***Station 1 Description****:*

Soil to many of us is just dirt. When looked at closely, soil is composed of particles of different sizes. The particles may be rounded by alluvial action (deposited by water) or may be jagged. The soil may contain transparent crystals or even gold. A good look at soil reveals many wonders. A soil smear is used by soil scientists as a color check and is a permanent record of their investigation of that particular site or soil sample.

***Materials*:**

Soils, hand lenses, specimen bowls, scoops, dropper bottles of water, cellophane tape

(Optional) Microscopes and slides, soil screens

***Procedure:***

* [Candidates] view each soil sample with hand lens or microscope and write observations in their science journals (see example data sheet in method guide).
* Add soil smears by picking up a pinch of soil on a moistened thumb and rubbing the thumb in their journal. Cover smear with a piece of cellophane tape.

***Station 2 Description:***

Making your own soil from rock is great fun. It helps to have rock of different densities and hardness values. Students who choose hard rocks find out that weathering these pieces of parent material requires a lot of energy. Those who choose the softer rocks can get a fairly smooth soil as a result of their efforts. A discussion of rock density prior to the activity will help the class evaluate the rock's ability to weather. If a student would choose three rock samples, measure their densities, and break them up with the rock hammers, they could make valuable correlations.

***Materials:***

Soil parent materials (rocks), hand lenses, small hammers, cloths or rock bags (or old socks), wooden board, water, 100 ml or larger graduated cylinder, balance scale

(Optional) Microscopes and slides

***Procedure:***

* Record data about three rocks in science journal (see example data sheet in method guide).
* Obtain densities (density = mass/volume) of rock samples using the balance and graduated cylinder.
* Put small pieces of rock into cloth and smash with hammer.
* Record observations about "soil" (broken rocks) in science journal.

***Station 3 Description:***

pH is a valuable test when evaluating a soil. Knowing the pH helps farmers evaluate what kinds of crops will do well in their soil and whether they will have to add materials to the soil to modify that pH for a specific crop. Different crops and native plants have different tolerances for soil acidity. Some plants like acid soils; some plants are adapted to basic soils. When collecting soils it is helpful to measure the pH at the time of collection to get a feeling of the range of soil pH in your region. This activity is also good for allowing students to practice estimation. The kits and pH strips do not give precise results.

***Materials:***

Soils, spoons, pH soil test kits (best) *or* pH strips with distilled water *or* universal pH indicator with test tubes and small beakers, filter paper, funnels, distilled water

***Procedure:***

* Test pH of each soil following kit directions
	+ pH strips — Scoop soil into beaker and wet to damp (no standing water) with distilled water. Touch pH strip to soil. Record data.
	+ Universal pH indicator — Scoop a spoonful of soil into a test tube. Pour 10 cc of distilled water on soil. Allow stand for 5–10 minutes. Strain solution through filter paper in a funnel into a small beaker. Test filtered sample with universal pH indicator.

***Station 4 Description:***

Pore volume is a soil measure that is arrived at in several different ways. All methods give an estimation of true pore volume. Pore volume is a measure of the space between soil particles. In a heavy, clay soil there is little pore volume. In a sandy soil there is a large pore volume. The pores are the pathways for water and air to penetrate into the soil.

***Materials:***

Heavy and light soils, spoons, water, 100–250 ml graduated cylinders, 100 ml beakers, balance scale, paper towels

***Procedure:***

* Weigh out a 100 g sample of soil and place in 100 ml beaker.
* Measure 100 ml of water in graduated cylinder and pour enough water into the soil sample to just cover the surface. Tap the beaker to release trapped air.
* Record the number of ml of water added to the soil sample in your science journal — this is your pore volume.
* Complete for 1 heavy and 1 light soil sample.

***Station 5 Description:***

This activity results in what is known as a soil profile or graph of relative amounts of different-sized particles in a soil sample. The soil screens may be simple squares of hardware cloth with different opening sizes or regulation soil screens. The profile is used to classify the soil. Agronomists and farmers use the profile when choosing which crops to plant.

***Materials:***

Heavy and light soils, spoons, soil screens, balance scale, paper towels, soil chart 2 (in procedure guide)

***Procedure:***

* Put 100 g of a soil sample through the screen system.
* Weigh each soil fraction.
* Calculate percentage of each soil fraction and record data in science journal.
* Complete for 1 heavy and 1 light soil sample.

***Station 6 Description:***

Water retention or “field capacity,” as this measure is known, is one of the most important measures of a given soil to a farmer. The farmer wants to know how much water his soil will hold against the pull of gravity. If you have 100 g of soil and it can hold 50 g of water against the pull of gravity, the field capacity of the soil is said to be 50%. The farmer can improve this figure by incorporating organic matter into the soil.

***Materials:***

Soil samples, filter paper, funnel, beaker, graduated cylinder, balance scale, water

***Procedure:***

* Place 100 g of soil into a filter paper in a large funnel. Place funnel onto beaker.
* Pour 100 ml of water slowly onto the soil and collect runoff in beaker.
* Measure amount of water runoff.
* Calculate water retention in ml of water per gram of soil and record data in science journal.

***Station 7 Description:***

Cryptogams hold soil together and prevent erosion. Cattle, sheep, horses, people all destroy the natural cryptogram layer in a healthy soil. Erosion causes soil degradation with many consequences, such as water and nutrient loss.

***Materials:***

Two stream/soil tables/troughs filled with cryptogram soil and straight soil, respectively, watering can, two catch buckets, two 250 or 500 ml beakers, short length of 2 x 4 (or similar) to prop up upstream end of troughs.

***Procedure:***

* Instructor preparation: Fill one trough 2/3 full of sod or forest soil that is covered by cryptogams. Fill a second trough 2/3 full with straight soil, collected in the field from below the sod used in the first trough. Place both troughs so that the screen/hole end hangs over a table and empties into the catch buckets. Place 2 x 4 under the upstream end of the trough to provide slope.

**Station 7 Continued:**

* Candidates sprinkle one of the troughs with water from the watering can and collect a beaker full of water.
* Repeat for second trough.
* Record observations of the water in each beaker and the leftover soil in the troughs in science journal.

***Station 8 Description:***

Water moves in all directions in the soil profile. It moves down due to gravity. Through capillary action it can move down, laterally, or up. It moves through the interstitial spaces and along the surfaces of the soil particles. It moves slowly in clay soils, which have a very slight electrical charge and are tightly bonded together, and rapidly in sandy soils that are not charged and are more loosely organized. Organic matter absorbs moisture and holds it in place. In arid climates the moisture wicks up in the soil profile to the point where the moisture evaporates and is lost into the atmosphere. At the point where the moisture evaporates, salts that were in the water may be deposited. These salts may make a layer that resists the penetration of water, called caliche.

***Materials:***

Soil samples, coffee filters, filter paper or cheese cloth, stout rubber bands or string, water, flat tray, stopwatch or second hand on clock, clear tubes (100-ml plastic graduated cylinders that have the bases removed with a hacksaw work well).

***Station 8 continued:***

***Procedure:***

* Attach two coffee filters or cheesecloth to the bottom of a glass cylinder or lamp chimney.
* Pour in soil to halfway up the chimney or cylinder.
* Place chimneys in tray and pour 2 cm of water into tray.
* After 5–10 minutes, note how far up the water column reaches. Record data in science journal.
* Complete for at least two soil types.