The Watershed Extension Final Paper NRS 591

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Soil Testing- Problem- In what type of soil is it best to site a well?

Gems: N/A

Grades :6-8

Subjects covered- Earth Science

GSE'S

ESS1 - The earth and earth materials as we know them today have developed over long periods of time, through continual change processes.

3c investigating the effect of flowing water on landforms (e.g. stream table, local environment).

Given information about earth materials explain how their characteristics lend themselves to specific uses.

6a determining and supporting explanations of their uses (e.g., best soils to grow plants, best building material for a specific purpose, determining which rock size will best prevent erosion).

PS1 - **All living and nonliving things are composed of matter having characteristic properties that distinguish one substance from another (independent of size or amount of substance).**

Given data about characteristic properties of matter (e.g., melting and boiling points, density, solubility) identify, compare, or classify different substances.

2a recognizing that different substances have properties, which allow them to be identified regardless of the size of the sample.

Duration : 40-60 minutes

Group size: 2-4

Skills:

Students will measure, create and interpret data tables, observe, compare, contrast, and draw a conclusion.

Objective of the Lesson: This lesson is designed to have students compare the water-holding properties of different soil types to determine the best type of soil for a well.

Setting: Classroom or lab

Method: Hands on activity where students will conduct an experiment to determine how much water different types of soil will hold.

Background: Water Underground and Soil type Characteristics

The three basic types of soil are sand, silt, and clay. Most soils are made up of a combination of the three. The texture of the soil, how it looks and feels, depends upon the amount of each one in that particular soil. The type of soil varies from place to place on our planet and can even vary from one place to another in your own backyard. In terms of soil texture, soil type usually refers to the different sizes of mineral particles in a particular sample. Soil is made up in part of finely ground rock particles, grouped according to size as sand, silt and clay. Each size plays a significantly different role. For example, the largest particles, sand, determine aeration and drainage characteristics, while the tiniest, sub-microscopic clay particles, are chemically active, binding with water and plant nutrients. The ratio of these sizes determines soil type: clay, loam, clay-loam, silt-loam, and so on.

Sandy Soils have a gritty texture and are formed from weathered rocks such as limestone, quartz, granite, and shale. If sandy soil contains enough organic matter it is easy to cultivate, however it is prone to over-draining and summer dehydration, and in wet weather it can have problems retaining moisture and nutrients.

Silty soil is considered to be among the most fertile of soils. Usually composed of minerals (predominantly quartz) and fine organic particles, it has more nutrients than sandy soil yet still offers good drainage. When dry it has rather a smooth texture and looks like dark sand. Its weak soil structure means that it is easy to work with when moist and it holds moisture well.

Clay Soil-When clay soils are wet they are very sticky, lumpy and pliable but when they dry they form rock-hard clots. Clay soils are composed of very fine particles with few air spaces, thus they are hard to work and often drain poorly - they are also prone to water logging in spring. Blue or grey clays have poor aeration and must be loosened in order to support healthy growth. Red color in clay soil indicates good aeration and a "loose" soil that drains well. As clay contains high nutrient levels plants grow well if drainage is adequate.

Other Terms: Hydrologists, permeable, impermeable, water table, saturated zone, and unsaturated zone.

Materials:

Hardware	Chemicals or Consumables
Hand lens	water, 400ml
Stopwatch	sand, 300ml
4 rubber bands	powdered potters clay, 100 ml
4 large funnels (or cut off plastic soda bottles caps removed)	pebbles
4 squares of cheese cloth (or double coffee filters)	silt or loam
Stopwatch	
100ml graduated cylinder	

Procedure:

1. Create a data table listing materials, observations, time it took the water to stop dripping, and amount of water that dripped from the material.
2. Use a hand lens to observe each of the three types of soil samples closely.
3. Place a piece of cheesecloth or 2 filter papers over the bottom top of each funnel and secure it with a rubber band.
4. Place a funnel on top of each of the three beakers.
5. Place the sand in one funnel, the pebbles in another, and the clay in another. Be sure that there is at least 5 cm of space above the material in each funnel.
6. Slowly pour 100 ml of water into the funnel containing the sand. Do not let the water overflow the funnel.
7. Start the stop watch when the water start's to drip out the bottom of the funnel.
8. Stop the stopwatch when the water starts dripping out of the funnel or when five minutes are up. Record your times.
9. Measure the amount of water that filtered into the beaker using a graduated cylinder.
10. Repeat steps 6-19 with the sand, silt, and then with the clay.

Evaluation:

1. Through which material did the water pass through the fastest? The slowest?
2. What can you conclude abut the permeability of the four materials?
3. What can you conclude about the saturability of the four materials?
4. Based on your observations of each sample suggest an explanation for the differences in their permeability and saturability.
5. Based on the results of this lab, would you expect to get more water from a well dug in pebbles, sand, silt, or clay? Explain
6. Why might gardeners and landscapers need to know about the permeability of different types of soils?

Variations and Extensions:

*Which of the soil samples that you tested do you think resembles the soil found on your school grounds?
*Which of the soil samples that you tested do you think resembles the soil found in and around your yard at home?

1. Have students design an experiment to test their hypothesis and carry out the experiment.

References:

Brooks Simmons, Barbara, Wellnitz, Thomas R. *Earth*. Upper Saddle River, New Jersey: Prentice Hall, 2000. Print.

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“Soil Type." *Wikipedia*. April 9, 2009. Wikipedia Foundation. 2May 2009 <http://en.wikipedia.org/wiki/Soil_type>.

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