**Discover how farmers care for air quality by preventing air pollution.**

**Unit: Pillar 1 D (4th – 8th Grades)**

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| **Activity**: Air Quality Activities <https://www.teachervision.com/pollution/investigate-activity-investigating-air-pollution> and **Digital Activity:** On iPads, play the game Power Up |

**Investigating Air Pollution**

**Interest Approach:** What is air pollution? Show the website <https://www.nashville.gov/Health-Department/Environmental-Health/Air-Pollution-Control/Air-Quality.aspx> and ask students if they have seen this sign over the highways in Nashville. Define air pollution as, “the presence in or introduction into the air of a substance which has harmful or poisonous effects.”

**Activity 1: Investigating Air Pollution** <https://www.teachervision.com/pollution/investigate-activity-investigating-air-pollution>

**Materials (per group)**

4 pieces of string

Petroleum jelly

Hand lens

**Advance Prep**

Pencil

Index cards

Paper towel

You may wish to pre–punch holes in the cards using a hole punch.

**Investigating Air Pollution**

Follow This Procedure

Spread the petroleum jelly on the cards and hang in different locations. Record your observations in the chart.

**Hints and Tips**

* Locations for pollution detectors may include: by a tree, in a parking lot, in the cafeteria, by windows, and by air vents.
* Encourage students to choose locations that are likely to have many pollutants as well as locations that are likely to have few pollutants.
* **Safety Note**  Remind students not to eat or taste the petroleum jelly and to avoid contact between it and their clothing.
* **Additional Comments**  You may wish to have students keep the pollution detectors hanging in their locations for two or more days, if they will not be disturbed.

**Investigating Air Pollution**

**Follow This Procedure**

Spread the petroleum jelly on the cards and hang in different locations. Record your observations in the chart.

**Investigate Activity**

|  |  |  |
| --- | --- | --- |
| **Card Number**  | **Location**  | **Observations**  |
| 1  |  |  |
| 2  |  |  |
| 3  |  |  |
| 4  |  |  |

**Interpret Your Results**

**1.** Compare and contrast your four cards. Describe the similarities and differences. Which location had the most particles? Which location had the fewest?

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**2.** Compare and contrast your cards with other groups. Did cards in similar locations show similar results?

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**3.** Make an **inference.** Explain why there may be differences in the amount of pollution you observed in different locations.

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**Inquire Further**

What are some other ways to detect air pollution? Develop a plan to answer this or other questions you may have.

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**Investigating Air Pollution (Answer Key)**

Follow This Procedure

Record your **observations** and data in the chart.

**Investigate Activity**

|  |  |  |
| --- | --- | --- |
| **Card Number**  | **Location**  | **Observations**  |
| 1  |  |  |
| 2  |  |  |
| 3  |  |  |
| 4  |  |  |

**Interpret Your Results**

**1.** Compare and contrast your four cards. Describe the similarities and differences. Which location had the most particles? Which location had the fewest?

**Answers will vary. Cards in similar locations should have similar results. Cards in different locations may differ greatly.**

**2.** Compare and contrast your cards with other groups. Did cards in similar locations show similar results?

**Answers will vary. Cards in similar locations should have similar results.**

**3.** Make an **inference.** Explain why there may be differences in the amount of pollution you observed in different locations.

**Particles in the air are one type of pollution. The more particles that are in the air, the more polluted the area. The most polluted area should have the most particles on the detector.**

**Inquire Further**

What are some other ways to detect air pollution? Develop a plan to answer this or other questions you may have.

**Students may want to research air pollution or call the EPA to discover what professionals use to study air pollution.**

**Teacher Background and Student Learning Objectives**

Each of your students begins the demonstration with a cup of clean water representing unpolluted air. During the demonstration, you'll read them 6 everyday activities. Each of the activities generates one or more of the pollutants listed below. When your students recognize an activity that they have participated in, they add a drop of food coloring to their cups to represent the pollutant or pollutants created by that activity.

At the end of the demonstration, their cups of colored water provide a striking visual reminder of each student's contribution to air pollution.

Familiarize yourself with the pollutants in the list below so that you can explain them to your students during the demonstration.

