



Atmospheric Gases



Essential Question: How would increasing the amount of greenhouse gases in Earth's atmosphere affect Earth's temperature?

Overview

If solar energy isn't enough to explain how warm Earth is, where does it get its additional heat? Only about 1/2 of the light from the Sun is usually transmitted through the atmosphere and reaches Earth's surface. The other half is either reflected or absorbed by the atmosphere. What else is happening in the atmosphere? When the Earth heats up (from the energy in sunlight), it radiates that heat. This is the same way all hot things warm the air around them. The particles and gases in the atmosphere absorb the infrared energy and radiate it both upward and downward. Much of the energy is emitted back toward Earth's surface.

In today's lab, you will be looking at the heat-absorbing ability of two gases. These gases are commonly found in the atmosphere and absorb long-wave or infrared radiation. Your focus in this lab is to compare the heat-absorbing ability of two atmospheric gases (carbon dioxide and air). You will assume that lamp in your experiment represents the sun. The gases in the atmosphere and also the earth absorb the energy from this lamp. The black paper on the bottom of each of the beakers represents the earth. Like the earth, they will radiate infrared energy. Similar to the Earth's atmosphere, each of the beakers contains one of the heat-absorbing gases. One beaker will contain air and the other beaker carbon dioxide. As the earth (the black paper) and the gases (air and carbon dioxide) absorb energy, they will also radiate energy. The question you need to figure out is which of these gases absorbs and radiates more energy? And how do these heat-absorbing gases affect the temperature on Earth?

Materials

For the class:

- 1 electronic mass scale

For each group:

- 1 ringstand
- 1 burette clamp
- 1 120-V light fixture with shield
- 1 250W heat lamp
- 2 alcohol thermometers
- 1 500-mL Erlenmeyer flask
- 2 250-mL Erlenmeyer flasks
- 2 3-in. pieces of acrylic tubing
- 1 #6 rubber stopper with hole
- 1 #6 rubber stopper with two holes