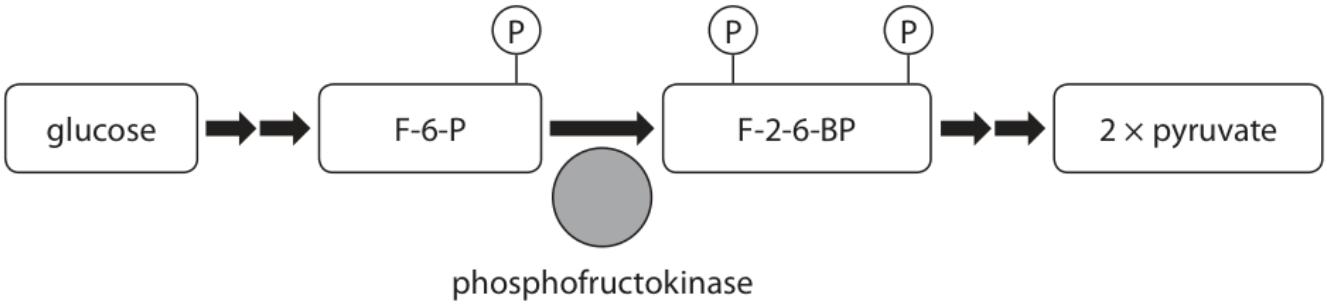
Photosynthesis (Topic 5): Edexcel SNAB A Level Biology Exam Questions by Topic

20 questions · 51 marks · about 61 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · A level Paper 3 · June 2019 · Q6(b)(i) · 3 marks

(b) Phosphofructokinase is an enzyme that uses ATP to convert fructose-6-phosphate (F-6-P) into fructose-2,6-bisphosphate (F-2,6-BP).

The conversion of F-6-P by this enzyme is a rate-determining step in glycolysis. This is shown in the diagram.



(i) Explain why ATP is required for this reaction.

(3)

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Question 2 · A level Paper 1 · June 2017 · Q4(a) · 5 marks

4 Photosynthesis is a two-stage process by which plants fix carbon dioxide.

(a) Describe the light-dependent reactions of photosynthesis.

(5)

Question 3 · A level Paper 1 · June 2024 · Q5(b)(i) · 1 mark

(b) (i) Give the names of **two** products of the light-dependent reactions of photosynthesis.

(1)

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Question 4 · A level Paper 3 · June 2024 · Q3(a)(iii) · 2 marks

(iii) Describe the role of chlorophyll in the light-dependent reactions of photosynthesis.

(2)

Question 5 · information from earlier in the question

10 Some plants are adapted to grow in shady conditions.

A study was carried out to compare the effect of growing in different light intensities on rates of photosynthesis of plants.

The plants are rated for levels of shade tolerance.

Plant seedlings of nine species were grown in either 25% or 5% of full sunlight. All other abiotic factors were controlled.

These seedlings were grown for six weeks and then exposed to full sunlight for 15 minutes. The rate of photosynthesis was measured during the exposure to full light.

The table shows the results of this investigation for four species of plant.

