



Soil Searching

Lesson Description

Students collect and handle samples of clayey, silty, and sandy soil.

Teacher Background

This lesson encourages students to think about the differences in *soil*. Soil is a naturally occurring mixture of *organic matter*, water, air, and minerals that forms on the surface of the land.

At first, most young learners make no distinction between soil and *dirt*. However, the differences should become clear with more careful thought. Dirt is soil that is out of place in the human world; for example, dust on the floor or mud on your shoes is often called dirt. Soil is the useful substance in which our food grows; the outermost solid surface of Earth that supports our cities, houses, and highways; and the medium that contains the minerals for plant and animal life. This thin layer of material may mean the difference between poverty and prosperity—even life and death—for all who inhabit the planet, since soil is the medium in which most of our food is grown.

There are three main components of soil: *clay*, *silt*, and *sand*. Clay is the smallest particle, with less than a 0.002-millimeter diameter. Silt particles are between 0.002 and 0.005 millimeters in diameter, and sand is the largest particle, ranging from 0.05 to 2.0 millimeters. Each soil has a characteristic *texture* that

Subjects

Art, Language Arts,
Science

Time

Prep: 30 minutes

Activities: 1 ¾ hours

(not including Extensions)



Topic: soil

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Student Objectives

Students will be able to:

- differentiate between soil and dirt;
- recognize three basic soil components through sight and touch; and
- identify the materials in soil.

depends on its main component: *clayey* soils are fine, but may turn sticky and form a lump when wet, *silty* soils are smooth like flour but crumble when wet, and *sandy* soils are grittier than the others.

Students may find the following materials in soil: wood, rocks, roots, leaves, seeds, pods, stems, bark, grass, corn cobs, insects, insect eggs, and worms. Students will also find that soil's *pore spaces* contain air, and that at certain times soil also holds moisture.

Learning Cycle

Perception: 30 minutes

Materials

For the Class

- White glue
- Three index cards
- Clayey, silty, and sandy soils (see page x)
- Permanent marker
- Newspaper
- Two clear plastic jars with lids—e.g., tennis ball containers
- Small rocks
- Squeeze bottle
- Water
- Bucket
- Golf ball
- Softball
- Basketball

- 1** Ask students about the difference between soil and dirt. Help students understand that people think dirt is a nuisance. “Dirt” is a negative term while “soil” is a positive term for something useful. Dirt can be dust on the floor and mud on shoes; soil is the medium in which plants grow and animals live, a material without which people can’t survive.
- 2** Demonstrate that soil contains air by filling a plastic jar half-full with soil. Slowly add water to approximately two centimeters from the top of the jar; air bubbles will rise as water displaces the air in the soil. Ask students why the air bubbles occur and guide them to the correct answer—that soil contains air. The air is contained in pore spaces in the soil.
- 3** Demonstrate that soil forms from the breakdown of rocks: put small clean rocks into a jar of water, then cover and shake vigorously. The water should turn cloudy as soil particles loosen from the rocks. Ask students to observe the jar carefully and then discuss their observations.



- 4 Clean up by emptying the two jars into the bucket, than dispose of the wastewater outside rather than in the sink or trash.

Exploration: 30 minutes

Prep Cover a demonstration table with newspaper. Spread a dollop of glue on each of the three index cards. Sprinkle one type of soil on the glue on each of the cards and use a marker to label samples "silty soil," "sandy soil," and "clayey soil." Allow index cards to dry.

Prepare student work areas by covering tables with newspaper. Each work area should have dry paper towels, damp paper towels, a magnifier, a spoon, and three labeled cups each filled halfway with the different soils.

- 1 Distribute hand magnifiers. Demonstrate how to use the magnifiers and allow students to examine clothing, newsprint, or their fingers for a few minutes.
- 2 Have students put on their smocks or shirts, then dump the silty soil onto a dry paper towel and examine the soil with magnifiers.
- 3 Ask students what they see in the soil, and list the discoveries on the board. Help younger students distinguish pieces of rocks, plant material, and twigs. By touching the soil, students may discover that their soil samples contain moisture.
- 4 Discuss the texture of the silty soil. Ask students to suggest words that describe how the soil feels on their fingers.

