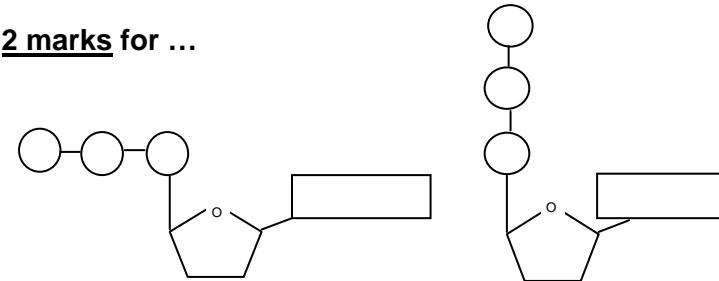
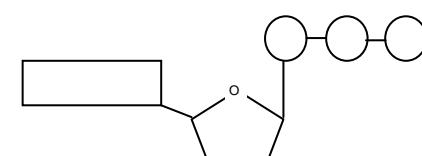
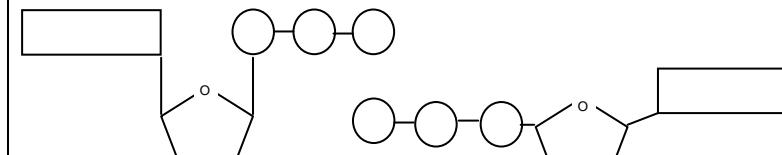


Question		Answer	Marks	Guidance
1	(a) (i)	<p>row of 3 phosphates joined to ribose and ribose joined to adenine ;</p> <p>phosphates and adenine shown joined to correct place on ribose</p> <p>or stated that phosphate(s) joined to carbon 5 and adenine joined to carbon 1 ;</p>	2	<p>CREDIT a written description that meets the requirements of the mark point</p> <p>IGNORE ribose drawn without an 'O'</p> <p>Phosphates must be attached to a vertical line from ribose</p> <p>Adenine must not be attached to a vertical line from ribose</p> <p>2 marks for ...</p>  <p>ALLOW 2 for reverse of above (as long as C atoms not numbered incorrectly) eg</p>  <p>1 mark for ... (as implies that adenine is attached to carbon 5)</p>  <p>(as implies that phosphates are attached to carbon 4)</p>

Question			Answer	Marks	Guidance
1	(a)	(ii)	hydrolysis ;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks ACCEPT dephosphorylation IGNORE ref to phosphorylation in glycolysis (as, even if addition of phosphate to glucose is explained, this is not the type of reaction)
	(b)	(i)	1 ;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks
	(b)	(ii)	none ;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks
	(b)	(iii)	2 / 3 ;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks
			Total	6	

Question		Answer	Marks	Guidance
2	(a)	crista(e) / inner mitochondrial membrane ;	1	<p>Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>ACCEPT thylakoid membrane / lamella(e) (of chloroplast)</p>
	(b) (i)	A has more stain than B <u>and</u> C has none ;	1	<p>All 3 seeds must be mentioned Staining ref. could relate to area or intensity of stain. DO NOT CREDIT implication that C has any staining</p> <p>ACCEPT 'shading' instead of 'staining' IGNORE ref to presence or absence of TTC (as it is present in all regions of all seedlings and it is the <i>staining</i> that is important)</p>
	(b) (ii)	<p>1 <i>idea that shaded areas in A are respiring ;</i></p> <p>2 <i>idea that 22°C is suitable temperature for respiration ;</i></p> <p>3 <i>reduced , NAD / FAD / coenzymes , produced in , glycolysis / link reaction / Krebs cycle ;</i></p> <p>4 <i>lots of / more , electron transfer (to TTC) / (oxidative) phosphorylation / chemiosmosis ;</i></p>	2 max	<p>1 ACCEPT a description of the respiring area(s) eg the outer regions of the seed are respiring</p> <p>3 ACCEPT NADH / NADH⁺ / NADH + H⁺ / NADH₂ / FADH / FADH⁺ / FADH + H⁺ / FADH₂</p>

