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What Is Soil Made Of?

The Science of Food: Activity 2

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What Is Soil Made Of?

This activity's objectives are aligned with the National Science Education Standards, specifically those related to Science as Inquiry and Physical Science. In this activity, students investigate a sample of natural soil to identify and separate its different components. Students will make and record observations, take measurements, and draw conclusions in the process of discovering that soil contains both living and non-living components.

Primary science concepts addressed in this activity include the following.

- Soil is a combination of many different living and non-living things.
- Soil provides raw materials needed by all living things.

Student Worksheets

Student pages in the teacher's guide are provided in English and in Spanish.

Reference

Moreno N., and B. Tharp. (2011). *The Science of Food: Teacher's Guide*. Fourth edition. Baylor College of Medicine. ISBN: 978-1-888997-76-7. 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.

Image Reference

Photo courtesy of the US Department of Energy, Argonne National Laboratory. <http://www.anl.gov/>

Key Words

food, plant, soil, soil layers,

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Materials



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Materials

Have students work in groups of 2-4 to conduct the activity.

Per Student Group

- 2 cups of natural soil
- 2 paper plates
- 1/2 tsp of alum
- Clear soft drink bottle with screw-on cap, 2-liter size
- Measuring cup
- Metric ruler
- Newspapers to cover work area
- Copy of “Soil Observations” student sheet

Per Student

- Craft stick, toothpick or coffee stirrer
- Hand lens (magnifier)

Setup

This activity works best with a sample of natural soil dug recently from a field, yard, garden, playground, etc. About one large shovelful of soil will be enough for an entire class. Collect the soil 24 hours or less before conducting the activity and store it in a large plastic bag. Do not seal the bag completely.

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Image Reference

Photo by Christopher Burnett © Baylor College of Medicine.

Key Words

materials needed, materials list,

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Science Safety Considerations

- Follow all instructions.
- Begin investigation only when instructed.
- Do not taste or smell any substances.
- Report accidents or spills.
- Wash hands thoroughly after the investigation.



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Science Safety Considerations

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.

Safety first!

- Always school district and school science laboratory 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 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*. National Science Teachers Association.
2. Moreno N., and B. Tharp. (2011). *The Science of Food Teacher's Guide*. Fourth edition. Baylor College of Medicine. ISBN: 978-1-888997-76-7. 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.

Key Words

science, classroom, safety, lab, laboratory, rules, safety signs,

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What's In Dirt?

- Have you ever wondered what dirt is made of?
- Is dirt made of both living and non-living components?
- Does dirt contain nutrients?
- How long does it take to make dirt?



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What's In Dirt?

To focus students' attention, begin by asking if they have ever wondered what's in dirt. Then ask, *Does dirt have both living and non-living components?* Lead a class discussion about some types of living and non-living things that might be found in soil. Examples may include tiny rock particles, decomposed plant and animal material, bacteria, fungi, algae, earthworms, insect larvae, and plant roots.

Next, ask, *Does dirt contain nutrients?* Tell students that dirt does contain nutrients, such as nitrogen, phosphorous, and potassium, which are important not only for supporting plant growth, but also for assuring that other organisms are able to grow and survive. Finally, ask, *How long does it take to make dirt?* Tell students that soil formation takes a very long time—up to 20,000 years to make 2.5 cm of topsoil. This is only as deep as a quarter standing on its side!

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Image Reference

Microsoft Office Clip Art.

Key Words

dirt, soil, nutrient, living, non-living,

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Session 1: Looking at Soil

- Measure 2 cups of soil onto a paper plate.
- Describe how the soil looks, smells, and feels.
- Spread out the soil and list or draw the different things you find in the sample.
- Put a star next to the items on your list that are living or came from something living.



Soil has both living and non-living components.



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Session 1: Looking at Soil

In this activity, students will explore a sample of natural soil, and will identify and separate its different components. In a second session, students will examine the texture of soil. By the end of the activity, students will discover that soil contains a variety of things of different sizes.

Direct students to cover their work areas with newspaper. Have the Materials Manager from each group measure about 2 cups of soil onto a paper plate and bring the soil back to his/her group. Have students place about 1/2 of their group's soil in the center of their work area. Have them take turns describing the soil, using all of their senses except taste.

Ask, *What does the soil look like? How does it smell? How does it feel?* Have students write three words on their "Soil Observations" sheets that describe some aspect of the soil sample.

Next, direct students to spread out the sample (using toothpicks, popsicle sticks, etc.) and observe the different components of the soil sample. Have students list or draw the different things they find in their soil samples, and then classify the different components of soil as coming from living or nonliving sources.

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Image Reference

Microsoft Office Clip Art.

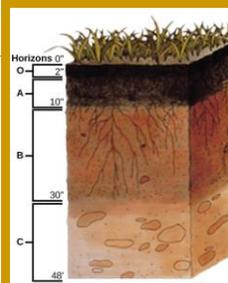
Key Words

lesson, experiment, soil, dirt, sample, living, non-living,

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Session 2: Soil Texture

- Add 1/2 cup of soil and 1/2 teaspoon of alum to the soft drink bottle.
- Add water until the bottle is 3/4 full.
- Cap the bottle tightly and shake the bottle for 1 minute.
- Set the bottle down and observe how quickly or slowly the different types of particles settle.
- Measure the layers and draw them on your “Soil Observations” sheet.



