



HANDS-ON LAB

Investigating Photosynthesis and Cellular Respiration

In this investigation, you will design an experiment to determine whether carbon dioxide cycles through a pond snail and a pond plant called *Elodea*.

SAFETY

- Sodium hydroxide is corrosive; avoid contact with the skin.
- Do not inhale through the straw while it is in the solution. If you need to take a breath, first remove your mouth from the straw. Do not share straws with other students.

PREDICTION

How do you think the presence of light affects the cycling of matter between photosynthesis and cellular respiration? Write a prediction explaining how light and dark conditions will affect the cycling of matter between aquatic plants and animals.

MATERIALS

- beaker, 100 mL
- bromothymol blue indicator in dropper bottle
- glass vials with screwcap lids (2)
- individually wrapped straw
- labeling tape
- marker
- pond snails (2)
- sodium hydroxide (NaOH) solution in dropper bottle
- sprigs of *Elodea* (2)
- tap water



PROCEDURE

1. In your Evidence Notebook, draw a diagram illustrating how matter cycles between photosynthesis and cellular respiration. Indicate the types of organisms that carry out each process, and write the names or chemical formulas for the specific molecules exchanged.
2. In your Evidence Notebook, make a data table to record your observations for Steps 3-4. For each step, record the color of the solution and write an explanation of what the color indicates about the presence or absence of carbon dioxide.
3. Place 30 mL of tap water into a small beaker. Add 7 drops of bromothymol blue (BTB) indicator. Bromothymol blue indicator is blue when there is no carbon dioxide present in a solution. If your solution is not blue, add one drop of NaOH solution and stir. Add drops only until the solution is blue. Record your observations.
4. Insert a straw into the beaker and gently blow through the straw until the solution stops changing color. Human breath contains carbon dioxide. Record your observations.

Name:

Date:

5. In your Evidence Notebook, draw or describe an experimental design to test the effect of light on the cycling of carbon dioxide between an aquatic plant and a snail. Refer to the following guidelines when writing your procedure:
 - One group of experimental setups (or vials) should be placed in the dark, and one group of setups should be placed in light.
 - When planning the experimental design, you should include enough experimental setups so that you can observe how matter cycles in the following scenarios: plant only, animal only, plant and animal, neither plant nor animal (this setup will serve as the control).
 - If you make two experimental groups with the conditions described above, you should have a total of 8 vials.
6. Show your teacher your written procedure and do not begin the investigation until approval is given.
7. Obtain the vials and prepare each one as described in your experimental design.
8. All vials should be filled to one-quarter inch from the top with water. Some pond snails breathe through gills and others through lungs. Air needs to be at the top of the vial so the snails with lungs can go to the top periodically for air. Use pieces of *Elodea* equal to the length of the vial. All caps should be screwed on loosely.
9. Label each vial with your name and whether it is being placed in light or dark conditions. Make a data table in your Evidence Notebook to record your daily observations. Record your observations for today, Day 1, and then place them in the designated light and dark areas. Let them remain undisturbed overnight.
10. After 24 hours have elapsed, examine the vials and record the results in your Evidence Notebook. You should record the color that is visible after 24 hours and any changes that are observed. Be sure to record the color of the controls.
11. Empty all vials of pond water, *Elodea*, and snails in the place designated by your teacher. Remove the labels from the vials and wash and rinse the vials. Return the clean vials and lids to the designated place. Wash your hands before leaving the lab.

ANALYZE

1. Summarize your results for the setups that contained *Elodea* plants only. How did light and dark conditions affect the use and production of carbon dioxide by the plants? What does this indicate about whether photosynthesis and/or cellular respiration occurred in each vial?

Name:

Date:

2. Summarize your results for the setups that contained snails only. How did light and dark conditions affect the use and production of carbon dioxide by the animals? What does this indicate about whether photosynthesis and/or cellular respiration occurred in each vial?

3. Summarize your results for the setups that contained both plants and animals. How did light and dark conditions affect the use and production of carbon dioxide? What does this indicate about whether photosynthesis and/or cellular respiration occurred in each vial?

4. What was the purpose of the control setups in this experiment? How did your observations of the control influence your analysis of the results?

Date:

Write a conclusion that addresses each of the points below.

Evidence Describe specific observations from your experiment to support your claim.

Reasoning Explain how the observations you cited support your claim. Describe, in detail, the connections between the evidence you gave and the argument you are making.

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