






Measuring Your Soil Samples

Overview:


Students will measure and determine percentages of their soil sample's layers (organic material, clay, silt, and sand). This lesson should be taught after "Does Dirt = Soil?"

Objectives:









At the end of the lesson, students will be able to:

-  **Identify** the four layers in a soil sample.
-  **Use** a ruler to measure the four layers of soil components in their soil sample jar.
-  **Set up** a ratio to determine the percent composition of each layer of their soil sample.

Preparation:

-  Prior to the lesson, prepare the soil sample in a cylindrical jar that has four layers of soil in the ideal proportions.








Vocabulary:

 sample	 sand
 strata	 percentage
 silt	 organic matter
 clay	 sedimentary layers




Learning Activities:

- I. Review the lesson "Does Dirt = Soil?" (5 min.)
 - A. Ask students to recall the four components of healthy soil: organic matter, clay, silt, and sand.
 - B. Ask students to recall which component is the largest and heaviest (sand)
 - C. Show them the corresponding objects to review their size. (Compare sand to a beach ball; silt to a frisbee; and clay to a dime.)



Materials:

-  Handout: "Measuring Your Soil Sample"
-  Student's soil samples from the Lesson: "Does Dirt = Soil?"
-  Demo soil sample in cylindrical jar that has the four layers of soil in the ideal proportions
-  4 rulers
-  Beach ball
-  Frisbee
-  Dime

On the Board:

-  The ideal breakdown of soil: organic matter (10%), clay (20%), silt (40%), sand (30%)
-  Vocabulary
-  Student Reflection Questions

Suggested Snack:

-  Seven Layer Bars: <http://ohsheglows.com/2012/12/18/lightened-up-magical-coconut-bars/>
-  Or, <http://amyshealthybaking.com/blog/2015/04/17/skinny-peanut-butter-banana-seven-layer-bars/>

- D. Ask students to look at their notes to recall which combination of soil components is best for planting most kinds of vegetables & why? (organic matter [10%], clay [20%], silt [40%], and sand [30%]). This ensures that the water and nutrients in the soil reach all the way down to the roots of the plants. This combination also helps to physically support the stem of the plant as it grows.
2. Garden Activity: Measuring Soil Samples (25 min.)
- A. Show students the demonstration soil sample in the cylindrical jar. Show students how they can see that the soil has divided itself into its component parts.
- B. Have students identify the order of the layers in their samples, based on the size of each component. From top to bottom: organic matter, clay, silt, and sand.
- C. Show them how, with a ruler, to measure the depth of the different levels, or strata.
- D. On the board, review how students can set up a ratio to determine percent composition.
- Do several simple examples of cross multiplication.
 - Tell students to remember to always include units in their answers (e.g., inches or centimeters).
 - Do an example of the full calculation with the class using the demo soil sample.
 - If the entire sample is 2.5 inches tall, and the silt layer is 0.9 inches tall then:
- $$\frac{0.9\text{in}}{2.5\text{in}} = \frac{x\%}{100\%} \longrightarrow (2.5)(x) = (0.9)(100) \longrightarrow 2.5x = 90 \longrightarrow x = 90 / 2.5 \longrightarrow x = 36\%$$
- So, the demo sample is made up of 36% silt. Since this ideal composition requires 40% silt, this is pretty good!
- E. Distribute the Handout: “Measuring Your Soil Sample.”
- F. Have students break into their four groups and retrieve their soil samples. They should use their rulers and the above calculation to determine the percent composition of all four components in their soil samples.
3. Snack: Serve Seven-Layer Bars. (They kind of look like a soil sample!) (5 min.)
4. Have students answer the Reflection Questions in their garden journals. (5 min.)

Student Reflection Questions:

1. Was it difficult to tell the different layers of the soil apart? What helped you differentiate each layer?
2. In what other situations in your life might you need to set up a ratio to figure out the percentage of something?

Assessment Questions:

1. If your soil sample is 3.5 inches tall, and the silt layer is 1.7 inches tall, what percentage of your soil sample is silt?
 - 48.6%

Standards:

Next Generation Science Standards

- MS-PSI-1.

Develop models to describe the atomic composition of simple molecules and extended structures.

- NGSS-CCC Cross Cutting Concept

Cause and Effect

Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS2-5)

- NGSS-SEP Science and Engineering Practices

Systems and System Models

Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. (MS-ESS2-6)

- NGSS-DCI Disciplinary Core Idea

ESS3.A: Natural Resources

Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (MS-ESS3-1)

Common Core State Standards

- ELA/Literacy: RST.6-8.7

Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-PSI-1)

Mathematics:

- MP.2

Reason abstractly and quantitatively. (MS-PSI-1)

- MP.4

Model with mathematics. (MS-PSI-1)

- 6.RP.A.3

Use ratio and rate reasoning to solve real-world and mathematical problems. (MS-PSI-1)

- 8.EE.A.3

Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. (MS-PSI-1)

Acknowledgements:

The Soil We Grow In. National Agricultural Literacy Curriculum.

<http://www.agclassroom.org/teacher/matrix/lessonplan.cfm?lpid=301>



Measuring Your Soil Sample

Name: _____

Teacher: _____

Date: _____



image from National Agricultural Literacy Curriculum

Have someone in your group obtain your soil sample from last week. **DO NOT SHAKE IT.**

The best soil for planting fruits and vegetables will contain an ideal breakdown of:

- 10 % organic matter
- 20% clay
- 40% silt
- 30% sand

This ensures that the water and nutrients in the soil reach all the way down to the plant roots. It also helps to physically support the plant's stem as it grows.



Fill in the illustration of a jar on the left with an accurate illustration of your soil sample by measuring the layers and drawing the layers and labeling with name and measurement. Then calculate the percent composition of your soil sample:

_____ % Organic Matter
 _____ % Clay
 _____ % Silt
 _____ % Sand

Use the measurements to calculate percentages. Show your work.