

3.C.7 Soil: Water Retention

A muddy introduction to dirt and its properties

Grade Level	3
Sessions	(1): 1 at 40-60 minutes
Seasonality	None
Instructional Mode(s)	Whole Class, Small Groups
Team Size	2-4 Students
WPS Benchmarks	03.SC.TE.05, 03.SC.IS.01, 03.SC.IS.04, 03.SC.ES.06, 03.SC.ES.07, 03.SC.ES.08
MA Frameworks	3-5.TE.2.2, 3-5.TE.2.3, 3-5.ES.0.5
Key Words	Dirt, Metric System, Retain, Soil, Water

Summary

Students will investigate the properties of various soil types. They will make predictions about the quantity of water that soil and sand mixtures can retain, and will then design an experiment to test these predictions.

Learning Objectives

2002 Worcester Public Schools (WPS) Benchmarks for Grade 3

1. 03.SC.TE.05 Develop a knowledge and understanding of the metric measurement system.
2. 03.SC.ES.07 Recognize and discuss the different properties of soil, including color, texture (size of particles), the ability to retain water, and the ability to support the growth of plants.
3. 03.SC.ES.08 Design an experiment to find out if different soil samples retain different amounts of water. Explain how the properties of the particles affect the large-scale properties of the soil like water retention and speed of water flow. Discuss how a soil's water retention affects the animals and plants that live in it.
4. 03.SC.IS.01 Ask questions and make predictions that can be tested.
5. 03.SC.IS.04 Conduct multiple trials to test a prediction. Compare the results of an investigation or experiment with the prediction.

2001 Massachusetts Frameworks for Grade 3

1. 3-5.TE.2.2 Describe different ways in which a problem can be represented, e.g., sketches, diagrams, graphic organizers, and lists.
2. 3-5.TE.2.3 Identify relevant design features (e.g. size, shape, weight) for building a prototype of a solution to a given problem.
3. 3-5.ES.3 Identify the three categories of rocks (metamorphic, igneous, and sedimentary) based on how they are formed, and explain the natural and physical processes that create these rocks.

Additional Learning Objectives

1. Students will learn how to develop a scientific experiment.
2. Students will practice using the metric system.

Required Background Knowledge

1. Basic understanding of the metric system (ex. milliliters).
2. Basic understanding of the composition of soil and how soil is formed (decomposing organisms and weathering of rock).

Essential Questions

1. How is soil formed?
2. Do some soils retain water better than others?
3. How much water do various types of soil (in milliliters ml)?
4. What types of soil best support plant life?

Introduction / Motivation

The instructor may ask students what they already know about soil formation. Students might share ideas about the weathering of rocks or decomposition of plant and animal material.

Procedure

The instructor will:

1. Create groups of approximately four students in each.
2. Provide groups with the following materials:
 - a. One empty plastic cup

- b. 240 ml (one cup) of sand
 - c. 240 ml of dirt
 - d. 240 ml of water
 - e. enough cheesecloth to line the inside of a plastic cup
3. Allow students time to examine the provided materials.
 4. Ask students for suggestions about how they might measure the amount of water that varying types of dirt can store.
 5. Begin to write several steps of the “Procedure” (see Vocabulary with Definitions) in a visible location. Let students take over the process of creating a “Procedure” in their groups, using the Sand & Soil: Procedure worksheet.
 6. Review each group’s “Procedure” before proceeding.
 7. Ask students to carry out the “Procedure” and to record results on the worksheet Soil & Sand: Results.

Materials List

Materials per Group	Amount	Location
Cheesecloth	Enough to line one plastic cup	Grocery store
Large, Disposable Plastic Cups	Four	Grocery store
Metric Measuring Cup	One	Home
Sand	240 ml (1 cup)	Backyard, garden supply store
Dirt	240 ml (1 cup)	Backyard, garden supply store
Paper Towels	Many!	Classroom

Materials per Student	Amount	Location
<u>Sand & Soil: Procedure</u> Worksheet	One	End of lesson plan – print or photocopy
<u>Sand & Soil: Results</u> Worksheet	One	End of lesson plan – print or photocopy

Vocabulary with Definitions

1. *Civil Engineer* – designs tunnels, roads, buildings, bridges, and dams using various materials such as soil, rocks, and concrete.
2. *Metric System* – a system of measurement based on powers of ten; the unit of measurement for volume is the liter (L) and one thousand milliliters equal one liter.
3. *Procedure* – the sequence of steps taken in an experiment, similar to the directions in a recipe for cooking.
4. *Sand* – loose particles of broken rock.
5. *Soil* – a mixture of sand and decaying plant and animal material.

