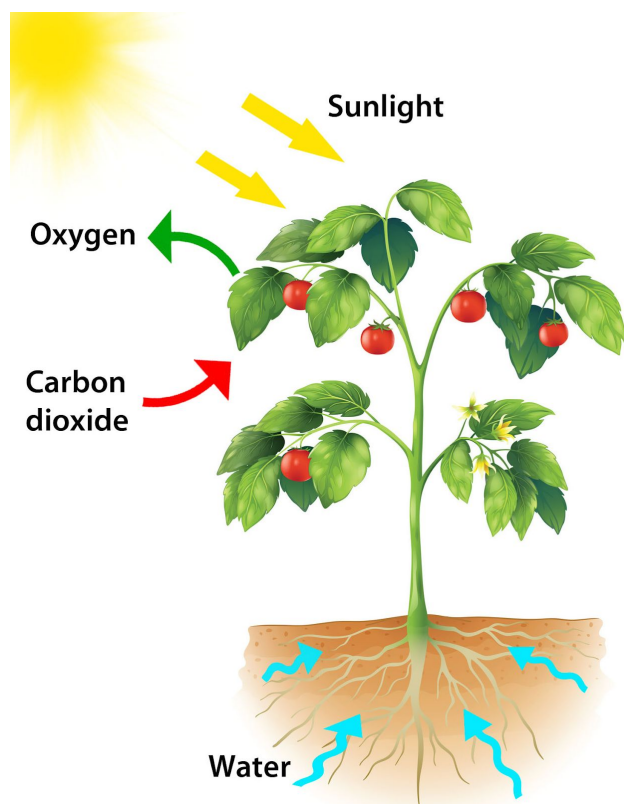


Lab 5: Photosynthesis: What Conditions Affect the Rate of Photosynthesis in Plants?

Introduction

Green plants have the ability to produce their own supply of sugar through the process of photosynthesis. Photosynthesis is a complex chemical process in which green plants produce sugar and oxygen for themselves. The equation for photosynthesis is as follows:



The plant uses the sugar it produces through photosynthesis to grow and produce more leaves, stems, and roots—the biomass of the plant. Plants therefore get their mass from air. The process of photosynthesis, however, does not happen all the time, and when it happens depends on a number of environmental factors. For example, plants need a supply of water, carbon dioxide, and light energy for photosynthesis to work. Plants must get these resources from the surrounding environment. The process of photosynthesis can also slow down or speed up depending on environmental conditions. In this lab investigation, you will explore how two different environmental conditions (temperature and light intensity) affect how quickly photosynthesis takes place within a plant. You will then develop a conceptual model that explains why.

Your Task

Design a series of experiments to determine how temperature and light intensity affect the rate of photosynthesis in plants. Then develop a conceptual model that explains why these environmental factors affect the rate of photosynthesis in the way that they do.

The guiding question of this investigation is: **Why do temperature and light intensity affect the rate of photosynthesis in plants?**

Materials

You may use any of the following materials during your investigation:

- Elodea plant
- Graduated cylinder
- Handheld light or desk lamp
- Ruler
- Ice
- Hot plate
- Thermometer

Getting Started

First, you will conduct a baseline test in order gather data as your control condition. Then, you will make hypotheses about how two different variables (light intensity and temperature) might affect the rate of photosynthesis in Elodea plants, and then you will design and carry out a series of experiments under different conditions to test your hypotheses. The rate of photosynthesis can be measured by counting the number of oxygen bubbles produced by the Elodea plants in each 2-minute trail. Once you have carried out your series of experiments, you will need to develop a conceptual model (diagram and/or explanation). Your model needs to explain why these environmental factors affect the rate of photosynthesis in the way that they do. The model should also explain what is happening at the cellular level during the process of photosynthesis.

Baseline Test: Control

First conduct a baseline test of the rate of photosynthesis under standardized conditions (room temperature water & 10 cm. light source).

- a. Peel the leaves off of the stem of the elodea and crush the stem with your fingers (this allows oxygen bubbles to escape from the stem more easily).
- b. Place the elodea sprig upside down into the graduated cylinder. The cylinder will be filled with normal tap water or spring water, and the stem of the elodea should be submerged 1-2 inches in the water.
- c. Place their light source 10 cm. from the body of the elodea sprig and count the number of oxygen bubbles released from the stem over a 2 minute period. This is the baseline test. Record data.

Experimental Conditions

After the baseline test, write several **hypotheses** about how changing the temperature or light intensity might increase or decrease the rate of photosynthesis. Then manipulate one variable at a time to test this hypothesis (i.e. increasing or decreasing the temperature of the water, or moving the light source closer or farther away). Record the conditions of the test and the oxygen bubble count for a 2-minute trial. Repeat as needed to collect necessary data.

Report

Once you have completed your research, you will need to prepare an investigation report that consists of four sections (be sure to have section headings):

1. Introduction: Give some background information on the topic. Explain what question were you trying to answer and include a hypothesis. (Background info, research question and hypothesis)
2. Procedure: What did you do during your investigation and why did you conduct your investigation in this way? (How you collected and analyzed data)
3. Data: Include a data table and/or graph to show your results. Be sure to include a title for your table or graph with labels for the variables.
4. Conclusion: What is your argument? (Claim - Evidence - Reasoning)

Your report should answer these questions in two pages or less. The report must be typed, and any diagrams, figures, or tables should be embedded into the document. Type your report on Google Docs (12 point font, double-spaced) and share it with your teacher. Your report will be graded based on the rubric in the class syllabus.