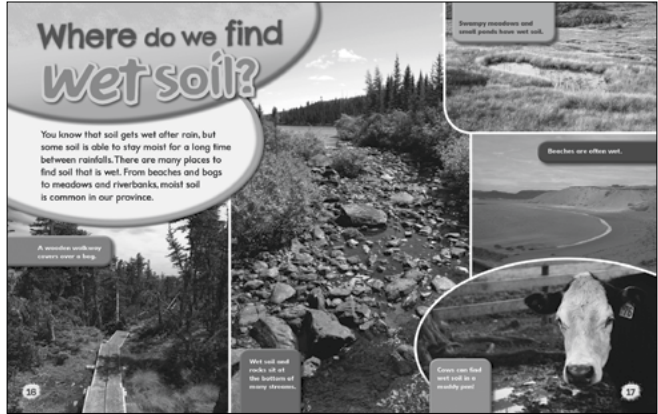


Does Soil Absorb Water?



Focus: Students will investigate the water-holding properties of different soil samples and make conclusions about which mixtures absorb the most water.

Specific Curriculum Outcomes

Students will be expected to:

- 9.0 compare the absorption of water by different soils [GCO 1/3]
- 10.0 make and record observations and measurements [GCO 2]
- 11.0 construct and label concrete-object graphs, pictographs, or bar graphs [GCO 2]

Performance Indicators

Students who achieve these outcomes will be able to:

- complete a graph to display the results of their investigation about the water capacity of different soils

NOTES:

Attitude Outcome Statements

Encourage students to:

- appreciate the importance of accuracy [GCO 4]

Cross-Curricular Connections

Math

It is expected that students will:

- demonstrate an understanding of measuring mass (g, kg) by measuring and recording mass [3SS4]
- construct, label, and interpret bar graphs to solve problems [3SP2]

English Language Arts

Students will be expected to:

- interpret, select, and combine information using a variety of strategies, resources, and technologies [GCO 5]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• Student Magazine, pages 14–17 • BLM <i>Which Soil Absorbs Water the Best?</i> • <i>What Is the Inquiry Process?</i> poster	• sponges • graduated cylinders • containers of water • buckets • paper towel tubes • stopwatch, smartphone, or watch with a second hand • four different samples of soil including sand, clay, and also some loam samples with varying levels of sand, silt, and clay • water • measuring cups • students' Science Folders • graph paper • round objects that represent different-sized particles (e.g., small beads, marbles, super balls, tennis balls) • funnels • container or jar • bristol board • spoons or scoops • paper towel • fine cotton cloths or pieces of fabric • plastic containers • electric fan, hair dryer, heat lamp, or oven • four to six clear jars • mixtures of soil (potting soil, peat moss, potting soil and gravel, gravel, soil from the schoolyard) • beakers filled with water • few drops of food colouring • students' Science Journals	• The activities Seeping Through Dry Soil (page 42) and Seeping Through Moist Soil (page 43) both require some teacher set-up prior to beginning them.	• absorption • loam • moisture

Safety

- Remind students of the procedure of washing their hands with soap and water after handling soil.
- Have students wipe up any spills, especially with water, to prevent slip hazards.
- Ensure students exercise caution around any electric devices such as electric fans or hair dryers.

Science Background

- Water is held in soil inside the pores between soil particles. If the moisture content is low, the spaces will be filled with air, as well as some insects, plant roots, and micro-organisms. If there is too much water, the water flows out and leaches into a lower area, farther under the ground.
- Too much water in soil will harm plants. Insufficient water will also harm plants. The moisture content of soil has an impact on the environment and food production.
- Farmers strongly prefer well-draining sandy loam soil. It's ideal for growing the majority of vegetables, including potatoes, tomatoes, peppers, green beans, carrots, and corn. Those who have clay loam soil have much more of a challenge. It is difficult to cultivate and dig in this hard-packed—often cement-like—soil. Clay loam gardeners can have some success growing vegetables with shallow roots such as lettuce, chard, squash, and pumpkins.

Possible Misconceptions

- After learning about the water-holding capacity of different types of soil, students may think that soil that contains a lot of clay—and holds the most water—will be best for growing plants. In fact, soil mixtures with a high concentration of sand are best for growing plants because they hold some water, but also drain well.

ACTIVATE



Holding Water

As a class, examine pages 14–15 of the Student Magazine. Allow students time to read the text and examine the photos. Discuss the fact that different types of soil hold varying amounts of water after a rainfall. Reread the final questions on page 14 aloud and share ideas as a class. Add the word “loam” to the Word Wall.

