What's Up There Besides Air?

Air & Waste Management Association

Objectives

Students will be able to do the following:

1. Write their own definition of air pollution
2. List some ways that we can tell that air pollution is present
3. List the various characteristics of air pollutants

Topics:
Definition of air pollution, ways to tell air is polluted, characteristics of pollutants

Time:
1-2 class periods

Subjects:
Science, language arts, social studies

Materials:
Notebook and pencil (or pen) for each student
5 or 6 plastic containers or milk cartons
Double-sided carpet tape
Stick-on labels
Waterproof pen or marker
A directional compass
OPTIONAL: See extension suggestions

Background Information

Clean air is healthy for us to breathe. However, air can become polluted—that is, contaminated with particles and gases that are not supposed to be there—making the air dirty and unhealthy. Air can also become imbalanced and unhealthy with excessive amounts of gases that are part of its natural composition. In general, air pollution is any visible or invisible particle or gas found in the air that is not part of the normal composition of air. Some air pollution is from natural causes, but much of it comes from man-made sources such as cars, factories, fires, and products that we use. It is important to note that both indoor air and outdoor air can be polluted. This unit focuses on outdoor air pollution; indoor air pollution is covered in Chapter 3.

Air pollutants can be in one of two forms: particulate or gaseous. Particulate pollutants (also referred to as particulate matter) are those that are in the form of small solids or droplets. Dust, smoke, sand, ash, smog, and pollen are examples of particulate air pollutants. Particulate pollutants are often easy for us to notice because they can make the air look dirty or smell unusual. We can also sometimes see particulate matter when it settles out of the air and accumulates on surfaces — our cars can be covered with yellow pollen, outdoor surfaces can be covered with dust, or clothes drying on the line can become dirty from deposited soot.

Gaseous air pollutants are those that are in the form of a gas: carbon monoxide, radon, ozone, and sulfur dioxide are a few examples. Some gaseous pollutants are invisible and/or odorless, making them more difficult to detect than are particulate pollutants. Two such pollutants are carbon monoxide and radon. Others are more obvious to us because we can smell them or immediately feel their effects. Gaseous pollutants can combine with water vapor and other elements to create other pollutants. For example, ozone is created by an interaction of volatile organic compounds (VOCs), nitrogen oxides, natural atmospheric gases, and sunlight. Acid rain can be created by an interaction of sulfur dioxide, nitrogen oxides, and water vapor.

How can we know when air pollutants are present? As we've mentioned, sometimes we can see them or smell them. Other times we might experience noticeable effects of the pollutants, such as when we have difficulty breathing on a very smoggy day, or have watering eyes when there is excessive pollen in the air.

Still, much of the time we have to rely on technology to inform us of the presence of air pollutants. Many cities now publish or broadcast air quality indices to let us know that there is a lot of ozone, pollen, or other pollution in the ambient air.

Procedure

I. Setting The Stage (For alternative, see next activity).

A. This activity relates to Objectives 1, 2, and 3. Students will discover ways in which they can tell that the air is polluted, learn that there are both particulate and gaseous air pollutants, and define (in their own words) the term air pollution.

Third-, fourth-, and fifth-graders

B. The class will be taking a "walking" field trip outside in the area around the school. Each student should have a notebook and pencil or pen. **NOTE:** This activity does *not* work as well immediately after a rain, because the air and surfaces have been cleansed of most air pollution.

C. Before going outside, ask the students the following questions:

1. Is air always clean? (No.)

2. When the air is dirty, we say that we have what kind of air? (Polluted air.)

3. What do we call the substances that make the air dirty? (Pollutants or air pollutants.)

D. Now take the students outside. Have the students "smell" the air. Ask them if it smells clean, the way it does right after it rains.

E. Ask them to write down how the air smells.

F. Have the students look at the air. Is it clear or hazy?

G. Ask them to write down how the air looks.

H. Have the students look at objects in the vicinity to see if they see any evidence of deposited air pollutants.

I. Ask them to write down all the examples they can find of deposited particulate air pollutants. They should describe the object and what the deposition looks like (color, texture, thickness, etc.).

J. When they have finished the field trip, return to the classroom and ask the students to share their findings. Ask them the following questions:

1. Do you think that polluted air always contains the same pollutants? (No.)

2. Why do you think that it does or doesn't? (The deposited pollutants look different, sometimes I sneeze when I go outside and sometimes I don't, etc.)

3. Do you think that air pollutants are particles or gases? (They can be either particles or gases.) Why do you think so? (Some we can see, but others we can smell, also.)

4. You mentioned several things that you smelled or saw that let you know that the air contained pollutants. Of those things, which indicate the presence of particulate air pollutants and which indicate the presence of gaseous air pollutants? (Deposited particles indicate particulate pollutants; smelly air indicates gaseous or particulate pollutants.)

5. Let's write a definition of the term "air pollution." How would you define it?

II. Activity (Alternative for Setting The Stage). What is Air Pollution?

A. This activity relates to Objectives 1, 2, and 3. Students will talk about ways in which they can tell that the air is polluted, learn that there are both particulate and gaseous air pollutants, and define (in their own words) the term air pollution. **NOTE:** This activity is a substitute for Activity 1 in situations in which it is not feasible (because of weather, safety, etc.) to take the class outdoors.

Third-, fourth-, and fifth-graders

B. Lead a class discussion by asking students the following questions:

1. Is air always clean? (No.)

2. How do you know that is isn't clean? (Can see or smell the dirt.)

3. What have you seen or smelled that makes you think that the air isn't clean? (Deposited particles, smoke, smog, deposited pollen, blowing sand, dirty clothes on the line, a sulfuric smell in the air, etc.)

