Photosynthesis: AQA A Level Biology Exam Questions by Topic

12 questions · 27 marks · about 35 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · A level Paper 2 · June 2019 · Q07.2 · 2 marks

0 7 . 2 Describe what happens during photoionisation in the light-dependent reaction.

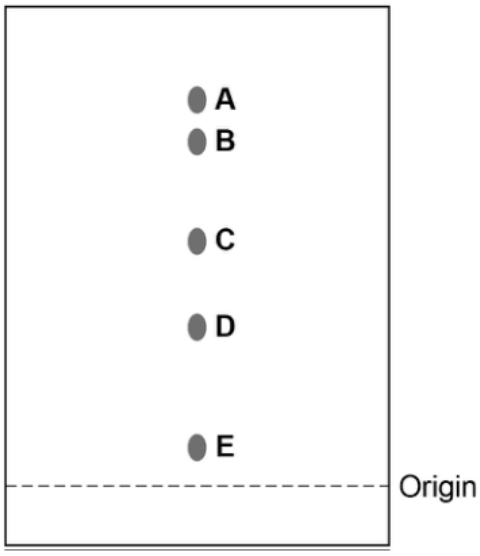
[2 marks]

Question 2 · information from earlier in the question

A student obtained a solution of pigments from the leaves of a plant. Then the student used paper chromatography to separate the pigments.

Figure 5 shows the chromatogram produced.

Figure 5



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Question 2 · A level Paper 2 · June 2019 · Q07.6 · 1 mark

0 7 . 6 The pigments in leaves are different colours. Suggest and explain the advantage of having different coloured pigments in leaves.

[1 mark]

Question 3 · A level Paper 2 · November 2020 · Q03.4 · 2 marks

0 3 . 4 The light absorbed by chlorophyll is used in the light-dependent reaction.

Name the **two** products of the light-dependent reaction that are required for the light-independent reaction.

[2 marks]

1

2

Question 4 · A level Paper 2 · June 2018 · Q01.1 · 2 marks

0 1 Heat stress is a condition that often occurs in plants exposed to high temperatures for a prolonged period of time. Heat stress is a major factor in limiting the rate of photosynthesis.

0 1 . 1 Heat stress decreases the light-dependent reaction of photosynthesis.

Explain why this leads to a decrease in the **light-independent reaction**.

[2 marks]

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Question 5 · A level Paper 2 · June 2018 · Q01.3 · 1 mark

0 1 . 3 Where precisely is rubisco found in a cell?

[1 mark]

Question 6 · A level Paper 2 · June 2018 · Q01.2 · 2 marks

0 1 . 2 Another effect of heat stress is a decrease in the activity of the enzyme rubisco. A decrease in the activity of an enzyme means that the rate of the reaction it catalyses becomes slower.

A decrease in the activity of the enzyme rubisco would limit the rate of photosynthesis.

Explain why.

[2 marks]

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Question 7 · A level Paper 2 · June 2024 · Q03.3 · 3 marks

0 3 . 3 Describe how the products of the light-dependent reaction are used in the light-independent reaction to produce triose phosphate.

Do **not** include the role of ribulose bisphosphate (RuBP) in your answer.

[3 marks]

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Question 8 · A level Paper 2 · June 2022 · Q01.2 · 6 marks

0 1 . 2 Describe the **light-independent** reaction of photosynthesis.

[6 marks]

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Question 9 · information from earlier in the question

0 6 Plants transport sucrose from leaves to other tissues for growth and storage. SUT1 is a sucrose co-transporter protein.

