

6. Photosynthesis

Dining by Light

Driving Question

What is photosynthesis?

Materials and Equipment

For each student or group:

- | | |
|--|--|
| <input type="checkbox"/> Data collection system | <input type="checkbox"/> Clay, modeling (golf ball-sized piece) |
| <input type="checkbox"/> Light sensor | <input type="checkbox"/> Baking soda, 1/4 tsp. |
| <input type="checkbox"/> Absolute pressure sensor with quick release | <input type="checkbox"/> <i>Elodea</i> (sometimes called <i>Anacharis</i>), 3 to 4 sprigs |
| <input type="checkbox"/> connector and plastic tubing | <input type="checkbox"/> Measuring spoons |
| <input type="checkbox"/> Sensor extension cable | <input type="checkbox"/> Water, distilled, 400 mL |
| <input type="checkbox"/> Beaker, 400 to 600 mL | |
| <input type="checkbox"/> Clear or translucent funnel | |

Safety

Add this important safety precaution to your normal laboratory procedures:

- Wear goggles and an apron when working with glassware.

Thinking about the Question

What is photosynthesis?

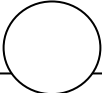
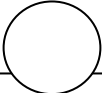
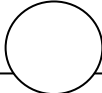
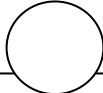
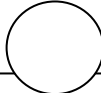
When do plants carry out the process of photosynthesis? Is there a particular time of day where they are likely to be more actively involved in photosynthesizing than at other times? Is there any way to tell by looking at a plant that it is carrying out this process? Discuss these questions with your lab group members. Be prepared to share your thoughts with the rest of the class.

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In this lab activity, you will measure the change in the pressure of a closed system as well as the amount of light available to the aquatic plant in the system to gather evidence of photosynthesis.

Sequencing Challenge

The steps below are part of the Procedure for this lab activity. They are not in the right order. Determine the proper order and write numbers in the circles that put the steps in the correct sequence.

				
Place 400 mL of distilled water and 1/4 teaspoon of baking soda in a beaker.	Make certain that each member of the lab group is aware of safety rules and procedures for this lab.	Use clay to seal the pressure sensor to the opening of the funnel.	Position a sprig of <i>Elodea</i> in distilled water in a beaker.	Invert and submerge a funnel in the beaker so it covers the <i>Elodea</i> .

Investigating the Question

Note: When you see the symbol "◆" with a superscripted number following a step, refer to the numbered Tech Tips listed in the Tech Tips appendix that corresponds to your PASCO data collection system. There you will find detailed technical instructions for performing that step. Your teacher will provide you with a copy of the instructions for these operations.

Part 1 – Equipment setup

- Start a new experiment on the data collection system. ◆^(1.2)
- Connect an absolute pressure sensor and a light sensor to the data collection system. ◆^(2.2) Use a sensor extension cable to connect the absolute pressure sensor.
- Display Absolute pressure and Light Intensity on the y-axis, with Time on the x-axis in a graph display. ◆^(7.1.10)
- Change the sampling rate to take one absolute pressure and light measurement every 30 minutes. ◆^(5.1)

5. What is the reason for using the absolute pressure sensor in this experimental setup?

Part 2 – Making predictions

6. Record your prediction about what will happen to the pressure inside the container holding the aquatic plant during the period when it is light. Explain your reasoning.

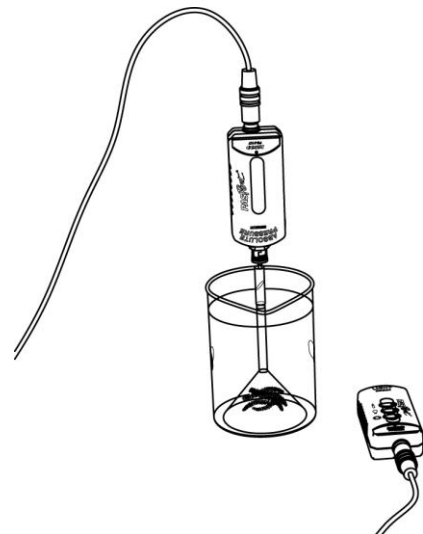
7. Record your prediction about what will happen to the pressure inside the container holding the aquatic plant during the period when it is dark. Explain your reasoning.

Part 3 – Measuring the changes that indicate photosynthesis

8. Add 1/4 teaspoon of baking soda to 400 mL of distilled water in a beaker. What is the function of the baking soda?

9. Place 3 or 4 sprigs of *Elodea* or other aquatic plant on the bottom of the beaker and set the beaker where it will receive direct sunlight.

10. Invert the funnel in the beaker and allow it to rest on the bottom of the beaker so it covers the plant, and the water fills up the funnel and stem of the funnel.



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11. Connect the absolute pressure sensor tubing to the stem of the funnel. Create a seal between the plastic tubing and the funnel stem by wrapping some clay around the joint and pressing it firmly to seal it. Why do you think it is important to have a good seal between these parts of the apparatus?

12. Place the light sensor so it is facing the window or other source of sunlight.

13. Start data recording. ♦^(6.2)

14. Record data for at least a 24 hour period to see the effects of the plant being in the dark as well as the light.

15. At the end of the 24-hour time period, stop data recording. ♦^(6.2)

16. Save your experiment according to your teacher's instructions.

Answering the Question

Analysis

1. Looking at your data, did the plant undergo photosynthesis during the night (dark)? Suggest reasons for this observation.

2. How did your prediction compare to the actual pressure data recorded during the day (light)?

3. How did your prediction compare to the actual relative pressure data during the night (dark)?

4. What happened to the relative pressure during the dark? Suggest reasons for this observation.

5. Describe what occurs during the process of photosynthesis.

6. Review your data. You may need to adjust the scale of your graph. ♦^(7.1.2) How fast did the aquatic plant undergo photosynthesis during the light? How fast did it undergo photosynthesis during the dark? Suggest reasons for this observation.

7. What are the two major factors that affect the rate of photosynthesis?

8. What would life be like if organisms did not undergo photosynthesis?

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Multiple Choice

Circle the best answer or completion to each of the questions or incomplete statements below.

1. Photosynthesis is a chemical reaction that:
 - A. Converts light energy to chemical energy
 - B. Converts chemical energy to light energy
 - C. Converts heat energy to chemical energy
 - D. Converts light energy to heat energy
2. In photosynthesis, energy is stored in the form of:
 - A. Glucose
 - B. Oxygen
 - C. Water
 - D. Carbon dioxide
3. Which of the following is NOT used in the overall reaction for photosynthesis?
 - A. Carbon dioxide
 - B. Oxygen
 - C. Water
 - D. Light
4. In a typical plant, all of the following factors are necessary for photosynthesis except:
 - A. Chlorophyll
 - B. Sugar (glucose)
 - C. Water
 - D. Carbon dioxide
5. In many plants, excess glucose is stored in:
 - A. The stem
 - B. The roots
 - C. The leaves
 - D. The flowers
6. Photosynthesis takes place in a plant's:
 - A. Mitochondria
 - B. Vacuoles
 - C. Ribosomes
 - D. Chloroplasts