Air Strips Lesson Plan

EPA
JUNE 2024

Grades: 6-8
Subject: Science
NGSS Connections: ESS3.C
Time: 2 Class Periods (1 Week Apart)

Student Objectives

Define particulate matter.

- Collect particulate matter from the air in test areas around the school.
- Analyze the particles collected and draw conclusions about the airborne particulate pollutants.

Materials

- Poster board or cardboard
- Scissors
- Rulers
- Clear tape (e.g. packing tape)
- String
- Magnifying glasses
- Hole punch
- Permanent markers
- Optional: compasses, dissecting microscope, balance, quarter
- Student directions sheet (included)
- Air strips template (included)

Background Information

Our atmosphere is almost completely made up of invisible gases. Most major air pollutants are also invisible gases, although large amounts of them concentrated in areas such as cities can be seen as haze or smog.

The air we breathe indoors and outdoors always contains particulate matter (PM). Some particles, such as dust, dirt, soot, or smoke, are large enough to be seen with the naked eye. Others are so small they can only be detected using an electron microscope. Particulate matter can accumulate on surfaces such as buildings and other structures.

Particulate matter is made up of tiny particles of solid matter and/or droplets of liquid. Natural sources include volcanic ash, pollen, and dust blown about by the wind. Diesel fuel burned by vehicles on the road, as well as coal and oil burned by power plants and industries, are the chief sources of human-made particulate pollutants. However, not all sources are large-scale. The use of wood in fireplaces and wood- burning stoves can also produce significant amounts of particulate matter in localized areas. The U.S Environmental Protection Agency provides information on types of wood-burning appliances. If you choose to heat your home with wood, use the cleanest wood-burning appliance – these are marked with EPA-certified and EPA-qualified labels.

Particulate matter can be harmful to plant life and to animals and human life when the pollutants are inhaled. Smaller particles, (10 micrometers in diameter or smaller), pose the greatest health problems since these smaller particles generally pass through the nose and throat and enter the lungs. Because it can have harmful and serious effects, particulate matter is one of the six criteria pollutants – a pollutant for which the federal government has established laws and air quality standards.

Air Quality Flag PROGRAM

Adapted from the Air and Waste Management Association Environmental Resource Guide for Air Quality
EPA- 456/F 24 006

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Setting the Stage

- Ask students to respond to the journal prompt: "Can we see air pollution? Explain your reasoning in 2-4 sentences."
- Define PM for students by sharing the "Background Information."
- Engage students in a classroom discussion about visible air pollution. Ask a few students who are comfortable doing so to share their journal responses. Encourage the class to give examples of visible air pollutants (e.g., smoke, dust, smog, etc.), drawing from facts in the background information and journal responses.

Activity

1. Make an air strip for yourself. Use this strip to show the students how their finished product should look, then use it as a control in step 4 for comparison with the test strips exposed to the air for 1 week.
2. Give each student a copy of the student directions sheet (included) and an air strip template (included). Provide the materials to make the strips and have the students follow the directions. *NOTE: Each student should make at least one air strip, more if there is time.*
3. Have the students hang the strips at different places around the school, both inside (e.g., hallways, cafeteria, bathrooms, classrooms, gym, kitchen, etc.) and outside (e.g., trees, walkways, entrances, etc.). Give each student tape to secure the air strip's string to a stable surface at the selected sites. The air strips should be able to move freely without bumping other surfaces. *NOTE: All air strips should be carefully labeled with date, location, and student's name.*
4. Have the students check the weather forecast to make sure that the air strips will not get wet in the rain. If the forecast calls for rain, bring the air strips in for that period of time before returning them outdoors.
5. After one week, have the students collect the strips. Tell them to be careful not to touch the sticky side of the tape.
6. Have the students visually compare the control air strip to the air strips used to collect particulate matter.
7. Distribute magnifying glasses and have the students try to identify as many particles on the tape as possible. Dust, ash/soot and/or other particles may be present. Depending upon the time of year, pollen may also have been collected. *OPTIONAL: You may choose to have the students use dissecting microscopes instead of, or in addition to, magnifying glasses.*
8. Ask the students to draw conclusions about the particulate air pollutants in the test areas. Are there differences in the particles based on where the air strips were placed?
9. Have each student develop a chart or graph using the information gathered by the class and write a summary paragraph about the activity.

