

Nutrition in flowering plants: practice questions

7 questions • 25 marks • mark scheme at the back

For Pearson Edexcel International GCSE Biology 4BI1 and Science (Double Award) 4SD0. **Biology only** is not in the Double Award and is only examined on Paper 2.

Name

Total / 25

- 1** (a) State the word equation for photosynthesis. (2) (b) Complete the balanced chemical symbol equation for photosynthesis: $\dots\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + \dots\text{O}_2$ (1) (c) Describe the energy conversion that takes place in photosynthesis. (1) **[4 marks]**

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- 2** A student measured the number of bubbles of oxygen released by a water plant in one minute at different light intensities. The temperature and carbon dioxide concentration were the same each time. The results are in the table. (a) State the light intensity at which light stopped being the limiting factor. (1) (b) Name two other factors that could be limiting the rate at light intensities of 30 and above. (2) **[3 marks]**

Bubbles of oxygen released per minute	
Light intensity (arbitrary units)	Bubbles per minute
10	4
20	8
30	12
40	12
50	12

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3 Explain how two features of a leaf make it well adapted for photosynthesis.

[4 marks]

4 **Biology only**

[3 marks]

Explain how the structure of a leaf is adapted for gas exchange.

5 The leaves of a plant growing in poor soil are yellow. Name the mineral ion the plant is likely to be short of and explain why it causes this.

[2 marks]

6 A student tests a leaf for starch. Describe the steps she should follow and the result that shows starch is present.

[3 marks]

7 Describe how you could investigate the effect of light intensity on the rate of photosynthesis of a water plant. Include how you would make the investigation a fair test. **[6 marks]**

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Mark scheme

One mark for each point unless a maximum is given. Words in brackets are not needed for the mark.

1. [4]

- carbon dioxide + water (1)
- → glucose + oxygen (1) allow light / chlorophyll written above the arrow; do not accept light as a reactant
- 6 and 6 (both needed for the mark) (1)
- light energy is converted to chemical energy (stored in glucose) (1)

2. [3]

- 30 (arbitrary units) (1)
- carbon dioxide concentration (1)
- temperature (1) allow amount of chlorophyll; ignore water

3. [4]

- thin / flat / large surface area (1) so light is absorbed / gases diffuse a short distance (1)
- palisade cells packed close to the upper surface with many chloroplasts (1) to absorb a lot of light / carry out most photosynthesis (1)
- air spaces in the spongy mesophyll (1) so carbon dioxide diffuses to the cells (1)
- stomata (1) allow carbon dioxide to diffuse in (1)
- transparent upper epidermis (1) lets light through to the palisade cells (1)
- Max 4. Each feature must be matched with a reason. Do not accept 'to absorb light' alone as a feature.

4. [3] **Biology only**

- thin, so there is a short diffusion distance (1)
- broad / flat, so there is a large surface area (1)
- (many) stomata let carbon dioxide diffuse in and oxygen diffuse out (1) allow guard cells open and close stomata
- air spaces in the spongy mesophyll let gases diffuse (quickly) to and from the cells (1) allow large internal surface area
- moist cell surfaces, so gases dissolve before diffusing into the cells (1)
- Max 3. A feature must be linked to how it helps gas exchange.

5. [2]

- magnesium (ions) (1)
- needed to make chlorophyll, so less chlorophyll is made (1)

6. [3]

- dip the leaf in boiling water (1)
- boil the leaf in ethanol (in a hot water bath) to remove chlorophyll (1)
- rinse the leaf in water, then add iodine solution; blue-black shows starch is present (1) ignore 'purple' if blue is also given

7. [6]

Level 3 5-6	A detailed, logical method that includes how light intensity is changed, how the rate is measured, repeats and at least two controlled variables, each with a reason. Terms are used accurately.
Level 2 3-4	A method that covers how light intensity is changed and how the rate is measured, with some attempt at controls or repeats. Some detail is missing.
Level 1 1-2	A limited or partly correct method, for example naming the plant and the lamp with no measurement or no control of variables.

Indicative content

- pondweed in water with sodium hydrogencarbonate to supply carbon dioxide
- lamp at measured distances from the plant, for example 10, 20, 30, 40, 50 cm; light intensity changes with distance
- count the bubbles of oxygen released from the cut stem in one minute, or collect the gas and measure its volume
- allow the plant to adjust at each new distance before counting
- repeat at each distance at least three times and calculate a mean
- control temperature (heat shield / water bath / LED lamp), carbon dioxide concentration (same sodium hydrogencarbonate) and the plant used
- plot rate against light intensity or distance