Lab: Exploring the Rate of Photosynthesis

Photosynthesis is the process by which plants take carbon dioxide from the atmosphere, add water, and use the energy of sunlight to produce sugar.

Photosynthesis occurs in the chloroplast, an organelle in plant cells that contains the molecule chlorophyll. Chlorophyll absorbs the energy of sunlight. That light energy is converted to chemical energy through the steps of photosynthesis.

The reactions of photosynthesis can be divided into two major types: light-dependent reactions and light-independent reactions. The light-dependent reactions convert energy from the sun into a form that the chloroplast can then use to make sugar from carbon dioxide, in the process producing oxygen as a waste product. The light-independent reactions use that energy to make glucose from carbon dioxide and water.

Materials Needed:

- ✓ 3 test tube
- ✓ Elodea cuttings (aquatic plant)
- ✓ sodium bicarbonate (baking soda)
- ✓ 3 beakers with water
- ✓ lamp

Measurement of Photosynthesis

There are various set-ups that can be used to measure the rate of photosynthesis, each relies on counting the oxygen produced during the reaction.

Start by setting up both test tubes and water beakers.

Add a pinch of baking soda to the bottom of both test tubes and then fill ¾ of the way full with water.

Cut 2 elodea stems at an angle, place the end of the stem between your fingers and crush the stem at the end where you made the cut. Each stem should fit into the test tube and should be completely submerged in water.

Fill each of the breakers halfway with water.

You will set up two different experiments to see which method captures the oxygen released the best.

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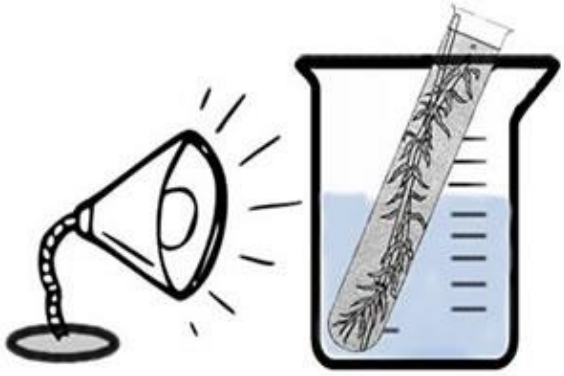
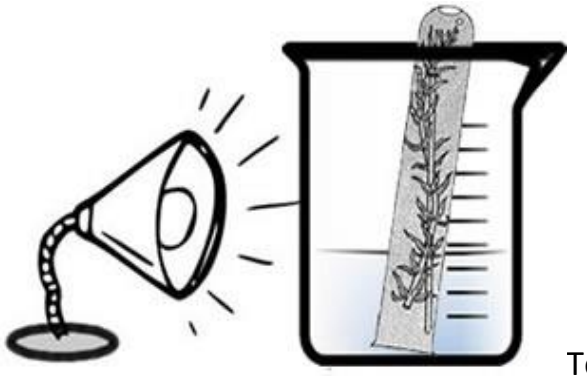
Test Tube 1: *Place the test tube inside the breaker with the opening of the test tube fasting upward. Place the breaker and test tube in front of the light. As the water warms up, count the bubbles as they escape from the test tube to measure the rate of reaction.*



Test Tube 1 Design

Test Tube 2: *Place the test tube inside the breaker with the opening of the test tube fasting down/ inverted. Place the breaker and test tube in front of the light. As the water warms up, the air bubble that forms at the end of the test tube can be measured to determine how much oxygen was collected.*



Test Tube 2 Design

If you do not see bubbles right away, re-cut and crush the stems, experiment with moving the light closer to the apparatus. Your goal is to find a way to consistently measure the rate of photosynthesis using any of the designs above.

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Written Lab Report: Exploring the Rate of Photosynthesis

Document the following items in the lab report below.

Group Members Names:

Explain photosynthesis and include the chemical equation:

Briefly discuss the experimental set-up and how it can be used to measure the rate of photosynthesis:

Group Hypothesis of which design you believe will work better and why:

<u>Photosynthesis Experiment Data collection:</u>

Design 1, first trial – Count for 30 seconds and record Air Bubbles Release _____

Design 1, second trial – Count for 30 seconds and record Air Bubbles Release _____

Design 1, third trial - Count for 30 seconds and record Air Bubbles Release _____

Design 2, first trial – Count for 30 seconds and record size of air bubble _____

Design 2, second trial – Count for 30 seconds and record size of air bubble _____

Design 2, third trial – Count for 30 seconds and record size of air bubble _____

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Conclusion: What your hypothesis correct? Explain by using your data to support or refute your claim (conclusion).

Summarize your overall findings and discuss any experimental errors or problems you encountered. This is also a good place to include any personal thoughts about your learning experience.

Critical Thinking Question: Conditions for Photosynthesis

1. With the members of your group, brainstorm variables which may affect the rates of photosynthesis.