MiSP Photosynthesis Lab L3

Name ______________________________ Date_____________

Objective:

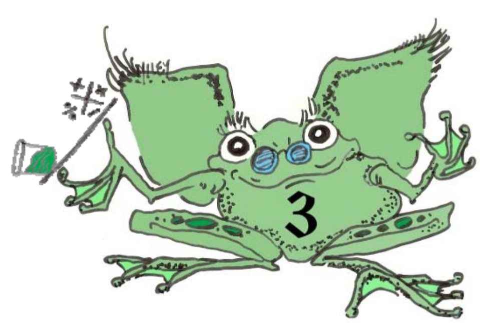
To compare the number of bubbles of oxygen produced over a period of time by an aquarium plant (elodea) when light intensity is changed.

Introduction:

Many people like to keep fish in an aquarium in their home. Fish need oxygen in order to live. One method to provide oxygen is to use a pump to bubble air (air contains about 20% oxygen) into the aquarium. Another method is to keep water plants in the aquarium. Plants use the energy in light to produce carbohydrates during photosynthesis. The process of photosynthesis also produces oxygen. (That is how all animals on Earth are provided with oxygen.) Since plants need light in order to perform photosynthesis and make oxygen, will more light cause plants to make more oxygen?

Materials:

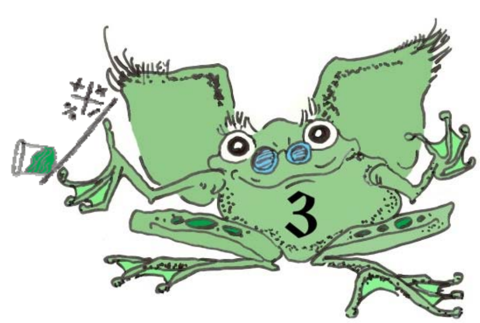
- 16 x 150 mm test tubes ¾-filled with aquarium water containing sodium bicarbonate (baking soda). (Sodium bicarbonate will provide carbon dioxide to the elodea for photosynthesis.)
- test tube rack
- Lamp and stand with 100 W lightbulb
- Metric ruler
- Scissors
- 1 piece of elodea (about 12 cm long)



Procedures:

Check off each step as you complete it.

1. ☐ Gather all of the materials EXCEPT THE ELODEA.
2. ☐ Set up the light with a 100 W bulb 2 cm above the top of the test tube.
3. ☐ Get the 12 cm piece of elodea by cutting it with scissors from a larger piece. (You may need to remove a few leaves from the cut end.)
4. ☐ Place the elodea piece in the test tube containing sodium bicarbonate solution. The CUT END of the elodea should be facing UP! Place the test tube in a test rack.
5. ☐ Turn on the light, and wait for 3-5 minutes.
6. ☐ Begin data collection. Start the timer and carefully count the bubbles of oxygen that rise from the cut end of the elodea in 3 MINUTES
7. ☐ Record the number of bubbles in the data table.
8. ☐ Turn the light off and move the light 10 cm from the top of the test tube containing the elodea.
9. ☐ Repeat steps 5, 6, and 7.
10. ☐ Turn the light off and move the light 5 cm from the top of the test tube containing the elodea.
11. ☐ Repeat steps 5, 6, and 7.
12. ☐ Turn the light off and move the light 2 cm from the top of the test tube containing the elodea.
13. ☐ Repeat steps 5, 6, and 7.
14. ☐ Return all materials to their proper location.
15. ☐ Record and average the data from all groups.

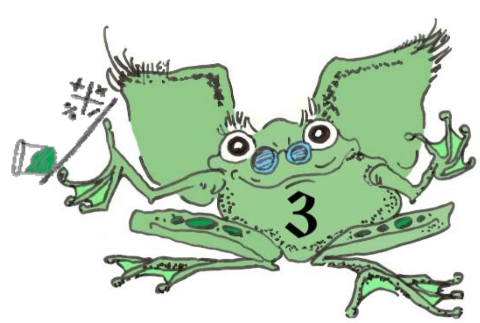


Record your data:

Distance from light (cm)	Number of Bubbles of Oxygen Produced in 3 Minutes
20 cm	
10 cm	
5 cm	
2 cm	

Record class data:

Distance from light (cm)	Number of Bubbles of Oxygen Produced in 3 Minutes						
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Average
20 cm							
10 cm							
5 cm							
2 cm							



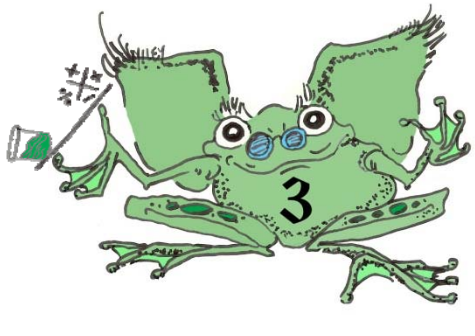
Graph class data:

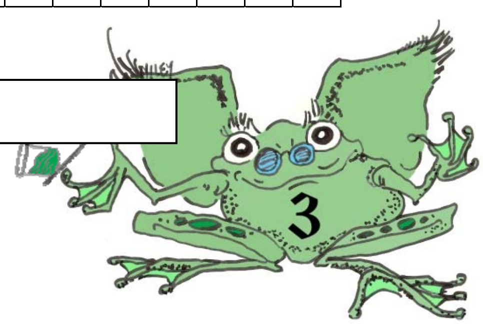
Use the class data table to create a graph on the next page. The graph will show the relationship between light intensity as measured by distance between the light source and the plant and the number of bubbles of oxygen produced in 5 minutes.

