Name _____ Class _____ Date _____

OBSERVING THE RELATIONSHIP BETWEEN PHOTOSYNTHESIS AND RESPIRATION

BACKGROUND INFORMATION

Green plants bask in sunlight. They use the energy in the sun's rays to make food. The production of food also requires raw materials. When plants synthesize food, more precisely carbohydrates, they use carbon dioxide and water. The process of synthesizing carbohydrates with the aid of the energy in light is known as photosynthesis. The carbohydrates plants make are used by plants and animals alike as a source of energy. To release the energy contained in the bonds of carbohydrate molecules, the chemical reactions of photosynthesis must be reversed. The process in which energy is released from food is called respiration. Respiration also produces waste products, carbon dioxide and water, which are the same substances that served as raw materials for photosynthesis.

In water, carbon dioxide dissolves to form a weak acid. As a result, an acid-base indicator such as bromthymol blue can be used to indicate the presence of carbon dioxide. In this laboratory investigation, you will use bromthymol blue to explore the relationship between photosynthesis and respiration.

PROBLEM

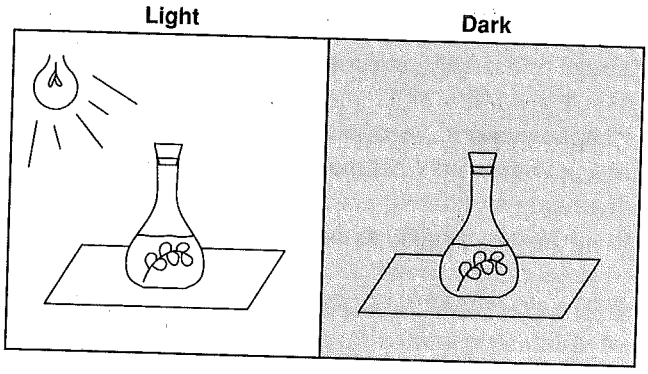
What is the relationship between the processes of photosynthesis and respiration?

MATERIALS *(per group)*

2 125-mL flasks	2 *Elodea*
2 #5 rubber stoppers	light source
100-mL graduated cylinder	drinking straw
bromthymol blue solution	

PROCEDURE

1. Using a graduated cylinder, measure out 100 mL of bromthymol blue solution for each of the two flasks. **CAUTION:** *Bromthymol blue is a dye and can stain your hands and clothing.*
2. Insert one end of a drinking straw into the bromthymol blue in one of the flasks. Gently blow through the straw. Keep blowing until there is a change in the appearance of the bromthymol blue solution. Repeat this procedure with the other flask. Record your observations in the data table.
3. Place a sprig of *Elodea* into each flask. Stopper the flasks.
4. Place one flask in the dark for 24 hours. Place the other flask on a sunny windowsill for the same amount of time. Artificial light may be used to supplement the sunlight.



5. After 24 hours, examine each flask. Note any change in the appearance of the bromthymol blue solution. Record your observations in the data table.

OBSERVATIONS

Data Table

	Bromthymol blue
Breath	
***Elodea* (light)**	
***Elodea* (dark)**	

1. What was the color of the bromthymol blue solution before you exhaled into it? After you exhaled into it?

_____

_____

2. What was the color of the bromthymol blue solution in the flask that was placed in the dark for 24 hours? In the flask that was placed in the light for 24 hours?

_____

_____

ANALYSIS AND CONCLUSIONS

1. What substance was released into the bromthymol blue solution when you exhaled into it?

How is this substance produced? _____

_____

_____

_____

_____

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2. Explain why the color of the bromthymol blue solution changed after you exhaled into it.

_____

_____

_____

3. Why was *Elodea* placed in both flasks? _____

_____

4. Which flask is the control? Describe additional controls that you might use for this experiment. _____

_____

5. Why are the results for the two flasks different? _____

_____

_____

6. How are photosynthesis and respiration related? _____

_____

_____

CRITICAL THINKING AND APPLICATION

1. Carbon dioxide was bubbled through two flasks of bromthymol blue until they became acidic. Then a sprig of *Elodea* was placed in each flask. One flask was left in green light for 24 hours, the other flask was left in red light. No change occurred in the flask left in green light. The bromthymol blue in the flask that was left in the red light turned back to blue.

   Explain these results. _____

   _____

   _____

2. A sprig of *Elodea* was placed into each of two flasks containing bromthymol blue. One flask was left in the dark, the other was left in the light for 24 hours. The bromthymol blue in the flask in the dark turned yellow. The other remained blue. Explain these results.

   _____

   _____

   _____

3. How would you demonstrate that *Elodea* carries out photosynthesis at a faster rate than it carries out respiration? _____

   _____

   _____

4. What would happen if plants carried out photosynthesis and respiration at the same rate?

_____

_____

_____

5. Based on your understanding of the chemistry of photosynthesis, why do plants need animals in order to survive? _____

_____

_____