Sponge Demo

Demonstrate for the class a sponge absorbing water. Dip a sponge into a container of water. Hold up the sponge over a bucket and then squeeze. Pour the water into a graduated cylinder and have a student measure the amount of water.



Ask:

- **What did you observe?**
- **What does this tell you about the absorption of water?** (lots of water was held in the sponge)
- **Where was this water held?** (inside the pores or air holes in the sponge)

Invite students to investigate absorption using different-sized containers and sponges.

Wet Locations

Introduce pages 16–17 of the Student Magazine. Read the title question aloud: *Where do we find wet soil?* and then read the introduction together with the students. Invite students to examine the photos on the spread and to read the caption text. Discuss marshes, fens, or other wet soil that students are familiar with, or have seen.

Time It

In groups of three or four, have students fill two or three paper towel tubes with different types of soil. (If possible, put a different soil type or different mixture in each tube.) Have them pour a measured amount of water into the tube. Using a stopwatch, smartphone, or watch with a second hand, challenge them to time how long it takes for the water to reach the bottom and flow out of the tube. Have them draw a conclusion about which sample lets the most water pass through and which sample absorbs the most water.

CONNECT

Which Soil Absorbs Water the Best?

Invite students to investigate four different samples of soil in small groups of three or four. Ideally, include sand, clay, and also some loam samples (mixtures) that have varying levels of sand, silt, and clay.

Have students place a scoop of dry soil into a colander placed over a bowl or other container. Students can then pour a measured amount of water on top of the soil. After several minutes, students measure the amount of water that has collected in the container below the colander. (Students might measure using mL, cm, or non-standard units.)

Have students compare the amount of water poured over the soil to the amount of collected water. Provide students with copies of BLM *Which Soil Absorbs Water the Best?* to record their results and observations. This procedure can be repeated for each soil sample, ensuring that the size of the sample and the amount of water poured is the same for each test. Encourage students to discuss the results of their investigations. Ask:

- **Which soil sample held the most water (was the most absorbent)?**
- **Which held the least?**



Remind students to store their completed BLMs in their Science Folders.

Graph It

Working in the same groups, have students construct a graph, such as a bar graph, to display the results of their investigation to show which sample holds the most water. Compare the graphs as a class. Sand will be the least absorbent, then silty loam, then clay loam, and finally clay.

Dr. Dirt's Best Pie

You may have had students make mud pies in the previous teaching plan, *How Does Soil Change When It Gets Wet?* (pages 30–36), where students added more and more water to observe the effect. For this activity, have students explore which soil mixture that you have available in the classroom makes the best mud pies. Explain that the best mud pie should hold its shape very well and contain some moisture.

Supply students with a variety of soil samples, including some loam soils. Divide the class in four, and have each group create a recipe for mud pie with one of the four mixtures or types of soil. Compare and discuss. Next, have students share portions of soil from other groups in the classroom to come up with a unique recipe for a blend of soil and water. Again, compare and discuss. Determine, as a class, through sharing and effective communication, which soil blend made the best mud pie.

Soil Modelling Demo

Teacher Set-Up:

Find a collection of round objects that will represent different-sized particles. For example, small particles in soil, such as grains of sand, can be represented by small beads. Medium-sized particles can be represented by marbles. Large particles can be represented by super balls. Very large particles, such as boulders, can be represented by tennis balls.

To begin, ask students to predict what they think will happen when they pour water through the different round objects. After they have recorded their predictions, have students put the smallest object—for example, the beads—into a narrow-necked funnel over a container or jar. Have students slowly pour water into the funnel.

Ask students to observe how quickly the water flows through the beads. Repeat with the next size of object. You may need to create your own large-size funnel out of bristol board for the largest objects (e.g., tennis balls). Ask:

- **How did water flow through the smallest size of particle?** (more slowly)
- **How did water flow through the largest size of particle?** (more quickly)
- **How do the different sizes of particles affect the flow of water?** (water flows more slowly through smaller particles, but more quickly through larger particles)
- **Do the results match your prediction?**
- **How do the sizes of the particles relate to the spaces between the particles?** (the bigger the particles, the bigger the spaces between the particles)

- **Before I added the water, what was in between the particles?** (air)
- **What can this demonstration tell us about soil?** (Soil with small particles seems to hold onto water more than soil with large particles. Soil with large particles lets the water just gush through it.)

Ensure students understand that this demonstration used a magnified, not an actual-sized, model. In real life, sand particles look tiny—much smaller than the beads, or smallest “particles” in the demo. But this doesn’t mean sand particles are tiny! At the particle or microscopic level, grains of sand may be relatively large compared to other particles of soil, such as those found in clay.

