

Respiration - Mark Scheme

Q1.

Question Number	Answer	Mark
(a)	molecule R - ATP / adenosine triphosphate ; molecule S - ADP / adenosine diphosphate ;	(2)

Question Number	Answer	Mark
(b)(i)	1. carbon dioxide / CO ₂ ; 2. idea that the C has been removed from C ₆ or C ₅ ;	(2)

Question Number	Answer	Mark
(b)(ii)	1. cycle would stop / eq ; 2. 4 carbon compound would accumulate / eq ; 3. 6 carbon compound would {run short / not be synthesised} / 5 carbon compound would run short / eq ; 4. idea that {molecule T / H} reduce ;	(3)

Question Number	Answer	Mark
(c)	1. idea of electrons being {passed along / eq} the electron transport chain ; 2. idea of {losing / eq} energy ; 3. (used to) add a phosphate to ADP to make ATP / eq ; 4. reference to ATPase ; 5. idea of chemiosmosis ; 6. idea of oxygen as the final acceptor ;	(3)

Q2.

Question number	Answer	Additional guidance	Mark
	<p>An explanation that makes reference to the following points:</p> <ul style="list-style-type: none"> • (muscles cells release lactate into blood) due to anaerobic respiration (1) • insufficient oxygen for aerobic respiration / aerobic respiration cannot meet the demand for energy (1) 		(2)

Q3.

Answer						Mark
(i)	Investigation	Type of respiration	Potassium hydroxide solution absent or present	Coloured liquid moved to the left	Coloured liquid moved to the right	Coloured liquid did not move
	1	Anaerobic	Absent	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	2	Aerobic	Absent	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> ;
	3	Aerobic	Present	<input checked="" type="checkbox"/> ;	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
						(2)

Question Number	Answer	Additional Guidance	Mark
(ii)	<ol style="list-style-type: none"> 1. (as anaerobic) no O₂ absorbed / eq ; 2. no CO₂ produced / eq ; 3. so no change in {volume/pressure} (so liquid does not move) ; 4. since for each 6C glucose respired, 2x3C lactate formed / eq ; 	1. ACCEPT No oxygen used	(3)

Question Number	Answer	Additional Guidance	Mark
(iii)	<ol style="list-style-type: none"> 1. (reduced NAD from glycolysis) enters mitochondria/ moves through outer mitochondrial membrane / eq ; 2. moves to inner membrane of mitochondrion / eq ; 3. becomes {oxidised /NAD / NAD⁺} ; 4. as {electrons / eq} transferred to {electron transport chain / eq} / eq ; 5. fate of hydrogen ions described e.g. pumped into membrane space ; 6. (NAD) returns to {Krebs cycle/ matrix / eq} ; 	<p>2. ACCEPT crista for inner mitochondrial membrane</p> <p>6. ACCEPT cytoplasm, glycolysis</p>	(4)

Q4.

Question Number	Acceptable Answer	Additional Guidance	Mark
(d)(i)	B		(1)

Question Number	Indicative content	
*(d)(ii)	<p>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme.</p> <p>The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> • cyanide inhibits cytochrome oxidase so it can no longer accept electrons • electrons stop moving along the electron transport chain • so no movement of hydrogen ions into intermembrane space • so no movement of protons down gradient / no chemiosmosis • NADH/FADH can no longer give up electrons and regenerate NAD/FAD so Krebs cycle stops • so no production of ATP from Krebs cycle or electron transport chain • so cellular processes have no energy source / reference to named muscle contraction e.g. heart muscle being prevented 	
Level	Mark	Descriptor
	0	No awardable content
Level 1	1-2	<p>Demonstrates isolated elements of biological knowledge and understanding to the given context with generalised comments made.</p> <p>The explanation will contain basic information with some attempt made to link knowledge and understanding to the given context.</p>
Level 2	3-4	<p>Demonstrates adequate knowledge and understanding by selecting and applying some relevant biological facts/concepts to provide the explanation being presented.</p> <p>Lines of argument occasionally supported through the application of relevant evidence (scientific ideas, processes, techniques and procedures).</p> <p>The explanation shows some linkages and lines of reasoning with some structure.</p>
Level 3	5-6	<p>Demonstrates comprehensive knowledge and understanding by selecting and applying relevant knowledge of biological facts/concepts to provide the explanation being presented.</p> <p>Line(s) of argument supported throughout by sustained application of relevant evidence (scientific ideas, processes, techniques and procedures).</p> <p>The explanation shows a well-developed and sustained line of reasoning which is clear, coherent and logically structured.</p>