Question		Answer	Marks	Guidance
2	(b) (iii)	<p>(named stage of) respiration uses , enzymes / proteins in ETC / electron carriers ;</p> <p><i>group B</i> not enough <u>kinetic</u> energy for , ESC formation / substrates and enzymes to collide (successfully) ;</p> <p><i>group C</i> enzymes / proteins in ETC / electron carriers , <u>denatured</u> by , high temperature / (almost) boiling water ;</p>	2 max	IGNORE coenzymes Note that a statement reading: 'the respiratory enzymes are denatured by 90°C in C' = 2 marks (mps 1 and 3)
	(c) (i)	<u>ethanal</u> ;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks ACCEPT acetaldehyde IGNORE formulae (as name asked for in Q)
	(c) (ii)	<u>ethanal</u> ;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks ACCEPT acetaldehyde IGNORE formulae (as name asked for in Q)

Question		Answer	Marks	Guidance
2	(c) (iii)	ethanol <u>and</u> carbon dioxide ;	1	<p>Mark the first 2 answers. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>ACCEPT formulae IGNORE alcohol unless specified as 'ethyl alcohol' IGNORE (oxidised) NAD DO NOT CREDIT NADP / reduced NAD / ATP</p>
	(c) (iv)	<p>1 releases NAD , to accept more H / to be reduced again / so glycolysis can continue or allows (some) ATP to be generated (in glycolysis) ;</p> <p>2 (some ATP available) for named cellular process ;</p> <p>3 AVP ;</p>	2 max	<p>1 the idea that cells can still respire is not quite enough</p> <p>2 eg • active transport • endocytosis / exocytosis / pinocytosis • mitosis / meiosis • protein synthesis • DNA replication • Calvin cycle / light-independent stage of photosynthesis</p> <p>3 eg • stated situation where oxygen is in short supply (e.g. waterlogging / compacted soil / roots situated very deep in soil) IGNORE can respire in low oxygen conditions (as stated in Q)</p>
		Total	11	

Question			Answer	Marks	Guidance
3	(a)	()	link reaction and Krebs cycle ;	1	Mark the first 2 answers. If they are correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks
3	(a)	(i)	oxidative phosphorylation ;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks ACCEPT electron transport chain / electron transport system / electron carrier chain IGNORE chemiosmosis DO NOT CREDIT photorespiration
3	(b)	()	<p>1 to make the <u>volume</u> of , contents / 'peas' , the same (in the respirometers) ;</p> <p>2 <i>idea that because</i> the <u>volume</u> of peas in A is greater than the volume of peas in B or the peas in A , are bigger / take up more space or the peas in A have absorbed water or the peas in B , are smaller / take up less space ;</p> <p>3 as without the beads there would be more , air / gas / oxygen , in B than in A ;</p>	2 max	<p>1 IGNORE ref to mass / weight</p> <p>2 IGNORE ref to mass / weight must refer to A / soaked / germinating and/or B / dry / dormant</p> <p>3 CREDIT idea that with the presence of beads the volume of gas would be the same</p>

Question		answer	Marks	Guidance
3	(b)	(i)		<p>ACCEPT ref to mass/weight instead of volume throughout (ii) as an error carried forward (ecf)</p> <p>1 (determined by) finding difference in volume between (30) soaked , seeds / peas and (30) dry , seeds / peas ;</p> <p>2 the difference represents the volume of glass beads required or add the quantity of glass beads necessary to make the volumes (of respirometer contents) equal ;</p> <p>3 calculate / knowing , volume of 1 bead to determine number of beads equivalent to volume required ;</p>
			2 max	<p>3 CREDIT any suitable <i>method</i> of determining the volume of beads required</p> <p>e.g. • displacement • put soaked peas in tube and measure volume; mark; then put dry peas in and add glass beads into tube and top up to mark</p>
3	(c)	(i)	0.014 ; ;	<p>Correct answer = 2 marks, even if no working</p> <p>If answer incorrect , not rounded correctly or given to more than 3 dp then ALLOW 1 mark for seeing</p> <ul style="list-style-type: none"> • $\frac{0.27}{20}$ or • 0.0135 <p>Only if there is no answer on the dotted answer line, should you look for the answer in the working or in the appropriate place in the table.</p>

