

Photosynthesis

As modified from: Karen F. Adams, Burnside Scholastic Academy, East 91st Place Chicago IL 60619

Background:

Plants use green pigments called chlorophylls to trap light energy. The chlorophylls give a plant its green color. Inside the cells that have chloroplasts, the light energy is used to make a simple sugar called glucose.

The process by which plants use light energy to make glucose is called photosynthesis.

During this process of sugar production, carbon dioxide combines with water to form glucose and oxygen is released (see Equation below). Oxygen that is produced in photosynthesis is given off as a gas. If a lot of oxygen is being given off, photosynthesis is occurring rapidly. If little oxygen is being given off, photosynthesis is occurring slowly. The amount of trapped light energy and the amount of carbon dioxide available affects the rate of photosynthesis.



The purpose of adding sodium bicarbonate powder to the water increases the amount of carbon dioxide in the water.

Objectives:

The student will:

1. Observe evidence of photosynthesis in a water plant.
2. Assemble the equipment needed to measure the rate of photosynthesis in elodea (water plant).
3. Count bubbles of oxygen gas given off by elodea to determine the rate of photosynthesis.
4. Change the conditions of photosynthesis by altering light intensity and carbon dioxide amount, and determine the effects on the photosynthesis rate.
5. Prepare a graph of the collected data and analyze it.

Materials:

(For each group of two students)

elodea (water plant)	lamp (40 - 60 watt)
plastic tube	metric ruler
dechlorinated water (room temperature)	tape
sodium bicarbonate powder (baking soda)	clock or timer
scissors	

Methods:

Setting Up the Experiments

1. Obtain a sprig of elodea. Remove several leaves from around the cut end of the stem. Slice off a portion of the stem at an angle and lightly crush the cut end of the stem.
2. Place the plant into the plastic tube, stem end down, filled with water.
3. Gently tap the tube on the table to remove any excess bubbles.

PART A Intensity vs oxygen production

1. Place a 40 watt lamp 5 cm from the plant. After one minute, count and record the number of oxygen bubbles rising from the plant. Count and record the number of bubbles for five minutes.
2. Run a second five-minute trial. Record and average your results.
3. Move the lamp so it is 10 cm from the plant. After one minute count and record bubbles for two five-minutes trials. Again, average and record your results
4. Move the lamp so it is 20 cm from the plant. After one minute count and record bubbles for two five-minutes trials. Again, average and record your results.

PART B Carbon Dioxide and oxygen production

4. Add a pinch of sodium bicarbonate powder to the plastic tube. Place the lamp 5 cm from the plastic tube. After one minute, record bubbles for two five-minute trials. Average and record your results.
5. Prepare a graph of your results. Use the average number of bubbles for the vertical axis. Use the type of environmental condition for the horizontal axis.

Questions:

1. How does this investigation demonstrate that plants give off oxygen during photosynthesis? Explain your answer based on your observations.
2. How does the rate of photosynthesis change when the light source is moved from a distance of 5 cm to 20 cm?
3. How does the rate of photosynthesis change when sodium bicarbonate is added to the water?