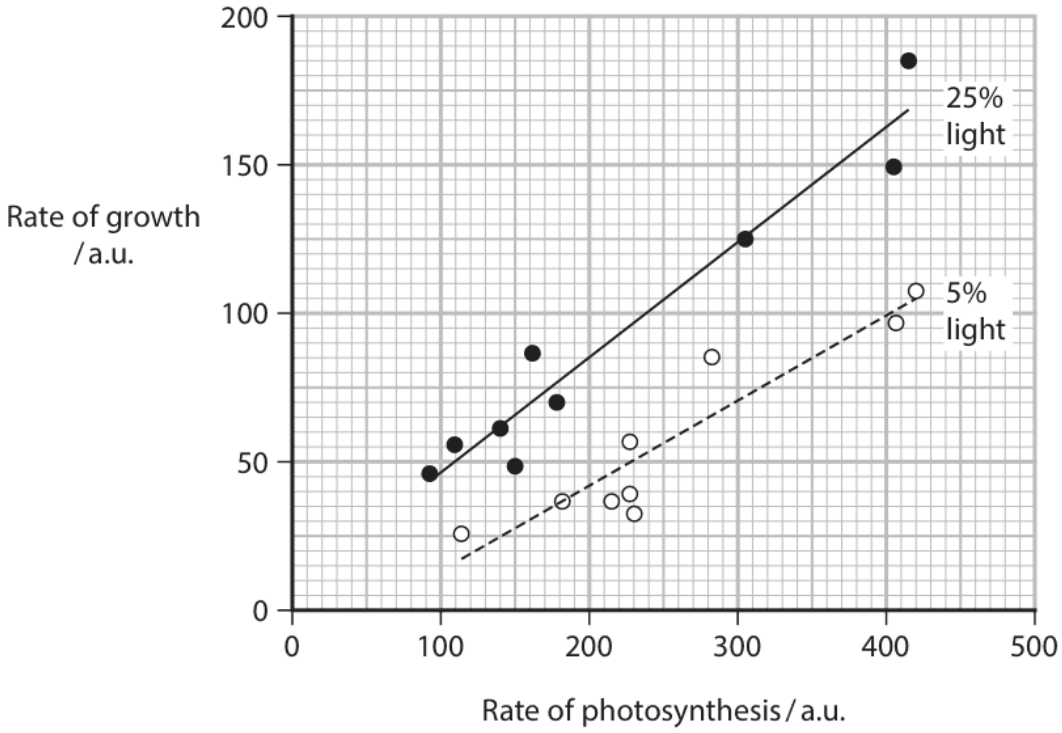
Species	Shade tolerance	Rate of photosynthesis / a.u.	
		Seedlings grown in 25% of full sunlight	Seedlings grown in 5% of full sunlight
A	Intolerant	410	415
B	Intermediate	300	275
C	Tolerant	180	210
D	Very tolerant	150	215

Questions, mark schemes and examiners' report extracts © Pearson Education Ltd.

Question 5 · A level Paper 1 · June 2022 · Q10(a)(ii) · 4 marks

(ii) The rate of growth for all nine species of plant was also measured.

The graph shows the effects of the rate of photosynthesis on the rate of growth of these plants.



Explain the effect of light intensity during the first six weeks of growth on the growth rate of these species of plant.

(4)

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Question 6 · A level Paper 1 · June 2024 · Q2(a) · 4 marks

2 Anthropogenic activities are increasing levels of carbon dioxide in the atmosphere.

An increased level of carbon dioxide in the atmosphere leads to an increased rate of photosynthesis in some plants.

(a) Describe how carbon dioxide is used in photosynthesis.

(4)

Questions, mark schemes and examiners' report extracts © Pearson Education Ltd.

Question 7 · A level Paper 1 · June 2025 · Q9(a) · 4 marks

9 An increasing concentration of carbon dioxide in the atmosphere has been linked to climate change.

(a) Cells in the leaves of trees contain chloroplasts that absorb carbon dioxide.

Describe what happens to carbon dioxide when it enters a chloroplast.

(4)

Questions, mark schemes and examiners' report extracts © Pearson Education Ltd.

Question 8 · A level Paper 1 · June 2019 · Q1(b) · 3 marks

(b) In some commercial glasshouses, the concentration of carbon dioxide in the atmosphere is increased.

Explain why this increase in carbon dioxide concentration affects the growth of plants in glasshouses.

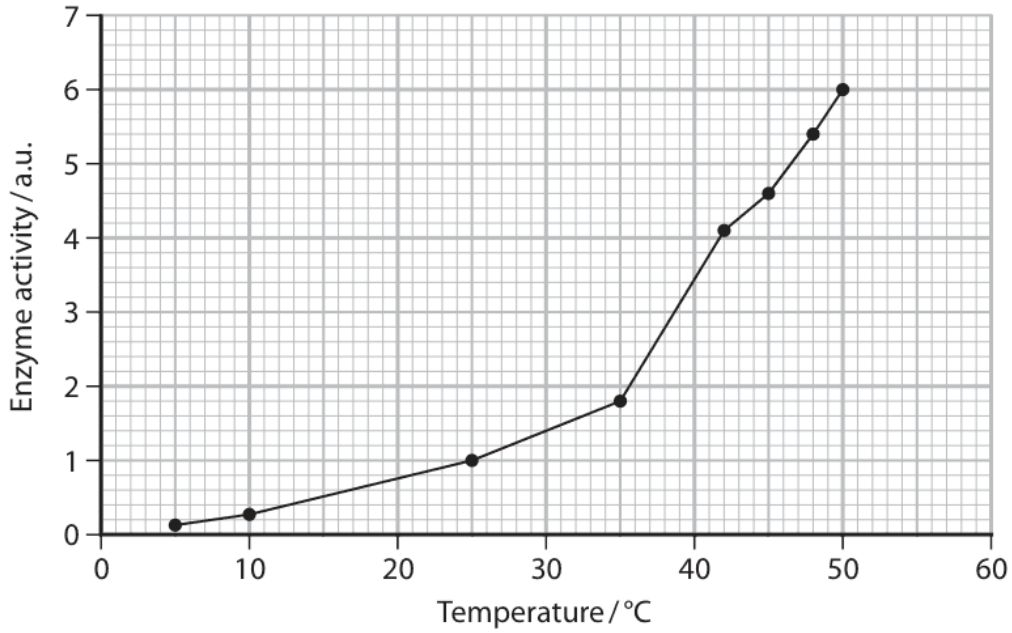
(3)