Assessment / Evaluation of Students

The instructor may assess the students in any/all of the following manners:

1. Collect student worksheets to ensure that students make reasonable predictions, record accurate observations, and use the metric system correctly.
2. Listen to oral responses and note whether students understand that soil is a mixture of sand and decaying plant and animal material.

Lesson Extensions

None

Attachments

1. Sand & Soil: Procedure
2. Sand & Soil: Results

Troubleshooting Tips

1. To be determined

Safety Issues

None

Additional Resources

None

Sand & Soil: Procedure

Name _____

Date _____

Directions: Pretend that you are a civil engineer. As a civil engineer, you have been asked to determine whether *sand* or *dirt* can hold more water. Engineers and scientists usually write a set of directions, called a *Procedure*, to organize the steps of an experiment. Here are some questions to help you write your procedure.

1. If you pour water into a cup, how will you know when the dirt can not absorb anymore water?

2. If you pour exactly 100 ml of water into a cup, and the dirt absorbed (soaked up) 60 ml of water, how much water was not absorbed?

3. If you had a way to cut a hole into the bottom of a cup to drain water, how would that help you decide whether *sand* or *dirt* can hold more water?

Use the space below to write a list of steps that you will follow in your experiment. Remember that you may use only the materials you have been given (plastic cups, cheesecloth, sand, dirt, water, and measuring cups).

Procedure:

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

Sand & Soil: Results

Name _____

Date _____

Directions: Now that you have written your **Procedure**, follow each step to measure how much water 200 ml of sand will retain and how much water 200 ml of dirt will retain. Using the metric markings on your measuring cup, measure (approximately) how much water has they absorbed.

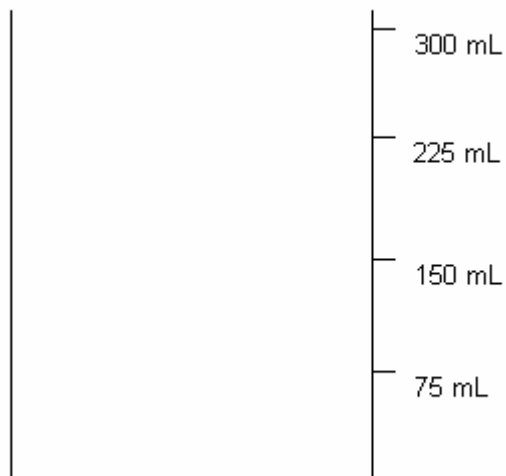
How much water dripped out of the sand into your measuring cup?

_____ milliliters (ml)

How much water did the sand absorb?

_____ milliliters (ml)

Use the cup pictured below to create a diagram, color in what the water look like in your measuring cup.



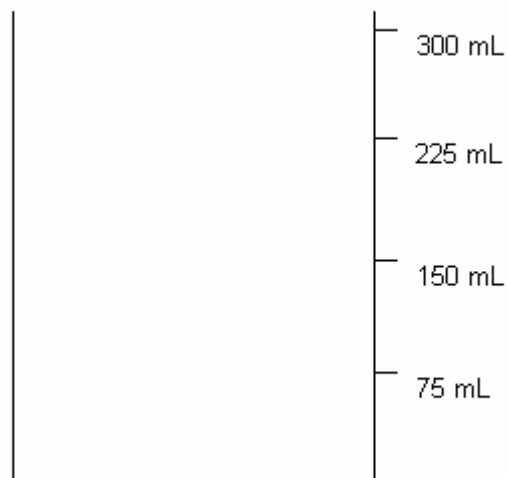
How much water dripped out of the dirt into your measuring cup?

_____ milliliters (ml)

How much water did the sand absorb?

_____ milliliters (ml)

Use the cup pictured below to create a diagram, color in what the water look like in your measuring cup.



Which material holds more water (dirt or sand)?

Plants need water to survive. What materials are best for growing a plant? (Remember that too much water can be bad for a plant!)

Why are the materials that you chose the best for growing a plant?
