

SCOOP ON SOILS

BEFORE 3: **Soil Stories** (adapted from [Project Learning Tree](#)):

Materials: (1 per team):

- Soil Percolation student page
- metal can with both ends removed
- measuring cup (8 oz)
- stopwatch that keeps time to the second
- 20-penny nail
- flat wooden board OR thick work gloves (to press can into ground)
- ruler
- paper/pencil
- container with water

Standards addressed: Science (2018) 3.1, 3.6, 3.8; Math (2023) 3.MG.1

Instructional Strategy

1. Read the mystery below to your students and lead a discussion about it by helping students identify key questions: What is a “perk test”? How would it prevent someone from building a house? To discover the answer, students will work in teams to perform a percolation (perk) test on soil in different areas of school grounds.
2. Group students into teams of four. Distribute the student page “Soil Percolation Test” and let students get to work! Some potential scenarios: water does not disappear completely during class period—ask students why they think this is the case? (Soil may already be saturated, soil may be compacted at ground surface, or there may be a hardpan layer near the surface, etc.)
3. Allow teams to finish summarizing their data before leading a class discussion about their results. Guide students toward the understanding that dense or compacted soil has fewer air passages so that water percolates (drains) through it more slowly, while porous soils drain water very quickly.
4. Ask students why it is important that soils drain near houses. (For houses not on a sewer system, soils need to be able to drain wastewater from sinks, showers, toilets, and washing machines. Soils also need to drain rainwater to prevent flooding.)
5. Ask students why it might be a problem if the soil drains *too* quickly (These soils may not properly filter out impurities which may result in groundwater contamination.)
6. Ask students if they have a solution to the mystery. Perhaps one solution they might suggest is that the house be connected to a sewer system because the soil does not drain properly for a septic system. This is a common problem in rural areas where the soil contains large amounts of clay.



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7. Explain to students that when a property fails the perk test, the land owner may be given permission to install an alternative system, called a “mound system.” However, this system is very expensive and may not be appropriate depending on the property. Ask students to consider other alternatives for Petra and Rocky instead of building their house on this property.

Soil Mystery Story

One misty morning, the phone rang. Petra slowly rose from her bed and answered, “Hello? Who’s calling so early!?” The man on the line was a lawyer from the city, calling to tell Petra that her grandfather who had passed a few weeks ago, left several acres of land to Petra in his will. Petra sprung to her feet and ran to her best friend Rocky and told him the news. Rocky and Petra had been dreaming of building their own house one day, and it seemed their deepest wishes were about to come true!

Petra and Rocky drove to the countryside to see the property, and it seemed perfect: had some trees for shade, lush grasses, even a creek nearby. They were so excited that they began the process to build immediately: they came to find out they would need to do a percolation or “perk” test. When they finally received the results, all their excitement faded into dismay... Their soil had failed the perk test! So, the house cannot be built. But... why? What’s wrong with the soil?



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Student Page

Soil Percolation Test

For Part B

Getting Ready

1. Within your team, choose a person for each role:
 - **Equipment Monitor**—collects equipment, keeps track of it, and returns it in good condition.
 - **Time Keeper**—uses a watch that tells time to the second.
 - **Recorder**—makes a data chart and records data for each experiment.
 - **Facilitator**—reads directions and helps everything get done.
2. Have the Equipment Monitor collect the necessary equipment from the instructor. Have the Facilitator read the instructions out loud to the team and make sure everyone understands.

Team Instructions

1. Choose five outdoor locations where there is a small patch of ground. Predict which location's soil will drain water the most quickly and which will be the slowest. Have the Recorder keep track of these predictions.
2. At each location, have the Recorder write a description of the location. Have one person push one end of the can 1" (2.5cm) into the ground. (It may be easier to rest a board on top of the can and firmly tap on the board with a hammer to push in the can.) Pour 1 cup (240 ml) of water into the can. Have the Time Keeper measure to the second how long it takes for the water to completely disappear. The Recorder records this time.
3. At each site, have one person in your team use a thumb to push a nail into the soil as far as it will go using moderate force. Then the student should measure the nail's height. Record this number.

Note: Try to use the same amount of force to push in the nail at each site. Do not use excessive force.
4. Discuss the following and record your group's answers:
 - a. Rank your sites by how long it took for the water to disappear (percolate).
 - b. How does this ranking compare with your prediction from step 1?
 - c. Is there a relationship between nail heights and the time it took for the water to disappear?
 - d. What does the data tell you about the soil's ability to filter water?
 - e. What assumptions can you make about the differences in soil you tested?
 - f. Why would a percolation test be important before someone builds a house?