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Question 9 · A level Paper 1 · November 2021 · Q10(c) · 4 marks

(c) The effect of temperature on the activity of RUBISCO was studied.

The results are shown in the graph.



Analyse the data to explain why temperature affects the growth of plants.

(4)

Questions, mark schemes and examiners' report extracts © Pearson Education Ltd.

Question 10 · A level Paper 3 · June 2024 · Q3(b) · 3 marks

(b) Describe the role of RUBISCO in the light-independent reactions of photosynthesis.

(3)

Question 11 · A level Paper 3 · October 2020 · Q3(a)(ii) · 3 marks

(ii) Describe the roles of the products of the light-dependent reactions in the Calvin cycle.

(3)

Questions, mark schemes and examiners' report extracts © Pearson Education Ltd.

Question 12 · A level Paper 3 · October 2020 · Q3(c) · 2 marks

(c) Explain the importance of RUBISCO to the productivity of an ecosystem.

(2)

Question 13 · A level Paper 1 · June 2018 · Q10(a)(ii) · 3 marks

(ii) Explain the relationship between the structure and functions of a granum in photosynthesis.

(3)

Questions, mark schemes and examiners' report extracts © Pearson Education Ltd.

Question 14 · A level Paper 3 · June 2017 · Q5(a) · 1 mark

5 The pigment content of mountain plants can be affected by various environmental factors. These factors include altitude (height up a mountain), exposure to ultraviolet radiation (UV-B) and temperature.

These pigments include chlorophyll, found in chloroplasts, and flavonoids that are found in sap vacuoles.

Flavonoids can protect plants from ultraviolet radiation (UV-B) that can damage DNA.

(a) State the location of chlorophyll in a chloroplast.

(1)

