

Activity 1: Carbon Dioxide on Your Breath

Description:

With this activity we will use the pH indicator, bromthymol blue, to visually demonstrate carbon dioxide going into solution in water from human breath.

Supplies:

- Bromthymol blue, a pH indicator
- Erlenmeyer flask, 250 mL
- Straw
- Protective goggles
- Water
- Water dropper (optional)

Activity Instructions:

In this activity you will observe that exhaled carbon dioxide can enter into a water solution and change the pH of the water, changing the color of the water from blue to yellow. Follow this procedure to complete this activity.

1. Fill the flask with 150 mL of water
2. Use the water dropper and drop five drops of bromthymol blue into the flask (or simply pour a small amount directly into the flask).
3. Use a straw to thoroughly mix the bromthymol blue with the water. Color of water should be a uniform light blue.
4. Softly blow into the straw for about 30 seconds (Note: although non-toxic, remind students to blow *not suck* in liquid).
5. Observe the color of the water again.

Background:

Normal tap water has a roughly neutral pH of 7. Bromthymol blue appears blue in a neutral or basic water solution. Carbon dioxide goes into water as carbonic acid. As the carbonic acid level increases in the water, the solution becomes slightly acidic, and the bromthymol blue will transition from blue to green to yellow.

This activity can be used as a great way to start a discussion about Earth's carbon cycle, humans as producers of carbon dioxide and/or the ability of carbon dioxide to enter into a water solution (at the macro scale, this can be compared to the Earth's ocean's ability to absorb carbon dioxide from the atmosphere).

Where to Purchase Materials:

Bromthymol Blue Solution, 0.04%, 100 mL (catalogue #: B0173) – Flinn Scientific

Activity 2: Greenhouse Gas Molecule Model Building

Description:

During this activity you will use a molecular model building kit to build molecular models for the following three common greenhouse gases:

- Carbon dioxide – CO₂
- Methane – CH₄
- Water vapor – H₂O

Supplies:

- Molecular model building kit
- Periodic table (optional)

Activity Instructions:

For this activity you will need a total of eleven colored spheres (representing atoms) and ten springs (representing bonds) of equal length from the molecular model kit. These are the specific numbers of each atom and the springs that you will need:

- 2 **carbon** atoms (black spheres)
- 3 **oxygen** atoms (red spheres)
- 6 **hydrogen** atoms (white spheres)
- 10 **springs** (of equal length)

Build your greenhouse gases as follows:

1. **Carbon dioxide – CO₂**
1 carbon, 2 oxygen, 4 springs – use two springs to connect each oxygen to the central carbon atom.
2. **Methane – CH₄**
1 carbon, 4 hydrogen, 4 springs – use one spring to connect each of the four hydrogen atoms to the central carbon atom.
3. **Water vapor – H₂O**
1 oxygen, 2 hydrogen, 2 springs – use one spring to connect each of the two hydrogen atoms to the central oxygen atom.

Background:

Greenhouse gas molecules are comprised of three or more atoms and have the ability to absorb infrared energy. By contrast, molecular nitrogen (N₂) and molecular oxygen (O₂) are each comprised of two atoms each, and do not absorb infrared energy.

Where to Purchase Materials:

Student Molecular Model Set, 3/4" Atoms, 185-piece (catalogue #: AP5447) - Flinn Scientific