

Do Plants Consume or Release CO₂?

In the presence of light, plants perform photosynthesis. Did you know that at the same time plants are also performing cell respiration? Think about the chemical equations for respiration and photosynthesis. Which one releases CO₂ causing an increase and which one uses up CO₂ which will cause a decrease?

Respiration:

oxygen + glucose → carbon dioxide + water + heat energy

Photosynthesis:

carbon dioxide + water + light energy → oxygen + glucose

The amount of light available to the plant also determines the rate of photosynthesis and respiration.

Dark – Only respiration takes place. Oxygen is consumed while carbon dioxide is released.

Dim sunlight – Photosynthesis rate equals respiration rate. A plant consumes all the oxygen photosynthesis generates. It also uses all the carbon dioxide respiration creates. As a result, no gas exchange takes place with the environment.

Bright sunlight – Photosynthesis uses carbon dioxide and makes oxygen faster than respiration produces carbon dioxide and consumes oxygen. Extra oxygen is released into the atmosphere.

Today lab will determine whether CO₂ is consumed or produced as elodea (anacharis) plants are placed in either a dim and bright light or dark environment. The change in CO₂ will be detected by the pH indicator phenol red. Phenol red is yellow under acidic conditions (high Hydrogen ion concentration), pink under basic or alkaline conditions (low Hydrogen ion concentration) and orange under neutral conditions.

If the elodea plants are releasing oxygen into the water or absorbing oxygen from the water, this will directly change the Hydrogen ion activity in the water resulting in a visible color change.

- If the CO₂ concentration decreases, the H ion concentration will also decrease and the solution will change to **pink**, becoming basic.
- If the CO₂ concentration increases, the H ion concentration will also increase and the solution will change to **yellow**, becoming acidic.
- Neutral solutions of phenol red will be **orange**.

This is a free resource provided by Georgia Agricultural Education
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Things you need:

Aluminum foil
Elodea (Anacharis) Plants
100ml graduated cylinder
Parafilm
Phenol Red
Straw
6 test tubes
Water

Preparation

1. Create a solution of phenol red by adding concentrated phenol red to 100 ml of water. The phenol red may change color as a result of adding water (depending on acidity of water).
2. Your goal is to make your solution a neutral orange color. You can do this by **gently** blowing into the solution with a straw in **small amounts at a time**.
3. Once you have the solution at an orange color, transfer your orange solution into the 6 test tubes until each test tube is 2/3 full.
4. Cut off 3 pieces of the elodea plant about 2 inches in length.
5. Place a cut piece of elodea (cut end facing up) into 3 of the 6 tubes. The other 3 test tubes will not have elodea and will serve as controls.
6. Cut off 6 pieces of parafilm – each piece should be about 1 ½ inches by 1 ½ inches
7. Cover each test tube with a piece of parafilm. Gently pull the parafilm over the opening of the test tube until there is a tight seal. Rub your finger along the edge of the rim to ensure there are no air bubbles under the seal.
8. Tear off 2 pieces of Aluminum foil that are about 6 inches in length.
9. Select one test tube containing the elodea plant and select a test tube with no plant. Wrap each of these test tubes in a piece of aluminum foil until no light can enter. Set these in a safe place where they will not be bumped or moved for the experiment.
10. Select one test tube containing the elodea plant and select a test tube with no plant. Set these test tubes in a window seal or area where they will receive full direct sunlight for the experiment.
11. Using your last test tube containing the elodea plant and your last test tube with no plant, set these in an area that gets indirect light. Possibly on the other side of the room from the window where the previous test tubes were placed away from other sources of direct light.
12. Clean up your area.
13. Record your observations about 24, 48, and 72 hours.
- 14.

Student Name _____

Data

Record the colors of the solutions in the test tubes.

	24 hours	48 hours	72 hours
Elodea / dark			
Control / dark			
Elodea / direct sun			
Control / direct sun			
Elodea / indirect sun			
Control / indirect sun			

Analysis

1. Answer the experimental question (Do Plants Consume or Release CO₂?).
2. Explain what happened in this lab, use complete sentences and be sure to provide supporting data or statements.