Particulate about Air

Objective:

Explain effects of particulate matter in the air and collect information on local air quality.

Overview:

Participants will look at air quality and collect data about particulate matter – small particles suspended in the atmosphere such as dust, pollen, sea salt, soil, mold, soot, smoke and other fine particles we breathe in.

Each group will collect 2 prepared hanging air collector samples and use tape to collect data on different surfaces.

Materials:

Preparation:

- Posterboard, cut in 4" (10.68 cm) squares
- Petroleum jelly
- Wax paper
- String

Per Group:

- Data collection sheet
- 4" (10.68 cm) wax paper squares
- Gallon Ziploc bag
- Clear tape
- Pencil

Recommended Ages: 10+

Content Areas: Earth Science, Life Science, Environmental Education, Community Planning

Duration: 30-45 minutes

Group Size: 2-5 participants per group

Predicted Cost: $10-$20

Setting: Outdoors, different types of outdoor spaces (more natural vs more developed) recommended

NGSS Disciplinary Content: LS2, ESS3, ETS1

Key Terms: Particulate Matter, Air Quality Index

Background:

Particulate Matter: important indicator of air quality. "Inhalable coarse particles" are particles equal to or smaller than 10 micrometers, including dust, pollen, mold, etc.

Air Particulates and Well-Being

The smaller the particle size, the farther it can move into our bodies. Coarse particles can pass into the lungs and create health problems. Air pollution is a leading cause of asthma.

Air Quality Index (AQI): reports the level of pollution in a specific location over a certain period to help understand our air

301+	HAZARDOUS
201-300	VERY UNHEALTHY
151-200	UNHEALTHY
101-150	UNHEALTHY FOR SENSITIVE GROUPS
51-100	MODERATE
0-50	GOOD

Air Quality Index (AQI)

Air Particulates and Infrastructure

Communities can mitigate bad air quality by:

- Closing coal-fired power plants
- Putting up walls/barriers near interstates
- Reducing the use of diesel trucks
- Using high-efficiency furnace filters
- Closing windows on bad air quality days
- Mowing lawns in the evening

Air Particulates and Natural Disasters

Increased ozone pollution and particulate pollution result in more severe weather.

- Suppress rain and evaporation of water to the surrounding air → increases humidity and provides favorable environment for thunderstorms and tornadoes.
- Circulate to polar regions, darkening ice and snow → absorbs more sunlight and contributes to global warming

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Preparation:

At least two weeks before the activity:



1. Cut out two posterboard squares per group and thread with string so the squares can be hung outside. Cover one side of each square with petroleum jelly. Place wax paper on top of petroleum jelly.

2. Hang the air sample collectors at least three feet (1 m) off the ground at different locations outside. Roughly half of the collectors should be hung near buildings or more developed areas, while the other half should be hung near relatively green spaces. Once an air sample collector is hung up, remove the wax paper.

Procedure:

1. Divide participants into groups. Review safety rules and instructions. If spreading across a wide area, assign specific locations to each group.
2. Each group will:
   a) Take down 2 air sample collectors, cover each with wax paper, and carefully place inside gallon-size Ziploc bag.
   b) Use tape to collect 3 samples.
      i. Press each piece of tape to different surfaces ~3 feet (1 m) off the ground (i.e., tree bark, bench) and leave for 10 seconds.
      ii. Carefully place each piece of tape in the boxes on the data collection sheet. Label each sample site (e.g., leaf)
3. Take groups outside to collect their data.
4. Once groups collect their data, return inside to complete their data sheet.
5. As a whole group, discuss their results.

Whole Group Discussion Questions

- What are the potential impacts of different types of particulates?

  Pollen may cause allergies, soot can lead to asthma, etc.
- What differences did you notice between the particulates and different sites? *Types (dust, pollen, soot), reflectivity, etc.*
- Why might the green spaces tend to have more variety in types of particulates?

  Higher biodiversity = more sources of particulates compared to single source (soot/exhaust) from built sites
- What types of particulates would you expect in communities with little green space and lots of concrete or asphalt surfaces? How does that affect how we should design new communities?

Extensions and Modifications

- For large event: Instead of a data sheet, have visitors add observations to a display chart (examples in resources). Fold tape in half and hold up to the light instead of using paper.
- Either data collection method can be used independently of the other if only time/materials for a single activity.
- For further air quality investigation, you can look up your area's current and forecasted air quality at map.purpleair.com
- This activity can be combined with the activity "Betting on Biodiversity" for a deeper investigation comparing green and developed spaces.