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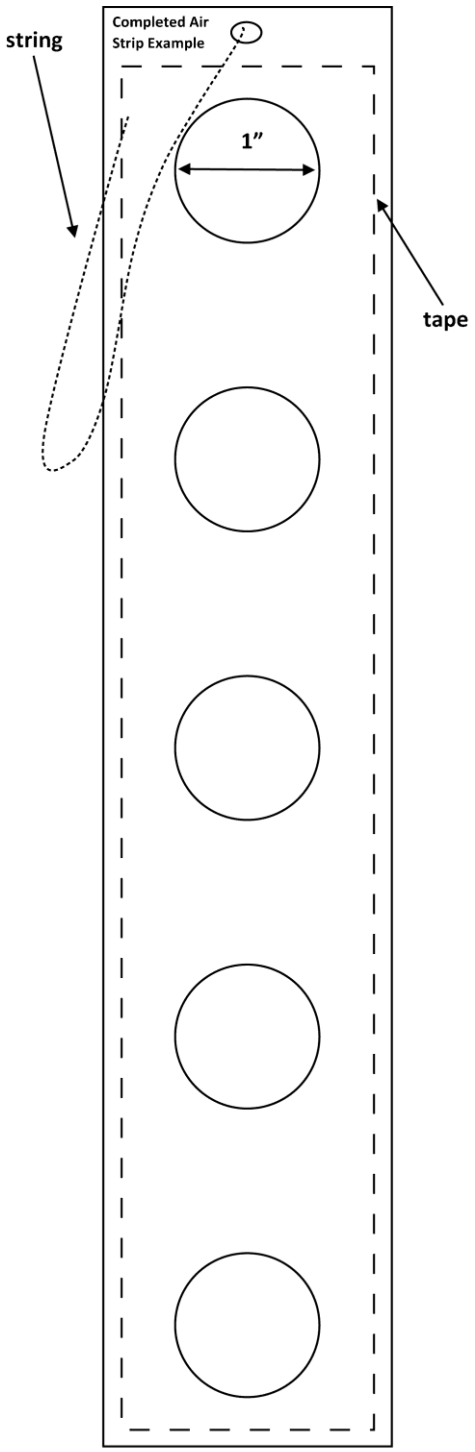
Student Directions

1. Cut out an air strip template (provided on page 5). Be sure to cut out the 5 circles in the center of the template strip.
2. Place the template on a piece of posterboard or cardboard. Trace around the outside of the template and each circle. Cut out the rectangular air strip. *Note*: *If you don't have a copy of the template, you can use a ruler to measure a rectangle that is 2 inches wide and 10 inches long on your posterboard or cardboard.*
3. Cut out the circles you traced on the posterboard or carboard. *Note: If you don't have a template, use a ruler to find a round object with a 1-inch diameter or use a compass to draw the circles*. *A quarter is about 1 inch in diameter.)*
4. Use a hole punch to put a small hole in one end of the strip. Tie a string through the hole; the string will be used to hang the strip at a selected site.
5. Put a long piece of clear tape over one side of the strip. Be sure to completely cover all 5 holes. (Depending upon the width of the tape, you may need 2 or more pieces.) The sticky side of the tape will collect particulate matter from the air. Make sure you do not touch the sticky side of the tape over the holes.
6. Before hanging the air strip at a selected site, use a permanent marker to write the date, location, and your name on the top edge of the strip.



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Extension

- Place air strips in a variety of other places for a week. Have the students compare the PM collected from the different areas.
- Hang new air strips daily and compare them to determine if the day of the week makes a difference in the amount of PM collected. Have the students consider possible factors such as weather, industrial schedules, etc.

Air Strip Template