)

Question Number	Answer	Mark
2(a)(iii)	two of B / C / D / E ; Note: no mark in presence of any wrong letter.	(1)

Question Number	Answer	Mark
2(a)(iv)	at least two from A, B and C ; Note: no mark if one letter only or presence of any other letters.	(1)

Question Number	Answer	Mark
2(b)	it is (re-)oxidised / idea that NAD <sup>+</sup> is regenerated / used to reduce ethanal (to ethanol) / eq ; Comment: ALLOW if clearly represented on a correct equation ALLOW “forms NAD” idea NOT “reduced to NAD” Answers must be in correct context i.e. of anaerobic respiration of <u>yeast</u>	(1)

Question Number	Answer	Mark
3(a)	<ol style="list-style-type: none"> <li>1. {rate increases / eq} from {0 / 30} - 90 minutes / up to 90 minutes ; ACCEPT if done in stages e.g. 0 - 30, 30 - 60, 60 - 90</li> <li>2. {rate decreases / eq} after 90 minutes / from 90 - 180 minutes ;</li> <li>3. {greatest increase (in rate) / eq} is from 60 - 90 minutes / slowest rate between 150 and 180 minutes ;</li> <li>4. correct manipulation of figures e.g. rate of urine production for first 60 minutes is <math>5\text{cm}^3/\text{minute}</math> ;</li> </ol> <p>Comment: Units only needed for mp4</p>	max (3)

Question Number	Answer	Mark
3(b)	<ol style="list-style-type: none"> <li>1. (rate is) slower / eq ;</li> <li>2. constant / eq ;</li> </ol> <p>Comment: “urine production” with no comment on rate does not get a mark</p>	(2)

Question Number	Answer	Mark
3(c)	<p>1. (saline would) {increase the concentration of solutes in / lower the water potential of / lower solute potential of } the blood / eq ;</p> <p>Then, any TWO from:</p> <p>2. this will be detected {by osmoreceptors / in the hypothalamus} / eq ;</p> <p>3. reference to {release / more} ADH (from posterior pituitary gland) ;</p> <p>4. increases the permeability of collecting duct / distal convoluted tubule to water / eq ;</p> <p>5. more water reabsorbed (back into the blood) ;</p> <p>6. therefore less water in urine / eq ;</p> <p>Comment: ALLOW converse for drinking water where accurately described</p>	max (3)

Question Number	Answer	Mark
3(d)	<p>activity may cause loss of water in sweat / more metabolic water produced / more water lost in breathing faster / so that a reliable comparison can be made / eq ;</p> <p>Comment: IGNORE "fair test"</p>	(1)

Question Number	Answer	Mark
4(a)	<ol style="list-style-type: none"> <li>1. both increase (conduction) velocity with (axon) diameter increase / eq ;</li> <li>2. {velocity increase greater in myelinated neurones than in non-myelinated neurones / converse / eq} / {increase in diameter has a greater effect on velocity in myelinated neurones / eq};</li> <li>3. at 1.05 <math>\mu\text{m}</math> both have same velocity ;</li> <li>4. above 1.05 <math>\mu\text{m}</math> (diameter) myelinated faster conduction / converse / eq ; [up to 1.05 myelinated slower conduction] ACCEPT range 1.01 - 1.09 NB don't penalise incorrect figures twice</li> <li>5. idea that myelinated has {linear / eq} relationship but non-myelinated is {partly non-linear / eq} ;</li> <li>6. comparative manipulated figures ;</li> </ol> <p>Comments: mp 2: Do NOT accept refs to faster increases in conduction velocity mp 4: ACCEPT reference to linear increase for myelinated fibre and a description of the conduction velocity with increase in axon diameter for non-myelinated fibre</p>	max (3)