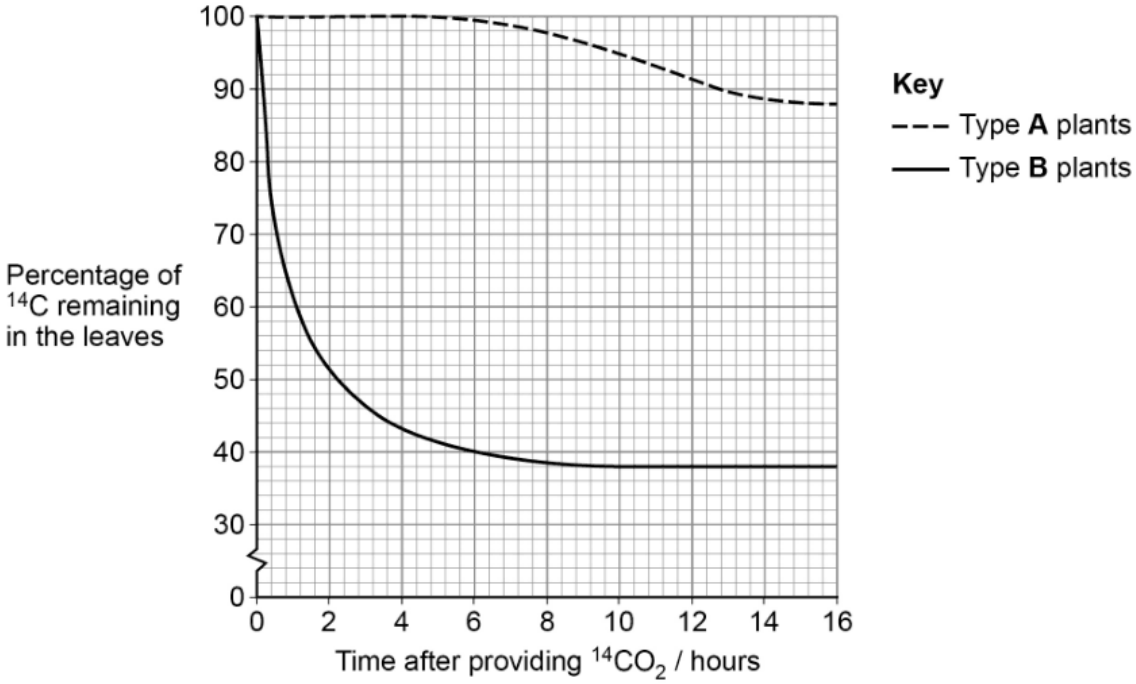
Scientists investigated whether the cells of tobacco plant leaves used SUT1 to transport sucrose to other tissues.

0 6 . 3 The scientists hypothesised that lower rates of sucrose transport from leaves would cause reduced growth.

To test this hypothesis, the scientists provided leaves of type **A** and type **B** plants with labelled carbon dioxide ($^{14}CO_2$). To estimate sucrose transport out of leaves, they measured the percentage of ^{14}C remaining in the leaves for 16 hours.

Figure 5 shows their results.

Figure 5



Calculate the ratio of percentage of ^{14}C remaining in leaves of type **B** to type **A** plants 16 hours after providing $^{14}CO_2$

[1 mark]

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Question 9 · A level Paper 3 · November 2021 · Q06.4 · 2 marks

0 6 . 4 In type **B** plants, the percentage of ^{14}C remaining in the leaves does not reach zero per cent, as shown in **Figure 5**.

Suggest **two** reasons why.

[2 marks]

1 _____

_____

2 _____

_____

Question 10 · information from earlier in the question

0 4 A student isolated chloroplasts from spinach leaves into a solution to form a chloroplast suspension. He used the chloroplast suspension and DCPIP solution to investigate the light-dependent reaction of photosynthesis. DCPIP solution is blue when oxidised and colourless when reduced.

The student set up three test tubes as follows:

- **Tube 1** – 1 cm^3 of solution without chloroplasts and 9 cm^3 of DCPIP solution in light.
- **Tube 2** – 1 cm^3 of chloroplast suspension and 9 cm^3 of DCPIP solution in darkness.
- **Tube 3** – 1 cm^3 of chloroplast suspension and 9 cm^3 of DCPIP solution in light.

The student recorded the colour of the DCPIP in each of the tubes at the start and after the tubes had been left at 20 °C for 30 minutes.

His results are shown in **Table 1**.

Table 1

Tube	Colour of DCPIP in tube	
	At start	After 30 minutes
1	blue	blue
2	blue	blue
3	blue	colourless

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Question 10 · A level Paper 2 · June 2017 · Q04.5 · 2 marks

0 4 . 5 Explain how chemicals which inhibit the decolourisation of DCPIP could slow the growth of weeds.

[2 marks]

