

Question Number	Answer	Additional Guidance	Mark
1(a)(i)	1. idea of binding of {bacteria / virus / pathogen / microorganism / antigen / non-self / foreign matter / eq} to (phagocytic) cell ; 2. idea that {bacteria / virus / pathogen / microorganism / antigen / eq} is {engulfed by / taken into / endocytosis into } (phagocytic) cell ; 3. idea of bacteria being inside a {vacuole / phagosome / eq} ;	1 ACCEPT phagocyte 2 ACCEPT phagocyte 3 ACCEPT vesicle	(2)

Question Number	Answer	Additional Guidance	Mark
1(a)(ii)	1. idea that the body {reacts / defends itself / responds / eq} to a {bacteria / virus / pathogen / microorganism / antigen / non-self / foreign matter / eq} ; 2. idea that the response is not dependent on the specific {bacteria / virus / pathogen / microorganism / antigen / eq} ; 3. credit named reaction e.g. lysozymes , inflammation, phagocytosis, interferon production ;	1 NOT reference to immune response 2 ACCEPT idea of no previous infection / responds to any pathogen 3 IGNORE egs of barriers	(2)

Question Number	Answer	Additional Guidance	Mark
1(a)(iii)	1. reference to {bacteria / virus / pathogen / microorganism / eq} ; 2. being inside {tissues / cells } / eq ;	1 IGNORE disease / infection / foreign matter / antigen 2 IGNORE body ACCEPT idea that has evaded barriers, named cell or tissue IGNORE {infects / attaches / harms / attacks} cells	(2)

Question Number	Answer	Additional Guidance	Mark
1(b)	reaction A = phosphorylation ; reaction B = hydrolysis ;		(2)

Question Number	Answer	Additional Guidance	Mark
1(c)(i)	Diagram marks : 1. two membranes shown ; 2. inner membrane folded into cristae ; Label marks (correct) : [max 2 marks] 3. outer membrane and {inner membrane / cristae} ; 4. matrix ; 5. stalked particles / ATPase / eq (labelled on inner membrane) ; 6. DNA (circular / loop) ; 7. ribosomes ;	1 NOT if cristae shown as a 3 rd membrane NB do not choose which labels to accept eg 2 right + 1 wrong = 1 mark 2 wrong = 0 marks 5 ACCEPT oxisome 6 ACCEPT plasmids 7 IGNORE size references	(4)
Question Number	Answer	Additional Guidance	Mark
1(c)(ii)	chloroplast ;	IGNORE chlorophyll	(1)

Question Number	Answer	Mark
2(a)(i)	B – nitrate ;	(1)

Question Number	Answer	Mark
2(a)(ii)	B – chlorophyll ;	(1)

Question Number	Answer	Additional guidance	Mark
2(b)(i)	<ol style="list-style-type: none"> 1. idea of greater mass with calcium nitrate ; 2. difference is significant / error bars do not overlap / eq ; 3. manipulation of data ; 		(2)

Question Number	Answer	Additional guidance	Mark
2(b)(ii)	<ol style="list-style-type: none"> 1. idea of choosing Red Delicious because of greater mass of apples ; 2. idea of choosing Red Delicious because fertiliser has less effect on mass of apples ; 3. idea of data overlap for Red Delicious and Golden Delicious when using calcium nitrate ; 4. idea of choosing calcium nitrate because of { greater mass of apples / has equal effect on both trees } ; 5. manipulation of data ; 	1. ACCEPT converse argument e.g. not Golden Delicious as lower mass of apples	(2)

Question Number	Answer	Additional guidance	Mark
2(c)	<ol style="list-style-type: none"> 1. idea that there is more contact between cells e.g. fewer spaces, cell shape ; 2. reference to calcium pectate ; 3. middle lamellae holding cells together ; 4. idea that more calcium resulting in more { pectate / middle lamellae } ; 5. idea of { stronger cell structure / less spaces between cells / thicker cell walls } resulting in firmer fruit ; 	<ol style="list-style-type: none"> 1. ACCEPT smaller cells, closer packing 5. CCEPT reference to cells being packed closer together 	(4)

Question Number	Answer	Additional Guidance	Mark
3(a) (i)	1. Molecule P - water / H ₂ O ; 2. Molecule Q - oxygen / O ₂ ;		(1)

Question Number	Answer	Mark
3(a) (ii)	D ATP and reduced NADP ;	(1)

Question Number	Answer	Additional Guidance	Mark
3(a) (iii)	1. reference to RUBISCO as an {enzyme / catalyst} ; 2. in the Calvin cycle ; 3. involved in {carbon fixation / bonding of CO ₂ to RuBP / reaction between CO ₂ and RuBP / eq} ; 4. to form GP / eq ; 5. GP converted to GALP / eq ; 6. using ATP and {reduced NADP / NADPH} (CO ₂ to GALP / GP to GALP) ;	1. ACCEPT catalyses 3. ACCEPT formation of 6C intermediate from RuBP 5. ACCEPT reduced to NB Award formation of GALP from reaction between CO ₂ and RuBP if mp 4 not awarded	(4)

