



Mark Scheme (Results)

January 2026

Pearson Edexcel International Advanced
Level In Biology
WBI15/01

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January 2026

Question Paper Log Number P79035A

Publication Code WBI15_01_2601_MS

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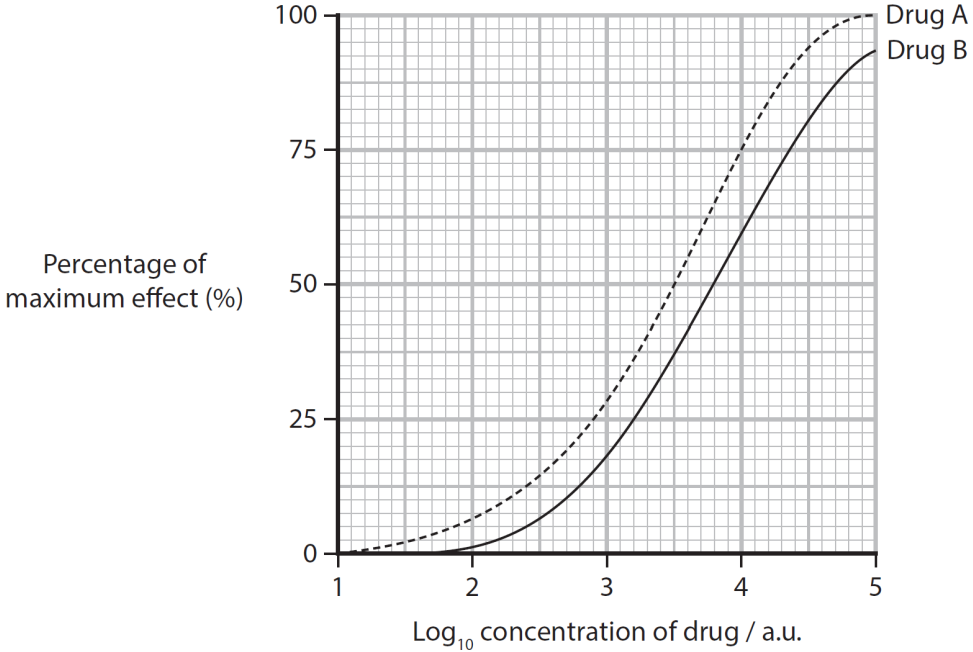
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General Marking Guidance

- 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	Additional guidance	Mark			
1(a)	Type of drug				(2)	
	Statement about the action of some drugs	both nicotine and CV	nicotine only	CV only		neither nicotine nor CV
	Binds to acetylcholine receptors	X				
	Stimulates nerve impulses		X			

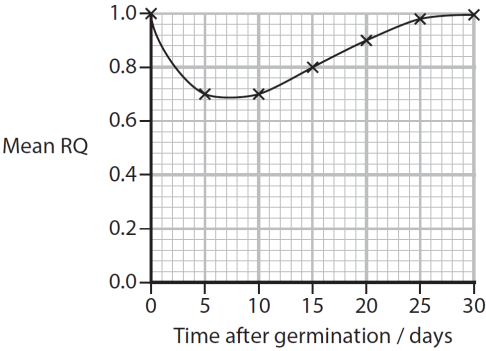
Question number	Answer	Additional guidance	Mark
1(b)(i)	<p>An answer that makes reference to the following points:</p> <ul style="list-style-type: none"> so that all the data will fit on one graph (1) as large range of concentration of drugs / a wide range of doses are plotted (1) Visualise the rate of change / determine any trends easier (1) 	<p>Allow to fit all the data on the x-axis / otherwise the scale will be too large</p> <p>Allow convert numbers to more manageable/plottable numbers</p> <p>Ignore quoted numbers</p> <p>Ignore easier comparison</p>	(2)

Question number	Answer	Additional guidance	Mark
1(b)(ii)	<ul style="list-style-type: none"> • correct values read from graph and converted to antilogs (1) • correct answer from values subtracted (1) 	<p>Values: 3.5 and 3.8 Antilogs: 3162.2777 and 6309.5734</p> <p>Difference = 3147.2958 / 3147 / 3147.3 Accept 3147.29 or 3147.3</p> <p>Correct answer with no workings gains 2 marks.</p> <p>1 mark for 3.8-3.5 = 0.3 1 mark for antilog 0.0357 = 1.086</p>	(2)