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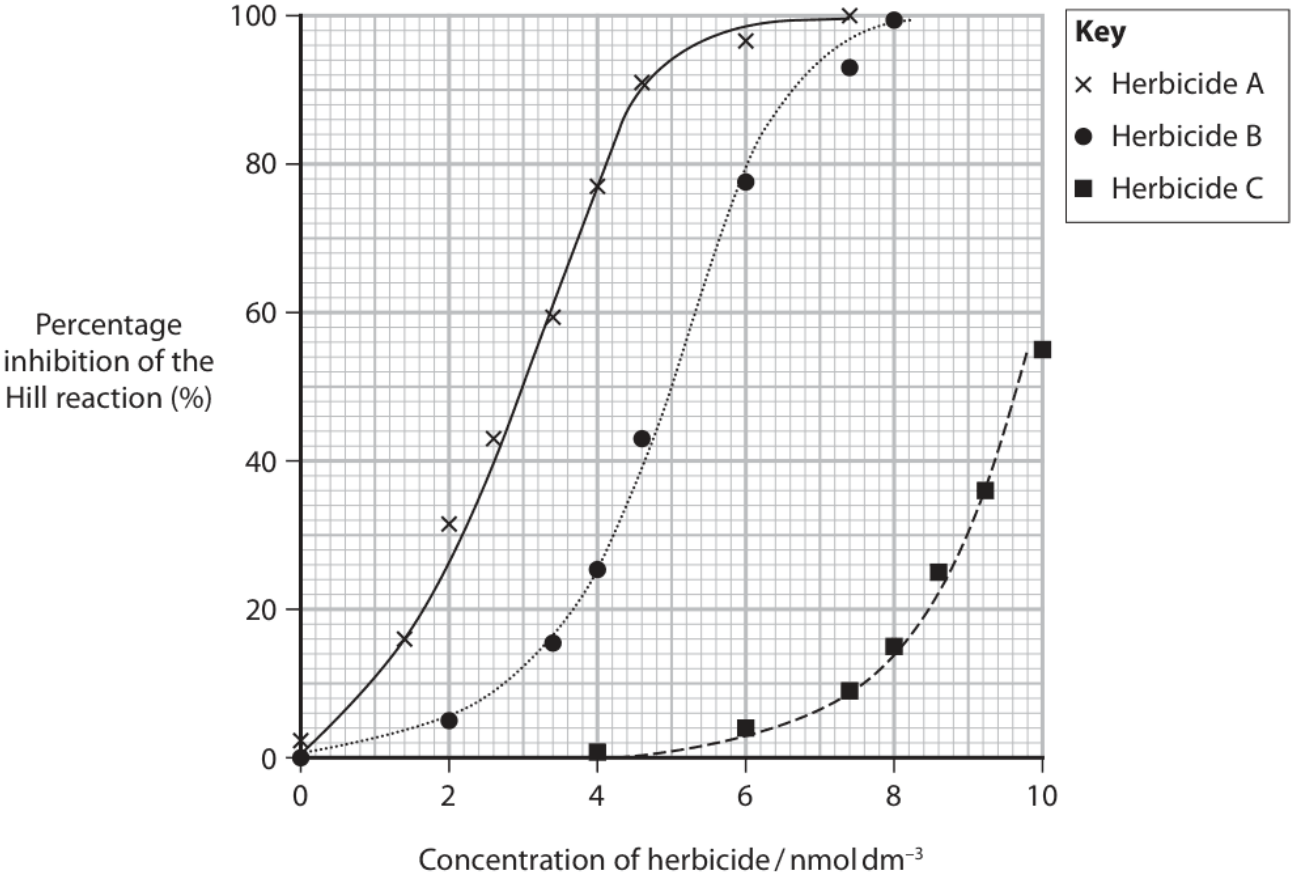
Questions, mark schemes and examiners' report extracts © Pearson Education Ltd.

Question 15 · A level Paper 3 · June 2024 · Q3(a)(i) · 1 mark

3 Photosynthesis takes place in chloroplasts.

(a) The light-dependent processes in photosynthesis can be investigated using the Hill reaction.

The graph shows the effect of three different herbicides, A, B and C, on inhibition of the Hill reaction in isolated chloroplasts.



(i) State the location of the light-dependent reactions in chloroplasts.

(1)

.....

.....

.....

Question 16 · A level Paper 3 · October 2020 · Q3(a)(i) · 1 mark

3 Photosynthesis in green plants involves light-dependent reactions and the Calvin cycle.

(a) The Calvin cycle uses the products of the light-dependent reactions.

(i) State the location of the Calvin cycle.

(1)

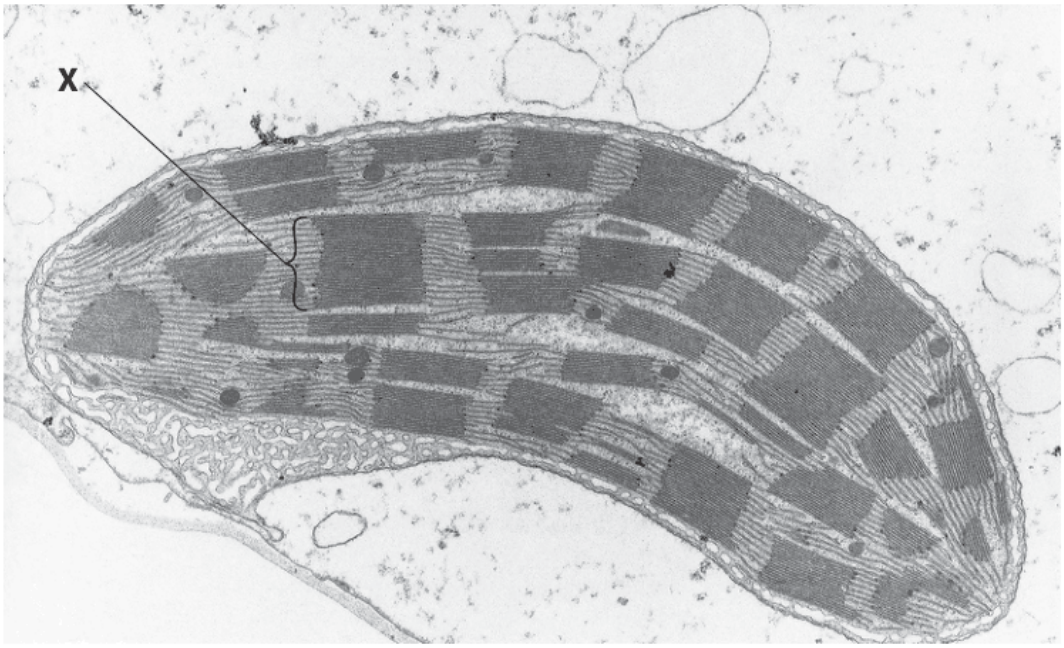
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Questions, mark schemes and examiners' report extracts © Pearson Education Ltd.