Materials Cont'd.

For Each Student Group

- Clayey, silty, and sandy soils (see page x)
- Three clear plastic cups
- Spoon
- Small plastic hand magnifier (approximately 5x magnification)
- Paper towels
- Resealable plastic sandwich bag
- Smocks or old shirts



- 5 Demonstrate how to use a spoon to scrape the silty soil into a neat pile on its paper towel and then ask students to do the same.
- 6 Tell your students that they just looked at one type of soil. Ask students to predict what the other two types of soil will contain. You may wish to list predictions on the board.
- 7 Repeat the discovery process with sandy soil and clayey soil.
- 8 Guide students to figure out which soil particle—clay, silt, or sand—is largest based on their discoveries. (Answer: clay is the smallest, sand is the largest.)
- 9 Model the size difference between particles using three types of balls: if a clay particle is represented by a golf ball, then a silt particle would be the size of a softball and a sand particle would be the size of a basketball.
- 10 Clean up, saving the materials on the demonstration table and work areas for the Application section. Make sure students wash their hands.

Application: 30 minutes



Use the demonstration table and work-area setup from the Exploration section.

- 1 Ask students to predict what might happen to each pile of soil as drops of water are added. List student predictions on the board.
- 2 Add a few drops of water from a squeeze bottle to students' soil piles, and ask students to observe and describe what happens.



- 3 Have students make three soil balls using soil from each pile. Students should wipe their hands on damp paper towels between handling different soils.
- 4 Ask students to describe what happens when they make soil balls. Students should discover that wet clayey soil forms a lump, wet silty soil crumbles easily, and wet sandy soil runs through their fingers. Discuss observations and write results on the board. Explain that soil's reaction with water is a model for what happens when rain falls on different kinds of soil in our yards, gardens, and fields.
- 5 Clean the demonstration table and work areas. Keep the piles of dry, unused soil for Lessons 2, 3, 6, 9, and 10, which also require soil. Collect wet and mixed soil in the bucket, then dispose of the waste material outside.

Evaluation: 15 minutes

Students should be able to describe the difference between dirt and soil, and compare silty, sandy, and clayey soil. They also should be able to identify some of the materials in soil based on their observations and discussions. Younger students can draw and color the three components of soil, while older students might label drawings of soil and choose the appropriate vocabulary words from a list that you provide (e.g., *dirt, soil, silty soil, sandy soil, clayey soil, pore space, rock, organic matter, twig, color, texture*). Figure i.4 on page xvii (in the introduction to this book) shows an example of a rubric you might use to assess your students.



Extensions: 30 minutes each

- Investigate settling rates of soil. Fill three jars three-quarters full of water and add a few drops of Calgon® bath gel or biodegradable liquid dish soap to each jar (soap speeds up settling). Add silty soil to the first jar, sandy soil to the second, and clayey soil to the third. Label the jars with tape and a permanent marker. Ask students to predict what will happen when the jars are shaken. Cover, shake the jars, and allow the soil to settle. Were students' predictions correct?
- Make mud pies. Students should first guess which soil would make the best mud pie, based on what they have learned. (Answer: clayey soil, because it sticks together when wet more than the other soils.) Demonstrate how to make a mud pie with clayey soil and water. Have students make a pie, then press a leaf into it to make a pattern or decorate the pie with other plant material. Explain that in nature, leaves and twigs land on the soil, eventually break into tiny pieces, and become a part of the soil, making the soil loose and dark.
- Take soil samples. Bring the class outside and dig a small hole in the ground, several centimeters deep. Have students feel the soil samples for moisture. If possible, repeat this activity throughout the year, and relate the soil moisture to precipitation, temperature, and season.