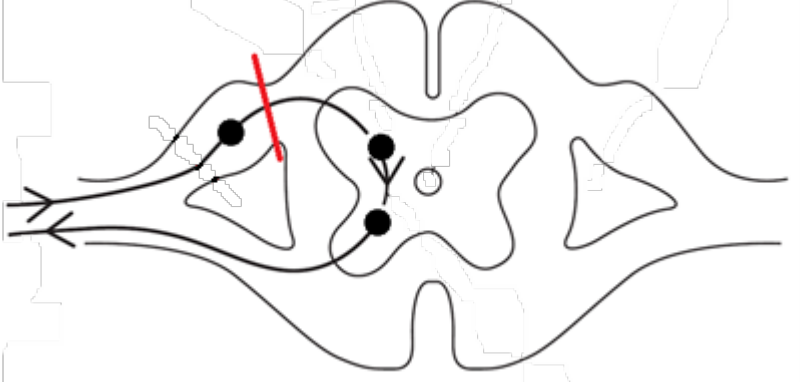
Question number	Answer	Additional guidance	Mark
2(a)(i)	<p>An answer that makes reference to the following points:</p> <ul style="list-style-type: none"> • carbon dioxide ÷ oxygen (1) • <u>volume</u> (carbon dioxide) produced and <u>volume</u> (oxygen) used (1) 	<p>Ignore amount</p> <p>Accept moles instead of volume Ignore number of molecules / oxygen available</p> <p>Accept RQ = vol of carbon dioxide released / vol of oxygen used for 2 marks</p>	(2)

Question number	Answer	Additional guidance	Mark
2(a)(ii)	<p>An explanation that makes reference to the following points:</p> <ul style="list-style-type: none"> • because carbon dioxide is produced in the {Krebs cycle / link reaction} (1) • and oxygen is needed {as a final electron acceptor / as final proton acceptor / in oxidative phosphorylation} (1) 	<p>If no other marks given accept for 1 mark if there is no oxygen you cannot use the equation as it is vol. CO₂ / vol O₂</p>	(2)

Question number	Answer	Additional guidance	Mark																					
2(b)(i)	<p>An answer that makes reference to the following points:</p> <ul style="list-style-type: none"> as the proportion of {carbohydrate decreases / lipid increases} the RQ decreases (1) calculation to support the relationship (1) <table border="1" data-bbox="383 616 1341 1281"> <thead> <tr> <th>Proportion of carbohydrate</th> <th>Proportion of lipid</th> <th>RQ</th> </tr> </thead> <tbody> <tr> <td>1.0</td> <td>0.0</td> <td>1.00</td> </tr> <tr> <td>0.8</td> <td>0.2</td> <td>0.88</td> </tr> <tr> <td>0.6</td> <td>0.4</td> <td>0.80</td> </tr> <tr> <td>0.4</td> <td>0.6</td> <td>0.76</td> </tr> <tr> <td>0.2</td> <td>0.8</td> <td>0.73</td> </tr> <tr> <td>0.0</td> <td>1.0</td> <td>0.70</td> </tr> </tbody> </table>	Proportion of carbohydrate	Proportion of lipid	RQ	1.0	0.0	1.00	0.8	0.2	0.88	0.6	0.4	0.80	0.4	0.6	0.76	0.2	0.8	0.73	0.0	1.0	0.70	<p>Accept converse Accept positive/negative correlation</p> <p>e.g. simple subtraction to illustrate increase and/or decrease between stated values of carbohydrate / lipid</p> <p>Drop from 1.0 to 0.0 in carbohydrate results in a drop in RQ of 0.3.</p> <p>Drop of 0.4 in carbohydrate proportion between 1.0 carbs to 0.6 carbs results in a 0.2 decrease in RQ.</p> <p>Increase of 0.4 in lipids between 0 lipids to 0.4 lipids there is a decrease RQ by 0.2.</p>	(2)
Proportion of carbohydrate	Proportion of lipid	RQ																						
1.0	0.0	1.00																						
0.8	0.2	0.88																						
0.6	0.4	0.80																						
0.4	0.6	0.76																						
0.2	0.8	0.73																						
0.0	1.0	0.70																						

