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Dust Catchers

The Science of Air: Activity 8

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Dust Catchers

Dust Catchers is the eighth activity in the My World Teacher's Guide for Air. This activity's objectives are aligned with the National Science Education Standards, specifically those related to Science as Inquiry and Physical Science. Dust Catchers uses guided inquiry to teach students that dust is present in the air inside houses and buildings. By making and using a simple device (a dust catcher) to collect particles from the air at home or in the classroom, students will discover that filters help to remove larger particles (like dust, mold, animal dander) from indoor air. In this activity, students will predict, measure, observe, estimate, graph, and draw conclusions based on their investigation.

Concepts

- Dust consists of individual particles of different substances.
- Even air that appears to be clean may contain dust and other pollutants.

Allows teacher to estimate students' prior knowledge related to air, gases, breathing and respiration, and environmental health.

Reference

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Key Words

lesson, slides, teaching slides, environmental science, environment, air, air filter, dust, air pollution, indoor air pollution, allergy, allergies, air particle, dust mite, lung, lungs, asthma, immune system, life science, biology

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Materials



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Materials

This activity works best when the class is divided into groups of four students. Have students work in groups to share materials, but each student should make his or her own dust catcher.

Teacher Materials (demonstration)

- Baking soda (or cornstarch, baby powder, or a dusty eraser)
- Cotton balls
- Flashlight with batteries

Materials per Student Group

- Glue sticks
- Plastic knife
- Petroleum jelly
- Wax paper

Materials per Student

- Hand lens (magnifier)
- Pair of scissors
- Large rubber band
- Sheet of construction paper (4-1/2 in. x 12 in., see Setup)
- Sheet of marked graph paper, 10 cm x 10 cm (paper with grid size of approximately

1 cm works well)

- Copies of Make a Dust Catcher student sheet

Setup

1. You may want to cut each sheet of construction paper in half horizontally to make 4-1/2-in. x 12-in. sheets.
2. You may want to make a dust catcher as a sample for the class.

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Science Safety Considerations

- Follow all instructions.
- Begin the investigation only when instructed to do so.
- Be careful when using the plastic knife.
- Report accidents or spills.
- Wash hands thoroughly after the investigations.



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Science Safety Considerations

Safety first! Students always must think about safety when conducting science investigations. This slide may be used to review safety with your class prior to beginning the activity.

Also, keep the following points in mind.

- Always follow your district school safety guidelines.
- Have a clear understanding of the investigation in advance. Practice any investigation with which you are not familiar before conducting it with the class.
- Make sure that appropriate safety equipment, such as safety goggles, is available.
- Continually monitor the area where the investigation is being conducted.

References

1. Dean, R., M. Dean, and L. Motz. (2003). *Safety in the Elementary Science Classroom*. Arlington, VA: National Science Teachers Association.
2. Moreno N., B. Tharp, and J. Dresden. (2011). *The Science of Air Teacher's Guide*. Third edition. Baylor College of Medicine. ISBN: 978-1-888997-74-3. Development of this student activity was supported, in part, by grant numbers R25 ES06932 and R2510698 from the National Institute of Environmental Health Sciences of the National Institutes of Health to Baylor College of Medicine.

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How Clean Is the Air You Breathe?

- How much dust is in the air?
- What is dust made of?
- Is dust dangerous to our health?
- How can you make the air in your house cleaner?



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How Clean is the Air You Breathe?

To focus students' attention, create a small cloud of dust by shaking a cotton ball dipped in baking soda (or cornstarch or baby powder). Alternately, you can bang a dusty eraser against the board. Shine a flashlight through the dust cloud. Ask, *What are we seeing? Do you think this dust is always in the air? How could we find out?*

Stimulate a deeper discussion by asking, *What is dust made of? Is it dangerous to our health? How can you make the air in your house cleaner?*

Show students your pre-made dust catcher. Mention that each student will make one to take home and place in areas that he or she predicts will have the most air pollution. After 1 or 2 weeks, students will bring their dust catchers back to school to see what the catchers have caught.

