Photosynthesis in Action - Experiment

Goals:
For photosynthesis to occur, a plant needs sunlight, water and carbon dioxide. To see photosynthesis in action, we will observe how a green plant (elodea or other available water plants) uses sunlight to take in CO₂ and release O₂ (control). In addition, we will deny sunlight to another specimen, to observe how photosynthesis does not occur without sunlight. Follow the procedures below to complete this experiment.

Materials for groups of students:
• (two per group) test tubes, stoppers, straws
• (one per group) wax pencil, scissors, eye droppers, measuring beaker
• specimens of elodea (or other available water plant from local pet store)
• light source (grow light or sunny window)
• bromothymol blue (BTB) as a CO₂ indicator
• prepared* tap water (prepare it by letting it sit out for at least 24 hours so chlorine evaporates)
• black construction paper and tape

Procedures:
Break students down into groups of 3-4 with each group getting a set of two test tubes. Students in each group should take turns completing each of the following steps in each group.

1. Measure 40ml of the prepared* tap water into each of their two test tubes.

2. Using the eye dropper, add about 100 drops of the bromothymol blue into each of the test tubes.

   **Important Fact:** Bromothymol blue is used as an indicator for the presence of carbon dioxide.

3. Using a separate straw for each test tube, mix the water and bromothymol blue in each of the test tubes (leaving the straws in each test tubes afterward).

   **Thinking Moment:** How can you add CO₂ to the test tubes?

4. Doing one test tube at a time, cover the top with a finger to prevent splashing and then gently blow carbon dioxide into the test tube through the straw until the liquid turns yellow.

   **Discuss** what the change in color indicates about the contents of the test tubes.

5. Cut a small sprig of water plant using scissors (make an angular cut in the stem) and place the plant bit in each of the test tubes. Then stopper them. Label each with the time, date and group number.

6. Add the words “no sun” to one of the test tubes using the wax pencil and wrap it with black construction paper, taping it in place so that no sunlight can get in.

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7. **Place** both test tubes in a holder in front of a light source (sunny window or grow light) so that they both get the same amount of warmth even though one will get no sunlight.

**Thinking Moment:** Can you predict what will happen over the next few hours? **Discuss.**

8. Several hours later (or next class period), have students remove the black paper from their test tube and **compare** the color of both liquids in the two test tubes.

**Observation:** Explain what changed in the test tubes.

**Critical Thinking:**
A. **Explain what happened in this experiment.**

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B. **In the formula for photosynthesis, explain how you simulated each part:**  
   $\text{water} + \text{CO}_2 + \text{sunlight} = \text{O}_2 + \text{glucose}$

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**LS1.C: Organization for Matter and Energy Flow in Organisms** – Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. (MS-LS1-6)
Photosynthesis in Action - Experiment Worksheet

1. How did blowing in the water and bromothymol blue provide one of the elements needed for photosynthesis?

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2. How did adding the elodea (pond weed) to the test tube and setting it in front of light cause the color of the liquid to change?

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3. Why did the liquid in the test tube covered in black paper not change color the way the uncovered liquid did?

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4. Why did you have to wait for a few hours for the color change to occur?

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5. Can you explain in your own words how this experiment demonstrated photosynthesis?

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