Activity #1

ARE LIVING ORGANISMS A SOURCE FOR CARBON DIOXIDE GAS?

Purpose: To use the color indicator bromothymol blue to determine if plants, animals, and decomposers release carbon dioxide gas.

Background Information

Are living organisms a source for carbon dioxide gas? Anything in nature, whether living, dead, or never alive (like a rock) is considered a source if it releases carbon dioxide into the atmosphere. Conversely, anything living or nonliving that takes up or absorbs carbon dioxide gas from the atmosphere or water environment is considered a sink (because like the sink in you home that holds water, it acts as a temporary "holding reservoir" for carbon dioxide). This investigation involves the detection of carbon dioxide gas. How can you detect the presence of a gas that is colorless, odorless, and tasteless? One method is through the use of a chemical indicator called bromothymol blue. Bromothymol blue is normally a blue liquid. If a small amount of carbon dioxide gas is added to it, the liquid turns blue-green or green. High levels of carbon dioxide gas causes the liquid to turn yellow.

Materials

Part I
- Setup shown in Fig. 1.1
- Vinegar
- Baking Soda
- Plastic Spoon
- Approx. 1 sq" Aluminum Foil pre-cut
- 2 Cotton balls
- Metric ruler

Part II
- 2 test tubes with stoppers
- Bromothymol blue
- Elodea
- Test tube rack
- Scissors
- Masking tape
- Foil

Part III
- Test tube
- Bromothymol blue
- 1 drinking straw

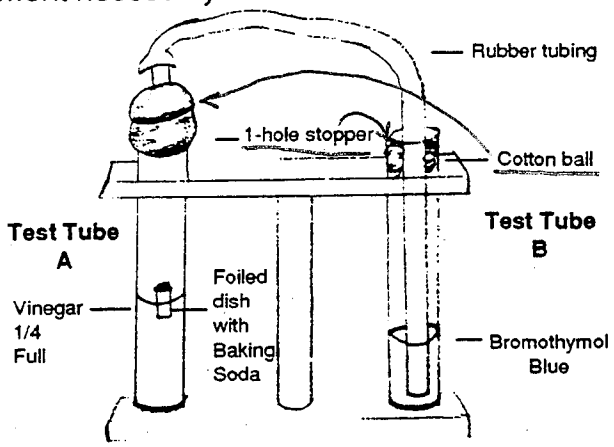
Part IV
- 2 test tubes
- Bromothymol blue
- Yeast solution
- Dropper
- Foil
- Test tube rack

Procedures

Part I. Detecting the Presence of Carbon Dioxide

1. Obtain the equipment necessary in order to assemble according to Fig. 1.1.

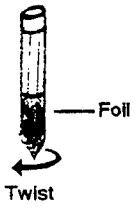
FIGURE 1-1

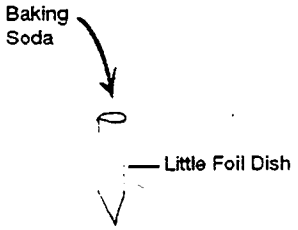


2. Fill Test Tube A 1/4 (.25) full with vinegar.

3. Fill Test Tube B 1/4 (.25) full with Bromothymol Blue. Record color in Table 1.1, Part 1 "Before".

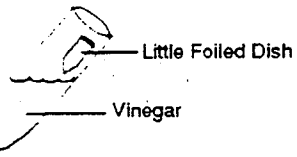
4. Wrap pre-cut aluminum foil (one square inch) around the pointed end of a pen or pencil. Twist the foil at the pointed end of the pen or pencil so that you have created a little dish that will be able to hold baking soda.





5. Using a plastic spoon, fill the aluminum cylinder half full with baking soda.

6. Tilt Test Tube A at an angle that will allow the little foiled dish with baking soda to be slid inside the test tube without mixing with the vinegar.



7. Carefully place one cotton ball inside Test Tube A about 1 cm from the top.

8. Place the rubber stopper (with tube attachment) into Test Tube A.

Part I. Detecting the Presence of Carbon Dioxide - Continued

9. Submerge the free end of the rubber tube into the bromothymol blue solution of Test Tube B (shown Fig 1.1). Place a cotton ball at the top of Test Tube B to hold the rubber tubing in place. Before continuing predict what color the Bromothymol Blue solution will be after the baking soda mixes with the vinegar. Record the color in Table 1.1, Part 1 "Predicted Results."

