



Throughout the guide teaching tips are in red.

### Activity Description and Estimated Class Time

This activity requires a total of about one class period of time: approximately half a class period to make the particle traps, and another half class period a week later to assess results. In this activity, students use a particle collecting system to count particles from the air taken at various locations.

### Objectives

Students will develop an understanding of the following ideas and content:

- The air contains particles that move from place to place,
- monitoring air quality includes capturing and counting particles from air at a given location for a specified amount of time,
- the amount and type of particulate matter in the air is an important component of air quality.

### Correlations to NC Science Standards

**7.E.1.6 Conclude that the good health of humans requires: monitoring the atmosphere, maintaining air quality and stewardship.**

### Brief Science Background

On a sunny day, air usually looks clear. However, even clear air contains lots of particles. Some particles are too small to see, such as pollen, bacteria, or mold spores. Some are big enough to see, such as dust, dirt or pieces of ash. Particles in the air come from many sources, including storms, volcanoes, forest fires, smokestacks, car exhaust, farm fields, and factories. Particles are the most visible air pollutant and are a factor in our health. Some particles can exacerbate existing conditions, such as asthma. They can also cause respiratory diseases and cancer. As a part of monitoring air quality, the EPA and other organizations examine the amount and types of particles found in the air.

### Materials

#### Materials for the whole class or the teacher

\*Materials to be supplied by the teacher or the students are marked with an asterisk.

- \*dissecting microscope (optional)
- \*a piece of white tissue paper
- hand lenses
- scissors
- ruler

#### Materials for each student

- one 3" x 5" index card
- one 5cm x 5cm grid
- one student instruction sheet
- clear contact paper
- sandwich bag
- \*science notebooks

**Preparation**

1. Photocopy SD-1, Procedure for Students, one copy per pair of students.
2. Make 2 copies of SD-2, 5 centimeter square grids, and cut out one grid per pair.
3. Be ready to project SD-3.
4. If you want, make a particle trap and place it somewhere in the room.

**Exploration – 5 minutes**

1. Project SD-3 and ask students to describe what they see. Explain that these objects are household air filters. The one on the right is unused. The one on the left is used. Air from an ordinary, relatively clean home has flowed through it for a few months. Ask what they think is on the filter.
2. Have students get SD-1, Procedure for Students, and the other materials needed to make the particle trap. Ask them to make their particle traps. Before they begin, remind them that is important to keep the contact paper clean when they are making the particle trap and avoid touching the surface where particles will settle.
3. Discuss good places to leave the traps. Remind them that we are trying to gather evidence about how much particulate matter is in the air and ask about problems that might occur, or things that might confuse results. **Ideally, leave traps where they are likely to be undisturbed, but also likely to get dusty quickly.**
4. Ask students to tell you where at their home they plan to place their particle traps. Ask for reasons for the choice. Explain that we will allow the traps to sit undisturbed for one week. Remind them to save the backing paper.
5. After a week, give each student a sandwich bag and ask them to bring the traps back to class in the bag. Remind them to cover the 5cm x 5cm sticky opening with backing paper as soon as they pick up the trap. If they have lost the backing paper, tell them they can use waxed paper.
6. When the traps are back in the classroom, give out the 5cm x 5cm grids and hand lenses and ask students to count the particles on the traps.

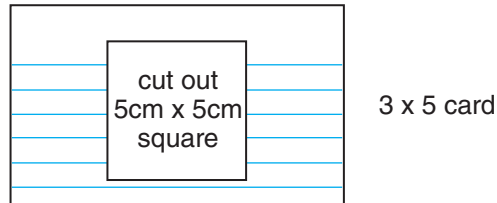
**Wrap-Up**

1. When the class is ready to analyze the traps, place them over the 5 centimeter square grids. Count particles using a hand lens. Record particle counts and the duration of the collection time in notebooks.
2. Ask students to design and write up an experiment in their notebooks using the particle trap to learn how fast particles settle on things. For example, we know that dust settles on undisturbed surfaces, but how fast? How can we figure it out? How long would it take to cover a particle trap in dust (so that you could no longer see the trap)?
3. Why would the Environmental Protection Agency (EPA) put out standards for particles in the air? What harm can particles do? Ask why the good health of humans might require monitoring the atmosphere and maintaining air quality.