Question number	Answer	Additional guidance	Mark																
2(b)(ii)	<p>An answer that makes reference to three of the following points:</p> <ul style="list-style-type: none"> • at germination (the respiratory substrate) is carbohydrate (1) • {during days 0 to 5 / as days increase to day 5}, proportion of {carbohydrate used decreases / lipid used increases} (1) • between 5 and 10 days after germination, lipid (is the respiratory substrate) (1) • after day 10 the proportion of {carbohydrate increases / lipid decreases} (1)  <table border="1" data-bbox="622 991 1106 1342"> <caption>Data points from the Mean RQ graph</caption> <thead> <tr> <th>Time after germination / days</th> <th>Mean RQ</th> </tr> </thead> <tbody> <tr><td>0</td><td>1.0</td></tr> <tr><td>5</td><td>0.7</td></tr> <tr><td>10</td><td>0.7</td></tr> <tr><td>15</td><td>0.8</td></tr> <tr><td>20</td><td>0.9</td></tr> <tr><td>25</td><td>0.95</td></tr> <tr><td>30</td><td>1.0</td></tr> </tbody> </table>	Time after germination / days	Mean RQ	0	1.0	5	0.7	10	0.7	15	0.8	20	0.9	25	0.95	30	1.0	<p>Ignore descriptions of data / RQ Don't piece together</p> <p>Accept at day 0 / first / the end / day 30 / after 25 days (the respiratory substrate) is carbohydrate</p> <p>Accept 0 and any value between 5-10 days</p> <p>Accept any values between 5-10 days</p> <p>Accept after 7 days the proportion of {carbohydrate increases / lipid decreases}</p> <p>If no other marks awarded Accept as days increase carbohydrate used decreases then increases / lipid used increases then decreases 1 mark</p>	<p>(3)</p>
Time after germination / days	Mean RQ																		
0	1.0																		
5	0.7																		
10	0.7																		
15	0.8																		
20	0.9																		
25	0.95																		
30	1.0																		

Question number	Answer	Mark
3(a)(i)	<p>The only correct answer is B</p> <p><i>A is incorrect because J is a motor neurone, K is a sensory neurone and L is the relay neurone</i></p> <p><i>C is incorrect because J is a motor neurone, K is a sensory neurone and L is the relay neurone</i></p> <p><i>D is incorrect because J is a motor neurone, K is a sensory neurone and L is the relay neurone</i></p>	(1)

Question number	Answer	Additional guidance	Mark
3(a)(ii)	<p>An answer that makes reference to the following points:</p> <ul style="list-style-type: none"> • {one cell body / two cell bodies} positioned correctly (1) • all cell bodies positioned correctly (1) 	 <p>Accept sensory neurone cell body circle anywhere to the left of the red line</p> <p>Accept fill in or blank circles or other clearly indicated shapes</p> <p>Do not accept circles that do not show a gap between the neurones</p>	(2)

Question number	Answer	Mark
3(a)(iii)	<p>The only correct answer is B</p> <p><i>A is incorrect because it is white matter</i> <i>C is incorrect because R is the spinal canal</i> <i>D is incorrect because S is not part of the spinal cord</i></p>	(1)

Question number	Answer	Mark
3(b)(i)	<p>The only correct answer is A</p> <p><i>B is incorrect because it is the calcium ion channels that open</i> <i>C is incorrect because it is the calcium ion channels that open</i> <i>D is incorrect because it is the calcium ion channels that open</i></p>	(1)

Question number	Answer	Mark
3(b)(ii)	<p>The only correct answer is B</p> <p><i>A is incorrect because guanine is a nitrogenous base</i> <i>C is incorrect because galactose is a sugar</i> <i>D is incorrect because guanine is a nitrogenous base and galactose is a sugar</i></p>	(1)

Question number	Answer	Additional guidance	Mark
3(c)	<p>An explanation that makes reference to four of the following points:</p> <ul style="list-style-type: none"> • (when the neurotransmitter binds to receptors it) triggers a (few) sodium ion channels open (1) • sodium ions move into the neurone depolarising the membrane slightly (1) • this causes more sodium ion channels to open (in same part of neurone (1) • so the membrane becomes (further) depolarised / an influx of sodium ions (1) • and this (cycle) continues until an action potential is produced (1) 	<p>Ignore potassium ions Ignore sodium unqualified – penalise once only</p> <p>Accept changes the membrane potential slightly</p> <p>Accept and this (cycle) continues until threshold is reached Accept a description of building up to an action potential</p>	(4)

Question number	Answer	Additional guidance	Mark
4(a)(i)	<ul style="list-style-type: none"> 5.6 	Ignore 'x' on the answer line	(1)

Question number	Answer	Mark
4(a)(ii)	<p>The only correct answer is C</p> <p><i>A is incorrect because filtration occurs in Bowman's capsule (L) and reabsorption occurs in the PCT (K)</i></p> <p><i>B is incorrect because filtration occurs in Bowman's capsule (L) and reabsorption occurs in the PCT (K)</i></p> <p><i>D is incorrect because filtration occurs in Bowman's capsule (L) and reabsorption occurs in the PCT (K)</i></p>	(1)

Question number	Answer	Additional guidance	Mark
4(b)(i)	<ul style="list-style-type: none"> 600 (%) 	$3.5 - 0.5 = 3$ $3 \div 0.5 = 6$ $\times 100 = 600$	(1)

