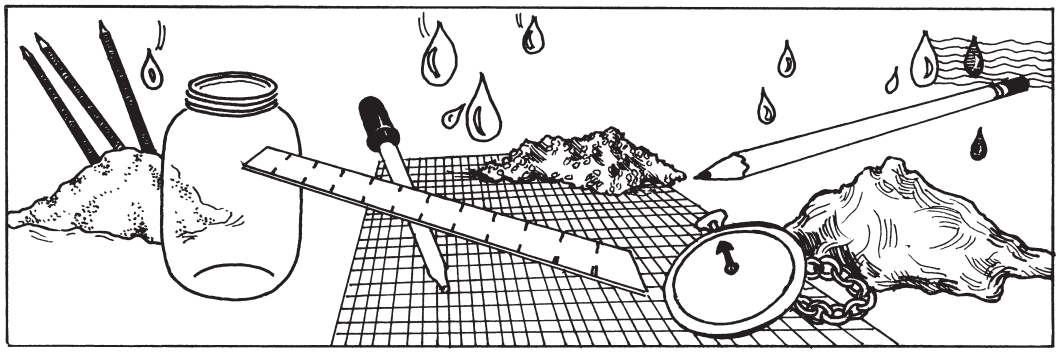


Activity #2: Determine Soil Particle Size

Adapted from "Determining a Soil's Textural Classification," CurriculumResources for Earth Science Teachers, Maine Department of Conservation.

California Content Standard
Earth Sciences 3c

Objectives:

To determine the particle size and composition of a sample of soil.

Time:

One 55-minute class period

Background:

Soil composition determines many characteristics of soils, such as infiltration rates (the rate at which water moves into a soil), percolation rates (how fast water moves through the soil), settling rates (how fast sediments sink to the bottom of a body of water), oxygen content, and the ability of the soil to support plant and animal life. Understanding these concepts will give students the background information they need to help them understand other estuarine processes that they will study later in this unit, such as why certain species can survive in one area of an estuary and not another, and how an estuary helps filter water and dampen tidal action.

In this activity, students will use the sieve sets they constructed in the previous activity to determine the percent composition of a sample of soil. These soil samples can be used for other activities in this chapter.

Materials:

Obtain a sample of soil from your school. It may be possible to obtain a sample fromt eh Reserve staff. Try to gather samples from a variety of locations that contain several different sediment sizes. You will need about 500 ml for each pair of students. Each student group can work on one sample, and then compare their soil particle size percentages with the groups who have analyzed a sample from a different location. Each group will also need one set of soil sieves, 2 plastic trays, access to a balance, 5 small plastic bags, and a 400 ml beaker. Sheets of newspaper are optional, but can help in clean-up. The students will save their separated soil sample for use in the next activity, The Percolation Rate of a Soil.

Procedure:

Have the students record the mass of a clean, dry 400 ml beaker, fill the breaker almost full with soil from their sample, and mass again. Subtract the mass of the empty beaker to obtain the mass of the soil. Place the sample in the soil sieve (number 1) and shake the can gently over a tray for several minutes. Be sure the students hold the can over one of the trays while they are pouring the sample into the can. Put the contents that pass through this mesh into the next smaller- meshed sieve (number 2) and repeat the process. Continue in this fashion until each can contains the materials that will NOT pass through the mesh size, and the tray contains the finest of all particles, the clay. Mass and volume comparisons will give relative percent values for each particle size in the sample. You may wish to retain materials of a given particle size for use in future activities.

Draw a data table on a large piece of paper or on the board for the students to record their group data. The class data table should include the five classifications of soil particles - gravel, coarse sand, fine sand, silt, and clay - and it should have one column for each group to record their data. The students will record their data into a group data table, and into a class data table.

Answers to student questions:

1. The introduction to this activity told you that the most common sizes of sediments in estuaries are sand, silt, and mud. Why do you think this is true?

   As moving water slows down, its sediment load is deposited according to grain size, with the larger particle sizes deposited first. By the time the water has reached an estuary, only the smaller sizes - sand, silt, and mud - remain in suspension.

2. Which sediment size made up the largest portion of your sample? Could your soil sample have come from an estuary? Give reasons for your answer.

   Answers will vary according to the sample the students are working with, but generally the largest portion of the sample will be coarse sand.

3. If you sampled soil from the Peninsular Mountain Range, how would you expect it to compare to your soil sample? Which particle size would be most common? Explain your reasoning

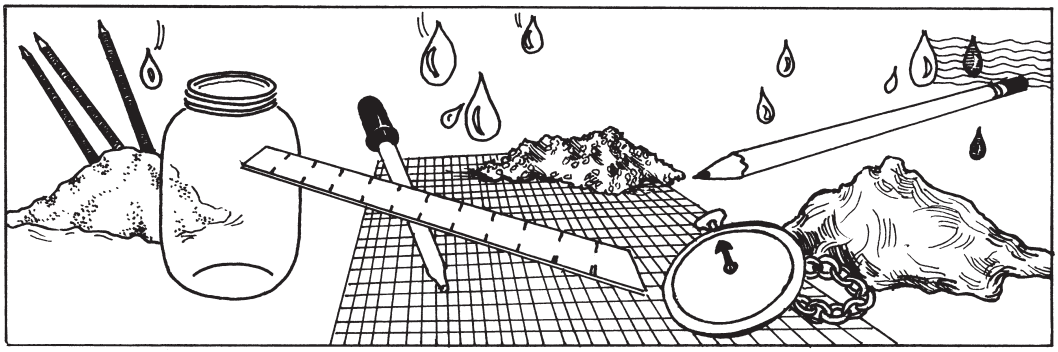
Soil from the mountains would probably be composed of a wide variety of grain sizes, including gravel and pebbles. Students should understand that only the smaller sizes would be found in the estuary.

