

Question Number	Answer	Additional Guidance	Mark
1(a)(i)	Two from: 1. idea of size of cube ; 2. same {species / eq} of carrot ; 3. same {age / source / eq} of carrot ;	1 ACCEPT surface area / volume IGNORE mass	(2)

Question Number	Answer	Additional Guidance	Mark
1(a)(ii)	1. (oxygen is) electron acceptor / eq ; 2. (also oxygen) binds with protons / H ⁺ /hydrogens ; 3. Idea of electrons from {electron transport chain / ETC} ; 4. to form (metabolic) water ;	3 ACCEPT from cytochromes	(3)

Question	Answer	Additional Guidance	Mark
Number			
1(b)	1. aerobic respiration ; 2. ref. to decarboxylation ; 3. (when) pyruvate broken down / eq ; 4. (decarboxylation occurs) in Krebs cycle ; 5. details of where in Krebs cycle e.g. removed from { C6 / C5 / eq } compound ;	4 ACCEPT link reaction 5 ACCEPT C3 to C2 if refer to link reaction	(4)
Question Number	Answer	Additional Guidance	Mark
1(c)	1. as temperature increases, percentage of CO ₂ in bag {increases / eq} ; 2. (as temperature increase) {reactants /named / eq} {gain more kinetic energy / collide more often} ; 3. increased enzyme activity / more E-S complexes form / eq ; 4. smaller increase between 5 and 10 because {more active sites occupied / some other factor is limiting / eq} ;	1 ACCEPT rises IGNORE change unqualified 4 ACCEPT e.g. O ₂ concentration could be limiting, high CO ₂ levels inhibit enzymes	(3)
Question Number	Answer	Additional Guidance	Mark
1(d)	anaerobic respiration ;	ACCEPT fermentation but not lactic acid fermentation IGNORE: respiration unqualified	(1)

Question Number	Correct Answer	Mark
2(a)	ATPase / ATP synthetase ;	(1)

Question Number	Correct Answer	Mark
2(b)	<ol style="list-style-type: none"> 1. (H⁺ ions) from reduced NAD / eq ; 2. H⁺ ions pumped into inter membrane space / eq ; 3. reference to energy needed (for pump) / eq ; 4. reference to movement of electrons along ETC /eq; 5. (ETC on) inner membrane / cristae; 	max (3)

Question Number	Correct Answer	Mark
2(c)	<ol style="list-style-type: none"> 1. H⁺ ions follow diffusion gradient / eq ; 2. idea that this causes an energy change or makes energy available ; 3. ATP is formed / eq ; 4. idea that this occurs on stalked particles ; 5. ATP is energy source for (biological processes) / eq ; 	max (2)

Question Number	Answer	Additional guidance	Mark
3(a)	<ol style="list-style-type: none"> 1. Idea an enzyme converts a named substrate into named product e.g. enzyme 1 converts P to Q ; 2. idea that this product becomes the substrate of next step ; 3. idea of specificity ; 4. {controls / eq} the conversion / eq ; 5. speeds up the conversion / eq ; 6. by reducing activation energy / eq ; 7. credit reference to control of whole process ; 	<p>ACCEPT answers in context of respiration</p> <p>ACCEPT 1 - ref to an enzyme converting one named intermediate to the next e.g. {enzyme/ named enzyme} used to convert hexose to phosphorylated hexose</p> <p>ACCEPT 3 - description of specificity e.g. active site of enzyme 1 only accepts substance P or in context of named respiratory intermediate</p> <p>ACCEPT 4 – regulates</p> <p>ACCEPT 5 - catalysis / enzyme acts as a catalyst</p> <p>ACCEPT 7 - end product inhibition or description</p>	(4)

Question Number	Answer	Additional guidance	Mark
3(b)(i)	<ol style="list-style-type: none"> 1. $W = \{NAD / NAD^+ / NAD_{ox} / eq\}$; <p>Any two of the following:</p> <ol style="list-style-type: none"> 2. (due to) reduced NAD {releasing/eq} {electrons / eq} ; 3. Idea of electrons go to {carrier A / ETC / eq} ; 4. idea of H^+ moved into inter-membranal space ; 	<p>ACCEPT 2 – being oxidized Releasing hydrogen (atoms), H^+/protons</p> <p>ACCEPT 3 – 1st electron carrier/correctly named carrier</p>	(3)

Question Number	Answer	Additional guidance	Mark
3(b)(ii)	1. substance X is ATP ; Any two of the following : 2. due to H ⁺ pass through {stalked particle / ATP synthase} ; 3. (H ⁺ passes) down an electrochemical gradient ; 4. (sufficient) energy is {released / eq} ; 5. to join ADP and {Pi / eq} ; 6. reference to chemiosmosis ;	ACCEPT 2 –ATPase ACCEPT 3 - description of electrochemical gradient ACCEPT 5 – phosphorylation of ADP	(3)

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3(c)	<table border="1"> <thead> <tr> <th rowspan="2">Situation</th> <th colspan="3">Movement of coloured liquid</th> </tr> <tr> <th>towards A</th> <th>towards B</th> <th>does not move</th> </tr> </thead> <tbody> <tr> <td>Screw clip is open</td> <td></td> <td></td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td>Screw clip is closed</td> <td><input checked="" type="checkbox"/></td> <td></td> <td></td> </tr> <tr> <td>Potassium hydroxide is replaced with water and screw clip is closed</td> <td></td> <td></td> <td><input checked="" type="checkbox"/></td> </tr> </tbody> </table>	Situation	Movement of coloured liquid			towards A	towards B	does not move	Screw clip is open			<input checked="" type="checkbox"/>	Screw clip is closed	<input checked="" type="checkbox"/>			Potassium hydroxide is replaced with water and screw clip is closed			<input checked="" type="checkbox"/>		(3)
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4(a)	molecule R - ATP / adenosine triphosphate ; molecule S - ADP / adenosine diphosphate ;	(2)

Question Number	Answer	Mark
4(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
4(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
4(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)