Question number	Answer	Additional guidance	Mark
4(b)(ii)	<p>A description that makes reference to the following points:</p> <p>(b) The graph shows how the rates of filtration and reabsorption of glucose in mammalian nephrons vary with the concentration of glucose in the blood plasma.</p> <p>Rate / mmol min⁻¹</p> <p>Concentration of glucose in blood plasma / mmol dm⁻³</p> <ul style="list-style-type: none"> • as concentration of glucose increases the filtration rate increases (1) • as concentration of glucose increases to {23 / 24 / 25} the reabsorption rate increases (1) • from a concentration of glucose of {13 / 14 / 15} to {23 / 24 / 25} the rate of reabsorption slows down (1) • as concentration of glucose increases above {23 / 24 / 25} the reabsorption rate remains constant (1) 	<p>Accept concentration of glucose written once for all marking points</p> <p>Ignore answers in context of rate / mmol min⁻¹</p> <p>Accept converse</p> <p>Accept positive correlation / directly proportional</p> <p>Accept {plateaus / remains the same / levels off} as equivalent to remains constant</p>	(3)

Question number	Answer	Additional guidance	Mark
4(b)(iii)	<ul style="list-style-type: none"> filtration rate is faster than reabsorption rate / reabsorption rate was at a maximum / reabsorption rate levels off / reabsorption rate is not fast enough (1) 	Accept converse	(1)

Question number	Answer	Additional guidance	Mark
5(a)(i)	<ul style="list-style-type: none"> {repetition of a / prolonged / non-threatening} stimulus results in a {decreased response / decreased polarisation / changed behaviour} (1) 	<p>Ignore references to save energy / further stimuli</p> <p>Accept where an organisms stops responding to a {repeated / prolonged / non-threatening} stimulus</p>	(1)

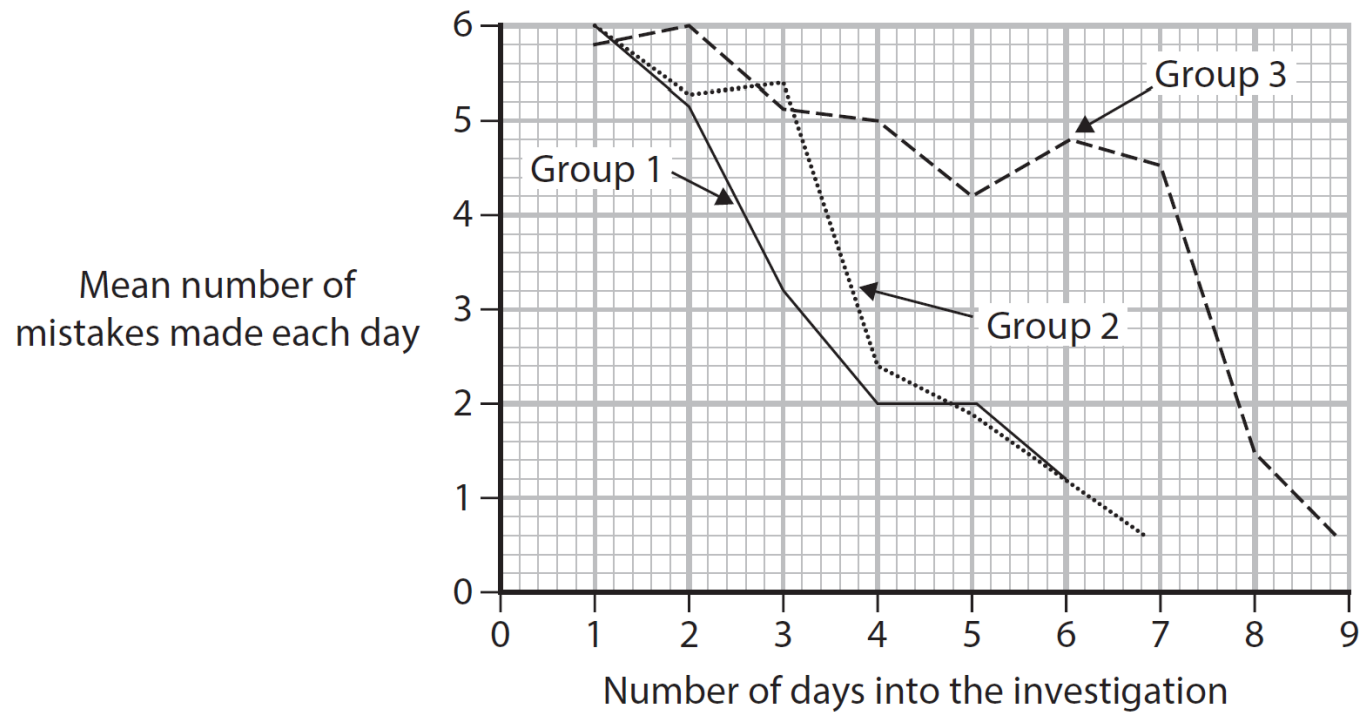
Question number	Answer	Additional guidance	Mark
5(a)(ii)	<ul style="list-style-type: none"> any two appropriate reasons 	<p>Examples elk will be {killed by the cars / injured by cars / hit by cars} elk more likely to be hunted / killed people will be hurt in a car crash people could be bitten by elk food being given to elk could harm them elk lose ability to find food zoonotic transmission other reasonable suggestions</p>	(1)