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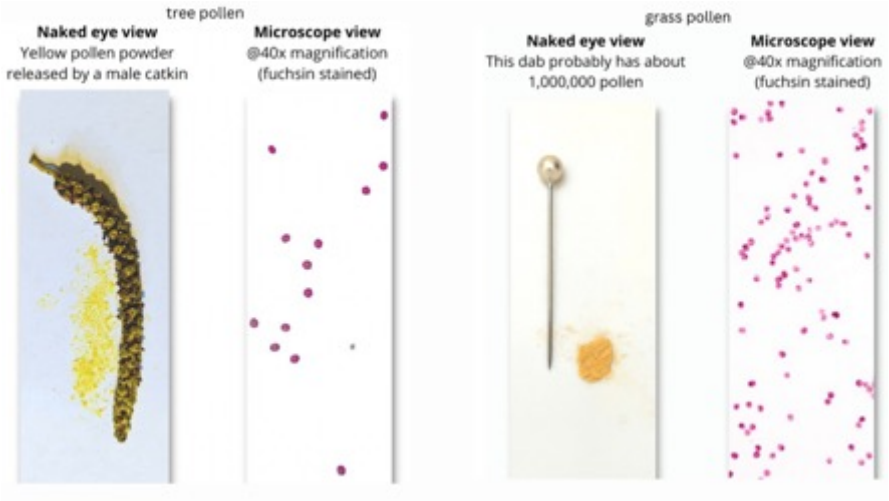
PARTICULATE MATTER

Part 1: Data Collection

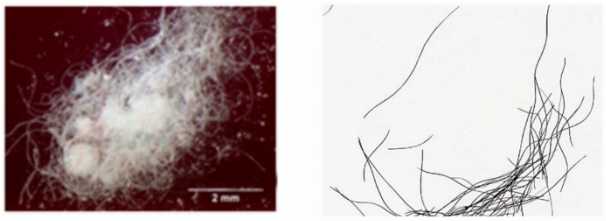
1. Take down 2 air sample collectors, cover with piece of wax paper, and carefully place inside gallon-size Ziploc bag.
2. Use tape to collect 3 samples.
    a. Press each piece of tape to different surfaces at least 3 feet (1 m) off the ground (i.e., tree bark, bench surfaces) and leave for 10 seconds.
    b. Carefully place each piece of tape in the boxes below. Label each sample site (e.g., leaf)

Site #1: _____ *Site #2: _____* *Site #3: _____*

Particulate Identification Guide



FIBERS



ASH/SOOT



DUST & DIRT



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Part 2: Analysis

Use the particulate matter identification guide on the front to analyze your air sample collectors and tape. Record data from particulate samples for your group below *(circle one for each option)*.

We collected in a **mostly green / mostly developed / combination** space

Hanging sticky card (air)	Tape (surfaces)
Density: How much of surface is covered? 0-25% 26-50% 51-75% 76+%	**Density:** How much of surface is covered? 0-25% 26-50% 51-75% 76+%
Reflective: Are particles dark or light colored? Mostly light equal light & dark mostly dark	**Reflective:** Are particles dark or light colored? Mostly light equal light & dark mostly dark
Size: What size are the particles? mostly small small & big mostly big	**Size:** What size are the particles? mostly small small & big mostly big
Identify: What type of particulate(s) do you see? pollen insects fibers ash/soot dust/dirt	**Identify:** What type of particulate(s) do you see? pollen insects fibers ash/soot dust/dirt

Part 3: Discussion

Based on your data, would you expect the area you sampled to have good or bad air quality? Why?

How could the type of area you sampled (green vs. developed) explain what you see in your data?

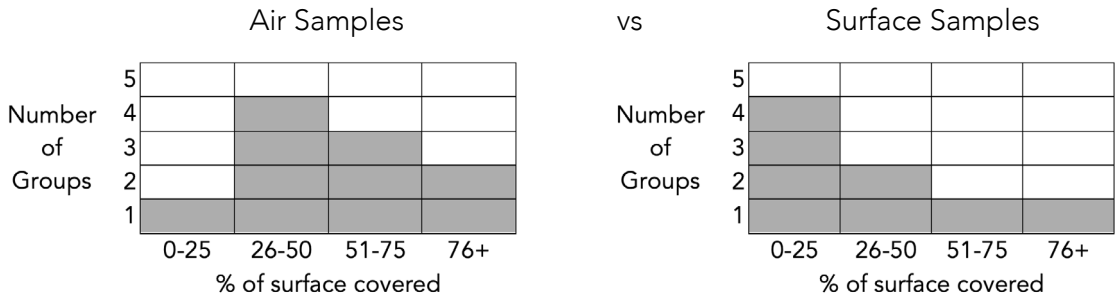
If you can, find a group who sampled a different type of site than you. How does their data compare to yours? Why do you think that is?

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Tabling Event Example Displays

Example 1: Comparing particulate density

As groups report their findings, shade in a box in the appropriate column. Alternatively, they can write the number of plant types they found on a sticky note and add it to designated locations on a poster. Different charts can also be used to compare different sampling sites like in Example 2.



Example 2: Comparing particulate identity

Groups can add either check marks, stickers, or sticky notes to each row to record if they observed each group. A chart can also be used like in Example 1 to compare hanging cards and tape samples.

	Observed in Green Space	Observed in Developed Space
Pollen	√√√√	√√
Insects	√	√√√
Fibers	√√√√	√
Ash/Soot	√	√√√
Dust/Dirt		√√√√√√√

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