Soil Characteristics Lab
(adapted from USGS's lab "What's in My Soil?)

Background

Sand, silt, and clay make up 40-80 percent of soil. These components are present in different proportions giving soils their different characteristics and textures. For example, a soil can have a sticky character if it contains mostly clay particles, velvety smooth if it has high silt content, gritty if it contains mostly sand, or spongy if it is high in organic matter.

Some soil components may constitute a small, but important percentage of the whole. For example, the organic component *humus* possesses important textural characteristics that allow good infiltration of precipitation.

Though humus normally makes up only 5 percent of the soil or less, it is an essential source of nutrients and adds important textural qualities that are critical for plant growth. Humus, which is rich in nitrogen, is the result of the cycle of plant and animal growth and decay. Besides plant matter, humus includes *macroscopic* organisms (such as insects and other arthropods, and worms), and *microscopic* organisms (such as bacteria). Humus also acts as a buffer against changes in pH.

Animal life contributes to soil development in two ways: it adds to humus by helping decompose dead plant and animal material, and by adding organic matter and nitrogen to the soil through its body wastes and by its own death and decomposition. Organic matter provides air space, insulation, and food for many soil-dwelling creatures. It also reduces surface runoff by absorbing water (as much as 2 pounds of water per pound of humus).

Sand helps increase permeability and lightness of the soil. Sand does not maintain nutrients or water very well (perhaps a mere 4 ounces of water per pound of sand) but helps water move downward toward the water table. *Silt* has high capillarity, pulling water upward from the water table to plant roots.

Clay, though often thought to be undesirable, is critical to a good soil composition due to its water-holding capacity and cation exchange capacity.

Cations are positively charged ions, and cation exchange capacity is a measure of the exchange sites in the soil which is influenced by the amount and type of clay and the amount of organic matter. Cation exchange influences the ability of a soil to retain important nutrients. Important nutrients include nitrogen (N), phosphorus (P), and potassium (K) (which represents the "NPK" values found on fertilizer labels) plus calcium, iron and magnesium.

Edible Soil Profiles Wrap Up Questions

1. Draw your soil profile. Be sure to include each layer (horizon) and describe what you see.
2. Label each horizon with its name (I'm not talking about "fudge", but rather R Horizon) and the major characteristics of each layer.

3. Explain how the top layers of soil are made during soil formation.

4. Define "leaching".

5. Explain how leaching creates a lighter-colored layer in your soil profile.

Instructions for Soil Settling Lab: Set Up

1. Dry your soil sample (at least 1.5 cups) for two days before the experiment. This can be done in class. Be sure to label which soil is your groups (there will be five groups)
2. Put your soil into a gallon-sized Ziploc bag and seal it. Using a large spoon or spatula, press against the bag to get rid of any clumps of soil. Do not crush gravel or sand.
3. Your group will need a long plastic tube, a stopper, a fabric measuring tape, a ring stand, a milk-jug funnel, and label tape.
4. Place the stopper in one end of the tub and press in (don't break the tube, but make a good seal). Check the seal by pouring a small amount of water into the tube. Carefully place it onto the counter and check for leaks. Dump out the water.
5. Stand you tube onto the counter (the stopper should sitting securely on the counter).
6. Pour 4 cups of detergent solution into your tube using the milk-jug funnel.
7. Dump ½ to ¾ cup of your dry, crushed, soil sample into the tube. Don't do this slowly, do it in one quick dump. This will give everything the same chance to get to the bottom.
8. Carefully rinse the sides of the tube with a quirt bottle of water.
9. Carefully tape the fabric measuring tape to the side of the tube. Line up the 0" with the top of the plug (inside of the tube).
10. Using the label tape, put your groups names on the ring stand.
11. Let the tube stand over two days.

After 2 Days: Analysis & Conclusion Questions

1. How many layers do you see in your tube? What are each layer's distinct characteristics?
2. Draw a quick sketch of your tube, noting any major characteristics. Label the sand, clay, and silt layers. Label any organic material (floating at the top of the tube)
3. Measure and record the thickness of the sand layer, the clay layer, and the silt layer.
4. Add the total thickness of all three layers to get the total thickness.
5. Calculate the percentages of sand, clay, and silt
   for example: (thickness of sand / total thickness) x 100

6. Plot your data on the Ternary Diagram. Label your data point.
7. Gather the other groups' data and graph their data points on the same Ternary Diagram. Be sure to label each groups point.
8. Were any of the groups' samples considered a good soil mixture?
9. For each sample that was not considered a good soil mixture, how could you improve the soil? Be specific.
10. Humus, Clay, and Silt have different porosities and permeabilities. Define porosity and permeability and describe each type of soil using these concepts.
11. You want to start a backyard garden and you perform this soil-settling test on your soil. You find that there is a high percentage of clay compared to sand and silt. Explain the positives and negatives to growing plants in this type of soil.
12. What if your garden was mostly sand? Why might this be difficult to grow in?

Analysis

Soil Components in Soil From________________________

Drawing of Tube After 2 Days

	Height of Layer after 2 days	Percentage of Soil Component
Sand		
Silt		
Clay		
Total:		

Ternary Diagram