

Soil Particle Exploration



STANDARD COURSE OF STUDY CORRELATIONS:

Science, Grade 3, Goal 2: The learner will conduct investigations to build an understanding of soil properties.

2.01 Observe and describe the properties of soil:

- Color.
- Texture.
- Capacity to hold water.

2.02 Investigate and observe that different soils absorb water at different rates.

INTRODUCTION TO LESSON:

To understand how soil properties determine whether particles will bind together, students will attempt to make a simple pinch pot (a hand-pressed pottery vessel) using a small soil sample. Students will observe soil particle size and texture using magnifiers. They will investigate hydrologic conductivity—the capacity of soil to hold and retain water—through an experiment using water and soil samples. Finally, they will investigate the historic use of clay in handcrafts.

BACKGROUND FOR TEACHER: Red clay is as much a part of our state’s heritage as pine tar and basketball. The sticky clay soils found in many parts of North Carolina can be a curse and a blessing. People who try to grow crops in clay often have a distinctly different viewpoint than those who make pottery or bricks. The fine particles (sheet silicates) in clay, its cohesive bond and its ability to hold and retain water make it a valuable natural resource.

MATERIALS

Per pair/group:

- 🔪 Copies of Assignment Sheet
- 🔪 Cup of soil, sand or clay
- 🔪 Magnifiers (hand lenses or loupes)
- 🔪 Three clear, 2-liter beverage bottles
- 🔪 Enough pea gravel, clay and sand to fill each group’s three containers
- 🔪 Three basins to collect water underneath containers
- 🔪 Three spray bottles with adjustable nozzles (for spritzing)
- 🔪 Timer
- 🔪 Large measuring cups

To share with class:

- 🔪 Images of farmland, clay and clay products
- 🔪 Materials for making posters or reports (paper, colored pencils, markers, etc.)

PREPARATION

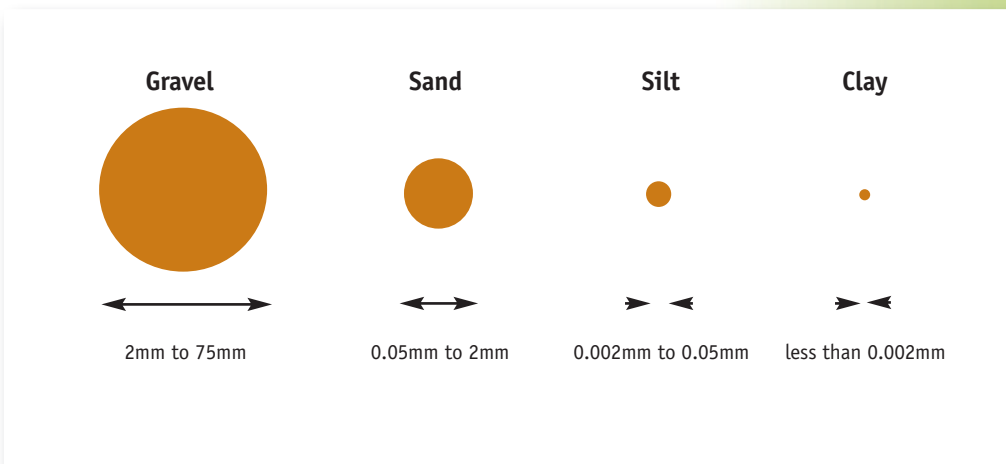
- 🔪 Gather images of farmland (<http://ga.water.usgs.gov/edu/earthrivrsedd.html> and <http://ga.water.usgs.gov/edu/mpg.html>), clay and clay products.
- 🔪 Make copies of lab sheets.
- 🔪 Obtain a display pottery piece.
- 🔪 For *Engage* exercise, prepare several small cups of soil, sand and clay. You will be distributing samples randomly so that pairs/groups will have different results to compare.
- 🔪 For *Explore* exercise, cut off tops of beverage bottles and punch drainage holes in bottom. Fill bottles of soil material such that each pair/ group will have three containers: one with pea gravel, one with sand and one with clay. Each bottle will need a basin underneath.
- 🔪 Fill spray bottles with equal amounts of water.

engage >

1. Divide class into pairs or small groups. Give each a randomly selected soil sample. Ask students to make a small pinch pot with their sample. Distribute water if requested. After about five minutes, have students report on their results. Have pairs/groups compare and contrast their experiences.
2. Distribute magnifiers and ask students to observe size and texture of soil particles. Lead a discussion about soil properties—size, texture and capacity to hold water.
3. Show images of farmland. Start a conversation about how different soil types affect how humans use the land. **Show Chapter 2 of the video.** Afterward, discuss the aesthetic and functional uses of clay.

explore > Place students into groups to investigate the hydrologic conductivity of clay. Distribute the following to each group: 1) three prepared beverage bottles: one each of pea gravel, sand and clay, 2) three spray bottles, 3) basins to collect water under bottles, 4) timer, 5) measuring cup, and 6) lab sheet.

1. Ask students to hypothesize which containers of material will expel the most water, at what rate and why. (*They might offer hypotheses that factor in particle size and texture.*) Have them enter predictions on their lab sheets.
2. Have students start their timers and spritz the contents of one spray bottle into one container of soil material. After water has had time to drain, have them measure the amount of water in the basin and note the time elapsed. Have them record the results on their lab sheets.



- Repeat the activity with the remaining two containers.
- Have teams record their observations and conclusions on lab sheets. Ask teams to share their results.

explain > Show Chapter 4 of the video. Have students check and measure water in basins again and make additional notes on lab sheets. Have them share conclusions and additional hypotheses with the class.

elaborate > Have students complete one of the following exercises:

- Research the history of North Carolina's "pottery highway" in Seagrove and present information as a report, poster or mock interview with an early potter. Helpful Internet resources include: http://www.seagrovetpotteryheritage.com/se_learn.html and <http://www.discoverseagrove.com/pottery-history.asp>.
- Research the African art of using soil to make Bogolanfini, known as mud cloth, and design a poster depicting the process and a finished product. A good resource is <http://soil.gsfc.nasa.gov/bogolan/bogolan.htm>.
- Design and conduct another hydrologic conductivity investigation using soil samples gathered from various sites on the school campus. Based on data collected, determine some appropriate uses of the land other than a school.

evaluate >

- Review lab sheets to determine students' understanding of how soil particle size and texture influences its ability to hold and retain water.
- Assess student understanding based on participation in team and class discussion.
- Use a class roll to check off Standard Course of Study objectives.
- Identify and note understanding of key concepts as indicated in reports, presentations or posters.

Teacher's Notes:

BEYOND THE CLASSROOM

- Have students take photographs or draw pictures that document the relationship between soil types and land uses they observe at different locations in the community.
- Have students gather soil samples from various locations to create a class collection. Samples can be matched with a state, national or world map to foster appreciation of soil diversity.

Additional Resources:

Water Science for Schools

"Earth's Water: Rivers and Sediment"

• Web page
<http://ga.water.usgs.gov/edu/earthriverssed.html>

The Great Plant Escape, Soil Types

includes simple descriptions of the texture of sand, silt and clay. • <http://urbanext.illinois.edu/gpe/case2/c2facts2.html>



Assignment
Soil Particle Research

Investigator(s) _____

How long will it take the water to pass through the soil material?

	Predicted Time	Actual Time	Amount of Water	FOLLOW-UP MEASUREMENTS	
				Time Elapsed	Amount of Water
Pea Gravel					
Sand					
Clay					

Conclusions:

Now I wonder...