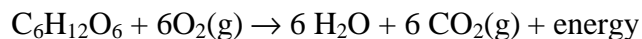


Cell Respiration

Cell 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 by the following equation:



All organisms, including plants and animals, oxidize glucose for energy. Often, this energy is used to convert ADP and phosphate into ATP. It is known that peas undergo cell respiration during germination. Do peas undergo cell respiration before germination? The results of this experiment will verify that germinating peas do respire. Using your collected data, you will be able to answer the question concerning respiration and non-germinating peas.

Using the O₂ Gas Sensor, you will monitor the oxygen consumed by peas during cell respiration. Both germinating and non-germinating peas will be tested. Additionally, cell respiration of germinating peas at two different temperatures will be tested.

OBJECTIVES

In this experiment, you will

- Use an O₂ Gas Sensor to measure concentrations of oxygen.
- Study the effect of temperature on cell respiration.
- Determine whether germinated and non-germinated peas respire.
- Compare the rates of cell respiration in germinated and non-germinated peas.

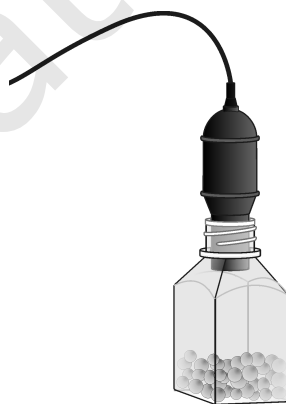



Figure 1

MATERIALS

computer
Vernier computer interface
LoggerPro
Vernier O₂ Gas Sensor
two 100 mL beakers

25 germinating peas
25 non-germinating peas
250 mL respiration chamber
ice cubes
thermometer

PROCEDURE

1. Connect the O₂ Gas Sensor to the computer interface.
2. Prepare the computer for data collection by opening the file “11A Cell Resp O₂” from the *Biology with Vernier* folder of *LoggerPro*.
3. Obtain 25 germinating peas and blot them dry between two pieces of paper towel. Use the thermometer to measure the room temperature. Record the temperature in Table 1.
4. Place the germinating peas into the respiration chamber.
5. Place the O₂ Gas Sensor into the bottle as shown in Figure 1. Gently push the sensor down into the bottle until it stops. The sensor is designed to seal the bottle without the need for unnecessary force.
6. Wait two minutes, then begin collecting data by clicking . Data will be collected for 10 minutes.
7. When data collection has finished, remove the O₂ Gas Sensor from the respiration chamber. Place the peas in a 100 mL beaker filled with cold water and an ice cube.
8. Fill the respiration chamber with water and then empty it. Thoroughly dry the inside of the respiration chamber with a paper towel.
9. Determine the rate of respiration:
 - a. Click the Linear Fit button, , to perform a linear regression. A floating box will appear with the formula for a best fit line.
 - b. Record the slope of the line, m , as the rate of respiration for germinating peas at room temperature in Table 2.
 - c. Close the linear regression floating box.
10. Move your data to a stored run. To do this, choose Store Latest Run from the Experiment menu.
11. Obtain 25 non-germinating peas and place them in the respiration chamber
12. Repeat Steps 5–10 for the non-germinating peas.

Part II Germinating peas, cool temperatures

13. Remove the peas from the cold water and blot them dry between two paper towels.
14. Repeat Steps 5–9 to collect data with the germinating peas at a cold temperature.
15. To print a graph showing all three data runs:
 - a. Label all three curves by choosing Text Annotation from the Insert menu, and typing “Room Temp Germinated” (or “Room Temp Non-germinated”, or “Cold Germinated”) in the edit box. Then drag each box to a position near its respective curve. Adjust the position of the arrow head.
 - b. Print a copy of the graph, with all three data sets and the regression lines displayed. Enter your name(s) and the number of copies of the graph you want.

DATA

Table 1	
Condition	Temperature (°C)
room	

Table 2	
Peas	Rate of Respiration (%/min)
Germinating, room temperature	
Non-germinating, room temperature	
Germinating, cool temperature	

QUESTIONS

1. Do you have evidence that cell respiration occurred in peas? Explain.
2. What is the effect of germination on the rate of cell respiration in peas?
3. What is the effect of temperature on the rate of cell respiration in peas?
4. Why do germinating peas undergo cell respiration?

EXTENSIONS

1. Compare the respiration rate among various types of seeds.
2. Compare the respiration rate among seeds that have germinated for different time periods, such as 1, 3, and 5 days.
3. Compare the respiration rate among various types of small animals, such as insects or earthworms.

Vernier Lab Safety Instructions Disclaimer

THIS IS AN EVALUATION COPY OF THE VERNIER STUDENT LAB.

This copy does not include:

- **Safety information**
- **Essential instructor background information**
- **Directions for preparing solutions**
- **Important tips for successfully doing these labs**

The complete *Biology with Vernier* lab manual includes 31 labs and essential teacher information. The full lab book is available for purchase at:

<http://www.vernier.com/cmat/bwv.html>



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