

# A08

# **Soil Characteristics**

Adapted from Merrill Earth Science (1995)

# Focus on Inquiry

The student will gather data to understand how much water soil can hold.

# **Overview**

Infiltration (the rate at which water enters a soil) and percolation (the rate at which water moves through a soil) are key factors in determining the value of a soil as a crop soil. These two factors influence the formation of natural wildlife habitats, and the nature and speed of flooding in a given area. Additionally they need to be considered in decisions affecting the conservation of water supplies.

Duration	Setting	Grouping	PTI Inquiry Subskills	
50-65 minutes	Classroom or lab	Small cooperative	2.6, 3.7, 3.5, 4.3, 5.4	
		groups		

Lesson Components	Estimated Time	Inquiry Subskills Used	Technology Used	Level of Student Engagement	Brief Description
Engage	10 min	3.7	None	2	Students observe soil samples prepared by the teacher and make observations about the similarities and differences.
Explore	25 min	3.7, 3.5	None	3	Students gather data on the amount of water sand, clay and a combination of sand, clay and gravel.
Explain	10 min	4.3	None	3	Students describe any patterns they discovered in their lab data.
Expand	20 min	2.6, 5.4	None	3	Students will repeat the lab using 3 soil samples brought to class by classmates and will predict which sample will have the least infiltration after 10 minutes.
Evaluate	varies			n/a	Teacher developed rubric for lab sheet.

#### Level of Student Engagement

 1
 Low
 Listen to lecture, observe the teacher, individual reading, teacher demonstration, teacher-centered instruction

 2
 Moderate
 Raise questions, lecture with discussion, record data, make predictions, technology interaction with assistance

 3
 High
 Hands-on activity or inquiry; critique others, draw conclusions, make connections, problem-solve, student-centered

National Science Education Standards – Inquiry

Develop description, explanations, predictions, and models using evidence.

National Science Education Standards – Earth Science

Structure of Earth. Water which covers the majority of the earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the "water cycle."

#### Louisiana Grade Level Expectations – Inquiry

Gr. 8, Inquiry GLE#7 - Record observations using methods that complement investigations (e.g., journals, tables, charts) (SI-M-A3)

Gr. 8, Inquiry GLE#8 - Use consistency and precision in data collection, analysis, and reporting (SI-M-A3)

Gr. 8, Inquiry GLE#13 - Identify patterns in data to explain natural events (SI-M-A4)

Louisiana Grade Level Expectations Earth Science

Gr. 8, GLE#24 – Investigate and explain how given factors affect the rate of water movement in the water cycle (e.g., climate, type of rock, ground cover) (ESS-M-A10)

# Materials List (per group)

- a sample of soil from each student's garden or lawn
- sand, clay, gravel
- hand lens
- water

- paper
- stopwatch
- scissors
- plastic coffee can lids (3)
- cheese cloth squares
- rubber bands
- 250 mL beakers (3)
- thumbtack
- large polystyrene cups (3)
- graduated cylinder



# Advance Preparation

- 1. Run off the worksheets. Blackline Master #1.
- 2. Assign group numbers for lab activity.
- 3. Dry soil samples for student use.
- 4. Cut holes in plastic lid so the cup will fit into the hole and be suspended over a beaker.

# Other Information

Learning Objective

The learner will:

• Determine how particle size and soil texture control water flow though soil

# Procedure

Engage

- 1. Have several different containers of soil. (sandy, rocky, or clay)
- 2. Have students examine these large samples and make some general observations about similarities and differences.

#### Explore

- 1. Review lab report (Blackline Master #1) with students.
- 2. Allow students time to complete the investigation.

#### Explain

- 1. How were the soil samples different? (answers should include color, types, texture, and drainage)
- 2. What cup of soil did the students with the fastest rate of percolation have? (the cup with the mixture)
- 3. WHY? (Has more spaces for water to easily flow through)
- 4. What type(s) of soils did the students with the slowest rate of percolation have? (Clay)
- 5. Why? (Clay is generally more compacted than sand or the mixture)
- 6. Are there other variables that could be tested? (Different quantities of gravel, sand, and clay)
- 7. What is the relationship between how fast the water filtered through the different soil? (*The closer the particles are together the slower the water will filter through.*)
- 8. What would happen if you mixed gravel with clay soil? (Speed up the rate of filtration. Would allow for better drainage.)
- 9. Why? (Because the particles would not be as tightly packed together.)

#### Expand

- 1. Have students pick three soil samples brought in by their classmates. Prepare the same experimental setup using the three soil samples as in the lab. Have students predict which of the samples will have the least infiltration of water and explain why they made that choice. Allow the water to pass through the setup for 10 minutes.
- 2. Compare the predictions with the results of the experiment.

#### Evaluate

- 1. Have students answer the following questions on a sheet of loose-leaf or in a science journal.
  - a. How does the rate at which water flows through soil affect erosion?

# **Blackline Master**

1. Dirt lab report

## **Supplementary Resources**

#### Types of Soil

This site contains details about what soil is, soil formation, and soil composition. http://library.thinkquest.org/J003195F/newpage4.htm



Enchanted Learning: Soil Layers Details on types of types, and charasteriscis of soil. http://www.enchantedlearning.com/geology/soil/

# The Great Plant Escape

This site contains details about soil types and why they are important. http://www.urbanext.uiuc.edu/gpe/case2/c2facts2.html



**A08** 

Date: \_\_\_\_\_ Class Hour: \_\_\_\_\_ Name:

### **Dirt Lab Report**

Problem/Purpose: How much water will soil, clay or sand hold?

Hypothesis:

Materials: \_\_\_\_\_

#### Procedure:

- 1. Remove some of the soil for later examination.
- 2. Punch the same number of holes in the bottom and around the lower part of each cup.
- 3. Label each cup A, B, or C.
- 4. Cover the holes in each cup with a square of cheesecloth and secure with a rubber band.
- 5. Place each cup in a coffee can lid and place the lid over a beaker.



- 6. Fill cup A half full of dry sand. Fill cup B half full of dry clay. Fill cup C half full with equal parts of clay, gravel and sand.
- 7. Use a graduated cylinder to **pour 100mL** of water into cups. Start stopwatch when all the water is in the cup. Stop the stopwatch when the water first drips from the cup.
- 8. Allow water to drip for 25 minutes, then measure and record the amount of water in each beaker
- 9. While waiting for time to expire, examine the soil samples.
- 10. Describe the color of the soil.
- 11. Spread some of the sample on paper and examine it with a hand lens.
- 12. Name or describe some of the different particles you see.
- 13. Place some of the soil in your hand and rub it between your fingers. Describe the texture (How does it feel?).

#### Data table:

	Cup A dry sand	Cup B dry clay	Cup C clay, gravel, sand
Amount of water in beaker	mL	mL	mL
Difference in starting and ending mL	mL	mL	mL

#### Analysis:

On a separate sheet, graph the amount of water in each beaker and difference in the starting and ending amounts of water. Do you see a pattern in your data? If so, describe it:

#### Conclusion:

- 1. Was your hypothesis supported or not?
- 2. Why?
- 3. What did you learn by doing this experiment?