Question 17 · A level Paper 3 · June 2022 · Q3(a)(i) · 1 mark

3 Eukaryotic cells contain membrane-bound organelles.

(a) The photograph, obtained using an electron microscope, shows an organelle.



(Source: © Science History Images/Alamy Stock Photo)

(i) Label a part of this organelle where carbon fixation occurs.

(1)

Question 18 · A level Paper 3 · June 2022 · Q3(a)(ii) · 1 mark

(ii) Give the name of the component labelled X.

(1)

.....

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Question 19 · A level Paper 3 · June 2022 · Q3(a)(iii) · 3 marks

(iii) Describe how the structure of a membrane in the part labelled X is related to its function.

(3)

Question 20 · A level Paper 3 · June 2022 · Q3(a)(iv) · 2 marks

(iv) Describe how GP is produced by carbon fixation in this organelle.

(2)

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Mark schemes

Question 1 · A level Paper 3 · June 2019 · Q6(b)(i) · 3 marks

Question Number	Answer
6(b)(i)	An explanation that makes reference the following: • hydrolysis of ATP (1) • provides energy for the reaction (1) • provides phosphate group for phosphorylation of F-6-P (1)

Additional guidance	Mark
ALLOW as the reaction requires energy ALLOW provides {phosphate / Pi} that is added to F-6-P	**(3)**

Questions, mark schemes and examiners' report extracts © Pearson Education Ltd.

Question 2 · A level Paper 1 · June 2017 · Q4(a) · 5 marks

Question Number	Answer
4(a)	A description that makes reference to the following: • use of light (energy) to excite electrons in chlorophyll (1) • {photolysis / splitting of water} to produce oxygen, electrons and hydrogen ions (1) • electrons used { in the electron transport chain / to replace those lost by chlorophyll } (1) • generation of ATP / photophosphorylation (1) • reduction of NADP (1)

Additional Guidance	Mark
ALLOW electrons promoted to higher energy level ALLOW photosystem (PS) I or II for chlorophyll ALLOW correct equation ALLOW electrons used in redox reactions / electrons move along electron carrier proteins	5

Question 3 · A level Paper 1 · June 2024 · Q5(b)(i) · 1 mark

Question Number	Answer	Additional guidance	Mark
5(b)(i)	An answer that makes reference to any two the following oxygen, ATP, reduced NADP	ALLOW O_2, NADPH, NADPH + H^+, $NADPH_2$	(1)

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Question 4 · A level Paper 3 · June 2024 · Q3(a)(iii) · 2 marks

Question number	Answer
3(a)(iii)	A description that makes reference to the following: • absorb light (1) • transfer (light) energy to electrons (1) • provides (high energy) electrons to the electron transport chain (1)

Additional guidance	Mark
IGNORE colour of light ALLOW photoactivation of chlorophyll ALLOW photoionisation ALLOW use (light) energy to excite electrons	Choose an item. (2)

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Question 5 · A level Paper 1 · June 2022 · Q10(a)(ii) · 4 marks

Question Number	Answer
10(a)(ii)	An explanation that makes reference to four of the following • the rate of growth increases as rate of photosynthesis increases (1) • growth rate is higher for plants grown at a higher light intensity (1) • role of light in light-dependent reactions described (1) • more photosynthesis means more {glucose/carbohydrate} produced (1) • (more carbohydrate produced) means more glucose for {energy/respiration } (1)

Additional guidance	Mark
ALLOW correlation between rate of growth and rate of photosynthesis e.g. photolysis / photophosphorylation – production of ATP or reduced NADP ALLOW other named product of photosynthesis	(4)

