**Observing Photosynthesis and Respiration**

BACKGROUND:

Plants do photosynthesis to store the energy of the sun in the bonds of the glucose molecule as chemical energy. When they need energy to power cellular processes (such as growth or development), they can use the energy stored in the glucose molecule to charge up ATP molecules during cellular respiration. **Plants can (and do) carry out both photosynthesis and respiration at the same time.**

**All organisms**, including plants and animals**, do cellular respiration all the time to transfer the energy stored in glucose into ATP.** They convert ADP and phosphate into **ATP**. The energy from **ATP** is used to:

* Synthesize molecules,
* Move materials around within the organism,
* Grow (create new cells)
* Reproduce.

**Prelab Questions:**

1. The process of **photosynthesis** involves the use of light energy to convert carbon dioxide and water into sugar, oxygen, and other organic compounds. Please write the equation for this process below:

**Photosynthesis Equation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

1. **Cellular respiration** is the process of transferring the chemical energy stored in the bonds of glucose into ATP (the more immediate energy molecule). When oxygen is present, Glucose is completely broken down into carbon dioxide and water. Please write the equation for this process below:

**Cellular Respiration Equation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

1. What is the difference between matter and energy? Where is the **matter** in the glucose molecule, and where is the **stored energy?**
2. Where does the **stored energy in glucose** come from originally**,** and **what process puts it there?**
3. Where does the **matter in glucose** come from**, and what process puts it there?**

In this activity you will make predictions about what will happen to the **concentration of CO2 and O2** in the air around spinach leaves in several different situations. You will make these predictions by drawing graphs of the change in concentration. You will then observe one of the situations, and adjust your predictions in the other two.

As you make your prediction, remember:

* Photosynthesis happens in leaves as long as they are green, and they have access to all the requirements of photosynthesis**. This is true even after the leaves are picked!**
* Concentration means the amount of something, per amount of space/other substance. **In other words, concentration is very similar to percent!**
* We will be measuring concentration in PPT (parts per trillion), which means \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Predictions:** On the graphs below, draw how you predict the concentration of CO2 and O2 will change over the 15-minute time period, in a **completely sealed container.** Don’t worry about exact values: just estimate the direction and steepness of the slope (change/time) of the graph. **After you have observed what happens in the light, adjust your predictions in a different color!**

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CO2 Concentration (ppt)

0 Time (minutes) 15

Change in CO2 Concentration over Time

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O2 Concentration (ppt)

0 Time (minutes) 15

Change in O2 Concentration over Time

Spinach Leaves **in the light**

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CO2 Concentration (ppt)

0 Time (minutes) 15

Change in CO2 Concentration over Time

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O2 Concentration (ppt)

0 Time (minutes) 15

Change in O2 Concentration over Time

Spinach Leaves **in the dark**

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CO2 Concentration (ppt)

0 Time (minutes) 15

Change in CO2 Concentration over Time

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O2 Concentration (ppt)

0 Time (minutes) 15

Change in O2 Concentration over Time

Spinach Leaves **in the light + a snail**

**Analysis Questions**

1. How do **matter and energy** move through the biochamber system? Either describe the movement of the matter and the energy, or draw a diagram to show it.
2. Why would the **amount of O2** different in some/all of the situations?
3. Why would the **amount of CO2** be different in some/all of the situations?
4. Where would the **slope of the CO2** concentration be positive, and what does that mean?
5. Where would the **slope of the O2** concentration be positive, and what does that mean?
6. What process is happening in each situation? Photosynthesis, respiration, or both?

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