Q5.

Question Number	Answer	Additional Guidance	Mark
(i)	<p>An explanation that makes reference to following:</p> <ul style="list-style-type: none"> the use of nandrolone reduces the (mean maximum percentage) recoil of the { aorta / artery } (1) <p>and two from:</p> <ul style="list-style-type: none"> increased risk of damage to the endothelium of arteries (1) inflammatory response / white blood cells accumulate (1) build-up of { cholesterol / calcium salts / fibrous tissue } leads to formation of { atheroma / plaque } (1) 		(3)

Question Number	Answer	Additional Guidance	Mark
(ii)	<p>An answer that makes reference to three of the following:</p> <ul style="list-style-type: none"> nandrolone reduces the production of (both) proteins when exercise is allowed (1) these proteins are involved in { ATP production / oxidative phosphorylation } (1) nandrolone has no effect on ATP production if there is no exercise (1) nandrolone reduces ATP production if exercise takes place (1) 	ALLOW nandrolone has no effect on the production of the proteins in absence of exercise	(3)

Question Number	Answer	Additional Guidance	Mark
(iii)	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> without exercise the values for mRNA for Tfam overlap for groups with and without nandrolone (1) as when exercise is carried out and nandrolone taken, the values for mRNA for Tfam overlap with no exercise and no nandrolone (1) 	<p>ALLOW overlap between groups P and Q</p> <p>ALLOW overlap between groups P and S</p>	(2)

Q6.

Question Number	Answer	Additional Guidance	Mark
(a)	<ol style="list-style-type: none"> 1. mice of different mass / eq ; 2. idea of concentration is a controlled variable ; 3. idea of increases validity of investigation or conclusions ; 4. maybe harmful in high doses / eq ; 	<p>ACCEPT converse statement where appropriate</p> <p>2. to overcome effect of {lighter mice receiving proportionately a higher dose / heavier mice receiving proportionately a lower dose} / to keep concentration per kg of mouse constant ;</p> <p>3. ACCEPT so comparisons can be made</p>	(3)

Question Number	Answer	Additional Guidance	Mark
(b)(i)	<ol style="list-style-type: none"> 1. increases the ratio; 2. by { 0.3 / 17.6%} ; 3. inner membrane is larger / eq ; 	<p>1. ACCEPT ratio is higher</p> <p>3. ACCEPT increases the surface area of inner membrane ACCEPT converse</p>	(2)

Question Number	Answer	Additional Guidance	Mark
(b)(ii)	<ol style="list-style-type: none"> 1. idea that fatigue may be due to less ATP ; 2. inner membrane is the site of {electron transport chain / oxidative phosphorylation / eq} ; 3. {more inner membrane / greater inner surface area} then more electron transport chain / eq ; 4. more ATP made / eq ; 5. detail of ATP synthesis e.g. ref to chemiosmosis, H⁺ down electrochemical gradient through ATP synthase ; 6. (so) delays onset of fatigue / eq ; 7. by 34 seconds in {group A / those fed epicatechin} ; 	<p>ACCEPT converse where appropriate</p> <ol style="list-style-type: none"> 1. ACCEPT running out of ATP, running short of ATP for less ATP 2+3 ACCEPT crista for inner membrane 4. ACCEPT idea that more ATP present / available 6. ACCEPT reference to muscles can contract for longer 	(5)