1. Which of the variables did you manipulate? ____This is the independent variable, and it should be on the ____ axis. Label and scale this axis.

2. Which variable was the responding variable? ____This is the dependent variable, and it should be on the ____ axis. Label and scale this axis.

3. Plot the data points and draw a line of best fit.

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Analysis:

1. According to your graph, how many bubbles of oxygen would be produced if your distance was 6 cm? ___________

2. According to your graph, how many bubbles of oxygen would be produced if your distance was 25 cm? _________

3. As the bulbs' distance increases from 2 cm to 10 cm, how many more bubbles of oxygen are produced? ______________

4. What is the relationship between distance from the light source and the amount of oxygen produced by elodea plants doing photosynthesis?

   ____

   ____

5. If you continued to increase the distance of the lightbulb from the plant (50 cm, 100 cm, etc.), do you think the trend you see in the graph would continue or change? Explain your answer.

   ____

   ____

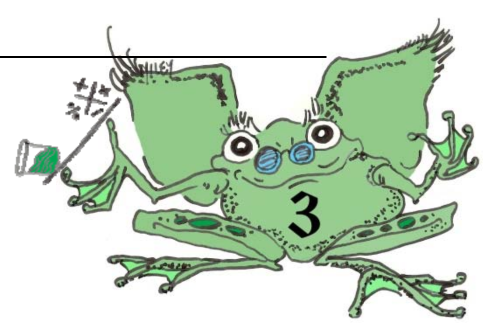
   ____

   ____

6. Recall what you know about science, plants, and photosynthesis. What two other variables can change the amount of oxygen produced by a water plant? Explain how changing the variables you picked will change the number of oxygen bubbles (cause an increase or a decrease).

   a. ____

   ____



b. ____

____

7. On the basis of this experiment, if you had an aquarium without an air pump, what would be the best lighting for the fish to get enough oxygen? Explain your answer.

____

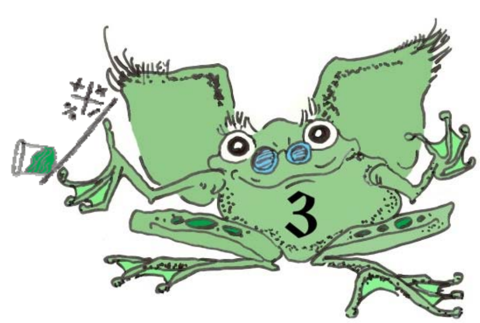
____

____

8. Use the information from the graph above to calculate the unit rates of change in oxygen produced as distance of the light from the plant changes. Use the formula below to complete the chart.

$$\text{Unit Rate of Change} = \frac{\Delta y}{\Delta x} = \frac{(y_2 - y_1)}{(x_2 - x_1)} = \frac{\Delta \text{ Number of bubbles produced in 3 minutes}}{\Delta \text{ distance of light from plant (cm)}}$$

Graph segment Ordered Pair (x_1, y_1) (x_2, y_2)	Δ Number of bubbles produced in 3 minutes Δy	Δ Distance of light from plant Δx	**Unit Rate of Change** $\Delta y/\Delta x$
2 cm to 5 cm			
10 cm to 20 cm			



9. How do the unit rates of change of the two sections of the graph compare (2 cm to 5 cm, 10 cm to 20 cm)?

____

____

____

10. The graph you made may not be a straight line. If it isn't a straight line, focus on the line segment from 10 cm to 20 cm.

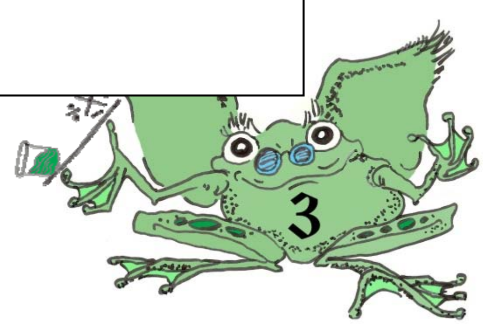
Use this section of the line, the unit rate of change you just calculated, and the equation for a line to find the *y*-intercept. The equation for a line is

$y = mx + b$, where m is the unit rate of change (slope) and

b is the *y*-intercept

Y-Intercept
$m =$ Ordered pair (x, y) = (___ , ___) $y = mx + b$ Solve for b:

11. Based on the unit rate of change you calculated above and the *y*-intercept, write an equation for the line segment from 10 cm to 20 cm.



12. Using the equation above, fill in the chart below to predict the number of oxygen bubbles that will be produced for each distance between the light source and the plant.

X	Y
Distance of light source from plant (cm)	Bubbles produced in 3 minutes
35	
50	
100