4. What is it called when air isn't clean? (Air pollution or polluted air.)

5. What do we call the substances that make the air dirty? (Pollutants or air pollutants.)

6. Do you think that polluted air always has the same pollutants? (No.)

7. Do you think that air pollutants are particles or gases? (They can be either particles or gases.)

8. You mentioned several things that you smelled or saw that let you know that the air contained pollutants. Of those things, which indicate the presence of particulate air pollutants and which indicate the presence of gaseous air pollutants?

9. Let's write a definition of the term "air pollution." How would you define it?

III. Activity. Catching Particulate Pollutants

A. This activity relates to Objectives 1, 2, and 3. Students will "catch" particulate pollutants.

Third-, fourth-, and fifth-graders

You will need the following materials:

- ☐ 5 or 6 jars or milk cartons (the small ones from the school cafeteria work well if you put sand in them to weigh them down)
- ☐ Double-sided carpet tape
- ☐ Stick-on labels
- ☐ Waterproof pen or marker
- ☐ A directional compass

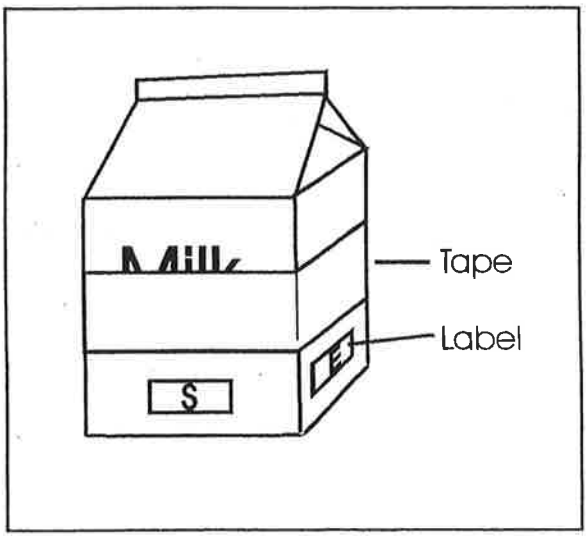
B. Have students make particulate-pollutant "catchers."

1. Wrap a piece of carpet tape around the middle of the container or carton.

2. On the four "sides" of the container or carton, place labels indicating the directions north (N), south (S), east (E), and west (W). Make sure that students have the labels in the correct orientations.

3. Label the catchers 1, 2, 3, etc.

4. Place the pollutant catchers in various spots around the school or community, using the compass to make sure that N is facing north, etc. Make a list showing where catchers 1, 2, 3, etc., were placed. (Note: You can write on the bottom of the catcher the location where the catcher was placed.)



√ 5. Have the students write their predictions about which side will "catch" more pollutants and explain why they think that side will have more.

6. After a few days, collect the pollutant catchers and examine them. Use a chart to write down the location of the particulate-pollutant catcher, how much particulate matter was stuck to the tape,
√ what it looked like (use a magnifying glass), the direction from which it came, etc.

IV. Follow-up

A. Make a simple map that shows all of the locations at which the jars or cartons were placed.

B. Using colored pencils, markers, or crayons, indicate the relative amount of particulate matter "caught" at each of the locations.

C. Have students discuss some possible reasons that more particulate matter was caught in some locations than in others.

D. Have the students make a bar graph illustrating their findings.

V. Extension

A. Turn off the lights in your classroom. Place an overhead projector at the front of the classroom and turn on the light to the projector. Ask the students if they think that the air in the classroom is clean. Have the students come forward and observe what they see around the projector. Have each student draw and describe in writing what they saw. Discuss their findings. Ask the students what senses were used and what senses were not used and why.

B. Light a candle or small lantern in the classroom. **NOTE: USE EXTREME CAUTION WHEN DOING THIS ACTIVITY AND DISCUSS WITH THE STUDENTS THE DANGER OF FIRE AND PLAYING WITH MATCHES. USE YOUR JUDGMENT AS TO WHICH PARTS OF THIS ARE APPROPRIATE AND SAFE FOR YOUR STUDENTS.** Ask the students to identify the smell being burned (wax or kerosene). Ask them if it qualifies as a particulate or gaseous pollutant. Discuss what senses were used to identify both. How were the odors alike? How were they different?

C. Have students write a persuasive paragraph telling why we should stop pollution and care for the environment.

D. Have the students make a collage using pictures cut from magazines. On one half of the paper, glue pictures of people or things polluting the air. On the other half, show pictures of people cleaning up and taking care of the earth.

E. Have students write a cinquain (5-line stanza) on the topic of air pollution.

F. Have students work in groups to create a "Don't Pollute" poster. They can make up their own catchy slogan. Display the posters around the school.

G. Have the students create an opinion survey with which to ask older students or adults what they think are the biggest contributors to air pollution . Have them record only what that individual thinks is the largest contributor. Have them bring the results back to class and record them.

Resources

Trefil, James. *1001 Things Everyone Should Know about Science.* New York: Doubleday, 1992.

United States Environmental Protection Agency, Education and Outreach Branch, *Course 422, Air Pollution Control Orientation Course.* Research Triangle Park, 1992.

United States Environmental Protection Agency Office of Air Quality Planning and Standards. *Environmental Science Summer Institute Workbook.* Research Triangle Park, NC. 1995.

World Book Encyclopedia, 1994 edition, s.v. "Air."

World Book Encyclopedia, 1994 edition, s.v. "Pollution."

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