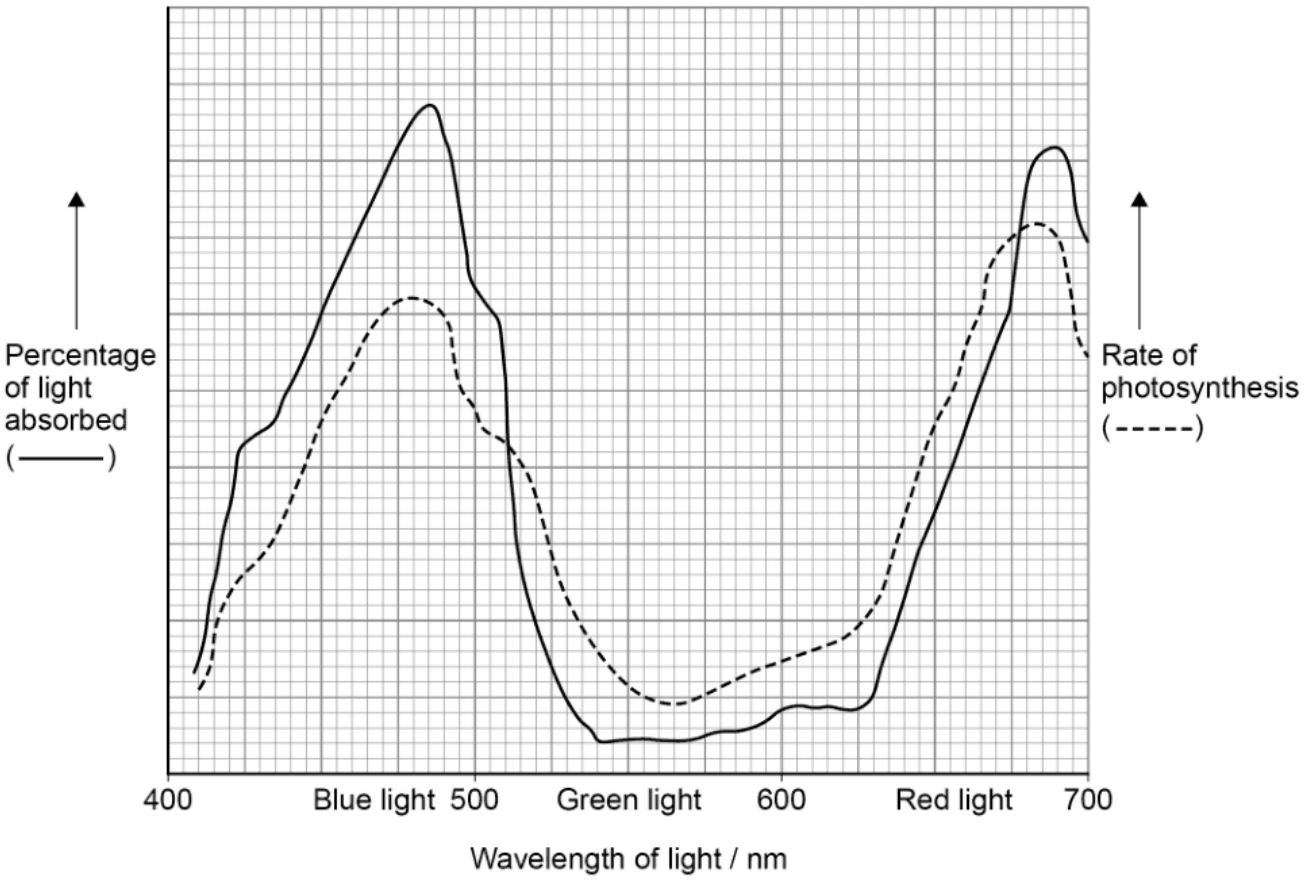
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0 3 . 1 A biologist investigated photosynthesis. They:

- measured the percentage of light absorbed by a plant when it was exposed to different wavelengths
- measured the rate of photosynthesis at each wavelength of light.

Figure 3 shows the results they obtained.

Figure 3



Using **Figure 3**, what can you conclude about the relationship between:

[2 marks]

the percentage of light absorbed and the rate of photosynthesis _____

_____

_____

the colour of light and the rate of photosynthesis _____

_____

_____

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Question 12 · A level Paper 2 · June 2024 · Q03.2 · 2 marks

0 3 . 2 Give **three** environmental factors that should be controlled when measuring the rate of photosynthesis in this investigation.

Do **not** include features of the plant in your answer.

[2 marks]

1 _____

_____

2 _____

_____

3 _____

_____

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Mark schemes

Question 1 · A level Paper 2 · June 2019 · Q07.2 · 2 marks

07.2	1. Chlorophyll absorbs light **OR** Light excites/moves electrons in chlorophyll; 2. Electron/s are lost **OR** (Chlorophyll) becomes positively charged;	2	1. Ignore photosystems. 2. Ignore site/molecule from where electrons are lost. 2. Accept electrons go to electron transport/carrier chain for 'electrons lost'.

Question 2 · A level Paper 2 · June 2019 · Q07.6 · 1 mark

07.6	(Absorb) different/more wavelengths (of light) for photosynthesis;	1

Accept wider/larger range of wavelengths.

Accept frequency for wavelength.