CONSOLIDATE

Show Me the Water

Have available some graduated measuring containers, spoons or scoops, paper towel, fine cotton cloths or pieces of fabric, and plastic containers. Have students re-use their mud pie soil and measure the amount of water in a 100 g sample of the soil. Encourage students to explore and find their own method of measuring the amount of water in the soil. Some students may put a sample on a piece of paper towel, fold the towel, and squeeze out the water over a container. After, they can measure the amount of water in mL (alternatively, students can measure using cm or non-standard units). Other students may measure the mass of the wet soil and then dry out their sample by using an electric fan, hair dryer, or heat lamp; putting the sample in an oven; or drying it out in the sun. Advise students to request assistance from you, or another adult, to use any electric devices. When the sample is sufficiently dry, students can take its mass and find the difference in mass between the wet sample and the dry sample. The difference will be the amount of water in grams.

Seeping Through Dry Soil

Teacher Set-Up:

- 1) Fill four to six clear jars with various mixtures of soil. For example, fill one with sand. Fill another with potting soil. Fill a third with peat moss, a fourth with potting soil and gravel, and a fifth with gravel. Put soil from the schoolyard in a sixth jar.
- 2) Place each jar at a separate station in the classroom.
- 3) Have some beakers filled with a solution of water and a few drops of food colouring next to each jar.

Student Hands-On Activity:

In small groups, have students discuss and record their own questions before they begin this activity. Have students make predictions about what they think will happen and record their predictions in their Science Journals.

Have students work in small groups, with each group working at one station and focusing on one of the jars. Have them slowly pour a measured amount of the coloured water solution into a jar. Have them use a stopwatch, smartphone, or watch with a second hand to time how long it takes for the





water solution to reach the bottom of the jar. Students can pick up the jar gently to observe the coloured water, but it's best if they don't shake the jar and disturb its contents. If the water is absorbed into the soil and doesn't reach the bottom, have students add another measured amount and try again. Ask students to record their findings in their Science Journals and note whether their prediction was supported.

Have students take a gallery walk around the classroom to visit other groups, chat with group members, and copy down other groups' data and observations. Encourage students to look for similarities in their group's results with those of others. Also have students explore and discuss any differences in results. Create a large chart with the whole class and talk about what each group observed. Ask:

- **Did you notice anything surprising or unexpected?**
- **Why do you think the water seeped through so slowly/quickly in your sample?**

Invite students to add any new questions they may have to the I Wonder Wall.

Seeping Through Moist Soil

Tell students you'll be repeating the previous activity, but with soil that has been pre-moistened. Ask students to make predictions about what might happen. Ask:

- **Will the coloured water solution seep through the soil sample more quickly or more slowly? Why?**

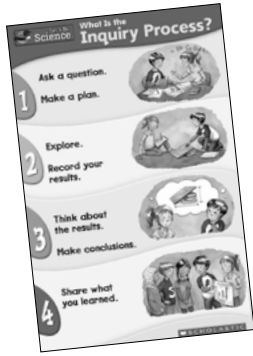
Teacher Set-Up:

- 1) Drain out the coloured water solution from each jar used in the previous activity, Seeping Through Dry Soil.
- 2) Then pour some water (about 50 mL) into each jar.
- 3) Wait for the water to be absorbed.
- 4) Add some more water if the soil still appears to be dry.
- 5) Pour off any excess water that may be sitting at the surface.

Student Hands-On Activity:

Have students re-do the activity with the moistened soil samples. Again, have them add another measure of coloured water solution (50 mL) and have them time how long it takes for the water to seep through to the bottom. Again, have some beakers filled with water and a few drops of food colouring.

Ask students to share their results with other groups through a gallery walk. Encourage them to discuss what they observed and whether their prediction was supported.



This activity can also be performed through a more open-inquiry approach by making the various materials available to students and posing a question to focus their experimentation. If you choose this approach, be sure to direct students' attention to the classroom poster about inquiry, entitled *What Is the Inquiry Process?* Ask:

- What happens when water and soil mix?
- Where does the water go?

Science Sketchers

Have students sketch a comparison drawing showing water being absorbed in two different types of soil. Have students label the drawings using science vocabulary, such as “particle” and “absorption.” Ask a few volunteers to share their drawings with the class. Discuss the drawings and review the key terms.

EXPLORE MORE

Best-of-the-Best Soil

In small groups of two or three, have students research the absorbing qualities of the ideal soil for growing crops. Then have them present their findings to the class.

Which Soil Absorbs Water the Best?

Name: _____

Sample #	Amount of Water Absorbed	Other Observations
Sample 1		
Sample 2		
Sample 3		
Sample 4		

Record the samples in order from least to most absorbent.

