



## Cleaning the Air – Student Instructions



### Conduct an Air Particle Observation

#### Tools of the Trade

To conduct your particle observations, you will need:

#### Observation Cards

- 3x5" index cards x 2
- 2 feet double-sided tape
- 2-oz weights (can be rocks) x 2
- magnifying glass
- camera

#### Prepare the Observation Cards

1. Cut the double-sided tape into 4" strips.
2. Place 3 tape strips on each index card, one below the next.
3. Label the index cards "Indoor Air" and "Outdoor Air."

#### Place the Observation Cards

Note: These observations are best done when there is no rain in the forecast for several days.





4. Place the card labeled "Indoor Air" on a flat surface in your home that will not be disturbed, like a windowsill or table. Make sure it is in a room that receives good air flow, like a living room.
5. Place the card labeled "Outdoor Air" on a flat surface outside of your home that will not be disturbed, like a lawn chair or patio table. Make sure it is in an area that is also away from animals.



#### Collect Observation Data

6. Take a picture of each card once a day for 7 days. Try to take the picture at the same time each day if possible.
7. After taking the picture, examine each card with a magnifying glass to get a close look at the particles the cards collected. Record a description of the particles you observe (size, shape, color).
8. Organize the photos and the descriptions in the data table on your student handout (see example below).

## Observation Card Data Table

	Indoor Air Observation Card		Outdoor Air Observation Card	
	Image	Description	Image	Description
Day 1		Size, shape color of particles		Size, shape color of particles
Day 2				



### Build an Air Filter

#### Tools of the Trade

Your **filter** will need to be housed inside a shoe box connected to an air source. In this case, the air source will be a hair dryer. For the shoebox design, you will need

<b>roll of tape</b>	<b>string – 1 foot</b>	<b>shoebox</b>
<b>3x5" index cards - 4</b>	<b>protractor</b>	<b>3x5" piece of foil</b>
<b>ruler</b>	<b>ground pepper</b>	<b>56 quart or larger clear box</b>
<b>clear plastic wrap</b>	<b>hair dryer</b>	<b>teaspoon measuring spoon</b>

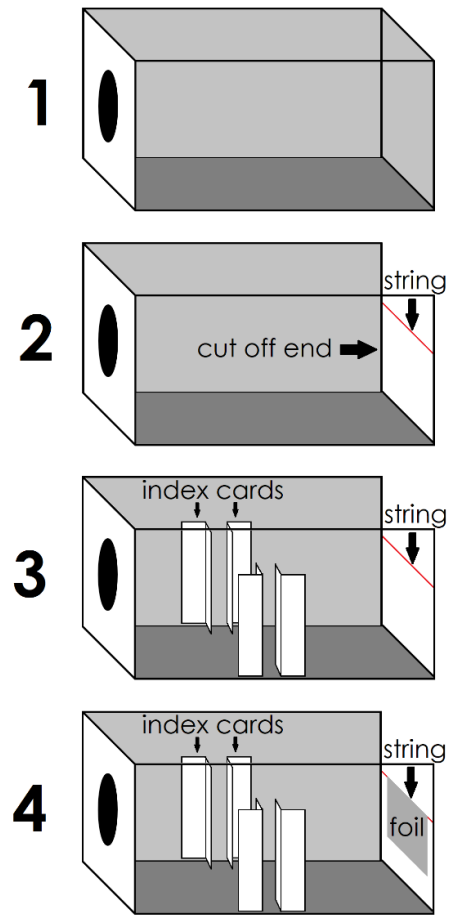
Your **filter** will be made from your own design. Gather the recommended materials below to create your design.

<b>tissue paper</b>	<b>tulle or netting</b>	<b>fine mesh</b>
<b>craft sticks</b>	<b>coffee filters</b>	<b>paper towels or napkins</b>
<b>tissue</b>	<b>pipe cleaners</b>	<b>cloth squares</b>

Remember that since it is your design, you may think of other materials that could work as a good **filter**. You can use those as well!

## Prepare the Filter House

1. On one of the short sides of the shoebox, trace the end of the hairdryer and cut out the circle. This is where you will insert the hair dryer.
2. Cut the second short side of the box completely off so that the end is open. Tape the string across the opening horizontally, cutting off any excess.
3. Fold the index cards in half lengthwise. Tape the index cards in the inside middle of the shoe box 1 inch apart, as shown in the picture. The cards will hold your **filter** in place.
4. Fold the foil in half crosswise and hang it over the string. The movement of the foil will show how much air is traveling through your **filter**.
5. Test your device by placing the hairdryer in the hole and turning the dryer on low. Use a protractor to measure the angle created between the table and the foil as the foil blows. This measurement should be somewhere between 0 and 90 degrees. The angle represents air flow at 100%.



## Build the Prototype

To build your **air filter**, you will first need to build a frame. Remember, the frame will need to fit inside the shoebox. Use your ruler to measure the height and width of the shoebox. Your **filter** will need to fit inside these measurements.

Once you have built your frame, you will need to cover it with material(s) that let(s) air through while blocking particles of pepper.

Some tips:

- Many **filters** have multiple layers to catch particles. However, more layers mean less air flowing through the **filter**.
- Aim to get at least 50% of the air through your **filter**. This means the angle between the table and the foil should be at least half as big as the first measurement. (For example, if the angle at 100% airflow is 90 degrees, then the airflow for your **filter** needs to be larger than 45 degrees.)
- Aim to block at least 50% of the pepper using your **filter**.

Once you have determined what your frame and **filter** layers will look like, draw a diagram of your **filter** on the Data Collection sheet.

## Test the Prototype

1. Place the large clear box on its side and place the shoebox, foil side first, inside the box.
2. Place your **filter** in the space created by the index cards.
3. Pour 2 teaspoons of pepper in the space between the **filter** and the hair dryer.
4. Turn the hairdryer on low and run it until all the pepper has gotten to the **filter**.
5. While the hairdryer is on, use the protractor to measure the angle created by the foil.
6. Turn the hair dryer off and measure the amount of pepper in the **filter**.
7. Repeat the test two additional times and record your results in the table in your student handout (example below).

Prototype 1: Data Table			
	Trial 1	Trial 2	Trial 3
<b>Air Flow</b>	Original Angle _____ °	Original Angle _____ °	Original Angle _____ °
	Angle w/ Filter _____ °	Angle w/ Filter _____ °	Angle w/ Filter _____ °
<b>Filtration</b>	Amount of pepper caught by filter _____teaspoons	Amount of pepper caught by filter _____teaspoons	Amount of pepper caught by filter _____teaspoons



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