



Photosynthesis

Scientific Investigation

Imagine a planet with limited oxygen. There would be few animals, if any. Earth could be such a planet if plants were removed from our biosphere. Plants produce more than food for consumers; they also take in carbon dioxide exhaled by humans and release oxygen gas, which is inhaled by humans. Without plants, Earth's atmosphere would run out of oxygen, and then organisms that depend on oxygen to breathe would choke in a carbon-dioxide-rich atmosphere. Fortunately, the Sun emits radiant energy in all directions, including toward Earth's surface. Some of this radiant energy is in the form of light and transforms to chemical energy during the process of photosynthesis.



Chemical energy is stored as sugar (glucose), which forms the basis of energy flow in ecosystems, and oxygen is released into the atmosphere, allowing organisms on Earth to survive and thrive.

In this investigation, you will learn how matter and energy interact when a water plant, *Elodea*, transforms radiant energy into chemical energy during the process of photosynthesis. You will do this by measuring the production of a gas that results from a photosynthetic reaction.

Pre-Activity Questions:

Answer the following questions before starting your investigation.

1. What is the question that you are trying to answer in this investigation, and why is it important?

2. What is the independent variable (also known as the manipulated variable)?

3. What is the dependent variable (also known as the responding variable)?

4. Is there a control, and if so, what is it?

5. How will the dependent variable change when the independent variable changes?



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Scientific Investigation, continued

Pre-Activity Questions, continued

6. What is your hypothesis?

7. What materials will you need to conduct this investigation?

8. Are there any safety considerations? If so, what are they?

Sample Procedure

1. Pour 500 mL of distilled water into each beaker.
2. Weigh 15 g of baking soda on the scale for each beaker. Add the baking soda to each beaker and stir well.
3. Place a sprig of *Elodea* inside each beaker, and place the weight to ensure the plant stays submerged in the water.
4. Put one *Elodea* plant setup under the desk so that light is blocked from it. Place another *Elodea* plant setup near the lamp. Leave one *Elodea* plant setup on the desk so that it is receiving only the amount of light available in the classroom.
5. One student in the group will serve as the timekeeper. Three other students from the group will each pick one setup to watch. They will observe their plant setup for one minute and count the total number of bubbles that are produced by the *Elodea* plant.
6. Share the data from each *Elodea* with the other members of the group.
7. Record group results on the Class Gas Data table.



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Group _____ Setup Results

Setup	Diagram	Observations (Bubbles per minute)
Control		
Added Radiant Energy		
Lack of Radiant Energy		



