

Collecting Carbon Dioxide Gas Samples

Objectives:

- To examine sources of carbon dioxide (CO_2)
- To comparatively measure the amounts of CO_2 released from these sources

Teacher Background:

Carbon dioxide is one of the natural greenhouse gases which help to keep our Earth warm enough to sustain life. Scientists have documented that the average carbon dioxide levels, and therefore the average temperature of the Earth's atmosphere, have risen. Where does this CO_2 come from?

Natural sources: A by-product of respiration by organisms, volcanic eruptions, decay of organic materials

Human sources: The burning of fossil fuels (coal, oil) and deforestation (burning of wood)

Vocabulary:

Carbon dioxide
Greenhouse Gas
Respiration
Yeast
Fermentation

Materials: balloons (4 per group - different colors)
Drinking straws (4 per group)
Twist-ties (8 per group)
BTB (Bromothymol Blue solution) (15 mls. Per beaker)
5 50 ml. Beakers (per group)
1 bottle white vinegar
1 box baking soda
Test tube (1 per group)
Exhaust from tail-pipe of a car (collected by teacher)

Sugar

Yeast

Bottle (must be able to hold 50 ml of liquid) (1 per group)

Procedure: Collecting the gas samples - Students must collect all four gas samples before making any tests. Each sample should be collected in a balloon of a different color and tied using a twist-tie. The balloons should all be the same size and at least 3 inches wide.

1. Human breath - collected from a student's lungs.
Student blows up the balloon and captures gas using a twist-tie to close the balloon.
2. Exhaust from burning fuel - teacher collects before class from the tail-pipe of a running car using a "funnel" made from a piece of cardboard. The gas goes directly into the balloons and is captured using a twist-tie.
3. Vinegar and baking soda - collected using a test tube filled with 3 oz. Vinegar and 4 tsp. (20 ml) Baking soda. Stretch a balloon over the mouth of the test tube to collect the gas.
4. Yeast - collected using a bottle. Dissolve 1 tablespoon (15 ml) of sugar in 100 ml of 80°F water in the bottle. Add 1 teaspoon (5 ml) of yeast to the bottle and stretch a balloon over the top of the bottle to collect the gas.

Testing the gas samples - Pour 15 ml BTB solution into all 5 beakers (one beaker should be used as a control so that students can see the color of the BTB if no CO_2 is present).

For each of the samples:

1. Tie a second twist-tie around the neck of the balloon to seal the opening of the balloon around a drinking straw.

2. Slowly open the first twist-tie so that the gas in the balloon can be bubbled into one of the beakers of BTB. Try to control the bubbling so that the BTB does not come out of the beaker.
3. Observe the color of the BTB when all of the CO_2 has been bubbled into the solution. Add this information to your data table.

Assessment:

Have students hand in their data sheets or if time permits allow for class discussion of the students' findings. We want to check for understanding of sources of CO_2 , relative amounts of CO_2 produced from these sources, and the impact on the environment.

Extension Activities:

How the Greenhouse Effect works
Alternatives to fossil fuels

Four Gas Samples – Student Data Sheet

Balloon Color	Gas Sample	Color of BTB Sol'n	Rank (most CO ₂ -least CO ₂)

Use the color scale below to determine the relative amounts of CO₂ that each sample contains:

Least CO₂ _____ Most CO₂

blue
greenish blue
bluish green
green
yellowish green
greenish yellow
yellow

Which sample contained the most CO₂? _____

Which sample contained the least amount of CO₂? _____

What conclusions can you make about Carbon dioxide production on our planet based upon your findings?