Light and pondweed gas production

Student activity • practical and reasoning

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The question

How does changing light availability affect gas production by pondweed?

Collect repeat observations with one pondweed shoot while controlling the other conditions. Use a separate gas test when sufficient gas is available.

Equipment

- Healthy pondweed shoot, 250 cm^3 beaker and 100 cm^3 supplied 0.2% hydrogencarbonate solution
- LED lamp, ruler, timer, thermometer and optional light meter
- Teacher gas-collection apparatus for a separate oxygen demonstration

Keep electrical equipment and cables away from water. Do not handle pondweed with uncovered cuts; wash hands afterwards. Staff trim shoots and carry out any glowing-splint demonstration away from pupils and flammable materials.

Course coverage: Shared Biology / Double Award: 2.20 and 2.23. Light intensity and oxygen evolution.

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. Set up one healthy teacher-trimmed pondweed shoot in 100 cm^3 of the supplied hydrogencarbonate solution. Keep the same shoot, solution and temperature throughout.

2. Position an LED lamp at the first assigned distance, measured from the light source to the shoot. Record distance, actual water temperature and light-meter reading if available; allow two minutes to settle.

3. Count bubbles for one minute, then repeat twice without changing the setup. Record individual counts rather than just a mean.

4. Repeat at 10, 20, 30 and 40 cm in a varied order, keeping background light and temperature controlled. If the shoot stops bubbling, record that observation and ask for a check; do not supply invented counts.

5. Pool repeats, calculate mean bubble counts and plot against measured light or distance. Treat $1/d^2$ as an approximate light model, not a calibrated measurement for every lamp.

6. Observe the teacher's separate oxygen-test demonstration on collected pondweed gas if enough is available. Explain why bubble counts alone do not identify the gas or give its exact volume.

Cleanup

- Return pondweed to the designated aquarium or biological-waste route; do not release it outdoors.
- Return solution as directed, dry the bench and wash hands.

Record your evidence

Blank spaces are for your own work

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Reference and task data

Bubble count is a proxy: bubbles can differ in size, oxygen can dissolve, and respiration continues. A glowing-splint test on sufficient collected gas supports oxygen identification; it is separate from counting. Light, carbon dioxide and temperature can each become limiting factors. No pre-filled results are supplied.

Distance / cm; temperature / °C	Bubble counts: 1 / 2 / 3	Mean / min^{-1}; light reading
10; temperature: ____		
20; temperature: ____		
30; temperature: ____		
40; temperature: ____		

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. Identify the changed variable and measured response.

2. Name three controls.

3. Calculate the mean for 12, 15 and 15 bubbles in one minute.

4. Why can lamp distance confound temperature?

5. Why may increasing light stop increasing the rate?

6. Give two limitations of bubble counting.