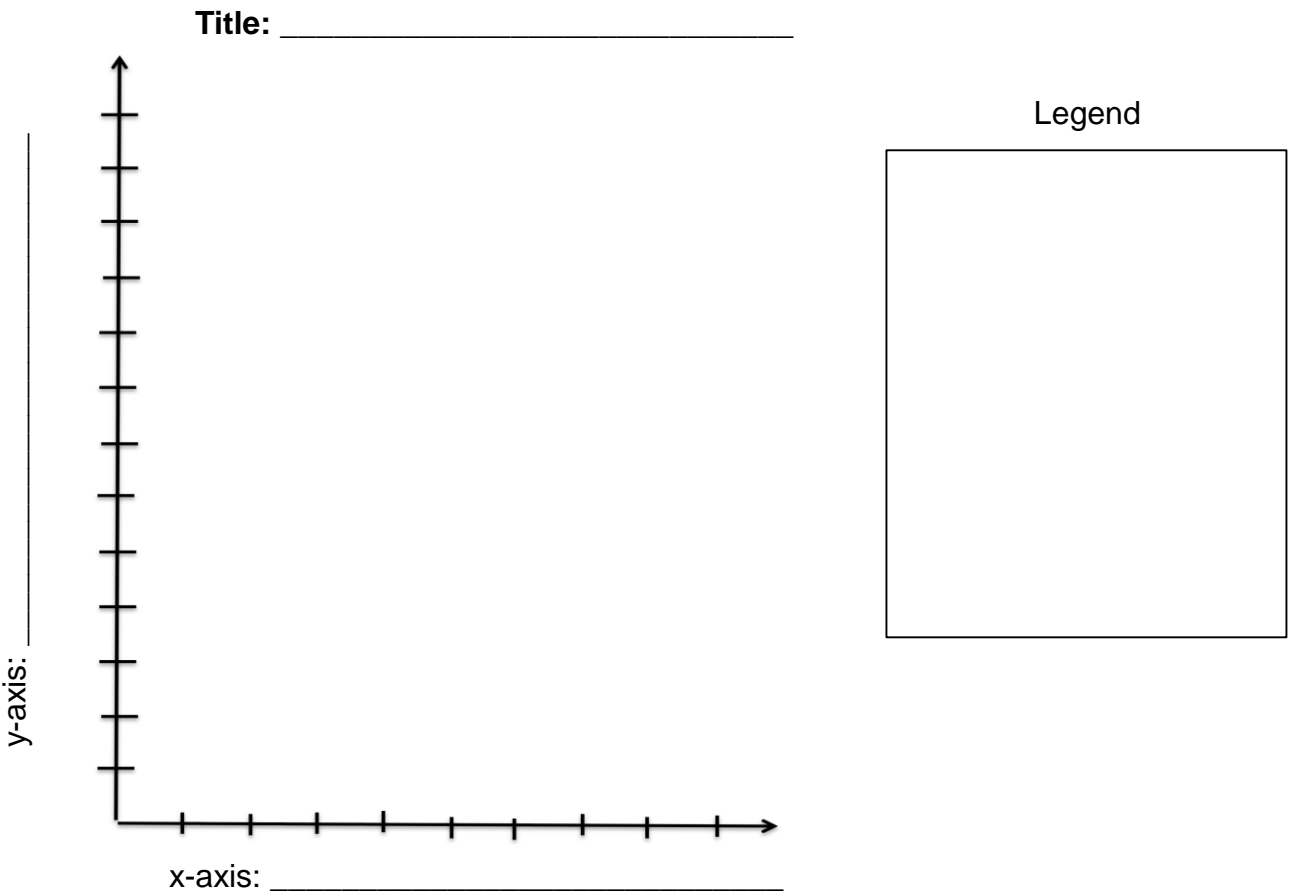
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Class Gas Collection Data

Number of O ₂ bubbles produced	1	2	3	4	5	6	7	8	Average
Control									
Added Radiant Energy									
Lack of Radiant Energy									

Use either your group's data or the class average data from the Class Gas Collection Data to make a bar graph. Title the graph and create a legend if needed. Label the x-axis (Setup) and the y-axis (Number of Bubbles) with the appropriate units.





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Data Analysis

Use the data you organized to answer the following questions:

1. What was produced by the plant?

2. What happened to the oxygen production when radiant light was increased?

3. What happened to the oxygen production when radiant light was removed?

4. How do my results compare to or differ from the other groups in the class?

Conclusion and Scientific Explanation

Using the data that you collected, write a scientific explanation with regards to what the three different setups of the *Elodea* plant tell us about the process of photosynthesis. In your explanation, make sure to include how matter and energy interact in the process. You may use a separate piece of paper if necessary.



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Rubric for Writing a Scientific Explanation

Points Awarded	2	1	0
Claim	Not applicable.	Answers the question and is accurate based on data.	No claim or does not answer the question.
Evidence	Cites data and patterns within the data. Uses labels accurately.	Cites data from the data source, but not within the context of the prompt.	No evidence, or cites changes but does not use data from data source.
Reasoning	Cites the scientifically accurate reason using correct vocabulary and connects this to the claim. Shows accurate understanding of the concept.	Cites a reason, but it is inaccurate or does not support the claim. Reasoning does not use scientific terminology or uses terminology inaccurately.	No reasoning, or restates the claim but offers no reasoning.
Rebuttal	Rebuttal provides reasons for different data or outliers in the data. Can also provide relevance to the real world or other uses for the findings.	Rebuttal is not connected to the data or is not accurate.	Does not offer a rebuttal.