

13.1 Detecting Air Pollution: Background Information

Clean, dry air near the surface of the earth consists primarily of nitrogen (78 percent) and oxygen (21 percent). The remaining 1 percent is mostly argon and carbon dioxide. Naturally occurring air also contains water vapor, dust, pollen, smoke, and a variety of chemicals such as carbon monoxide, sulfur dioxide, nitrogen oxides, salt, ozone, and many other chemicals. What, then, is "air pollution"?

Generally, a chemical in the air would be called a pollutant when it is present in quantities that are large enough to cause harm to humans, other animals, plants, metals, stone, or other materials. There are nine major classes of pollutants:

1. **oxides** of carbon: carbon monoxide (CO) and carbon dioxide (CO₂)
2. oxides of sulfur: sulfur dioxide (SO₂) and sulfur trioxide (SO₃)
3. oxides of nitrogen: nitric oxide (NO), nitrogen dioxide (NO₂), and nitrous oxide (N₂O)
4. volatile organic compounds such as methane (CH₄) and chlorofluorocarbons
5. suspended **particulate** matter including *solids* such as dust, soot, salts, and pollen and *liquids* such as sulfuric acid, oils, and pesticides
6. **petrochemical** oxidants formed in the atmosphere by the reactions of various chemicals found in the atmosphere
7. radioactive substances
8. heat
9. noise

There is little that we can do to prevent or reduce naturally occurring pollutants. Many pollutants, though, are produced by human activities, and we can do something about these. Nearly half of the major outdoor air pollutants in the United States comes from transportation. Thus, when we use mass transit, carpool, walk, or ride our bikes, we reduce air pollution. Using more fuel-efficient vehicles and keeping them tuned properly is important, too. Burning fuels, for example, to produce electricity and heat, produces another 28 percent of the outdoor air pollution in the United States. Thus, anything we can do to save energy will help reduce air pollution. Most of the rest of the air pollution comes from various industrial processes. When we make our material goods last by taking care of them and when we refuse to buy unnecessary products we help reduce air pollution.

Many important pollutants such as CO₂, CO, and radiation are invisible. Water vapor, smoke, and dust are often visible when viewed from a distance or when they are especially abundant. When particulates are not especially abundant, though, they must be concentrated to be seen. In this activity, you will be collecting particulate matter from the air in your community.



13.2 Detecting Air Pollution: Instructions

In this activity, you will be making particulate collectors to test for the presence of particulates in various areas of your community. Each student should make at least one particulate collector. When you place your detector(s), be sure to record the information on the top part of the data page.

To make your particulate collector:

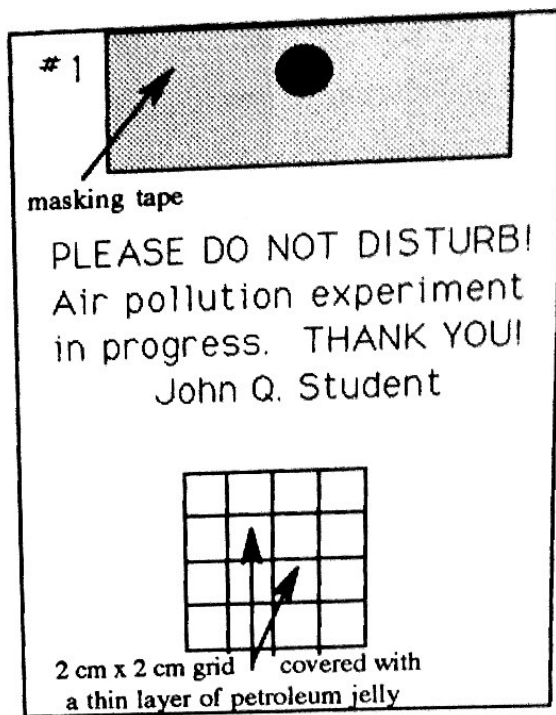
1. Attach a 1" (2–3 cm) piece of masking tape to the narrow side of a 2.5" × 3" card provided by your teacher. Use a hole punch to make a hole in the masking tape. The hole is for attaching a string with which to hang the card if it is not attached with push pins or tape. The masking tape will reinforce the hole.
2. Use a PENCIL to write the following on both sides of your card(s):
"Please do not disturb. Air pollution experiment in progress. Thank you!"
3. Use the pencil to write your name on the card. If you are placing more than one card, number each one so that you do not get them mixed up.
4. Use the pencil to draw a 2 cm × 2 cm square on one side of the card. Use the pencil to divide the square into a grid of squares with 0.5 cm sides.
5. EITHER:

- a. Place a small amount of petroleum jelly in the middle of the square. Use your (clean) finger, a clean toothpick, or the edge of a card to spread the petroleum so that it forms a thin, even layer over the square. Carry your pollution detector in a small box so that the petroleum doesn't get smeared or contaminated before you place it in the community.

or

- b. Obtain a small amount of petroleum jelly in a piece of foil or plastic. Apply the jelly as above when you place the card in the community.

6. Obtain push pins, masking tape, and/or string to use to place the pollution detector(s) in the community.
7. On the assigned day, place your collector(s), recording the appropriate data.
8. On the assigned day, bring your collector(s) to class, again recording the appropriate data.
9. Use magnifying lenses or microscopes to examine the particulates collected.
10. Record your observations on the data table.



Name _____ Class _____ Date _____

13.2 Detecting Air Pollution: Data

collector # _____

SITE OF PLACEMENT: address or location: _____

description of site/area: _____

prevailing winds from: _____ wind condition today: _____

sticky side facing (direction): _____ height above ground: _____

possible pollution sources in the area (what and where?): _____

COLLECTOR SET OUT: date: _____ day of week: _____ time: _____

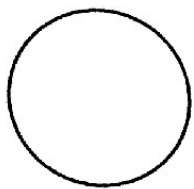
position (horizontal, vertical, or?): _____

notes:

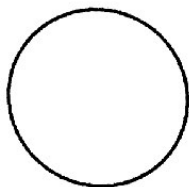
COLLECTOR PICKED UP: date: _____ day of week: _____ time: _____

notes:

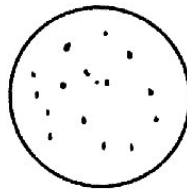
The particulates on my collector look most like:



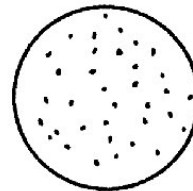
mine



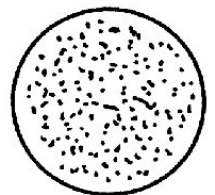
none



light



moderate



heavy

Can you identify any of the particles?

Other notes:

13.3 Detecting Air Pollution: Questions

1. What are "particulates"? (Define and give several examples.)

2. What is the major single source of outdoor air pollution in the United States?

3. List the major stationary sources of air pollution in your community. For each one, list one thing that you could do to reduce its air pollution.

source	something that I can do
_____	_____
_____	_____
_____	_____

4. Describe several things that you as an individual can do to reduce air pollution from transportation. Circle those that you are now doing or are willing to do.

5. Some people feel that what they as individuals do is not important, that they cannot do much to address major problems such as air pollution. Others say that the problems are caused by individuals and that individuals can work together to address the problems. Individuals can change buying habits, which will then change the habits of industries; they can drive more fuel-efficient cars that pollute less; they can save energy; and they can enact and enforce laws. What do you think—can the individual make a difference? Why do you think as you do?

