Just Passing Through

Overview
Students will investigate soils and observe how water moves through soil, how soil properties affect flow rate and water holding capacity. Students time the flow of water through different soils and measure the amount of water held in these soils. They will also observe the filtering ability of soils by noting the clarity of the water before and after it passes through the soil.

Suggested Grade Level
6 - 8

Estimated Time
45 minutes

Objectives
Students will be able to:

1. develop an understanding of how water flows through soils and how the water changes as it goes through.
2. utilize the scientific method; i.e., ask questions, develop and test hypotheses, observe and analyze results, and draw conclusions.
3. work together in small groups and share findings with classmates.

Materials
(per group of 3-4 students)

1. "Just Passing Through" Activity Sheet A
2. Clear 2L (soda) bottle
3. Three 500mL beakers or similar size clear containers marked off in cm to pour and catch water
4. Soil samples: bring to class 1L samples of different types of soil from around the school grounds or from students' homes. Possibilities include topsoil, potting soil, sand, soils that are compacted, soils with grass growing on top, soils with clearly different textures.
5. Fine window screen or other fine mesh that does not absorb or react with water (1mm or less mesh size).
6. Quantity of clean sand
7. Water
8. Clock or timer

9. Red and black marking pens
10. pH Test Kit (Extension option)

NOTE: Smaller containers may be used, if desired, as long as the soil container sits firmly on the water-catching container. Reduce the amounts of soil and water, but have all students begin with the same amounts.

Background

What happens to water when it passes through soil depends on many things such as the size of soil particles (texture and particle size distribution), how the particles are arranged (structure), how tightly they are packed (bulk density), and the chemical attraction between the soil particles and the water. Some types of soil let water flow in quickly, and then hold the water inside the soil like a sponge. This might give plants a better chance of using some of that water. Other types of soil may let the water go completely through in just seconds. Still other soils may keep water from getting in at all. None of these soil types is better than the other; they are simply different.

Activity

1. Hand out "Just Passing Through" Activity Sheet A
2. Remove label and lid and cut off bottom (above curve) of the 2L bottle.
3. Turn the bottle over so it looks like a funnel and place a circle of screen inside the bottle so that it covers the cap opening.
4. Pour 3-4 cm of sand onto the screen. The sand will keep the screen from becoming clogged.
5. Place the bottle, mesh side down, on a beaker or clear container.
6. Pour 1L of soil into the bottle over the sand.
7. Conduct the Class Demonstration and Inquiry.
8. Have students do the Group Investigation.

Class Demonstration and Inquiry

1. Choose a soil for the classroom demonstration (a sandy loam works best) and put some of the soil out on white paper on a table for students to observe. Have students look closely at the soil and notice the color, presence of plant material or other organic matter, the feel, the shape of the particles and record their observations of the soil on the board.

2. Next, place a 1L soil sample in the cut off 2L bottle inverted over the beaker. Pour 300mL of water into a 500mL beaker or other clear container and mark the level in black. Have students notice the clarity of the water. Ask students what will happen when we pour the water into the soil. Ask follow-up questions that get students to explain why they think the soil and water will behave as they predict. Possible questions may include: Will the water run through the bottom of the bottle? Will it <u>all</u> run out? If not <u>all</u>, how much?

What will the water look like? Clear? Murky? Very dirty? How long will it take for the water to flow through? Record all the student hypotheses on the board. Mark the pouring container with a red line where the students predict how much water will flow through the soil.

3. Pour the water onto the soil and begin timing. Ask students to describe what happens as you pour the water. Is the water staying on top? Where is it going? Do you see air bubbles? Why or why not? Does the water coming out of the soil look the same as the water going in? Record the class observations on the board. Also record the time it took for the water to go through the soil.

4. Ask students to compare their hypotheses with what they observed. Once the water has stopped dripping from the bottom of the bottle, remove the soda bottle and hold up the beaker of water that passed through the soil. Ask students to compare their hypotheses about the water to their observations. Pour the water back into the pouring container and compare the amount with the starting amount (black line). How much water is missing? How can we measure the missing amount? Compare the amount of water with the amount students predicted would come through the soil (red line). Is there more or less water then the class predicted? What happened to the missing water? Is the water more or less clear than the water that was poured through the soil? Compare samples.

