Name_____Period_____Assignment #_____

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 according to the following equation:

$$C_6H_{12}O_6 + 6O_2(g) \rightarrow 6\ H_2O + 6\ CO_2(g) + \text{energy}$$

All organisms, including plants and animals, oxidize glucose for energy. Often, this energy is used to convert ADP and phosphate into ATP. Peas undergo cell respiration during germination. Do peas undergo cell respiration before germination? Using your collected data, you will be able to answer the question regarding respiration and non-germinating peas.

Using the CO_2 Gas Sensor and O_2 Gas Sensor, you will monitor the carbon dioxide produced and 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 investigated.

OBJECTIVES

In this experiment, you will

- Use an O_2 Gas Sensor to measure concentrations of oxygen gas.
- Use a CO_2 Gas Sensor to measure concentrations of carbon dioxide gas.
- Determine whether germinating peas and non-germinating peas respire.
- Compare the rates of cell respiration in germinating and non-germinating peas.

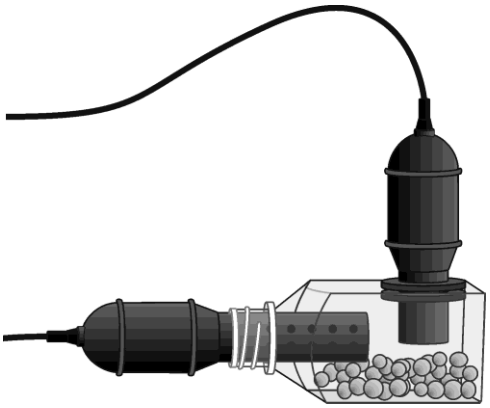

Figure 1

MATERIALS

LabQuest
25 germinated peas
25 non-germinated peas
BioChamber 250
Logger *Pro* (optional)

PROCEDURE

1. If your CO_2 Gas Sensor has a switch, set it to the Low (0–10,000 ppm) setting. Connect the O_2 Gas Sensor and the CO_2 Gas Sensor to LabQuest. Choose New from the File menu. If you have older sensors that do not auto-ID, manually set up the sensors.

2. On the Meter screen, tap Rate. Change the data-collection rate to 0.1 samples/second and the data-collection length to 600 seconds.

3. Obtain 25 germinated peas.

4. Place the germinated peas into the respiration chamber.

5. Place the O_2 Gas Sensor into the BioChamber 250 as shown in Figure 1. Insert the sensor snugly. The O_2 Gas Sensor should remain vertical throughout the experiment. Place the CO_2 Gas Sensor into the neck of the BioChamber 250.

6. Wait two minutes, then start data collection.

7. When data collection has finished, remove the sensors from the respiration chamber.

8. Fill the respiration chamber with water and then empty it. Thoroughly dry the inside of the respiration chamber with a paper towel.

9. Perform a linear regression to calculate the rate of respiration.
   a. Choose Curve Fit from the Analyze menu and select CO_2 Gas.
   b. Select Linear as the Fit Equation. The linear-regression statistics for these two data columns are displayed for the equation in the form
   $$y = mx + b$$
   c. Enter the absolute value of the slope, *m*, as the rate of respiration for the CO_2 Gas Sensor in Table 2.
   d. Select OK.

10. Calculate the rate of respiration for the O_2 Gas Sensor.
    a. Choose Curve Fit from the Analyze menu and select O_2 Gas.
    b. Select Linear as the Fit Equation. The linear-regression statistics are displayed for the equation in the form
    $$y = mx + b$$
    c. Enter the absolute value of the slope, *m*, as the rate of respiration for the O_2 Gas Sensor in Table 2.
    d. Select OK.

11. Repeat Steps 4–10 substituting the germinated peas with non-germinated peas.

DATA

_____Teacher Initials for data collection germinating peas

_____Teacher Initials for data collection non-germinating peas