Required Practicals 7 and 8, Photosynthesis: AQA A Level Biology Exam

8 questions · 15 marks · about 20 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · A level Paper 2 · June 2023 · Q01.1 · 4 marks

0 1 . 1 A student used chromatography to separate the different photosynthetic pigments in a chlorophyll solution. She had the following materials.

Chromatography paper
A ruler and pencil
Suitable glassware
A solvent (solvent **A**)
2 cm^3 of the chlorophyll solution

Describe how she could use these materials to separate the photosynthetic pigments by chromatography.

[4 marks]

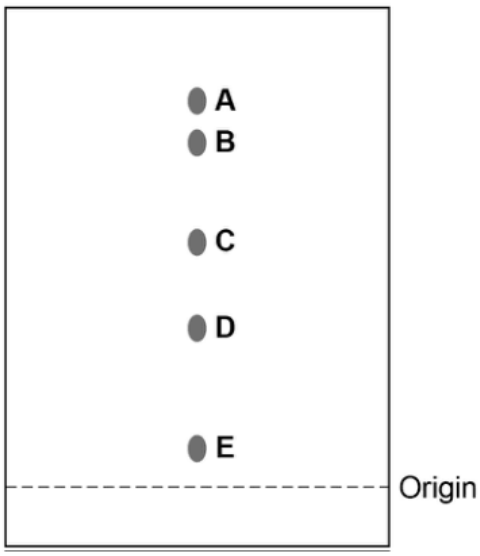
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Question 2 · information from earlier in the question

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



Question 2 · A level Paper 2 · June 2019 · Q07.4 · 2 marks

0 7 . 4 Describe the method the student used to separate the pigments after the solution of pigments had been applied to the origin.

[2 marks]

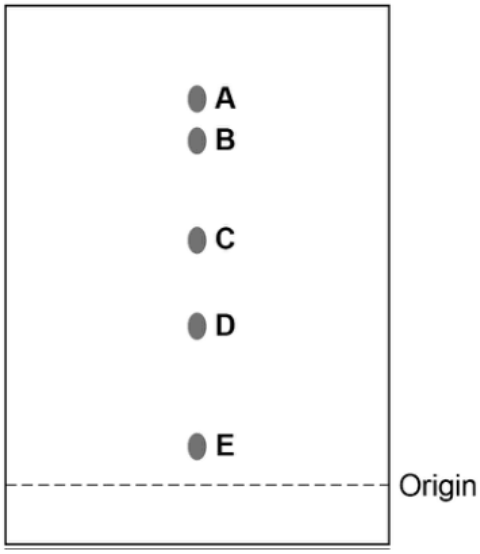
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Question 3 · A level Paper 2 · June 2019 · Q07.3 · 1 mark

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



0 7 . 3 Explain why the student marked the origin using a pencil rather than using ink.

[1 mark]

Question 4 · A level Paper 2 · June 2023 · Q01.2 · 2 marks

0 1 . 2 Using solvent **A**, the student separated five pigments. She then repeated her method using a different solvent, **B**. Using solvent **B**, she separated six pigments.

Explain the difference between these results.

[2 marks]

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Question 5 · 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

Question 5 · A level Paper 2 · June 2017 · Q04.3 · 2 marks

0 4 . 3 Explain the results in **Tube 3**.

[2 marks]

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Question 6 · A level Paper 2 · June 2017 · Q04.2 · 2 marks

0 4 . 2 Explain why the student set up **Tube 1**.

[2 marks]

Question 7 · A level Paper 2 · June 2017 · Q04.4 · 1 mark

0 4 . 4 The student evaluated the effectiveness of different chemicals as weed-killers by assessing their ability to prevent the decolourisation of DCPIP in chloroplast suspensions.

He added different concentrations of each chemical to illuminated chloroplast suspensions containing DCPIP. He then determined the IC_{50} for each chemical. The IC_{50} is the concentration of chemical which inhibits the decolourisation of DCPIP by 50%.

Explain the advantage of the student using the IC_{50} in this investigation.

