



The information in this lesson plan is current as of July 27, 2004.

Ozone Pollution: Smog Alert

Purpose

To help students understand ozone pollution and make them aware of how it is formed.

Grade Level

- ◆ 4th grade
- ◆ 5th grade

Science TEKS

- ◆ 4.1 a, b
- ◆ 4.2 a-e
- ◆ 4.6 a
- ◆ 5. a, b
- ◆ 5.2 a-e
- ◆ 5.7 c

Objectives

Student will simulate the development of smog and infer how it occurs in nature.

Focus

Hold up a news headline about air pollution. Ask if anyone knows what ozone pollution or smog is.

Materials

- ◆ glass jar
- ◆ water
- ◆ aluminum foil
- ◆ 2 or 3 ice cubes
- ◆ paper
- ◆ ruler
- ◆ scissors
- ◆ matches

Background

Ozone is the same molecule regardless of where it is found, but its significance varies. Stratospheric ozone is found 9 to 18 miles high where it shields us from harmful ultraviolet rays from the sun. High accumulations of ozone gas in the lower atmosphere at ground level is air pollution and can be harmful to people, animals, crops and other materials.

Elevated levels above the national standard may cause lung and respiratory disorders. Short-term exposure can result in shortness of breath, coughing, chest tightness, or irritation of nose and throat. Individuals exercising outdoors, children, the elderly, and people with pre-existing respiratory illnesses are particularly susceptible. Chemists have found that the materials damaged by ozone include rubber, nylon, plastics, dyes, and paints.

Ozone pollution, a component of smog, is mainly a daytime problem during summer months because sunlight plays a primary role in its formation. Nitrogen oxides and hydrocarbons are known as the chief "precursors" of ozone. These compounds react in the presence of sunlight to produce ozone. The sources of these precursor pollutants include cars, trucks, power plants and factories, or wherever natural gas, gasoline, diesel fuel, kerosene and oil are combusted. These gaseous compounds mix like a thin soup in the atmosphere, and when they interact with sunlight, ozone is formed.

Large industrial areas and cities with heavy summer traffic are the main contributors to ozone formation. When temperatures are high and the mixing of air currents is limited, ozone can accumulate to unhealthy levels.

Weather conditions such as lack of wind or a "thermal inversion" can cause smog to build up in an area. A thermal inversion occurs when a layer of warm air settles over a layer of cool air that lies near the ground. This condition prevents the smog from rising and scattering. Mountain ranges near cities may also trap smog in an area.

Procedure

- ◆ This activity should be done with adult supervision. Do not breathe in the "smog."
- ◆ Cut a strip of paper about 15 centimeters X 1 centimeter. Fold the strip's length in half and twist the paper.
- ◆ Make a "lid" for a glass jar by shaping a piece of aluminum foil over the open end of the jar. Remove the foil and put it aside.
- ◆ Put some water in the jar and swish it around so that the inside walls of the jar are wet. Pour out the water.
- ◆ Place two or three ice cubes on top of the foil lid to make it cold.
- ◆ Light the strip of paper and drop it and the match into the damp jar. Put the foil lid on the jar and seal it tightly. Keep the ice cubes on top of the foil, in the middle. You must do all of this very quickly.
- ◆ What do you see in the jar? How is this like real smog? when you're finished, release the "smog" outdoors.

Extensions

Does your local newspaper or weather channel have a pollution index or other type of report on pollution in your area? Record this information over several days and see how it changes.

Reference

Taken from: Dr. Milton Payne's Outdoor Education Class. Spring 1994. Dr. Milton Payne, Department of Elementary Education, Stephen F. Austin State University, P.O. Box 13017, Nacogdoches, TX 75962.

Acknowledgment

Lois Myers and Kelly West, Teaching Environmental Sciences Class, Stephen F. Austin State University, 1995