

Photosynthesis · supported focus

International Baccalaureate · IB Diploma · Biology · SL

Scope and prerequisites

Supported SL focus. First assessment 2025; current subject brief acquired; full Biology guide not acquired. Remaining guide, assessment and practical requirements retain their recorded holds.

Prerequisites: read the stated quantities and units, use arithmetic and the model conditions below. Each lesson develops its own method before independent transfer.

These are original or explicitly fictional teaching examples, not actual measurements or completed assessed learner investigations.

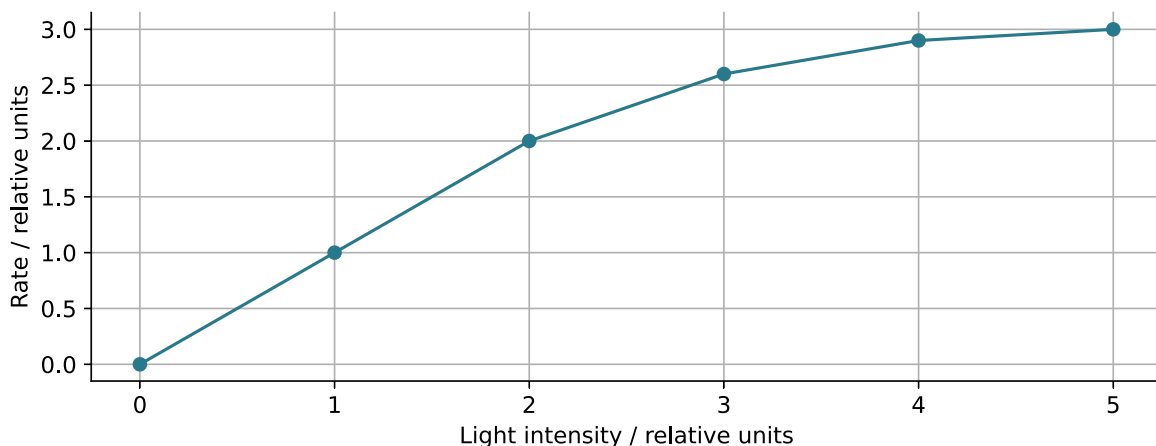
Photosynthesis and limiting factors

■ What would explain this observation?

- A brighter lamp does not always produce more oxygen from pondweed. Another factor may limit the process when light is already sufficient.
- Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

■ Build the model

- **Photosynthesis** transfers energy from light into chemical stores. Carbon dioxide and water form carbohydrate, releasing oxygen. Chlorophyll absorbs light; light intensity, temperature and carbon dioxide supply can affect rate.
- **limiting factor** : A factor whose shortage restricts rate; photosynthesis: Light-driven formation of carbohydrate.



■ Choose evidence that can test it

- Change only one factor when testing a limiting factor. At low light, extra light may increase rate. At a plateau, the changed factor is no longer the main limit in that range; the graph alone does not identify which other factor is limiting.
 - Measure collected gas volume over a fixed time instead of assuming all bubbles have the same volume. Control temperature, plant size and carbon dioxide supply. Allow the plant to adjust before each reading and repeat.
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■ Work from known quantities

- State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution.
- Known: 6.0 cubic centimetres of gas are collected in 3.0 minutes. Use $\text{rate} = \text{volume}/\text{time}$. $\text{Rate} = 6.0/3.0 = 2.0$ cubic centimetres per minute. Bubble counts can be a rough proxy, but bubbles of different size make comparisons less reliable.

Example:

9.0 cubic centimetres of gas are collected in 3.0 minutes. Find the rate. Use the same sequence: known quantities $\rightarrow$ model $\rightarrow$ relation $\rightarrow$ substitution $\rightarrow$ unit and interpretation.

■ Check the conclusion and its limits

- Moving a lamp changes light and may also change temperature. A photosynthesis experiment needs control of heating, not just a ruler.
- Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

Warn:

All oxygen bubbles have exactly the same volume. This claim is false: Moving a lamp changes light and may also change temperature. A photosynthesis experiment needs control of heating, not just a ruler.

Key:

Photosynthesis and limiting factors: Change only one factor when testing a limiting factor. At low light, extra light may increase rate. At a plateau, the changed factor is no longer the main limit in that range; the graph alone does not identify which other factor is limiting.