Question Number	Answer	Mark
4(b)	<ol style="list-style-type: none"> <li>1. insulates (electrically) the axon / eq ;</li> <li>2. reference to nodes of Ranvier ;</li> <li>3. {depolarisation / action potential} at nodes of Ranvier) / eq / converse ;</li> <li>4. impulse jumps from node to node / eq ;</li> <li>5. reference to saltatory conduction ;</li> </ol> <p>Comment: mp 4: Do NOT accept "action potential jumps"</p>	max (3)

Question Number	Answer	Mark
4(c)(i)	<ol style="list-style-type: none"> <li>1. correct division i.e <math>25 / 3.4</math> ;</li> <li>2. correct answer = <math>7.35 / 7.4</math> (m per second) ;</li> </ol>	(2)

Question Number	Answer	Mark
4(c)(ii)	<p>1.7 - 1.7 5 (<math>\mu\text{m}</math>) ;  [allow consequential error from part (i)]</p> <p>Comment:  If answer not as above, then check that answer to Q4(c)(i) gives this reading on graph  ALLOW <math>\pm 0.05</math></p>	(1)

Question Number	Answer	Mark
4(d)	<ol style="list-style-type: none"> <li>1. (toxin) {binds to / competes / blocks / eq } for receptors (on post -synaptic membrane) / stops {acetylcholine / neurotransmitter} / cannot bind to {receptors / acetylcholinesterase} ;</li> <li>2. reference to <math>\text{Na}^+</math> gates not opening / eq ;</li> <li>3. depolarisation does not occur / description of depolarisation not occurring / reference to threshold level not reached / eq ;</li> </ol>	max (2)



Question Number	Answer	Mark
5	<p>General (allow in the context of either insulin or adrenaline):</p> <ol style="list-style-type: none"> <li>1. transported in blood ;</li> <li>2. binds to {receptors / proteins / eq} on membrane;</li> <li>3. reference to {activation / eq} of enzymes ;</li> </ol> <p>Insulin:</p> <ol style="list-style-type: none"> <li>4. idea that insulin causes a decrease in (blood glucose / sugar) levels ;</li> <li>5. after a meal / eq ;</li> <li>6. reference to pancreas detecting increased (glucose / sugar) levels ;</li> <li>7. insulin {released / eq} from <math>\beta</math> cells ;</li> <li>8. reference to inhibition of breakdown of lipids / increase in {cell respiration rate / permeability of membrane to glucose} / eq ;</li> <li>9. reference to stimulates {formation of glycogen / glucose converted into glycogen / glycogenesis} ;</li> </ol> <p>Adrenaline:</p> <ol style="list-style-type: none"> <li>10. idea that adrenaline increases (blood glucose / sugar) levels;</li> <li>11. (adrenaline) released in response to danger / stress / eq ;</li> <li>12. (adrenaline) released from adrenal glands ;</li> <li>13. credit details of intracellular events (e.g. causes release of adenylyl cyclase / activates a second messenger / stimulates formation of cAMP ;</li> <li>14. reference to cascade effect :</li> <li>15. reference to glycogenolysis / conversion of glycogen to glucose ;</li> </ol>	<p>max (10)</p>

Question Number	Answer			Mark
6	Ventilation mechanism	Site of nervous control of ventilation	Name of nerve involved in ventilation mechanism.	(4)
		inspiratory centre / medulla ;	phrenic / intercostal ;	
		stretch receptors / {pneumotaxic / expiratory} centre / pons ;	vagus / (tenth) cranial nerve ;	

Question Number	Answer	Mark
7(a)	<ol style="list-style-type: none"> <li>1. idea of rapid production ATP ;</li> <li>2. {releases / eq} phosphate ;</li> <li>3. to convert ADP into ATP / eq ;</li> </ol> <p>Comment mps 2 and 3 could be from a complete equation e.g. creatine phosphate + ADP -&gt; ATP + creatine</p>	max (2)