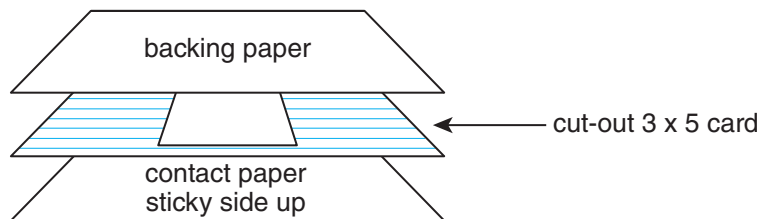
**Information on EPA air quality standards can be found at:**

**<https://www.epa.gov/pm-pollution>**

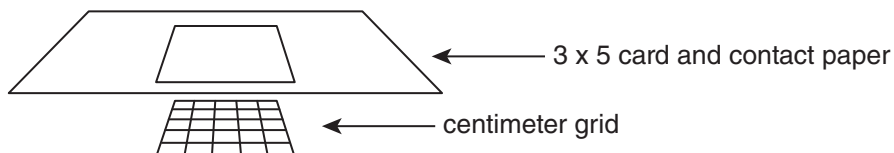
1. Use the ruler to draw a 5 cm x 5 cm square in the center of a 3 x 5 card. Poke a hole inside the square with one blade of the scissors, and cut out the square. It should look about like this:



