

### Investigation 2a: What Do Particles Look Like?

#### Goals and Objectives

Students will understand that particles in the air can be collected in various ways and observed.

- Students will use the engineering design process to design a method for collecting particle pollution data.
- Students will calculate the rate of particle collection.

#### Time Required

Two 50-minute periods.

You will need a minimum of one class period to design the collectors and a second class period to analyze the results.

#### Standards

##### Grade 6-8, Science, Strand 3, Concept 2

PO 3. Design and construct a solution to an identified need or problem using simple classroom materials.

##### Grade 6, ACCRS, Mathematics, 6.RP.A.3

Use ratio and rate reasoning to solve real-world and mathematical problems.

##### Grade 7, ACCRS, Mathematics, 7.NS.A.3

Solve real-world and mathematical problems involving the four operations with rational numbers.

##### Grades 6-8, ELA, 6.W.1, 7.W.1, 8.W.1

Write arguments to support claims with clear reasons and relevant evidence.

##### Grades 9-12, ELA, 9-10, W.1 and 11-12.W.1

Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

#### Materials

- Class set of Investigation 2a: Lab Sheet
- Class set of Investigation 2a: Planning Sheet (Option 1 or Option 2)
- Filter paper, one 12 inch piece for each group
- 3X5 index cards
- Graph paper
- Hole punches, one per group
- Scissors, one per group
- String
- Pipe cleaners
- Craft sticks
- Clear transparent tape (not the invisible kind)
- Glue sticks
- 40X Magnifiers or hand lens, one per group
- Microscopes and glass slides (optional)
- Science journals or notebooks

#### Essential Question

What is in the air we breathe?

## Investigation 2a: Lesson Plan

### Pre-Lab Guiding Questions



Begin the lesson by asking students the following questions:

1. **What gases are in the air we breathe?** Oxygen, nitrogen, water vapor, carbon dioxide methane, ozone, etc.
2. **What else is in the air we breathe?** Water droplets, dust, soot, particles, volatile organic compounds, etc.

### Introduction



1. Divide students into cooperative learning groups. Pass out samples of filter paper to each group. Ask them to discuss what they think the papers might be, what the different colored circles represent and how the circles got onto the paper, etc. Students record their ideas in a science journal or notebook.
2. Tell students: **Particles in the air can have harmful effects on people's health. So, it makes sense that scientists want to better understand what kind of particles are floating around the different spaces in which people spend time.** Collect the filter papers. Students will return to these in Investigation 3b.

### Procedure



Students will work in groups to complete an engineering design project. Their challenge is to design and build an instrument that will collect airborne particles.

**Explain:** One way scientists collect particles in the air is to use something called a **high-volume sampler**. This sampler uses a pump to pull air through a filter that traps particles of a certain size. The longer the pump is run, the greater the number of particles that will get trapped.

Another way to collect particles is to wait for them to settle onto a sticky surface, like a piece of tape. This method works well with coarse particles, since they settle out of the air quickly. Because coarse particles are larger, you can view them using a classroom microscope or hand lens.

There are two options for this investigation.

Name: \_\_\_\_\_

## Investigation 2a: Planning Sheet-Option 2

### Procedure



**1. Identify the Problem**

**2. Brainstorm Your Ideas**

**4. Test Your Collector! Sketch the Location**

**3. Choose the Best Solution - Draw a Diagram**

**5. Improve - How can you refine your design?**

**List all Needed Materials**

Name: \_\_\_\_\_

## Investigation 2a: Lab Sheet

### Data



Examine a clean piece of tape first. This is your control. Now examine your exposed tape. Count the number of particles you see by size and record the numbers in the table below.

If you are using a microscope, gently peel the exposed tape off of the card and stick it to a microscope slide. If you're using a hand lens, be sure to keep your card *sticky side up!*

Location	Small Particles	Medium Particles	Large Particles

### Observations



- Describe some of your largest particles here, include drawings.
- Can you tell where they came from? How do you know? Cite specific evidence to support your claim.