Soil layers: organic matter, surface soil, clay, and rock



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Session 2: Soil Texture

Each group will need a soft drink bottle (with cap) and the second half of its soil sample. Ask students to describe the different components of the soil they investigated during the previous session. Tell them that now they will observe the make-up of soil in a different way.

Instruct each group to add about 1/2 cup of soil and 1/2 teaspoon of alum to the soft drink bottle, and then add water until the bottle is 3/4 full. If students have difficulty pouring soil into the bottle, show them how to make a paper funnel by rolling a sheet of paper into a cone shape. Direct students to cap their bottles tightly and shake the bottles for about one minute.

Next, have students place their bottles in the center of their group work areas and observe how quickly or slowly the different types of particles settle. When layers are visible at the bottom of the bottle, have students measure and mark the layers, and draw their observed results on their “Soil Observations” sheets.

To facilitate accurate measuring, you may want to instruct students to fold a sheet of paper lengthwise, hold it against the side of the bottle, and mark the boundaries of each layer on the paper.

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Image Reference

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http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/office/ssr7/tr/?cid=nrcs142p2_047970

Key Words

lesson, experiment, soil, dirt, texture, water, particles soil layers, organic matter, surface soil, clay, rock, sediment,

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Let's Talk About It

- What did you see in the soil?
- How many different layers of soil formed in the plastic bottle?
- What type of soil particles were on the bottom?
- What type were on the top?
- What do you think is the primary component of soil?



Soil layers can appear in different colors.



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Let's Talk About It

This activity enables students to learn about soil by exploring a sample of natural soil and identifying and separating its different components. During this activity, students discover that soil contains both living and non-living components.

Stimulate a discussion about what students observed by asking, *What are some of the things that you saw in the soil?* (Possibilities include twigs, pieces of leaves, plant roots, insects, worms, small rocks and particles of sand.) Then ask, *What are some things in soil that we can't see?* (Answers may include air, water and microorganisms.) Invite students to share their observations.

Ask, *How many different layers did you find? What was on the bottom? What was on the top?* The heaviest particles, such as sand and rocks, usually will make up the bottom layer, followed by fine sand and silt. Some clay particles are so tiny that they will remain suspended in the water. Plant and animal material also may float at the top of the water. You also might ask, *What do you think is the primary component of soil?*

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Image Reference

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<http://commons.wikimedia.org/wiki/File:Stagnogley.JPG>

Key Words

lesson, experiment, soil, layers, soil particles, top layer, dirt, sediment,

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The Science of Dirt

- All of our food depends on the sun and nutrients in soil and water.
- Soil provides raw materials like nitrogen, phosphorous, and potassium to living things.
- Soil is a combination of many different living and non-living things, including:
 - Bacteria
 - Fungi
 - Insects
 - Air and water
 - Tiny rock particles
 - Decomposed animal and plant material



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The Science of Dirt

In this activity, students learned the following concepts.

- **Soil is a combination of many different living and non-living things.** Soil contains many kinds of organisms: bacteria, single-celled organisms, fungi, algae, decomposed animal and plant material, plant roots, insects, and other animals, as well as air spaces and water. Soil develops very slowly over time from weathered rock and sand. The non-living parts of soil originate as rocks in the Earth's crust. Over time, wind, water, intense heat or cold, and chemicals gradually break rocks into smaller pieces. The size and mineral composition of these tiny rock particles determine many properties of soil. Typical garden soil is 25% water, 45% minerals, 5% material from living organisms and 25% air.
- **Soil provides raw materials needed by all living things.** All living things, including plants, require additional materials to carry out the chemical processes necessary for life. Where do these other materials come from? Most are released into water from soil. Plants and plantlike organisms, such as algae, absorb nutrients that are dissolved in water, such as nitrogen, phosphorous and potassium. Non-photosynthetic organisms obtain the minerals and more complex molecules they need by consuming plants and other living things. Thus, the nutrients in soil are needed not only to support plant growth, but also to enable other organisms to grow and survive.

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Key Words

dirt, soil, science, food, sun, nutrient, water, living, non-living, bacteria, fungi, plant matter, insect, air, rock particles, rocks, nitrogen, phosphorous, potassium,

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Extensions

- Examine soil samples by mixing soil and sand from different sites.
- Compare/contrast samples of pure sand and pure dry clay.
- Make your own pH paper to compare the soil acidity of dirt samples collected from different locations.
- Research the partnership between plants and nitrogen-trapping organisms.



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Extensions

- Create unique soil samples for each group by mixing varying amounts of soil and sand from different sites. Have students conduct the experiment again with these new samples, compare their results, and predict which samples might be the best to use in a vegetable garden. Have students test their predictions by putting the different kinds of soils in pots or cups and planting flower or vegetable seeds in each one.
- Provide samples of pure sand and pure dry clay for students to examine with their magnifiers. Have them write about and/or draw the difference between the samples.
- Try making your own pH paper to test soil acidity. Place about 1 cup of sliced purple cabbage into a sealable bag filled with warm distilled water. When the water is dark blue or purple, pour it into a container. Cut white coffee filters into strips that are 1 inch wide and 6 inches long. Dip the strips into the cabbage water and allow them to dry on a hard surface. Test the pH strips in vinegar (weak acid) and water with baking soda (weak base) to see how they change color.
- Measure 1/5 cup of soil into 2 cups of distilled water. Test the water using the pH strips. Compare several soils from different locations.

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Key Words

lesson, experiment, extension, soil, sample, sand, clay, pH paper, soil acidity,

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