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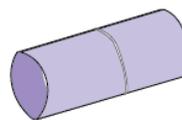
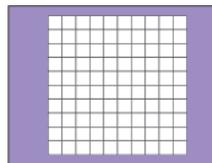
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Let's Get Started

1. Collect materials.
2. Glue the graph paper onto the center of the construction paper.
3. Cover the graph paper grid with a piece of wax paper.
4. Glue the edges of the wax paper to the construction paper.
5. Spread a thin layer of petroleum jelly over the wax paper.
6. Roll the construction paper into a loose tube and fasten with a rubber band.



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Let's Get Started

Show students an example of a “dust catcher” that you have made. Students will make their own dust catchers to collect particles from the air at home or in the classroom. They will discover that even apparently clean air may contain dust and other pollutants. They also will learn that dust consists of individual particles of different substances, such as cigarette smoke, animal dander, mold spores and dust mites.

Divide the class into groups of 4 students. Each student will construct his/her own dust catcher.

Have the Materials Manager from each group collect the necessary materials.

Guide students as they construct their dust catchers, following the instructions on the “Make a Dust Catcher” student sheet.

After making the dust catchers, students are instructed to roll the dust catchers into a loose tube. This procedure enables students to transport the dust catchers home with a minimum of mess. Make certain that students roll the tubes loosely, so that the petroleum jelly does not coat what will be the outside of the dust catcher. You also can request that students coat the wax paper with petroleum jelly or double stick tape once they have the dust catchers at home.

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Let's Continue

1. Take your dust catcher home.
2. Decide where you will place the dust catcher. Where do you predict you might collect the most dust in your house?
3. Remove the rubber band.
4. Unroll the dust catcher and lay it on a flat surface for 1–2 weeks (You may want to tape it in place to keep the dust catcher flat).



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Let's Continue

Once students have their dust catchers at home, they should place them in areas that they predict will have high levels of dust (indoor air pollution). If the dust catchers will not lie flat (due to being rolled), they can be taped gently in place or held in place with a couple of heavier objects. After one or two weeks, have students bring the dust catchers back to class for observations.

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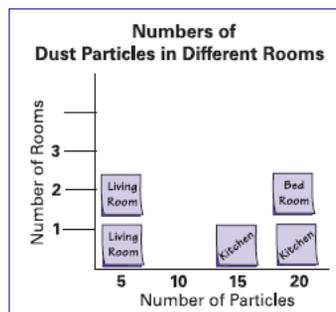
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Class Bar Graph

- X Axis: number of particles observed
- Y Axis: number of rooms for each “count” category
- Use sticky notes labeled with the name of the room observed.



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Class Bar Graph

Have students use magnifiers to count the number of dust particles in one or more squares on their dust catchers. Depending on your students’ ages and math backgrounds, have students count several squares and obtain an average number of particles per square.

Conduct a brief survey of the values that students obtained for their dust counts. Then, create a chart on the board, similar to the one pictured on this slide (also see the illustration within the lesson description), to accommodate the range of counts reported by the students. Label the x-axis “number of particles” and the y-axis “number of rooms.” Have each student label a sticky note with the type of room that he or she tested, and then place the sticky note on the appropriate place on the graph.

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Let's Talk About It



- Which type of room has the most dust particles?
- How many different kinds of particles were collected on the class's dust catchers?
- What materials can be found in dust?



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Let's Talk About It

Discuss the survey results with the class. Students should begin to understand that different amounts and kinds of dust particles are found in different rooms of a house. Ask them to identify rooms that tended to have more or less dust. Also ask, *Did different kinds of dust collect on dust catchers in different rooms?*

Stimulate a discussion about the composition of household dust by asking, *What is indoor dust made of?* Tell students that dust and other particles in the air can come from cigarette (tobacco) smoke, animal dander (flakes of dead skin), insect parts, mold spores, fibers and dust mites. Mention that some people are allergic to one or more of these things.