4. Surface runoff across the watershed brings fresh water and sediments to the Tijuana Estuary. How do dams on the rivers of the watershed affect the sediment deposits in the estuary?

Dams affect sediment deposits in two ways. First, they prevent larger sediments from moving downriver, and second, they slow down the movement of the water so sediments settle out of the water sooner. The slower movement of the water also prevents sediments from being washed out of the estuary into the ocean because the force of the water has been decreased.

5. As surface runoff travels across the estuary to the ocean, the land becomes flatter. How do you think that would affect sediment deposits?

The force of the water would slow down as it moved across flatter land. As the water slows, larger sediments settle out and are deposited onto the stream bed. The slower the water, the more sediments are deposited.



Activity #2: Determine Soil Particle Size

PURPOSE:

To determine the composition and particle size of a sample of soil.

INTRODUCTION:

Soil composition determines many characteristics of soils, such as infiltration rates (the rate at which water moves into a soil), percolation rates (how fast water moves through the soil), settling rates (how fast sediments sink to the bottom of a body of water), oxygen content, and the ability of the soil to support plant and animal life. In estuaries, sand, silt, and mud are the most common particle sizes. The sediment particles have very specific size ranges, and a change in the amount of any one can greatly affect the characteristics of a given soil. This activity will give you the opportunity to use the sieve sets you constructed in the previous activity to determine the percent composition of a sample of soil.

MATERIALS:

One set of soil sieves, numbers 1, 2, 3, and 4
2 plastic trays
5 small plastic bags
One clean, dry 400 ml beaker
Balance

PROCEDURE:

1. Sort through your sample and remove any roots, rocks, or pieces of organic debris larger than 1.25 cm before starting.

2. Record the mass of a clean, dry 400 ml beaker

   Mass of beaker: _____grams.

3. Fill the beaker almost full with soil from your soil sample and mass the beaker again. Subtract the mass of the empty beaker from the mass of the full beaker to get the mass of the soil.

   Mass of soil sample:_____grams

4. You may choose to spread out a sheet of newsprint before you start this next part. This is especially true if you tend to be a "messy" worker. Hold the number 1 soil sieve over one of the plastic trays and pour the entire soil sample into the sieve. Using a sheet of paper as a cover, shake the sieve gently over the tray until no more material passes through the sieve. The material left in the sieve is the gravel portion of your sample. Pour this gravel portion back into the beaker, mass it, subtract the mass of the empty beaker, and record the mass of the gravel. Pour the gravel into a plastic bag and label it.

   Mass of gravel:_____grams

5. Hold the number 2 sieve over the other tray and pour the contents that passed through the number 1 sieve into the number 2 sieve. Sieve the sample, and place what is left in the sieve into the empty beaker; mass the beaker and contents, subtract the mass of the empty beaker, and record the mass of the coarse sand. Pour the coarse sand into a plastic bag and label it.

   Mass of coarse sand:_____grams

6. Repeat this process for the number 3 and 4 sieves. The number 3 sieve will contain fine sand.

   Mass of fine sand:_____grams

   The number 4 sieve will contain silt.

   Mass of silt:_____grams

   The material that passed through the number 4 sieve is in the tray. This material is clay.

   Mass of clay:_____grams

NUMBER	MESH	PARTICLES REMAINING	MASS	PERCENT
1	#10	gravel		
2	#35	coarse sand		
3	#230	fine sand		
4	5 micron	silt		
Tray		clay		

7. Using the starting mass of the entire soil sample, calculate the percent value of each fraction and record your percentages in your group data table above and in the class data table. Construct a graph of the percentages of each particle size for your sample.

   ((Mass of gravel) / (Mass of entire sample)) x 100 = _____% gravel
   ((Mass of coarse sand) / (Mass of entire sample)) x 100 = _____% coarse sand
   ((Mass of fine sand) / (Mass of entire sample)) x 100 = _____% fine sand
   ((Mass of silt) / (Mass of entire sample)) x 100 = _____% silt
   ((Mass of clay) / (Mass of entire sample)) x 100 = _____% clay.

QUESTIONS:

1. The introduction to this activity told you that the most common sizes of sediments in estuaries are sand, silt, and mud. Why do you think this is true?

2. Which sediment size made up the largest portion of your sample? Could your soil sample have come from an estuary? Give reasons for your answer.

3. If you sampled soil from the Peninsular Mountain Range, how would you expect it to compare to your soil sample? Which particle size would be most common? Explain your reasoning.

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5. As surface runoff travels across the estuary to the ocean, the land becomes flatter. How do you think that would affect sediment deposits?

6. Analyze the data on the Class Data Table. Why do you think the percentages of soil types are different based on the origin of the soil sample?