

Question Number	Answer	Additional Guidance	Mark
1(a)(i)	Line to diagram feature {grana / thylakoids / thylakoid membrane / inter-granal membrane } ;	Ignore any labelling of the line	(1)

Question Number	Answer	Additional Guidance	Mark
1(a)(ii)	A ; ATP		(1)

Question Number	Answer	Additional Guidance	Mark
1(b)(i)	stroma ;	Accept phonetic spelling eg strona, stromma Not stoma / stomata	(1)

Question Number	Answer	Additional Guidance	Mark
1(b)(ii)	Y. uBP / ribulose bisphosphate ; Z. GP / glycerate (3) phosphate ;	Y. Acce ribulose biphosphate Not ribose Z. Accep (3) phosphoglyceric acid / (3) PG / PGA / 2-Hydroxy-3-phosphonoxypropanoic acid Not glyceraldehydes (3) phosphate / GALP	(2)

Question Number	Answer	Additional Guidance	Mark
1(b)(iii)	RUBISCO / ribulose bisphosphate carboxylase (oxygenase) ;	Accept ribulose biphosphate carboxylase RUBISCO written in upper or lower case or a mixture Not ribose	(1)

Question Number	Answer	Additional Guidance	Mark
*1(b)(iv)	<p>QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence</p> <ol style="list-style-type: none"> 1. idea of conversion (of <i>GP / Z</i>) to <i>GALP</i> / eq ; 2. using <i>ATP</i> and reduced <i>NADP</i> / eq ; 3. idea of conversion (of <i>GALP</i>) to {<i>glucose / hexose</i>} eq ; 4. (which is) a <i>glucose</i> ; 5. reference to formation of <i>glycosidic bonds</i> ; 6. these bonds are 1-4 and 1-6 (<i>glycosidic bonds</i>) / eq ; 7. by <i>condensation</i> ; 8. ref to <i>amylose</i> and <i>amylopectin</i> ; 9. credit details of <i>amylose</i> e.g. straight chain, 1-4 bonds ; 10.credit details of <i>amylopectin</i> eg branched, 1-4 and 1-6 bonds ; 	<p>QWC emphasis is spelling</p> <p>NB this is a question about the conversion of GP and the formation of starch, not its structure</p> <ol style="list-style-type: none"> 1. NB idea of conversion needed 3. NB idea of conversion needed 5. a reference to these bonds being formed must be made 	(5)

Question Number	Answer	Additional guidance	Mark
2(a)	<ol style="list-style-type: none"> idea that products of light-dependent stage are {needed for / used in / eq} {light-independent stage / Calvin cycle} ; reference to (products of light-dependent stage) are {reduced NADP / eq} and ATP ; reference to use of {reduced NADP / eq} for {reduction / eq} of {carbon dioxide / GP / eq} ; reference to use of ATP as source of energy ; 	<p>3. Acce source of hydrogen ions for GALP Ignore ref to ATP</p>	(3)

Question Number	Answer	Mark
2(b)(i)	D volume of oxygen produced ;	(1)

Question Number	Answer	Additional guidance	Mark
2(b)(ii)	<ol style="list-style-type: none"> (minimum temperature) is {between 0 °C and 10 °C / above 0 °C but less than 10 / 10 °C} ; idea of no photosynthesis at 0°C but photosynthesis is taking place at 10 °C ; reference to no {data / readings / measurements / evidence / eq} between 0 °C and 10 °C ; idea that at 0 °C water is frozen ; 	<p>3. Accep if correct temp range has been given already</p>	(2)

Question Number	Answer	Additional guidance	Mark
2(b)(iii)	<ol style="list-style-type: none"> reference to abiotic factors { are non-living / non-biological / do not involve organisms / eq } ; idea that other factors need to be kept constant ; 	2. Igno controlled	(2)

Question Number	Answer	Additional guidance	Mark
2(b)(iv)	<p>Supporting conclusion:</p> <ol style="list-style-type: none"> idea that shape of graph is typical of an enzyme-temperature graph ; rate increases (up to 30 °C) because more { enzyme-substrate complexes / collisions between enzymes and substrates } / eq ; rate decreases (after 30°C) due to enzyme denaturation / eq ; <p>Not supporting conclusion:</p> <ol style="list-style-type: none"> idea that other factors could be affecting photosynthesis ; idea of { gas / oxygen / carbon dioxide } solubility changing with temperature ; idea of { correlation / not causation } ; 	1. idea that rate of photosynthesis is affected by temperature in a similar way to enzymes	(4)

