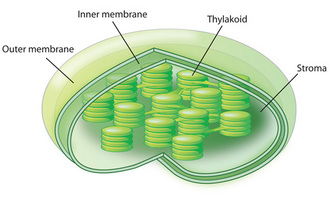
Photosynthesis Gizmo: Virtual Lab Experience

Directions: Read the **Background** information and then answer the **Pre-Lab Questions.**

**Background:**

Photosynthesis is the process of converting light energy to chemical energy and storing it in the bonds of sugar molecules. This process occurs in plants and some algae (kingdom *Protista*). The process of photosynthesis occurs in the chloroplasts of the plant cells, where sacs (known as thylakoids) filled with the green pigment chlorophyll absorb/reflect light energy. Photosynthesis primarily occurs in plant leaves, and little to none occurs in the plant stem. As long as a plant is in water-rich soil, has access to carbon dioxide in the air, and has a light source, the plant can go through photosynthesis. When the plant then produces glucose (along with which other by-product that is released to the air?) though photosynthesis, it can then go through the process of cellular respiration to produce cellular energy.

**Pre-Lab Questions:**

1. Define photosynthesis: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. Plants are the only organisms that use photosynthesis. Agree or Disagree  
Cite evidence from the text: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. Where does photosynthesis occur both in the plant and in the plant cell? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. The green pigment responsible for absorbing/reflecting light: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. Using the information above, write the chemical equation for photosynthesis.   
(Using words, not chemical formulas.)

light

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Lab Intro:**

Today you will be investigating the variables that affect the rate of photosynthesis, as measured by the amount of oxygen produced by a plant. Because oxygen is produced when plants go through photosynthesis, we can use this to determine photosynthetic rate (the rate at which plants go through photosynthesis). This is a similar concept to when we used carbon dioxide production to determine the rate of cellular respiration during the BTB lab. There are four variables you will investigate today:

Variables

1. light intensity
2. carbon dioxide (CO2) level
3. temperature
4. color

Your job is to use the toggles on the gizmo to determine how each of the variables affects the rate of photosynthesis. This is where you will use your laboratory/investigative skills to effectively answer each scientific question. For example, how many variables should you adjust at one time if you want conclusive data? (answer: \_\_\_\_\_\_\_\_\_\_\_) As the great scientist you are, remember to record data points using the gizmo’s graphing function so you have evidence for your claims. We will review how to do this as a class.

Finally, we need to set up a control. For the purposes of this activity, let’s assume that the control setting on the gizmo is as follows:

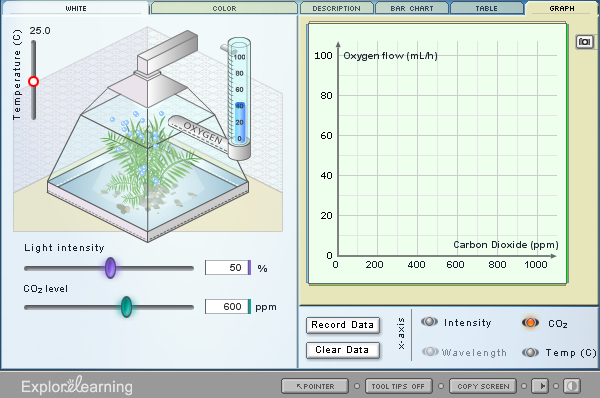
Control

-white light

-temperature = 25 °C

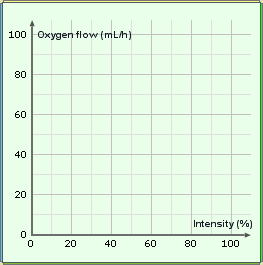
- CO2 level = 600ppm

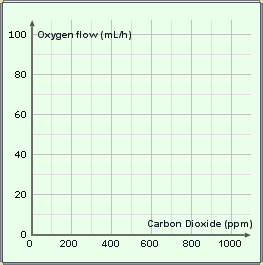
-light intensity = 50%

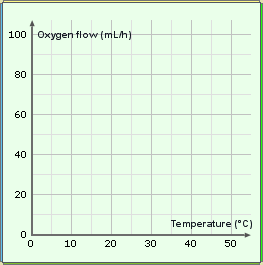
With this in mind, you will now alter the settings such that you can determine how each variable affects photosynthetic rate. Remember, you will tell this by how much the oxygen meter rises, with a higher oxygen level representing a higher rate of photosynthesis.

For each variable you will be expected to explain how it affects the rate of photosynthesis, and provide a graph as evidence. The space to record your data is found on the next page, along with a few additional questions. Now that you have completed the pre-lab questions and read the laboratory intro, you are fully prepared to complete this assignment.  
First watch your teacher demo how to use the gizmo, then get a computer, and begin! Go to [www.explorelearning.com](http://www.explorelearning.com) username AND password: tbaGIZMO

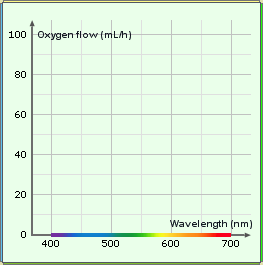
**Laboratory Questions**:  
Directions: Use complete sentences to fully explain each relationship, and draw a graph to support your claim on the provided graphing space as created by your data from the gizmo.

1. What is the relationship between light intensity and the rate of photosynthesis?

2. What is the relationship between CO2 level and the rate of photosynthesis?



3. What is the relationship between temperature and the rate of photosynthesis?

4. What is the relationship between the light's wavelength (color) and the rate of photosynthesis?

Which colors produce the greatest amount of oxygen production (photosynthetic rate)?

Which colors produce the least amount of oxygen production (photosynthetic rate)?

Why do you think each of these is the case?

5. Now toggle the controls to see which experimental setup leads to the highest amount of oxygen production possible (you should be able to nearly reach 100% oxygen production).

What oxygen level did you reach? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ What levels of each variable are required?

Light intensity = CO2 Level = Temp. = Wavelength =

6. Now take the five Assessment Questions at the bottom of the gizmo.

What score did you get the first time you took the test? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
  
Now take it again. What score did you get the second time? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Write down any notes you wish to record from these assessment questions. (Hint hint!)

Notes:

7. Based on the information you gathered today, you now have the ability to inform local farmers of the ideal conditions in which to grow their greenhouse plants. Write a paragraph (meaning complete sentences!) describing how they should set up their greenhouse to allow their plants to be healthy and photosynthesize at the greatest rate. Make sure to include evidence in your explanation (how each variable affects the rate of photosynthesis). You may attach an additional piece of lined paper if necessary.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_