Question number	Answer	Additional guidance	Mark
5(b)(i)	<ul style="list-style-type: none"> three correct values read from graph (1) correct ratio (1) 	<p>2, 2.4, 5</p> <p>1 : 1.2 : 2.5 OR 0.4 : 0.48 : 1 Correct answer with no workings scores 2 marks</p>	(2)

Question number	Answer	Additional guidance	Mark
5(b)(ii)	<p>An explanation that makes reference to three of the following points:</p> <ul style="list-style-type: none"> • group 1: (mean) number of mistakes decrease as rats {learnt how to get to the food / wanted to get to the food / could smell the food} (1) • group 1: learnt faster as they {wanted to reach the food / could smell the food} (1) • group 3: {slow decrease / fluctuating} in the number of mistakes in the first 6 days (as no food is rewarded) (1) • group 3: {faster / steeper / significantly} decrease in number of mistakes after day 6 due {the presence of food / the rats being able to smell the food} (1) 	<p>Ignore references to group 2 Accept reward instead of food</p> <p>Accept Group 1 had the lowest (mean) number of mistakes (than Group 3) each day as rewarded by food</p> <p>Ignore steepest decrease</p> <p>Accept faster learning after day 6 due to {the presence of food / the rats being able to smell the food}</p>	(3)

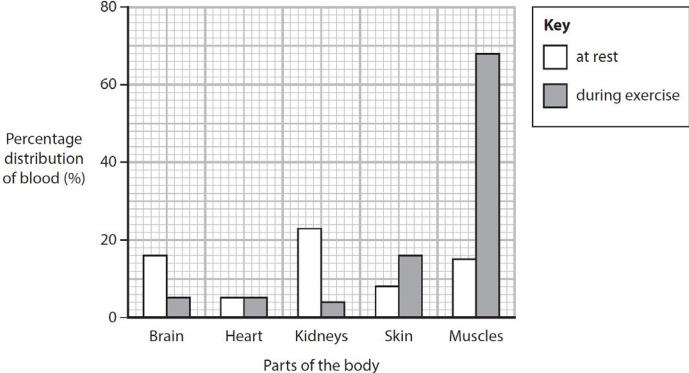
Group of rats	Investigation set-up
1	A food reward placed at the end of the maze each day of the investigation
2	A food reward placed at the end of the maze from day 3 onwards
3	A food reward placed at the end of the maze from day 6 onwards

The graph shows the results of this investigation.



Question number	Answer	Mark
6(a)	<p>The only correct answer is C</p> <p><i>A is incorrect because cardiac output is the product of heart rate and stroke volume</i></p> <p><i>B is incorrect because cardiac output is the product of heart rate and stroke volume</i></p> <p><i>D is incorrect because cardiac output is the product of heart rate and stroke volume</i></p>	(1)

Question number	Answer	Additional guidance	Mark
6(b)(i)	<ul style="list-style-type: none"> • 3.4 		(1)

Question number	Answer	Additional guidance	Mark																			
6(b)(ii)	<p>An explanation that makes reference to four of the following points:</p> <ul style="list-style-type: none"> • increase in blood (flow) to skin by vasodilation (1) • for thermoregulation (1) • (in exercise) as heat (energy) produced during {muscle contraction / respiration in muscles} (1) • decrease in blood (flow) to kidney as blood is {increased in/redistributed to} skin (1) • decrease in blood (flow) to kidney as blood is {increased in/redistributed to} muscles (1) 	<p>Accept dilation of arterioles equivalent to vasodilation</p> <p>Accept help cool the body down / heat loss from skin / heat loss by radiation / to increase sweating</p> <p>Accept {heat (energy) released / body temperature increases} as equivalent to heat (energy) produced</p> <p>Piece together mp 4 and 5</p>	(4)																			
	 <p>The bar chart displays the percentage distribution of blood to five parts of the body: Brain, Heart, Kidneys, Skin, and Muscles. The y-axis represents the percentage distribution of blood, ranging from 0 to 80. The x-axis lists the parts of the body. For each part, there are two bars: a white bar for 'at rest' and a grey bar for 'during exercise'. The data shows that during exercise, blood flow is significantly redirected towards the muscles and skin, while flow to the brain, heart, and kidneys decreases.</p> <table border="1"> <thead> <tr> <th>Parts of the body</th> <th>at rest (%)</th> <th>during exercise (%)</th> </tr> </thead> <tbody> <tr> <td>Brain</td> <td>15</td> <td>5</td> </tr> <tr> <td>Heart</td> <td>5</td> <td>5</td> </tr> <tr> <td>Kidneys</td> <td>22</td> <td>5</td> </tr> <tr> <td>Skin</td> <td>8</td> <td>15</td> </tr> <tr> <td>Muscles</td> <td>15</td> <td>68</td> </tr> </tbody> </table>			Parts of the body	at rest (%)	during exercise (%)	Brain	15	5	Heart	5	5	Kidneys	22	5	Skin	8	15	Muscles	15	68	
Parts of the body	at rest (%)	during exercise (%)																				
Brain	15	5																				
Heart	5	5																				
Kidneys	22	5																				
Skin	8	15																				
Muscles	15	68																				