[1 mark]

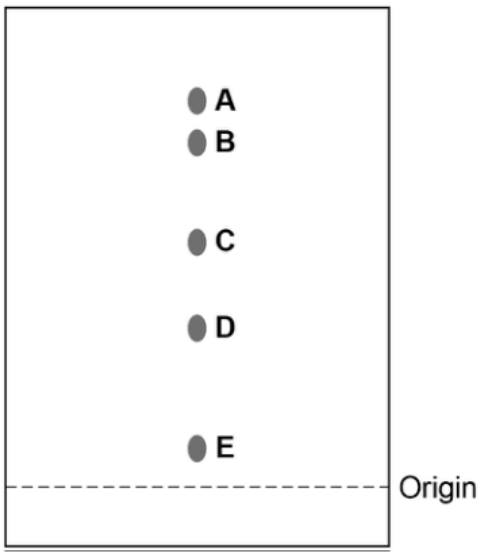
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Question 8 · information from earlier in the question

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



Question 8 · A level Paper 2 · June 2019 · Q07.5 · 1 mark

0 7 . 5 Calculating the R_f values of the pigments can help to identify each pigment. An R_f value compares the distance the pigment has moved from the origin with the distance the solvent front has moved from the origin.

$$R_f = \frac{\text{distance pigment has moved from the origin}}{\text{distance solvent front has moved from the origin}}$$

The distance each pigment has moved is measured from the middle of each spot.

Pigment **A** has an R_f value of 0.95

Use **Figure 5** to calculate the R_f value of pigment **C**.

[1 mark]

R_f value of pigment **C** = _____

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Mark schemes

Question 1 · A level Paper 2 · June 2023 · Q01.1 · 4 marks

01.1	1. Draw line/origin on (chromatography) paper (using ruler and pencil); 2. (Use pipette/tubing/dropper to) add chlorophyll/solution to origin/line; 3. Add solvent/**A** below line/origin; 4. Remove/stop (from glassware) before solvent reaches end (of chromatography paper) **OR** Mark (position) where solvent reaches/front;	4 (4 x AO1)

Accept all marks on a labelled diagram.

Allow filter paper for chromatography paper.

3. Accept ‘so solvent is not above line’ for ‘solvent below line’.

4. Accept remove/stop (immediately) when solvent reaches end/top.

4. Accept ensure solvent does not reach top/end.

4. Ignore Rf values.

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Question 2 · A level Paper 2 · June 2019 · Q07.4 · 2 marks

07.4	1. Level of solvent below origin/line; 2. Remove/stop before (solvent) reaches top/end;	2

1. Reject water or any named aqueous solution.

1. Accept named organic solvent.

Question 3 · A level Paper 2 · June 2019 · Q07.3 · 1 mark

07.3	Ink <u>and</u> (leaf) pigments would mix **OR** (With ink) origin/line in different position **OR** (With pencil) origin/line in same position **OR** (With pencil) origin/line still visible;	1	

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01.2	For **2 marks** = two pigments have same solubility in (solvent) **A** but different solubility in (solvent) **B** **OR** For **2 marks** = one pigment is soluble in (solvent) **B** but not in (solvent) **A** **OR** For **2 marks** = pigments have different solubilities in the solvents/**A** and **B** **OR** For **2 marks** = one pigment is only soluble in (solvent) **B** **OR** For **2 marks** = one pigment is insoluble (only) in (solvent) **A**;; For **1 mark** = response as for 2 marks but refers to solution rather than solvent;	2 (2 x AO3)

Accept ‘dissolves’ for solubility.

Accept correct reference to ‘affinity’ for solubility e.g., ‘greater affinity’ (to solvent) indicates more soluble.

Accept correct reference to ‘polarity’ for solubility’ e.g. pigments have different polarities.

Accept ‘Rf value’ for solubility.

Ignore ‘solvent stronger’

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Question 5 · A level Paper 2 · June 2017 · Q04.3 · 2 marks

04.3	1. Reduction of DCPIP by electrons; 2. (From) chlorophyll/light dependent reaction;	2	1. Accept: hydrogen/H for electrons but not protons/hydrogen ions/H^+ on their own. 2. Accept: from chloroplasts/photosystems/water.

Question 6 · A level Paper 2 · June 2017 · Q04.2 · 2 marks

04.2	1. To show light does not affect DCPIP; 2. To show chloroplasts are required;	2	Ignore: comparison with other tubes.

Question 7 · A level Paper 2 · June 2017 · Q04.4 · 1 mark

04.4	Provides a standard / reference point OR Can compare different chemicals/weed-killers OR Can compare different concentrations of chemicals/weed-killers;	1	Accept: decolourises quicker than 100% **or** saves time waiting for complete decolourisation. Note: comparisons must be qualified. Accept: find the most effective weed-killer **or** the most effective concentration. Accept: answers relating to cost effectiveness.

Question 8 · A level Paper 2 · June 2019 · Q07.5 · 1 mark

07.5	Accept any answer in range of 0.58 to 0.62;	1	Accept 0.58 or 0.62. Ignore any numbers which follow numbers in range.

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