Question Number	Answer	Mark
7(b)	<p>up to 0.5</p> <ol style="list-style-type: none"> <li>1. both rise ;</li> <li>2. anaerobic rises {faster / more / eq} / more anaerobic than aerobic ;</li> </ol> <p>after 0.5</p> <ol style="list-style-type: none"> <li>3. aerobic rises more than anaerobic / more aerobic than anaerobic / eq ;</li> <li>4. anaerobic falls aerobic (continues to) rise ;</li> <li>5. aerobic {plateaus / eq}, anaerobic {continues to rise / eq} ;</li> <li>6. credit any correct manipulated quantified comment ;</li> </ol> <p>Comment Apply mps to answers relating aerobic before and after 0.5 and anaerobic before and after 0.5</p>	max (3)

Question Number	Answer	Mark
8(a)	<ol style="list-style-type: none"> <li>1. one from the following list of factors that cause arthritis: genetic / chemical / wear and tear / eq ;</li> <li>2. synovial joints are affected / eq ;</li> <li>3. reduced (synovial) membrane /change in fluid / eq ;</li> <li>4. {deterioration / eq} of the cartilage / chondrocytes affected / eq ;</li> <li>5. results in {bone destruction / the formation of new bone in the form of spurs / fused bones} / eq ;</li> <li>6. reference to {inflamed / misshapen / swollen / painful / less mobile / eq} joints ;</li> </ol> <p>Comment: mp 1: “worn down” is not an alternative to “wear and tear”</p>	max (4)

Question Number	Answer	Mark
8(b)(i)	<ol style="list-style-type: none"> <li>1. female total (21600 + 72800 + 296000) and male total (5400 + 18200 + 74000) ;</li> <li>2. correct numerator (390400 - 97600) x 100% ;</li> <li>3. denominator 97600 = answer 300% / denominator 390400 = answer 75% ;</li> </ol>	(3)

Question Number	Answer	Mark
8(b)(ii)	<ol style="list-style-type: none"> <li>1. both types of osteoarthritis (OA) increase with age (for both males and females);</li> <li>2. hips: (at each age group) OA affect the males and females the same ;</li> <li>3. hands: OA of the hand affects more females than males (at each age group) ;</li> <li>4. hands: OA shows the longer occurrence(than hips) in both males &amp; females (across all age ranges) ;</li> <li>5. quantitative manipulation of figures ;</li> </ol> <p>Comment: mp 1: be prepared to “piece together” information to award this mark</p>	max (3)

Question Number	Answer	Mark
8(c)	increase in the occurrence obesity / reference to the increase in the aging population / increase in repetitive movements / eq ;	(1)

Question Number	Answer	Mark
9(a)	<ol style="list-style-type: none"> <li>1. volume of blood pumped by {the heart / both ventricles} / stroke volume (each heart beat) ;</li> <li>2. in one minute / multiplied by number of beats per minute ;</li> </ol> <p>Comment: "stroke volume x heart rate" is worth 2 marks</p>	(2)

Question Number	Answer	Mark
9(b)(i)	<ol style="list-style-type: none"> <li>1. increase to muscles and skin ;</li> <li>2. increase more to muscle / converse ;</li> <li>3. no change to heart ;</li> <li>4. decrease to brain and kidney ;</li> <li>5. decrease greater to kidney / converse ;</li> <li>6. manipulation of figures to quantify any of above marking points ;</li> </ol>	max (3)

Question Number	Answer	Mark
9(b)(ii)	<ol style="list-style-type: none"> <li>1. (during exercise) muscles are contracting faster / eq;</li> <li>2. need more {ATP / respiration} / eq ;</li> <li>3. more {oxygen / glucose} needed ;</li> <li>4. more carbon dioxide to be removed ;</li> <li>5. blood diverted away from less active organs / eq ;</li> <li>6. (increase in) blood flow to skin to lose heat / eq ;</li> <li>7. maintains body temperature / eq ;</li> <li>8. allow appropriate explanation for no change in heart ;</li> </ol>	max (5)