Question number	Answer	Additional guidance	Mark
6(c)	<p>A description that makes reference to two of the following points:</p> <ul style="list-style-type: none"> • cardiac cycle is {faster / shorter} (1) • atrial systole is shorter (1) • force (of contraction) is greater during ventricular systole (1) 	<p>Ignore references to heart rate / PQRST waves / cardiac output</p> <p>Accept greater stroke volume during ventricular systole</p> <p>Ignore more contraction of ventricles unqualified</p>	(2)

Question number	Answer	Additional guidance	Mark
7(a)	<p>A description that makes reference to three of the following points:</p> <ul style="list-style-type: none"> • (light absorbed by) rhodopsin (1) • which splits into opsin and (trans) retinal (1) • (opsin) causes sodium ion channels to be {blocked / closed} (1) • more sodium ions pumped out of the rod cells than diffuse in (1) 	<p>Accept positive ions</p>	(3)

Question number	Answer
*7(b)	<p>Basic knowledge (B):</p> <ul style="list-style-type: none"> • P_R converts to P_{FR} in red light / wavelength 660nm • P_{FR} converts to P_R in far red light / wavelength 730nm • P_{FR} converts slowly into P_R in the dark • P_{FR} is the active form that stimulates germination / P_R inhibits germination • P_{FR} concentration is greater than P_R for germination to occur <p>Explaining group data (E):</p> <p>Group 1:</p> <ul style="list-style-type: none"> • red light converts P_R into P_{FR} / red light increase P_{FR} • P_{FR} causes germination <p>Group 2:</p> <ul style="list-style-type: none"> • P_{FR} slowly converted back into P_R in darkness / slowly decreases P_{FR} / increases P_R • no P_{FR} so no germination / P_R inhibits germination <p>Group 3:</p> <ul style="list-style-type: none"> • red light converts P_R into P_{FR} / red light increase P_{FR} • darkness not long enough to convert P_{FR} back into P_R so germination occurs <p>Group 4:</p> <ul style="list-style-type: none"> • red light converts P_R into P_{FR} / red light increase P_{FR} / far red light converts P_{FR} (back) into P_R / far red increase P_R / darkness converts remaining P_{FR} (back) to P_R / darkness increases P_R • results in less P_{FR} (than P_R) so no germination/ not enough P_{FR} so no germination / more P_R (than P_{FR}) inhibits germination <p>Group 5:</p> <ul style="list-style-type: none"> • far red light will convert P_{FR} into P_R / far red increase P_R / red light will convert P_R (back) into P_{FR} / red light increase P_{FR} • darkness not long enough to convert P_{FR} back into P_R so germination occurs <p>Additional knowledge (A):</p> <ul style="list-style-type: none"> • P_{FR} initiates the transcription of genes involved in germination / activates transcription factors for genes involved in germination • P_{FR} causes activation of amylase gene • amylase breaks down the starch into maltose/glucose • used in respiration / for cell division / for protein synthesis • Accept other relevant information • DO NOT ACCEPT P_{FR} acts as a transcription factor

			Additional guidance
Level 0	0	No awardable content	
Level 1	1-2	Demonstrates isolated elements of biological knowledge and understanding to the given context with generalised comments made. Vague statements related to consequences are made with limited linkage to a range of scientific ideas, processes, techniques and procedures. The discussion will contain basic information with some attempt made to link knowledge and understanding to the given context.	Simple descriptions of data 1 mark = two pieces of information described 2 marks = three pieces of information described
Level 2	3-4	Demonstrates adequate knowledge and understanding by selecting and applying some relevant biological facts / concepts. Consequences are discussed which are occasionally supported through linkage to a range of scientific ideas, processes, techniques and procedures. The discussion shows some linkages and lines of scientific reasoning with some structure.	Simple discussion of data 3 marks = two pieces of information about one group (E) OR one explanation from two groups (E) 4 marks = two explanations from two groups (E)
Level 3	5-6	Demonstrates comprehensive knowledge and understanding by selecting and applying relevant biological facts / concepts. Consequences are discussed which supported throughout by sustained linkage to a range of scientific ideas, processes, techniques and procedures. The discussion shows a well-developed and sustained line of scientific reasoning which is clear and logically structured.	Extended discussion of data 5 marks = two explanations from two groups (E) plus one additional explanation linked to why germination occurs 6 marks = two explanations from two groups (E) plus two additional explanations linked to why germination occurs