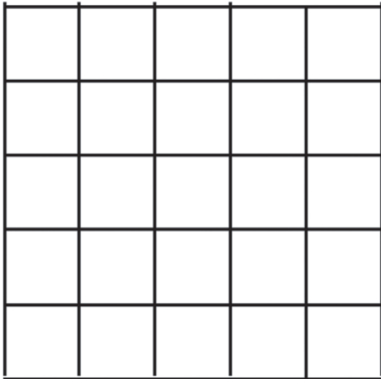
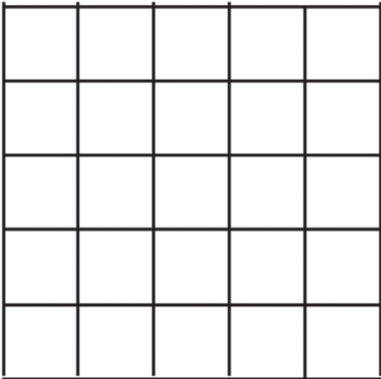
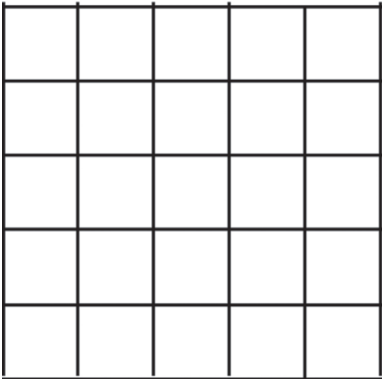
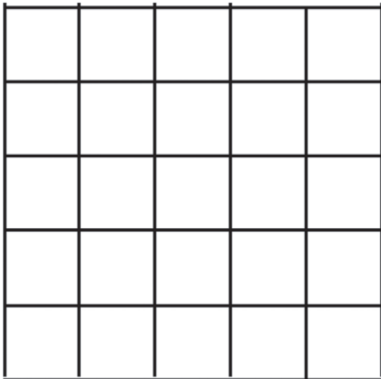
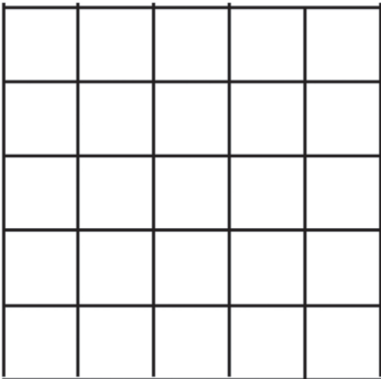
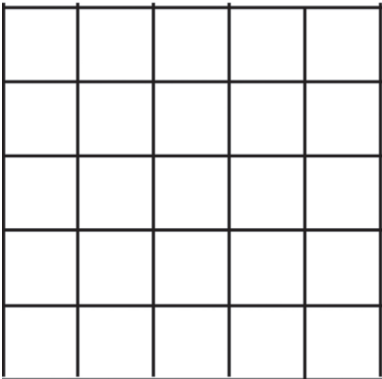
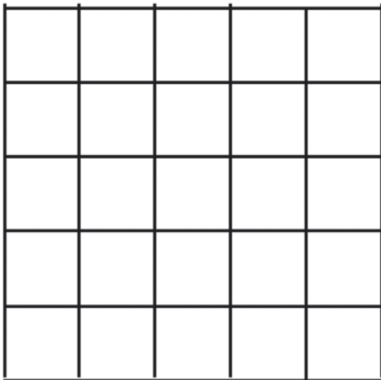
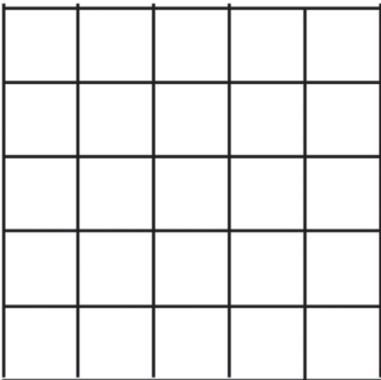
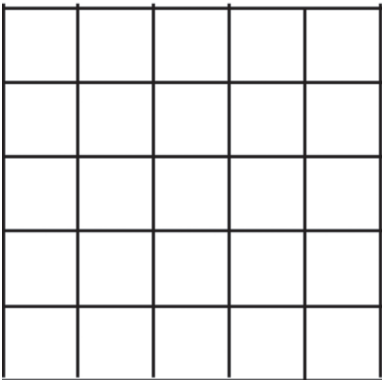
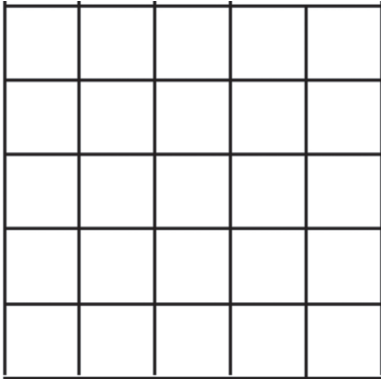
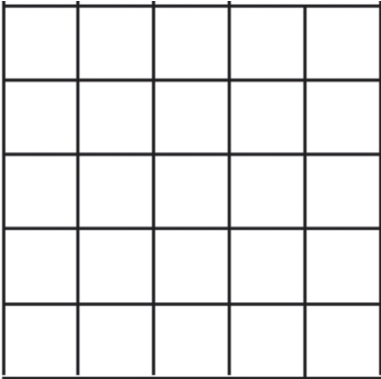
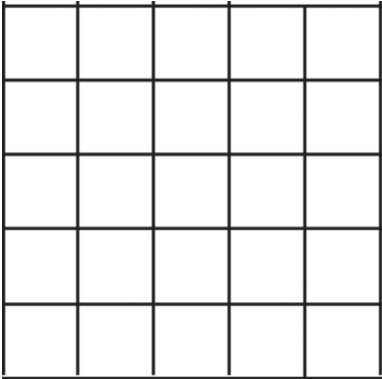
2. Cut a piece of clear contact paper the shape of the card and slightly smaller. Leave the paper backing on the contact paper when you cut. After you cut, remove the backing, taking care not to get anything on the sticky side of the contact paper. Keep the backing clean. Lay the contact paper sticky side up on a flat surface.
3. Center the cut-out 3 x 5 card over the sticky side of the contact paper and press it down. Be sure to keep the contact paper clean. Place the backing paper over the whole thing when you are done. The particle trap is ready to place.



4. Place your particle trap at your test site. Remove and save the backing paper to re-use later on. Be sure the trap will remain undisturbed. Leave it for 1 week.
5. After 1 week, collect your trap and cover it with the backing paper. If you have lost the backing paper, cover it with clean waxed paper. Place the covered trap in the sandwich bag that your teacher has provided.
6. When you get back to class, align the trap over the centimeter square grid.



7. Use a hand lens to count the particles. Record the number of the particles and the length of the collection time in your notebook.



## A Dirty and a Clean Filter From a Household Heating and Cooling System

