

Grade Level(s): 4, 5, 6

Subject(s):

- Science/Environmental Education

Purpose: This lesson plan is designed for 4th-6th grade students. Its multi-subject theme make it an ideal lesson plan for Earth Day.

Overview:

Air pollution is a growing problem today. This lesson plan is designed to teach students about the problem, its effects on our environment and health and the latest methods designed to combat air pollution.

Objectives:

1. Define air pollution.
2. Identify major causes of air pollution (e.g., automobiles, burning garbage, electric power plants emissions, industrial boilers and certain consumer products).
3. Identify the effects of air pollution (health effects in humans, effects such as acid rain on the environment, effects on the ozone layer, ground level-smog).
4. To identify programs in place to reduce air pollution (passage of The Clean Air Act, industry programs such as the development of reformulated gasoline).
5. To identify personal methods of reducing air pollution (car-pooling, reduction in use of aerosol spray products, choosing biodegradable products).

Materials/Resources:

Teacher Materials: Air pollution fact sheet, Pollution Solutions hand-out (available at no charge from The National Reformulated Gasoline Hotline, (1-800-GO-TO-RFG))

Student Materials: Flower seeds, Potting soil, Paper cups, Marker, Paper, Pencils

Procedures:

Science Class:

1. Students should plant an identical amount of flower seeds in two separate paper cups. One cup should be placed in a heavy traffic zone (such as the place where school buses enter and exit). The other cup should be placed in a relatively clean air environment such as the class room.
2. The class should discuss and form a definition of air pollution and hypothesize its effects on their plants.
3. Students should observe the growth of the seeds over a 2-week period of time, during which the plants are watered on a regular basis with identical amounts of water. Students should observe the plants regularly and record growth activity.
4. At the end of 2-weeks, the students should plot the number of plants grown, the size of the plants, the color of the plants, and write a short conclusion about the effect of air pollution on growth.

Social Studies/History:

Open the classroom discussion to a brief history of the industrial age and the advent of the automobile.

Discuss how dependent our society is on the use of autos and the effect of automobiles on the level of air pollution.

Discuss government (The Clean Air Act) versus industry (reformulated gasoline) versus individual (car-pooling, walking, biking) solutions to the air pollution problem.

Ask the students to identify methods of reducing air pollution.

Reading:

" Where does pollution come from? " by Clever Calvin

Air Pollution Definition:

Air pollution is toxic contaminants or Volatile Organic Compounds (VOCs) which have been released into the air. All over the world, fuel, in the form of oil and coal, is burned to run factories, machinery and all forms of transportation. The burning of these fuels creates by-products such as smoke and invisible irritants which contaminate our atmosphere. Many consumer products such as hair spray, paint, cleaners, windshield washers, etc. release high levels of VOCs into the atmosphere. The cumulative effect of air pollution destroys our environment and poses health treats to humans.

Air Pollution Sources:

Cars, Consumer Products, Gas Stations, Power Stations, Agriculture & Forestry, Chemical Industry

Air Pollution Effects:

The effects of air pollution are a major threat to our health. The American Lung Association believes that sulfur-dioxide exposure (one source is the internal combustion engine of automobiles) is the third leading cause of lung disease following smoking.

Air pollution has also been implicated in the rising occurrence of asthma, bronchitis and emphysema.

The air pollution effects on our environment are immense. Contaminating particles from sulfur dioxide emissions which are released into the air by factories, power plants and cars combine with water particles in the atmosphere and fall to the earth in the form of rain or snow. This is called acid rain. The acidity or basicity of this precipitation is dependent upon the concentration and type of contaminants with which the water particles have been combined. When oceans, lakes and streams absorb acid rain their support structure of algae, plankton and other aquatic life which provide food and nutrients for fish are destroyed. Acid rain damages trees and plants. Buildings are also effected by acid rain.

Another form of pollutant in our air is known as CFCs or chlorofluorocarbons does major damage to our environment. CFCs are chemicals created by industrial usage such as solvents, refrigerant gases and paints. CFCs combine with the earth's upper atmosphere, attaching themselves to the molecules of ozone. The ozone layer protects the earth from ultraviolet radiation of the sun. The CFCs transform and destroy the ozone layer. If the ozone shield gets too thin or disappears, exposure to ultraviolet radiation can cause crop failures, skin cancer and other environmental and health disasters.

Historical Perspective:

In 1970, the United States Congress passed legislation aimed to curb sources of air pollution and setting standards of air quality.

Over the past 25 years, major improvements in motor vehicle technology have led to exhaust emission reductions of up to 96 percent compared to the vehicles of the 1960s. By the early to mid 70's, Congress passed laws to phase out the uses of lead as an additive in gasoline. In the 1980s,

regulations were passed to limit gasoline evaporation. Most recently, fuel refiners have created reformulated gasoline (RFG) with additives called oxygenates which help to reduce harmful emissions by burning more completely.

In 1987, more than 20 nations signed an agreement to limit the production of CFCs and to work toward their eventual elimination.

In 1989, the major car manufacturers and oil companies funded a \$40 million research study to help find ways to reduce emissions.

Most recently, Congress passed The Clean Air Act of 1990 which requires industry and individuals to take additional steps to clean the air in our cities.

Air Pollution Solutions:

An effective way of deterring pollution is for the government to continue to pass strict legislation that controls the amount of by-products released by industrial companies and modes of transportation. Until these causes are eliminated completely we should conserve our use of products producing pollutants that are created by companies violating the government standards. Whenever possible we should use products that are people and earth friendly.

One product which has been revised for a safer environment is gasoline. Since we use gasoline in so many machines (automobiles, lawn mowers, motorboats, all types of small engines), our use of a safer form of gasoline will have a big effect on the level of pollution we project into the atmosphere. ReFormulated Gasoline (RFG) is a cleaner-burning form of gasoline. It reduces the amount of pollutants emitted into the air through the tailpipe or via evaporation from the gas tank. RFG's environmental standards are new, but its ingredients aren't. Oxygenates - a principal component of RFG - have been blended into gasoline since the late seventies as a replacement for toxic lead, reducing the least environmentally-desirable compounds. Oxygenates help fuels burn cleaner and more completely reducing levels of carbon monoxide and ozone-forming compounds. RFG lowers the rate at which pollutants evaporate into the air.

Pollutants from consumer products can be reduced if we try to use less aerosol products and more water-based products, biodegradable products and products which list low VOC content on their labels.

for FREE student handouts and a printed copy of the lesson plan call or write:

National Reformulated Gasoline Hotline
1925 N. Lynn Street
Suite 1090
Arlington, VA 22209
1-800-GO-TO-RFG
(703) 841-9674
Fax (703) 528-1603