Question Number	Answer	Mark																																																			
3(b) (i)	C stroma	(1) COMP																																																			
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3(b) (ii)	1. (image length) 76 / 76.5 / 77 (mm) ; 2. (correct calculation = length /7500) / eq ; 3. (correct units for given answer) μm / eq ;	Correct answer with units = 3 marks 2. CE applies 3. CE applies ACCEPT as standard form	(3) P																																																		
	<table border="1"> <thead> <tr> <th>length</th> <th>answer in μm</th> <th>answer in mm</th> <th>answer in cm</th> <th>answer in m</th> </tr> </thead> <tbody> <tr> <td>7.6 (cm)</td> <td>10</td> <td>0.01</td> <td>0.001</td> <td>0.00001</td> </tr> <tr> <td>76 (mm)</td> <td>10.1</td> <td>0.0101</td> <td>0.00101</td> <td>0.0000101</td> </tr> <tr> <td>76000 (μm)</td> <td>10.13</td> <td>0.01013</td> <td>0.001013</td> <td>0.00001013</td> </tr> <tr> <td>7.65</td> <td>10</td> <td>0.01</td> <td>0.001</td> <td>0.00001</td> </tr> <tr> <td>76.5</td> <td>10.2</td> <td>0.0102</td> <td>0.00102</td> <td>0.0000102</td> </tr> <tr> <td>76500</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>7.7</td> <td>10</td> <td>0.01</td> <td>0.001</td> <td>0.00001</td> </tr> <tr> <td>77</td> <td>10.3</td> <td>0.0103</td> <td>0.00103</td> <td>0.0000103</td> </tr> <tr> <td>77000</td> <td>10.27</td> <td>0.01027</td> <td>0.001027</td> <td>0.00001027</td> </tr> </tbody> </table>	length	answer in μm	answer in mm	answer in cm	answer in m	7.6 (cm)	10	0.01	0.001	0.00001	76 (mm)	10.1	0.0101	0.00101	0.0000101	76000 (μm)	10.13	0.01013	0.001013	0.00001013	7.65	10	0.01	0.001	0.00001	76.5	10.2	0.0102	0.00102	0.0000102	76500					7.7	10	0.01	0.001	0.00001	77	10.3	0.0103	0.00103	0.0000103	77000	10.27	0.01027	0.001027	0.00001027		
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3(b)(iii)	1. idea of compartmentalisation (from stroma) ; 2. site of light-dependent reaction ; 3. credit named molecules {within / on / eq} membrane ; 4. idea of {ATPase / eq } in (thylakoid) membranes ; 5. idea that (thylakoid) membranes provide a space for accumulation of H^+ ; 6. reference to photophosphorylation ;	1. ACCEPT description of separation 3. e.g. photosynthetic pigments / chlorophyll / carotenoids / photosystems / electron carrier proteins IGNORE electron acceptors 4. ACCEPT {ATP synthase / synthetase}, NADP reductase 6. ACCEPT chemiosmosis	(3)

Question Number	Answer	Mark
4(a)(i)	C reduced NADP	(1) COMP

Question Number	Answer	Additional Guidance	Mark
4(a)(ii)	1. ADP / adenosine diphosphate ; 2. PO_4^{3-} / phosphate ;	ACCEPT either way round 2. CCEPT Pi / inorganic P	(2) RAD

Question Number	Answer	Additional Guidance	Mark
4(a)(iii)	1. molecule Q is {oxygen / O_2 }; 2. made from water / H_2O ; 3. idea of {photolysis / light splitting the water molecule / eq} ; 4. into {O / (atom of) oxygen} (and H^+ and electrons) ; 5. idea that two water molecules are needed to form one molecule of oxygen ; 6. in chloroplast ;	1. eject O , $1/2 \text{O}_2$ 4. CCEPT $\text{H}_2\text{O} \rightarrow 1/2 \text{O}_2 + 2\text{H}^+$	(4) XP

Question Number	Answer	Mark
4(b)(i)	A granum	(1) COMP

Question Number	Answer	Additional Guidance	Mark
4(b)(ii)	1. (image length) 76 / 76.5 / 77 (mm) / eq ; 2. image length / 0.007 ; 3. (76) 10857.14286 / eq (76.5) 10928.57143 / eq (77) 11000 / eq	2. CE applies 3. CE applies	(3) XP

Question Number	Answer	Additional Guidance	Mark
4(b)(iii)	1. idea of compartmentalisation (from cytoplasm); 2. thylakoid (membranes) are site of {light-dependent reaction / photophosphorylation / chemiosmosis} ; 3. credit named molecules {within / on / eq} membrane ; of idea of { / eq } in (thylakoid) membranes ; 4. idea that (thylakoid) membranes provide a space for accumulation of H ⁺ ; 5. stroma is site of {light-independent reaction / Calvin cycle / carbon fixation} ; 6. reference to {RuBP / RUBISCO / eq} ;	1. ACCEPT description of separation 3. e.g. chlorophyll / carotenoids / photosystems / electron carrier proteins / ATP synthetase / NADP reductase	(3) EXP