Question		Answer	Marks	Guidance
3	(c) (i)	<p><i>at, higher temperature / 25⁰C</i> <i>increased <u>kinetic</u> energy ;</i></p> <p><i>(named respiratory) enzymes / decarboxylases / dehydrogenases , involved ;</i></p>	2	<p>CREDIT ora for lower temperature</p> <p>IGNORE more collisions / ESCs</p> <p>Needs a clear statement that they are involved in <u>respiration</u></p> <p>IGNORE (named) co-enzymes</p>
3	(c) (ii)	<p>1 reactions require aqueous medium / reactions need to take place in water / reactions need to take place in solution ;</p> <p>2 enzymes and substrates can move (to collide) in soaked seeds or movement (of reactants) , prevented / limited , in dry seeds ;</p> <p>3 soaked seeds need more , ATP / energy or dry seeds need less , ATP / energy ;</p> <p>4 for , protein synthesis / mitosis / other (named) metabolic reaction ;</p>	2 max	<p>ACCEPT ‘germinating’ for ‘soaked’, ‘peas’ for ‘seeds’, ‘dormant’ for ‘dry’ throughout</p> <p>1 IGNORE ref to reactants dissolving</p> <p>2 IGNORE ref to ESC as the mp is for the idea of mobility</p> <p>3 DO NOT CREDIT ‘no’ ATP / energy</p> <p>4 CREDIT soaked peas have increased metabolism IGNORE growth / respiration DO NOT CREDIT ref to photosynthesis</p>
		Total	12	

Question		Expected Answers		Marks	Additional Guidance												
4	(a)	Award 1 mark per correct row															
			<table border="1"> <thead> <tr> <th></th> <th><i>mammal</i></th> <th><i>yeast</i></th> </tr> </thead> <tbody> <tr> <td><i>name of hydrogen acceptor after glycolysis</i></td><td>pyruvate</td><td><u>ethanal</u></td> </tr> <tr> <td><i>is CO₂ produced?</i></td><td>no / ✗ / none / no molecules</td><td>yes / ✓ / some / one molecule</td> </tr> <tr> <td><i>name of final product</i></td><td>lactate</td><td><u>ethanol</u></td> </tr> </tbody> </table>		<i>mammal</i>	<i>yeast</i>	<i>name of hydrogen acceptor after glycolysis</i>	pyruvate	<u>ethanal</u>	<i>is CO₂ produced?</i>	no / ✗ / none / no molecules	yes / ✓ / some / one molecule	<i>name of final product</i>	lactate	<u>ethanol</u>	;	<p>Mark the first answer in each box. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>ACCEPT phonetic spelling except for ethanal and ethanol</p>
	<i>mammal</i>	<i>yeast</i>															
<i>name of hydrogen acceptor after glycolysis</i>	pyruvate	<u>ethanal</u>															
<i>is CO₂ produced?</i>	no / ✗ / none / no molecules	yes / ✓ / some / one molecule															
<i>name of final product</i>	lactate	<u>ethanol</u>															
				;	<p>ACCEPT pyruvic acid (instead of pyruvate) ACCEPT acetaldehyde (instead of ethanal) IGNORE formulae The spelling of ethanal must be unambiguous</p>												
				;	<p>ACCEPT 2 molecules for yeast (from 1 glucose molecule)</p>												
				;	<p>ACCEPT lactic acid (instead of lactate) ACCEPT ethyl alcohol (instead of ethanol) IGNORE alcohol IGNORE formulae The spelling of ethanol must be unambiguous</p>												
				3													

Question		Expected Answers	Marks	Additional Guidance
4	(b)	<p>1 <i>idea that ATP produced / energy released ;</i></p> <p>2 <i>idea that recycles NAD / NAD can be used again ;</i></p> <p>3 <i>allows , glycolysis / description of glycolysis , to take place / to continue ;</i></p>	1 max	<p>IGNORE ref to specific metabolic reactions other than glycolysis (mp 3)</p> <p>IGNORE ref to respiration without oxygen</p> <p>1 DO NOT CREDIT this mark point with any ref to energy , generated / produced / made [eg energy made in the form of ATP = 0 ATP (energy) is produced = 0]</p> <p>2 ACCEPT 'reoxidises red NAD' (as implies recycling) CREDIT NADH / NADH⁺ / NADH₂ for red NAD DO NOT CREDIT 'oxidises red NAD' without further qualification</p> <p>3 If glycolysis used as a term, the spelling of 'glyco' must be correct.</p>
		TOTAL	4	

