Net gas exchange in a leaf

Student activity • observation and reasoning

YEAR 10 / LESSON 33 / BIOLOGY ONLY

The question

Why does net gas exchange change with light intensity?

Use the supplied examples, record your reasoning and correct it using evidence.

Equipment

- Student booklet, paper models, pencil and ruler

Paper, modelling and written reasoning only. No chemicals or biological samples are handled.

Course coverage: Biology only: 2.40B–2.41B and 2.44B. Diffusion, photosynthesis and respiration.

Plan, model or apparatus sketch

Draw and label the apparatus or biological model; identify one limitation.

Method and reasoning

Read the whole sequence before starting

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1. Draw carbon dioxide and oxygen movements for respiration alone, then for photosynthesis alone.

2. Combine both processes for a living leaf in light. Show that respiration continues rather than switching off when photosynthesis starts.

3. Use illustrative rates: respiration consumes 2 oxygen units per minute; photosynthesis releases 0, 2 or 7 units under three light conditions. Calculate net oxygen exchange.

4. At equal rates, draw continued gross exchange processes but zero net exchange; label this balance rather than claiming no reactions occur.

5. Explain net diffusion in terms of concentration gradients between air spaces, cells and the surrounding air.

6. Predict the direction of a carbon-dioxide indicator change in darkness and sufficiently strong light, then identify the need for an indicator-only control.

Cleanup

- Return models and keep the corrected work.

Record your evidence

Blank spaces are for your own work

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Reference and task data

Illustrative rates only: respiration uses 2 oxygen units min^{-1}; photosynthesis produces 0, 2 or 7. Net exchange is production minus consumption. The balance point depends on the plant and conditions; no universal light intensity is supplied.

Example / trial	Observation / evidence	Explanation / limit
Separate processes		
Net-rate calculations		
Prediction / control		

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. Does respiration stop in daylight?

2. Calculate net oxygen exchange for the three examples.

3. What does zero net exchange mean?

4. Why can carbon dioxide move into a leaf in strong light?

5. What is expected in darkness?

6. Why can an indicator show net rather than gross photosynthesis?