Question number	Answer	Mark
8(a)	<p>The only correct answer is A</p> <p><i>B is incorrect because only statement 1 is correct as slow twitch muscle have more mitochondria than fast twitch</i></p> <p><i>C is incorrect because only statement 1 is correct as slow twitch muscle do not fatigue as easily</i></p> <p><i>D is incorrect because only statement 1 is correct as slow twitch muscle have more mitochondria and therefore do not fatigue easily</i></p>	(1)

Question number	Answer	Additional guidance	Mark
8(b)	<p>An explanation that makes reference to three of the following points:</p> <ul style="list-style-type: none"> • (because more capillaries will result) in more {oxygen / glucose} (to the muscle cells) (1) • glucose will provide the respiratory substrate (1) • oxygen will result in aerobic respiration (1) • therefore {more / increase / a lot of} ATP (for muscle contraction) (1) • increased removal of carbon dioxide (1) 	<p>Accept faster diffusion of {oxygen / glucose}</p> <p>Accept glucose needed for glycolysis</p> <p>Accept less likely to become anaerobic / reduce build-up of lactic acid</p> <p>Accept energy equivalent for ATP</p>	(3)

Question number	Answer	Additional guidance	Mark
8(c)(i)	<p>An explanation that makes reference to the following points:</p> <ul style="list-style-type: none"> so that there will be no (overall / net) movement of water into and out of the (muscle) cells (1) so that the cells do not {burst / shrivel up / change size} (1) so that only the {ATP / glucose} affects the length of the fibres (1) 	<p>Accept fibres equivalent for cells</p> <p>Accept no (overall / net) osmosis</p>	(2)

Question number	Answer	Additional guidance	Mark
8(c)(ii)	<ul style="list-style-type: none"> water and ions / saline (solution) (1) 	<p>Do not allow glucose / ATP / sodium / calcium / minerals</p> <p>Accept Sodium ions / Na⁺ / Ca²⁺ / calcium ions / salt solution / any named ion solution</p>	(1)

Question number	Answer	Additional guidance	Mark
8(c)(iii)	<ul style="list-style-type: none"> • mean of three fibres calculated (1) • percentage decrease calculated (1) 	<p>25mm, 27mm, 24mm $25+27+24 = 25.3\text{mm} / 2.53\text{cm}$ Answer between 23-27mm</p> <p>Mean 23 = 23.3% $(30-25.3) / 30 = 15.7\%$ Mean 27 = 10% Accept range 10 – 23.3 %</p> <p>Correct answer with no working out receives 2 marks</p> <p>Ignore minus signs</p> <p>Do not accept more than 2 decimal places</p>	(2)

Question number	Answer	Additional guidance	Mark
8(c)(iv)	<p>An explanation that makes reference to three of the following points:</p> <ul style="list-style-type: none"> • ATP binds to myosin head (1) • causing a shape change (in the myosin) (1) • so myosin {detaches from the actin / returns to original position / reposition the myosin head / breaks cross bridges} (1) • so that the myosin head can bind to the {actin / myosin binding sites} again (1) 	Ignore references to tropomyosin and troponin	(3)

Question number	Answer	Additional guidance	Mark
8(c)(v)	<p>An answer that makes reference to two of the following points:</p> <ul style="list-style-type: none"> • glucose supplied a respiratory substrate to produce ATP (1) • but time taken for ATP to be produced (1) • less ATP produced (from respiration of glucose) than provided in ATP solution (1) 	<p>Accept glucose is used in respiration to produce ATP</p> <p>Accept slower to produce ATP</p> <p>Accept less ATP produced from anaerobic respiration</p>	(2)

Question number	Answer	Additional guidance	Mark
9(a)	<p>An explanation that makes reference to two of the following points:</p> <ul style="list-style-type: none"> • food production requires land which {destroys habitats / deforestation removes trees which removed CO₂ / decreases biodiversity} (1) • food production requires burning of fossil fuels which release greenhouse gases (1) • food production requires water (for irrigation) which could divert water away from {wildlife / humans} (1) • food production may {use / produce} chemicals which could {poison wildlife / accumulate in food chain} (1) 	<p>Accept food production requires land which {causes deforestation / soil erosion / other name destruction of habitat}</p> <p>Accept other named causes of greenhouse gases / named greenhouse gases Eg farming machinery / factories / methane from cows</p> <p>Accept waste products as equivalent for chemicals</p>	(2)

