

Antarctica's Influence—Ozone

Integration: Health (Environmental Health); Science

Grade Levels: 5-6

Time: 2-3 class periods

Materials:

- Index cards
- Petroleum jelly
- Yarn or string
- Hole puncher (optional)
- Poster board
- Drawing materials
- Research materials (books, internet, etc.)

Objectives:

Students will:

1. Explain the importance of ozone in the atmosphere.
2. Describe the existence of the hole in the ozone layer.
3. Determine ways to prevent air pollution.

Lesson:

Full group

1. Ask students to provide a definition of the word *atmosphere* (the mass of air surrounding the earth).
2. Ask students to name some of the gases that are found in the atmosphere (oxygen, carbon dioxide, hydrogen, and nitrogen).
3. Tell students that a very important gas in the atmosphere is ozone.
 - a. Ozone is a pale blue gas.
 - b. It is toxic and explosive.
 - c. It occurs naturally in small amounts close to the earth, but is found in higher concentrations in the upper atmosphere.
4. Ask students if anyone has ever heard of the ozone layer. Allow students to present the idea to their classmates.
 - a. The ozone layer (or ozonosphere) is a layer of ozone that surrounds the Earth between 6 and 30 miles (10 and 50 km) altitude. The layer is therefore about 24 miles thick.
 - b. The ozone layer absorbs harmful solar radiation that would otherwise harm or kill living things on Earth.

- Radiation can cause cataracts and skin cancer in humans.
- c. The ozone layer also helps to keep the Earth from getting too hot
 - Ask students what would happen if the Earth got extremely hot (plants would not grow, animals would be harmed, all living things would die).
 5. Inform students that scientists found a “hole” in the ozone layer above Antarctica that appears in the beginning of each summer. The ozone layer becomes thinned to 40-50% of its normal concentration.
 - a. Ask students to reiterate what could happen without the ozone layer.
 6. Have students brainstorm possible causes of the hole.
 - a. After allowing for responses, inform students that some breakdown of the ozone layer is natural but that air pollution caused by humans has made the ozone layer breakdown worse.
 - b. Ask students to define *air pollution*.
 - c. One definition is "harmful or objectionable substances in the air that cause harm to the human health, animals, or the environment."
 7. Tell students that some of the chemicals that help to break down the ozone layer are called CFC's (chlorofluorocarbons) and halons. They were produced for use in aerosol cans, fire extinguishers, and refrigerators.
 - a. These chemicals are not harmful on Earth but when they reach the ozone layer, they are broken down by the solar radiation
 - b. The chemical components of CFC's and halons, namely chlorine and bromine, react with ozone and cause it to be broken down—causing the hole.
 8. Tell students that the scientists have found this hole over Antarctica.
 - a. Inform the students that during the dark winter, Antarctica is the coldest place on earth.
 - b. The strong winds hold the air above Antarctica and create ice clouds.
 - c. The reaction of ozone with chemicals occurs on the surface of these ice crystals (like in a petri dish) when the sun rises again at the beginning of the summer.
 9. Initiate a discussion where students discuss what they would do about these chemicals that contribute to the hole in the ozone layer.
 - a. In 1987, the governments of many countries signed the Montreal Protocol.
 - b. With the Montreal Protocol, the countries agreed to limit the amount of CFC's and halons that could be produced.
 - c. Since then, more countries have signed the Protocol and the number of chemicals on the list has increased.
 - d. There has been a decrease in the chlorine and bromine in the atmosphere but scientists think it will take 20-30 years for the ozone layer hole to close up.

Small group

10. Allow students to investigate the air pollution around them by creating “pollution gauges”.
 - a. Take an index card and punch a hole at one end.
 - b. Label one side with the group members’ names.
 - c. Coat the other side of the card with petroleum jelly.
 - d. Loop a piece of yarn or string through the hole so that the pollution gauge can be hung.
 - e. Repeat the process to create another pollution gauge.
 - f. Each group will hang one pollution gauge inside and one outside.
 - g. After a few days, check each gauge for signs of pollutants.
 - h. Discuss the results.
11. Tell students that they will investigate how they are affected by air pollution. Divide the students into small groups and have them brainstorm different types of indoor and outdoor air pollution (smog, cigarette smoke, automobile exhaust, pet hair/dander, etc.)
12. Brainstorm the effect the pollution has on human health (harms lungs, makes it difficult to breathe, makes people sneeze, irritates eyes, etc.)
13. Each group should pick one type of air pollution to investigate. They should find information on the sources of the pollution, how it affects humans, and suggestions for decreasing or eliminating the pollution.

OPTIONAL: This activity can be assigned as a long-term project.

14. Instruct each group to create an illustrated poster that contains some of the important information they have found and present it the rest of the class.

OPTIONAL: Have each student create a written report on their topic before presenting the poster to the class.

EXTENSION: Invite a representative from a local environmental protection group to speak to the class about air pollution.

Assessment:

Teacher will assess:

1. Student’s comprehension of the purpose of the ozone layer.
2. Student’s description of the hole in the ozone layer and its causes.
3. Student’s analysis of the sources of air pollution.
4. Student’s research capabilities.
5. Student’s ability to work cooperatively.