**Tools and Set Up**

* Arrange students so they’re sitting in groups of 4
* Each student will have 1 cup filled ½ with water
* Each group will have 1 bottle of red food coloring, 1 bottle of green, 1 bottle of blue, and 1 bottle of yellow

**Vocabulary:**

**Particulate matter (PM10)—**Particulate matter consists of airborne solids less than 10 micrometers in diameter. These tiny particles are easily inhaled into the lungs, where they can cause damage to lung tissue. Diesel fumes from busses and trucks are a source of airborne particulate matter. **Sulfur dioxide (SO2)—**Sulfur dioxide is a toxic gas with a pungent odor. Electric power plants fuelled by coal or oil are the primary source of sulfur dioxide pollution. Sulfur dioxide emissions can cause respiratory diseases and are a key factor in acid rain formation.

**Nitrogen dioxide (NO2)—**Nitrogen dioxide is a toxic, reddish brown gas by product of the combustion of fossil fuels (e.g., coal, diesel fuel, and gasoline). Nitrogen dioxide can irritate airways and increase susceptibility to respiratory diseases. It is also a factor in the formation of acid rain.

**Carbon monoxide (CO)—**Carbon monoxide is a colorless, odorless toxic gas. Motor vehicles are the primary source of carbon monoxide pollution. CO is highly toxic. At low concentrations it causes drowsiness and headache; it is lethal in high concentrations.

**Volatile organic compounds (VOCs)—**Volatile organic compounds are toxic gases made of carbon, hydrogen, oxygen, and other atoms that form gases easily. They are found in nature as well as in glue, paint, gasoline, tobacco smoke, and clothes that have been dry-cleaned. VOCs form ground level ozone, a main component of smog.

**Air Quality Activity**

We are often unaware of how our everyday activities contribute to air pollution. The purpose of this demonstration is to make you aware of the air pollution you create every day. The cup of clean water in front of you represents unpolluted air. You'll add drops of food coloring to the cup to represent the different types of air pollutants caused by the everyday activities that I'll describe to you. We'll use the following colors to represent these pollutants:

**Color Key**

Blue—pollutants from consumer products and paints (VOCs)

Green—pollutants from lawn, garden, and construction machinery (CO, NO2, PM10, SO2, and VOCs)

Red—pollutants from cars and trucks (CO, NO2, PM10, SO2, and VOCs)

Yellow—pollutants from power plants and industrial processes (CO, NO2, PM10, SO2, and VOCs)

 Interest Approach

Listen carefully while I describe the following activities. If you participated in the activity during the past 24 hours, add one drop of the appropriate color of food coloring to your cup of water. Some activities may not apply to you (for example, applying nail polish or mowing the lawn). That's why you each have your own cup, because each individual's contribution to air pollution is unique.

**1. You showered and got ready for school.** Add one drop of **blue** and one drop of **yellow** food coloring to your cup if this activity applies to you.
**Blue—**VOCs emitted by soap, shampoo, deodorant, hair spray, perfume, and fingernail polish.

**Yellow—**CO, NO2, PM10, and SO2 emitted by combustion used to heat the water for the shower. Remember, electric water heaters often depend on combustion too, because a lot of power plants burn fossil fuels to generate electricity.

**2. You put on your favorite shirt, which your mom had dry-cleaned for you.** Add one drop of **yellow** food coloring to your cup if this activity applies to you. **Yellow—**VOCs emitted by the dry-cleaning process.

**3. Coming to school, you took the bus or rode in a car.** Add one drop of **red** food coloring to your cup if this activity applies to you.
**Red—**CO, NO2, PM10, SO2, and VOCs emitted by the engine in your school bus or car.

**4. At lunchtime, you bought lunch in the cafeteria.** Add one drop of **yellow** food coloring to your cup if this activity applies to you.
**Yellow—**CO, NO2, PM10, SO2, and VOCs emitted by cooking lunch, Styrofoam trays, and plastic utensils.

**5. Going home, you took the bus or rode in a car.** Add one drop of **red** food coloring to your cup if this activity applies to you.
**Red—**CO, NO2, PM10, SO2, and VOCs emitted by the engine in your school bus or car.

**6. You mowed the lawn with a gasoline-powered lawnmower.** Add one drop of **green** food coloring to your cup if this activity applies to you.
**Green—**CO, NO2, PM10, SO2, and VOCs emitted by your lawnmower's engine.

Review/Summary

Ask your students the following questions:

1. Look inside your cups. If the air pollution around you were this apparent, would you want to breathe the air?
2. What other sources of air pollution, beyond those mentioned in this demonstration, could you think of as being produced in a single day?
3. What could you do to reduce the number of pollutants released each day?
4. If you have a container large enough, ask your students to pour their water into it, and then ask them to comment on the combined effect of each individual's pollution.