Question number	Answer	Additional guidance	Mark
9(b)	<p>An explanation that makes reference to two the following points:</p> <ul style="list-style-type: none"> • plants have to be grown to feed the animals (1) • less energy is lost from the food chain (1) • animal farming produces methane which {is a greenhouse gas / causes global warming} (1) • plants {have a lower carbon footprint / are carbon neutral / photosynthesise to remove carbon dioxide} (1) • plants will use less land than animals to obtain the same {energy / mass of food} (1) 	<p>Accept plant based foods are eaten directly by humans</p> <p>Accept less energy lost between trophic levels</p> <p>Accept cattle equivalent to animals</p> <p>Accept plants act as a carbon sink</p>	(2)

Question number	Answer	Additional guidance	Mark
9(c)	<p>An explanation that makes reference to four of the following points:</p> <ul style="list-style-type: none"> • glucose is converted into ethanol and carbon dioxide (1) • glucose is broken down into pyruvate / glycolysis occurs (1) • alcohol is formed when pyruvate {is reduced / undergoes decarboxylation / converted to ethanal} (1) • when (pyruvate) is used to oxidise NADH (1) • (in anaerobic respiration) only glycolysis occurs / pyruvate will not go through {link reaction / Krebs's cycle} (1) 	<p>Ignore references to lactate</p> <p>Piece together</p> <p>Accept regenerate NAD / convert NADH to NAD</p>	(4)

Question number	Answer	Additional guidance	Mark
9(d)	<p>An explanation that makes reference to three of the following points:</p> <ul style="list-style-type: none"> • probiotics increase the natural gut flora / enhance the microbiome (1) • when they have been depleted by {antibiotics / disease} (1) • so that pathogens can be reduced by competition for {space / nutrients} (1) • so that pathogens can be {inhibited / destroyed / reduce growth} by toxins produced by gut flora (1) • in order to reduce inflammation / prevent infection (1) 	<p>Ignore maintaining gut flora / microbiome</p> <p>Accept depleted by aging</p> <p>Accept outcompeted as equivalent for 'reduced by competition'</p> <p>Accept chemicals produced instead of toxins</p>	(3)

Question number	Answer	Additional guidance	Mark
9(e)	<p>An explanation that makes reference to two of the following points:</p> <ul style="list-style-type: none"> • fewer free radicals would cause less {cell / endothelium lining / oxidative stress} damage (1) • therefore reduction in {atheroma / plaque} formation (if damage is in blood vessels) (1) • which would result in fewer {heart attacks / strokes / deaths} (1) <p>OR</p> <ul style="list-style-type: none"> • fewer free radicals would reduce damage to DNA (1) • therefore less {chance of mutation / change in base sequence} (1) • which would result in fewer cases of {cancer / death} (1) 	<p>Accept tissue as equivalent for cell</p> <p>Accept reduced (risk of) CVD / angina</p>	(2)

Question number	Answer	Additional guidance	Mark
9(f)	<p>An explanation that makes reference to two of the following points:</p> <ul style="list-style-type: none"> • microorganisms reproduce rapidly (1) • therefore rapid protein synthesis (1) • RNA needed for translation (1) 	<p>Accept replicate / divide rapidly</p> <p>Accept {lots of / more / increased} protein synthesis</p> <p>Accept description of translation</p>	(2)

Question number	Answer	Additional guidance	Mark
9(g)	<p>An explanation that makes reference to three of the following points:</p> <ul style="list-style-type: none"> • the genes for pleasant {texture / taste} are {identified / isolated / cut} (1) • use the same restriction enzymes to cut the gene out (from the organism) and cut the vector (1) • insert the gene into a vector (1) • introduce the vector into the microorganism (1) • genetically modified organisms identified and cloned (1) 	<p>Accept plasmid for vector throughout</p> <p>Accept use (DNA) ligase to insert the gene into a vector</p> <p>Accept suitable method of introducing vector into microorganism</p>	(3)

Question number	Answer	Additional guidance	Mark
9(h)	<p>An explanation that makes reference to the following points:</p> <ul style="list-style-type: none"> • to identify the sources of information • so that other people’s work can be cited <p>OR</p> <p>so that the original work can be looked at</p> <p>OR</p> <p>to verify the work of the author</p> <p>OR</p> <p>to obtain further information about the work (1)</p>	<p>Accept these are the {references / bibliography}</p> <p>Accept for copyright reasons</p> <p>Accept original work can be read</p> <p>Accept to help peer reviews</p> <p>E.g. date of publication</p>	(2)