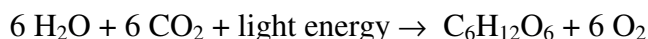


Lab #7H Photosynthesis and Respiration

Plants make sugar, storing the energy of the sun into chemical energy, by the process of photosynthesis. When they require energy, they can tap the stored energy in sugar by a process called cellular respiration.

The process of photosynthesis involves the use of light energy to convert carbon dioxide and water into sugar, oxygen, and other organic compounds. This process can be summarized by the following reaction:



Cellular respiration refers to the process of converting the chemical energy of organic molecules into a form immediately usable by organisms. Glucose may be oxidized completely if sufficient oxygen is available in the following reaction:



All organisms, including plants and animals, oxidize glucose for energy. Often, this energy is used to convert ADP and phosphate into ATP. Using the O₂ Gas Sensor, you will attempt to monitor the oxygen consumed or produced by plants.

OBJECTIVES

In this experiment you will

- Use an O₂ Gas Sensor to measure the amount of oxygen gas consumed or produced by plants during photosynthesis or respiration.
- Determine the rate of respiration and photosynthesis of a plant.

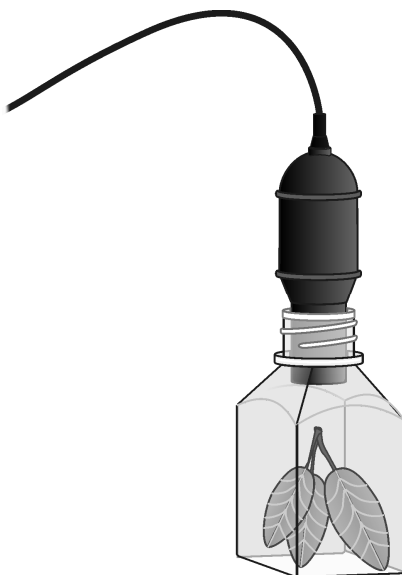


Figure 1

MATERIALS

LabQuest	aluminum foil
LabQuest App	plant leaves
Vernier O ₂ Gas Sensor	lamp
250 mL respiration chamber	forceps
500 mL tissue culture flask	

PROCEDURE

1. Connect the O₂ Gas Sensor to LabQuest and choose New from the File menu. If you have an older sensor that does not auto-ID, manually set up the sensor.
2. On the Meter screen, tap Length. Change the data-collection length to 600 seconds.
3. Obtain several leaves from the resource table and blot them dry, if damp, between two pieces of paper towel.
4. Place the leaves into the respiration chamber, using forceps if necessary. Wrap the respiration chamber in aluminum foil so that no light reaches the leaves.
5. Place the O₂ Gas Sensor into the bottle as shown in Figure 1. Gently push the sensor down into the bottle until it fits snugly. The sensor is designed to seal the bottle without the need for unnecessary force. Wait 3 minutes before proceeding to Step 7.
6. Start data collection. Data will be collected for 10 minutes. Record percent O₂ at 60 second intervals in data table 1.
7. Remove the aluminum foil from around the respiration chamber.
8. Fill the tissue culture flask with water and place it between the lamp and the respiration chamber. The flask will act as a heat shield to protect the plant leaves.
9. Turn the lamp on. Place the lamp as close to the leaves as reasonable. Do not let the lamp touch the tissue culture flask. Create a heat shield for the sensor. Direct heat on the sensor may alter data collection. Note the time, the leaves should be exposed to the light from the lamp for 3 minutes prior to beginning data collection.
10. Start data collection. Data will be collected for 10 minutes. Record percent O₂ at 60 second intervals in data table 2.
11. Wait three minutes and then repeat Steps 7–9.
12. Graph both runs of data on a single graph.
13. Remove the plant leaves from the respiration chamber, using forceps if necessary. Clean and dry the respiration chamber.

DATA

Table 1	
Time in seconds	% O ₂
60	
120	
180	
240	
300	
360	
420	
480	
540	
600	

Table 2	
Time in seconds	% O ₂
60	
120	
180	
240	
300	
360	
420	
480	
540	
600	

QUESTIONS

1. Did the percent O₂ decrease in either data table? If so, what is the biological significance of this?
2. Did the percent O₂ increase in either data table? If so, what is the biological significance of this?
3. Do you have evidence that cellular respiration occurred in leaves? Explain.
4. Do you have evidence that photosynthesis occurred in leaves? Explain.
5. What would happen to the data in trial 1 if you added crickets to the chamber? Explain.
6. What would happen to the data in trial 2 if you added crickets to the chamber? Explain.
7. List three factors that might influence the rate of oxygen production or consumption in leaves. Explain how you think each will affect the rate.

EXTENSIONS

1. Design an experiment to test one of the factors that might influence the rate of oxygen production or consumption in Question 5.