5. Have students predict what will happen if they poured more water into the soil. Record their hypotheses and try it. Compare the observations with their predictions and ask clarifying questions. Next, have students try the same investigation with other soil samples. **NOTE:** Wash funnel and screen and add more clean sand before using a new soil sample.

Group Investigations

1. Give each student the "Just Passing Through" Activity Sheet A, which is a place to record hypotheses, observations, and conclusions. Have the students, in groups of 3-4, repeat the above investigation with the other soil samples.

2. Have students share their results and conclusions with the whole class. Discuss why there were differences between soil samples. Have students draw conclusions about water holding capacity based on the properties of soils.

3. Compare the results of the group investigations. Discuss the differences in soils. Ask questions about soil properties and uses of soils. Which soil property would you look for if you wanted to plant a garden? …build a

driveway or a playground? What happens if the soil is full of water and a heavy rain falls on it? How can you change the way the soil holds water? What happens to the soil when organic matter is added, when plants are growing on top of it, when it is compacted, or when it is plowed?

Extensions

1. Have students try this activity with soil components such as pure sand or clay and compare the differences. They could also do the activity with other materials such as commercial potting soil, perlite, compost, and vermiculite and make conclusions about the properties of these soil enhancements.

2. Students can experiment with filtering by using very murky water and passing it through clean sand.

3. Using distilled water, have students measure the pH of the water. Predict whether the pH will be different after the water passes through the soil. Pour the water through, and then test the pH again. Have students draw conclusions about the affect of soil on water pH.

Adapted from the GLOBE Program, Global Learning and Observing to Benefit the Environment.

Name _____ Activity Sheet A

Just Passing Through

1. Describe your soil sample (color, texture, feel, shape of particles, size of particles, plant material, etc.)

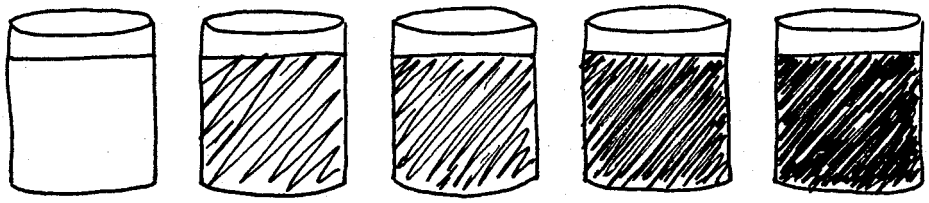
Hypotheses:

2. What do you think will happen when you pour water through the soil sample?

3. How long do you think it will take for the water to flow through the soil?

4. How much water do you think will pass through the soil sample?

5. What will the water look like? (Circle your prediction.)



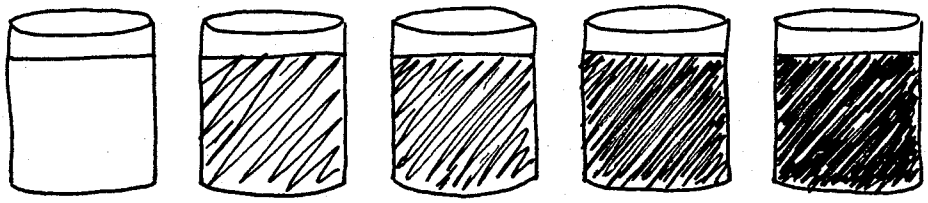
Observations:

6. What happened when you poured the water onto the soil?

7. How long did it take for the water to flow through the soil?

8. How much water flowed through the soil?

9. What did it look like? (Circle your observation.)



10. Did your observations match your hypotheses? In what ways?

11. What do you think would happen if you poured more water onto the wet soil?

12. What can you conclude about this soil sample and its capacity to hold water?

13. What might this soil be good for? Explain your answer.