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Question 6 · A level Paper 1 · June 2024 · Q2(a) · 4 marks

Question Number	Answer
2(a)	A description that makes reference to the following • (carbon dioxide is) needed for { light-independent stage / Calvin cycle } (1) • it combines with RuBP / ribulose bisphosphate (1) • catalysed by RUBISCO (1) • for the synthesis of named organic molecules (1)

Additional Guidance	Mark
ALLOW carbon fixation ALLOW involves the enzyme RUBISCO e.g. GP, GALP, glucose	(4)

Question 7 · A level Paper 1 · June 2025 · Q9(a) · 4 marks

Question Number	Answer
9(a)	A description that makes reference to the following: • light independent reactions (of photosynthesis) / Calvin cycle (1) • (carbon dioxide) {combines with / fixes to} RuBP (1) • (carbon fixation) catalysed by the enzyme RUBISCO (1) • leading to the formation of {GP / GALP / organic molecules / glucose} (1)

Additional guidance	Mark
ALLOW G3P, PGA, PG, TP, triose phosphate	(4)

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Question 8 · A level Paper 1 · June 2019 · Q1(b) · 3 marks

Question Number	Answer
1(b)	An explanation that makes reference to three of the following points • description of carbon dioxide as a limiting factor (1) • carbon dioxide is fixed to produce { GP / GALP } (1) • (therefore increased carbon dioxide) results in more { carbohydrate / polysaccharides / glucose } being produced (1) • which would lead to a greater rate of { growth / cell division } (1)

Additional guidance	Mark
ALLOW other relevant biological molecule e.g. amino acids, lipids, nucleic acids ALLOW faster growth	**(3)**

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Question 9 · A level Paper 1 · November 2021 · Q10(c) · 4 marks

Question Number	Answer
10(c)	An answer that makes reference to four of the following: • the light independent stage of photosynthesis is catalysed by enzymes / RUBISCO (1) • activity of RUBISCO increases as the temperature increases (1) • more carbon is fixed in the Calvin cycle (1) • greater rate of production of { GP / GALP / glucose } (1) • leading to increase to growth (1)

Additional guidance	Mark
ALLOW RUBISCO is needed for the Calvin cycle ALLOW more carbon dioxide reacts with RuBP ALLOW more { GP / GALP / glucose }	**(4)**

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Question 10 · A level Paper 3 · June 2024 · Q3(b) · 3 marks

Question number	Answer
3(b)	A description that makes reference to the following: • RUBISCO is an enzyme (1) • RUBISCO combines carbon dioxide with RuBP (1) • to form {GP / glycerate 3-phosphate} (1)

Additional guidance	Mark
ALLOW RUBISCO fixes carbon / ALLOW RUBISCO catalyses the reaction between CO_2 and RUBP}	Choose an item. (3)

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Question 11 · A level Paper 3 · October 2020 · Q3(a)(ii) · 3 marks

Question number	Answer
3(a)(ii)	An answer that makes reference to the following: • (the products) ATP and reduced NADP (1) • ATP is used (by the enzyme) converting {GP to GALP / GALP to RuBP} (1) • reduced NADP used to convert GP to GALP (1)

Additional guidance	Mark
ALLOW $NADPH_2$ or NADPH for reduced NADP IGNORE $NADPH^+$ and reduced NAD ALLOW ATP is used to provide energy for the Calvin cycle	**(3)**

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Question 12 · A level Paper 3 · October 2020 · Q3(c) · 2 marks

Question number	Answer
3(c)	An answer that makes reference to two of the following: • fixes (inorganic) carbon (1) • allowing formation of organic molecules (by the Calvin cycle) (1) • these organic molecules allow transfer of energy to next trophic level (1)

Additional guidance	Mark
ALLOW fixes CO_2 / combines RUBP and CO_2 ALLOW suitable examples of organic molecules e.g. GP / GALP / glucose / hexose sugars / amino acids ALLOW these organic molecules can be converted into biomass	**(2)**

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Question 13 · A level Paper 1 · June 2018 · Q10(a)(ii) · 3 marks

Question Number	Answer
10(a)(ii)	An explanation that makes reference to three of the following: • (granum) is formed from many layers of thylakoid membranes to increase surface area (for absorbing light) (1) • thylakoid membranes contain chlorophyll to absorb light (1) • electron carrier molecules in thylakoid membrane involved in ATP production (1)