10. Rock Test Tube A from side to side (not up and down) mixing the viengar with the baking soda.

11. Note the production of gas (bubbles of carbon dioxide gas, CO_2). After three minutes of bubbling in Test Tube B, record the color in Table 1-1, "Observed Results."

PART II. Determining If Plants Are a Source for Carbon Dioxide

1. Fill two clean test tubes about 1/3 full of bromothymol blue. Label one tube C and the other D.

2. Place a 3.0 cm segment of the freshwater plant, Elodea, into tube D. Push the Elodea plant down to the bottom of the test tube using a pen or pencil. Test Tube C should contain just bromothymol blue solution. Label each tube with your name and the contents of the tube (masking tape may be used to label).

3. Roll each tube seperately in a sheet of aluminum foil so that no light may get to these tubes. Label with masking tape with your name. Place tubes as instructed by your teacher. Predict what color the bromothymol blue solution will be in 24 hours. Record the color in Table 1.1, Part II, Tube C, "Predicted Results."

4. Following the 24 hours of darkness, note the color of the liquid in each tube. Record the colors in Table 1-1. You may wish to hold both test tubes up to a white background like a pice of note paper for better color comparison. You may also remove the Elodea for a better color comparison of the liquids. Use running water or wire loop to flush the Elodea from the test tube.

Part III. Determining If Animals Are a Source for Carbon Dioxide

1. Fill a test tube labeled E, about 1/4 full of bromothymol blue. Record the "Before" color of liquid in Table 1-1, Part III.

2. Predict the color change of the bromothymol solution before blowing into it. Record your "Predicted Results" in Table 1-1, Part III.

Part III. Determining If Animals Are a Source for Carbon Dioxide - Continued

3. Place one straw into the test tube and place a cotton ball between the straw and the test tube. Then exhale **gently** through the straw so that your breath bubbles through the liquid. Exhale through the straw until there is a distinct color change. ***CAUTION: Do Not Drink The Bromothymol Blue Solution***

4. Record the color of the liquid in Table 1-1, Part III, "Observed Results."

Part IV. Determining If Decomposers Are A Source for Carbon Dioxide

Decomposers are microrganisms like bacteria and fungus that break down dead tissue and return the nutrients to the environment.

1. Fill two clean test tubes about 1/4 full of bromothymol blue. Label one tube F and the other G.

2. Using a dropper, add 5 drops of yeast soiution to tube G. Add no yeast solution to Test Tube F. With masking tape, label each tube with your name and contents of the tube.

3. Predict what color the bromothymol blue solution will be in 24 hours. Record the color in Table 1-1, Part IV, "Predicted Results."

4. Place tubes in teacher designated area.

5. Following 24 hours, note the color of the liquid near the bottom of each tube. Record the colors in Table 1-1, Part IV, "Observed Results." Use the white background method for color comparison.

Data and Observations

TABLE 1-1. DATA				
PART	TUBE	"BEFORE" COLOR	PREDICTED RESULTS	OBSERVED RESULTS
Part I Detection of CO_2	B Bromothymol Blue plus gas from Tube A		COLOR	COLOR
Part II Detection of CO_2 from Plants	C Bromothymol Blue only		COLOR	COLOR 24 hrs. later
	D Bromothymol Blue plus Elodea		COLOR	COLOR 24 hrs. later
Part III Detection of CO_2 from Animals	E Bromothymol Blue plus your breath		COLOR	COLOR
Part IV Detection of CO_2 from Decomposers (yeast)	F Bromothymol Blue only		COLOR	COLOR 24 hrs. later
	G Bromothymol Blue plus yeast		COLOR	COLOR 24 hrs. later

Conclusions

1. List the organisms in this lab activity that are considered a source for carbon dioxide.

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2. Explain how one can experimentally detect the presence of carbon dioxide.

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Conclusion - Continued

3. Are **plants** a source for carbon dioxide? _____ What is your evidence?

4. Are **animals** a source for carbon dioxide? _____ What is your evidence?

5. Are **decomposers** a source for carbon dioxide? _____ What is your evidence?

6. What is the purpose for having only bromothymol blue in test tubes C and F?

7. Design an experiment that would allow you to test whether an organism was a sink for carbon dioxide. _____