Question		Expected Answers		Marks	Additional Guidance
5	(a)	(i)	<p>W glycolysis ;</p> <p>X Calvin cycle / light-independent stage (of photosynthesis) ;</p> <p>Y Krebs cycle ;</p>	3	<p>Mark the first answer for each letter. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>W CREDIT glycolytic pathway ACCEPT phonetic spelling but must have 'glycol' IGNORE respiration</p> <p>X IGNORE dark reaction / photosynthesis ACCEPT phonetic spelling</p> <p>Y ACCEPT citric acid cycle / TCA cycle / (tri)carboxylic acid cycle ACCEPT phonetic spelling IGNORE respiration / link reaction</p>
	(a)	(ii)	<p>1 take place in different , parts / organelles , of the cell or compartmentalisation / reactions separated by membranes ;</p> <p>2 W / glycolysis , in cytoplasm ;</p> <p>3 X / Calvin cycle , in , chloroplast / stroma (of chloroplast) ;</p> <p>4 Y / Krebs cycle , in , mitochondrion / matrix (of mitochondrion) ;</p> <p>5 AVP ;</p>	3 max	<p>1 Must be a clear statement and not implied from others. DO NOT CREDIT different parts of the leaf DO NOT CREDIT no interference between pathways (as rephrasing the Q)</p> <p>2</p> <p>3 DO NOT CREDIT if thylakoid / membranes stated or implied</p> <p>4 DO NOT CREDIT if cristae / membranes stated or implied</p> <p>5 eg • different enzymes for each pathway • different conditions for each pathway</p>

Question		Expected Answers	Marks	Additional Guidance
5	(a) (iii)	X ; W and Y ;	2	<p>IGNORE names. The question has asked for letters.</p> <p><i>photosynthesis</i></p> <p>Mark the first answer. If the answer is correct and an additional letter is given then = 0 marks</p> <p><i>aerobic respiration</i></p> <p>Mark the first two answers. If these answers are correct and an additional letter (ie 3rd etc) is given then = 0 marks</p> <p>Both letters required for this mark, in any order.</p>
5	(a) (iv)	ATP / adenosine triphosphate ; water / H ₂ O ; (oxidised) NAD / FAD ;	2	<p>If any answer(s) incorrect then Max 1</p> <p>IGNORE energy / heat</p> <p>IGNORE numbers</p> <p>eg oxygen (✗) and ATP (✓) and water = max 1 oxygen (✗) and energy (<i>ignore</i>) = 0 ATP (✓) and energy (<i>ignore</i>) and H₂O (✓) = 2 reduced NAD (✗) and ATP (✓) and energy (<i>ignore</i>) and H₂O = max 1</p>

Question		Expected Answers	Marks	Additional Guidance
5	(b)	<p>1 NAD / FAD / NADP , can , accept hydrogen / accept H / be reduced ;</p> <p>2 reduced , NAD / FAD , supplies / carries , electrons , to the electron transport chain / for oxidative phosphorylation ;</p> <p>3 reduced , NAD / FAD , supplies / carries , hydrogen ions for , chemiosmosis / oxidative phosphorylation ;</p> <p>4 reduced NADP , supplies / carries , hydrogen to , light independent stage / Calvin cycle / X ;</p> <p>5 coenzyme A / CoA , carries , <u>acetate</u> / <u>ethanoate</u> / <u>acetyl group</u> , to , Krebs cycle / Y ;</p> <p>6 AVP ;</p>	3 max	<p>1 DO NOT CREDIT hydrogen ions / protons , unless there is an electron as well DO NOT CREDIT accepts hydrogen molecules /H₂ CREDIT equation showing the reduction ACCEPT eg NAD converted to NADH IGNORE 'carries hydrogen'</p> <p>2 Must refer to <i>reduced NAD or reduced FAD or NADH / NADH⁺ / NADH₂ / FADH / FADH⁺ / FADH₂</i></p> <p>3 Must refer to <i>reduced NAD or reduced FAD or NADH / NADH⁺ / NADH₂ / FADH / FADH⁺ / FADH₂</i></p> <p>4 Must refer to <i>reduced NADP or NADPH / NADPH⁺ / NADPH₂</i></p> <p>5 DO NOT CREDIT acetyl CoA carries acetate</p> <p>6 eg • co-enzyme(s) / cytochrome(s) , transfer / accept and release , electrons along the electron transport chain • can be , recycled / oxidised and reduced</p>
		TOTAL	13	