Additional Guidance	Mark
ALLOW stacks of thylakoids provide a large surface area ALLOW photosystems / photosynthetic pigments in place of chlorophyll ALLOW for light dependent reaction in place of absorb light ALLOW ATP synthase / photophosphorylation	**(3)**

Question 14 · A level Paper 3 · June 2017 · Q5(a) · 1 mark

Question Number	Answer	Additional Guidance	Mark
5(a)	An answer that makes reference to the following: • thylakoid membrane / grana / granum **(1)**	ALLOW phonetic spelling ALLOW lamella	**(1)**

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Question 15 · A level Paper 3 · June 2024 · Q3(a)(i) · 1 mark

Question number	Answer
3(a)(i)	An answer that makes reference to the following: • thylakoid (membrane) (1)

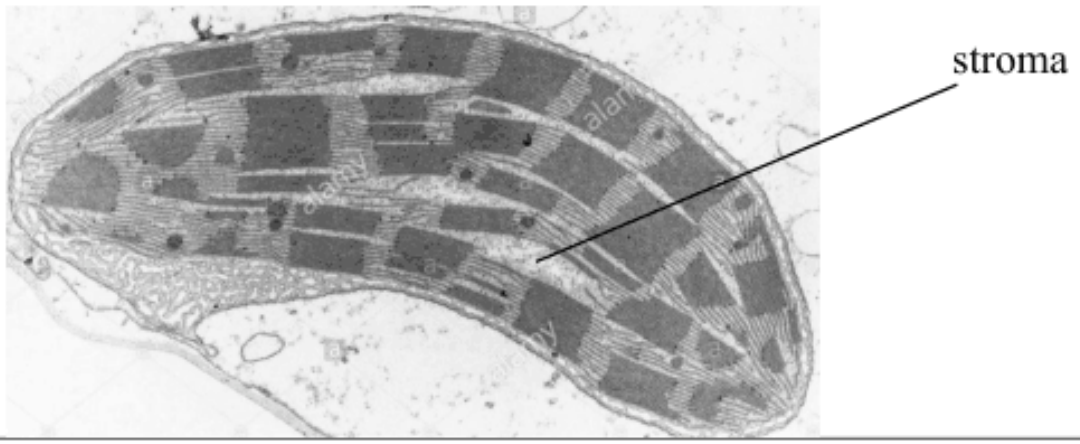
Additional guidance	Mark
ALLOW grana / granum / thylakoids ALLOW on thylakoids DO NOT ACCEPT thylakoid space	Choose an item. (1)

Question 16 · A level Paper 3 · October 2020 · Q3(a)(i) · 1 mark

Question number	Answer	Additional guidance	Mark
3(a)(i)	An answer that makes reference to the following: • stroma of the chloroplast (1)		**(1)**

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Question 17 · A level Paper 3 · June 2022 · Q3(a)(i) · 1 mark

Question number	Answer
3(a)(i)	

Additional guidance	Mark
ALLOW location of carbon fixation IGNORE unqualified letters	(1)

Question 18 · A level Paper 3 · June 2022 · Q3(a)(ii) · 1 mark

Question number	Answer	Additional guidance	Mark
3(a)(ii)	• granum	ALLOW stack of thylakoids / thylakoid / grana	(1)

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Question 19 · A level Paper 3 · June 2022 · Q3(a)(iii) · 3 marks

Question number	Answer
3(a)(iii)	A description that makes reference to three of the following: • large surface area (1) • containing {chlorophyll / photosystems / photosynthetic pigments} (1) • to absorb as much light as possible (1) • the membrane (contains) electron transport chain / (contains) ATP synthase for the synthesis of ATP (1)

Additional guidance	Mark
ALLOW PSII IGNORE to absorb light unqualified ALLOW ATP-ase	(3)

Question 20 · A level Paper 3 · June 2022 · Q3(a)(iv) · 2 marks

Question number	Answer
3(a)(iv)	A description that makes reference to the following: • (the enzyme) RUBISCO (1) • combines carbon dioxide with RuBP (1) • unstable {6 carbon / 6C} molecule breaks down into (two) GP (1)

Additional guidance	Mark
ALLOW five carbon molecule / 5C molecule / ribulose bisphosphate ALLOW glycerate phosphate	(2)

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