Question Number	Answer	Mark
3(a)	(leave it) in the dark / eq ;	(1)

Question Number	Answer	Mark
3 (b) (i)	<ol style="list-style-type: none"> 1. ss higher in A (compared with B) for both studies ; 2. t difference is less in repeat study ; 3. mparative manipulation of data e.g. 13g decrease for A to B for original and 5 g for repeat ; 4. ss lower in repeats (of both A and B) / eq ; 	(3)

Question Number	Answer	Mark
3(b) (ii)	<ol style="list-style-type: none"> 1. { increase / eq} in stem length ; 2. correct manipulation of the data e.g. by 23cm / 18.4% ; 3. reference to { taller / faster growing / eq} seedling ; 4. to receive { more light / higher red light / eq} / to maximize photosynthesis / eq ; 5. idea of allows { active phytochrome / eq} to be made ; 	(3)

Question Number	Answer	Mark
3(b) (iii)	<ol style="list-style-type: none"> 1. less red light {increases / eq} mean stem length / more far red light increases stem length / eq ; 2. the (significant) difference in mean stem length is not due to {chance / eq} / eq ; 3. the mean length for repeat was close to the original ; 4. suggesting it is likely to be reliable ; 	(3)

Question Number	Answer	Mark
4(a)	D - stroma;	(1)

Question Number	Answer	Mark
4(b)(i)	<ol style="list-style-type: none"> 1. idea that samples (of cells) can be taken {easily / eq} ; 2. reference no damage to {plant / leaf / other cells} (during sampling) / eq ; 3. idea of carbon dioxide level (in water) can be {adjusted / maintained / changed / eq} (easily) ; 4. idea of {RuBP / GP / products / eq} cannot pass into {other cells / rest of plant} ; 5. reference to only one kind of cell / eq ; 6. idea of controlling the {mass / number/surface area} of cells ; 7. idea that genetically-similar cells used ; 	(2)

Question Number	Answer	Mark
4(b)(ii)	<ol style="list-style-type: none"> 1. light is needed for light-dependent reaction ; 2. light (intensity) will not be a limiting factor / eq ; 3. idea that {the effect of carbon dioxide concentration can be seen / carbon dioxide (concentration) is (only) limiting factor / eq} ; 4. {ATP / NADPH / eq} produced during light-dependent reactions ; 5. {ATP / NADPH / light-dependent products / eq} required for {light-independent reactions / Calvin cycle / carbon dioxide fixation} ; 	(3)
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Question Number	Answer	Mark
4(b)(iii)	<p>1. both RuBP and GP levels constant until carbon dioxide {lowered / eq} ;</p> <p>2. ref to (RuBP and GP in) Calvin cycle ;</p> <p>RuBP</p> <p>3. (at lower carbon dioxide levels) the RuBP increases and drops (and then stays constant) ;</p> <p>4. rises because being regenerated / eq ;</p> <p>5. falls as being used to {fix / eq} carbon dioxide ;</p> <p>6. idea that RuBP level remains constant once (new) equilibrium reached ;</p> <p>GP</p> <p>7. (at lower carbon dioxide levels) the GP drops (and then stays constant) ;</p> <p>8. drops because less {carbon dioxide available to convert into GP) / less carbon fixation / eq} ;</p> <p>9. levels out at a lower level as carbon dioxide still available but at lower level;</p> <p>10. credit correct manipulation of figures for a description of either RuBP or GP ;</p>	(6)

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5	<table border="1" data-bbox="359 312 1315 694"> <thead> <tr> <th data-bbox="359 312 940 380">Statement</th> <th data-bbox="940 312 1315 380">Tick (✓) or cross (x)</th> </tr> </thead> <tbody> <tr> <td data-bbox="359 380 940 447">Cause cell depolarisation</td> <td data-bbox="940 380 1315 447">x</td> </tr> <tr> <td data-bbox="359 447 940 515">Affected by all wavelengths of light</td> <td data-bbox="940 447 1315 515">x</td> </tr> <tr> <td data-bbox="359 515 940 622">Involved in plant growth and development</td> <td data-bbox="940 515 1315 622">✓</td> </tr> <tr> <td data-bbox="359 622 940 694">Affected by darkness</td> <td data-bbox="940 622 1315 694">✓</td> </tr> </tbody> </table> <p data-bbox="359 738 699 766">1 for each correct row.</p>	Statement	Tick (✓) or cross (x)	Cause cell depolarisation	x	Affected by all wavelengths of light	x	Involved in plant growth and development	✓	Affected by darkness	✓	<p data-bbox="1369 803 1422 836">(4)</p>
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