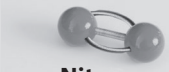
☑ Greenhouse Gas Molecular Models


Water


Carbon Dioxide


Oxygen


Nitrogen


Methane

⚠ Dry Ice Safety

Carefully review the *Dry Ice Safety* sheet on page 21.

Dry ice can be obtained from many grocery stores. If you do not have access to dry ice, you can produce CO_2 gas by mixing equal parts baking soda and vinegar.

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Preparation

- Make models of the compounds listed below. Example photos can be found in the left margin.
  - carbon dioxide (CO_2)
  - water vapor (H_2O)
  - nitrogen (N_2)
  - methane (CH_4)
  - oxygen (O_2)

✔ Procedure

1. Show students the models you created or ask students to create their own if supplies allow. Explain the following:

   Carbon dioxide (CO_2), methane (CH_4), and water vapor (H_2O) are three of the major greenhouse gases. When the radiant energy from the sun travels through the Earth's atmosphere and strikes the surface of the Earth, some of that energy is radiated back as thermal energy and infrared energy that will leave the atmosphere, but much of it is absorbed by the greenhouse gases.

   The Earth's atmosphere is composed of around 78 percent nitrogen gas (N_2), which has a triple bond between the nitrogen atoms, and 21 percent oxygen gas (O_2), which has a double bond between the oxygen atoms. The energy is stored within the movement of those molecules. Nitrogen gas and oxygen gas do not have a great deal of flexibility in the vibrations, rotation, expansion, and contraction of the bonds within the molecule.

2. Demonstrate to students how there is a great deal of flexibility in the bonds of water, methane, and carbon dioxide, while there is very little in the flexibility of the other gases in the atmosphere. While holding the central atom in the structures of water, carbon dioxide, and methane, apply a slight force to the atoms attached to the central atom and show how the bonds are able to move freely indicating the ability to store more energy than the bonds within nitrogen gas or oxygen gas.

Activity 3: Properties of CO_2

Background

In this activity, students will explore how CO_2 behaves in order to develop a better understanding of its role in our climate system.

Objective

- Students will be able to list or describe properties of carbon dioxide.

Time

- One class period

Materials

- Plastic trash bags
- 5-10 lbs. of Dry ice (keep in foam cooler until ready to use)
- Work gloves
- Tongs
- Large, clear containers or tubs
- Plastic trays
- Bottles of bubbles
- Bottles of water
- Balloons
- Pipe cleaners
- Tea light candles
- Matches
- Plastic cups
- Safety glasses
- *Properties of CO_2*, page 36
- *Dry Ice Safety*, page 21