Accept light-dependent reaction /photophosphorylation /photoionisation for photosynthesis.

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Question 3 · A level Paper 2 · November 2020 · Q03.4 · 2 marks

03.4	1. ATP; 2. Reduced NADP;	2	Accept 1 and 2 in either order. 2. Reject Reduced NAD. 2. Accept NADPH/$NADPH_2$.

Question 4 · A level Paper 2 · June 2018 · Q01.1 · 2 marks

01.1	1. (Less/no) ATP; 2. (Less/no) reduced NADP;	2	2. Accept NADPH, NADPH + H, $NADPH_2$ $NADPH + H^+$ 2. Reject reduced NAD, NADH etc,

Question 5 · A level Paper 2 · June 2018 · Q01.3 · 1 mark

01.3	1. Stroma (of/in chloroplast);	1	Reject: stoma Reject stroma of cytoplasm/chlorophyll Reject stroma of mitochondrion Ignore references to Calvin cycle or the light-independent reaction

Question 6 · A level Paper 2 · June 2018 · Q01.2 · 2 marks

01.2	1. (Less/no) carbon dioxide (reacts) with RuBP; 2. (Less/no) GP;	2

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Question 7 · A level Paper 2 · June 2024 · Q03.3 · 3 marks

03.3	1. ATP and reduced NADP; 2. ATP provides <u>energy;</u> 3. GP reduced to triose phosphate;	3 (3 x AO1)	1 Accept NADPH or $NADPH_2$ or NADP + H for reduced NADP. 3. Must have idea of reduction. This may be conveyed by stating GP converted to triose phosphate using reduced NADP. 3. Accept TP for triose phosphate as triose phosphate is named in the question. 3. If GP named it must be correct.

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01.2	1. Carbon dioxide combines/reacts with ribulose bisphosphate/RuBP; 2. Produces two glycerate (3-)phosphate/GP using (enzyme) Rubisco; 3. GP reduced to triose phosphate; 4. Using reduced NADP; 5. Using <u>energy</u> from ATP; 6. Triose phosphate converted to glucose/hexose/RuBP/ribulose bisphosphate/named organic substance;	6 (6 x AO1)

1 to 6. Accept marks in suitable diagram.

1. Accept idea of fixation for 'reacts'.

2. Accept: any answer which indicates that 2 × as much GP produced from one RuBP catalysed by Rubisco.

2 and 3. Reject GP once if incorrectly named e.g., glucose 3- phosphate.

3. Must have idea of reduction. This may be

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Question 9 · A level Paper 3 · November 2021 · Q06.4 · 2 marks

06.4	1. Some ($^{14}CO_2$) used to make cellulose/cell walls; 2. Some ($^{14}CO_2$) converted into starch (which remains in the leaf); 3. Not all ($^{14}CO_2$) fixed/used in photosynthesis; **OR** Not enough RuBP (to combine with all of the $^{14}CO_2$); 4. Some used to reform RuBP **OR** Some (is still) in glycerate 3-phosphate/GP/triose phosphate/in the Calvin cycle;	2 max

1. Accept some becomes lipids/ proteins/DNA/RNA/ nucleotides
2. Accept some ($^{14}CO_2$) converted into glucose
3. Accept descriptions of this

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Question 10 · A level Paper 2 · June 2017 · Q04.5 · 2 marks

04.5	1. Less/no ATP produced; 2. Less/no reduced NADP produced; 3. Less/no GP reduced/converted to TP;	2 max

2, Accept: less/no NADPH/$NADPH_2$/NADPH + H

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03.1	1. (Percentage of light absorbed at each wavelength) correlates (with rate of photosynthesis); 2. High(er)/increases (rate of photosynthesis) with blue **and** red light **and** low(er) /decreases (rate of photosynthesis) with green light;

2 (2 x AO3)	1. Accept description of correlates e.g. as % light absorbed increases so does photosynthesis or converse. 1. Ignore directly proportional. 2. Ignore wavelength. 2. Reject '**no** photosynthesis with green light'. 2. Accept other words which are equivalent to 'high(er)' and 'low(er)'.

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03.2	1. Intensity/brightness of light (at each wavelength) 2. Carbon dioxide concentration 3. Temperature 4. Water **OR** Humidity;;	2 max (2 x AO2)

3 correct = **2 marks**

2 correct = **1 mark**

0–1 correct = **0 marks**

Ignore pH and nutrients.

1. Accept ‘distance of/from light source’.

1. Reject sunlight.

2. Accept conc. for concentration.

4. Accept water potential/Ψ (of soil).

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