Talk about ways in which household dust can be reduced or eliminated. (Examples include installing clean air conditioning filters to help remove particles from the air, keeping living areas dry and well ventilated, and removing curtains and other materials that hold dust.)

Ask students how our bodies eliminate dust from the air. Tell them that our respiratory systems have several defense mechanisms against dust and air pollutants. Some particles are filtered out in the passages of the nose. When inhaled into the lungs, some particles get trapped in mucus and are transported up into the esophagus; others are surrounded and destroyed by special cells. Sneezing and coughing help prevent irritating gases and dusts from entering the respiratory system.

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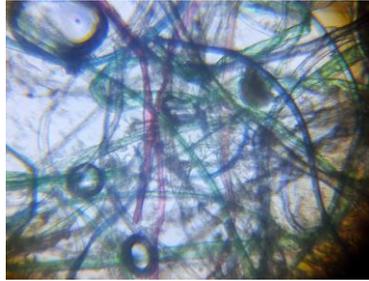
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The Science of Dust and Air Particles

- Dust contains individual particles of many different substances.
 - Animal dander (flakes of skin)
 - Particles from tobacco smoke
 - Dust mites and pieces of dead insects, like cockroaches
- Even air that appears clean may have contain dust and other pollutants.
- We can reduce dust by replacing filters and keeping living areas dry and ventilated.



Microscopic image of house dust.



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The Science of Dust and Air Particles

Dust consists of individual particles of different substances, such as animal dander, cigarette (tobacco) smoke, pieces of dead insects, such as cock roaches, and dust mites. Even air that appears to be clean may contain dust and other pollutants. And while we may think most air pollutants are concentrated outdoors, energy-efficient building designs can cause levels of some contaminants to be higher indoors. The Environmental Protection Agency (EPA) estimates that 30% of all buildings and homes in the United States contain enough pollutants to affect people's health by causing allergic reactions, infectious diseases, chronic irritation of the airways, and even toxic reactions (including damage to tissues and organs, including the liver, central nervous system, and the immune system).

We can reduce indoor dust in a number of ways: removing unneeded "dust collectors," such as curtains; cleaning or changing filters in heating and cooling systems frequently; washing bedding in very hot water; keeping living areas dry and well ventilated, and storing food leftovers in sealed containers (to discourage insect pests).

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Extensions



Domestic cat



Dust mite

- Compare the numbers and kinds of dust particles in different rooms of your home.
- Investigate whether different types of substances can trigger asthma or allergy attacks.
- Learn about allergy symptoms. Are they more severe at certain times of the year. Why might this be?



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Extensions

Encourage students to suggest variations of the investigation. For example, older students may enjoy making multiple dust catchers, so they can compare the numbers and kinds of particles found indoors and outdoors, or in different rooms in their houses. With young students, you may prefer to make dust catchers as a class project and position the catchers throughout the classroom.

If any of your students have allergies to dust or other substances, invite them to share their experiences with the class.

One character in the Air unit's story, *Mr. Slantail's Secret*, suffers from several different common allergies. Ask students, *Who is she? What does she do to help her allergies?* Follow up by asking, *Does anyone else in the story have allergy problems?*

Open a discussion on indoor air pollution elsewhere in the world. (It is a much greater problem in developing countries, where wood and coal still are used for cooking inside homes.) Ask students, *Why do you think this might be so?*

Have students conduct a survey of asthma and allergy sufferers at school or at home. Ask, *What types of allergens (substances that cause an allergic response) trigger each person's asthma or allergy symptoms? Are their symptoms better or worse at certain times of the year?*

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Image References

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http://en.wikipedia.org/wiki/File:Felis_silvestris_-_July_2007-1.jpg.

2. Dust mite courtesy of the U.S. Food and Drug Administration. Public domain.

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