Sieves Set

Purpose:

To enable the easy separation of dry soil samples into five different sizes from pebbles to silt. Porosity, permeability, and capillarity are all greatly affected by the particle size of earth materials.

Background:

Students should gather actual soil samples from places where all vegetation has been removed. In the classroom, the samples should be spread on paper towels and allowed to dry. After drying, the soil clumps should be crushed into individual particles by students, using only their fingers. The dry weight of each sample should be recorded. Samples are considered dry if their weight does not change over time. The screen sieve set is arranged with the largest mesh on top, using progressively smaller mesh on down through the stack, until the closed bottom container completes the assembly.

Begin by placing one of the soil samples in the top container, cover it, and gently shake it back and forth with a horizontal motion. Remove the cover after measured intervals to check on the separation. The particles are then carefully removed from each sieve, and their separate weights obtained. The sieves should contain particles of a size larger than the mesh in the bottom, but smaller than the mesh in the container above it. The sieves should contain the following particles:

- 1st sieve -- gravel
- 2nd sieve -- fine gravel
- 3rd sieve -- coarse sand
- 4th sieve -- fine sand
- 5th sieve -- silt and clay

A useful scale of particles sizes can be prepared by projecting each sieve along with a transparent metric scale onto a distant screen. Measuring the projected scale and the interval between wires in the projection of the mesh, enables the calculation of the actual mesh size.

The masses measured for the contents of each sieve, made by weighing the sieve before and after filling it, can be converted into a percentage of the sample. The mass of a given sample, when divided by the sum of the sample masses, sets up the calculation. It is useful to express the results in the form of a bar graph, or histogram. Students can often tell, by visually comparing the graphic results, when two samples are similar or different.

Evaluation:

It is often useful to have standard soil samples on hand, and this is most easily accomplished if sand and gravel mixtures of known composition are prepared in advance. By repeatedly screening and collecting the contents of each sieve in a sealed container, a known composition by weight can be quickly fabricated. Following the activity, the contents of each sieve can be returned to the proper container to be ready for the next time.

Extensions:

Again, sand samples that are free of organic material and silt or clay can be stockpiled in labelled containers for percolation and capillarity measurements. It is instructive to arrange two batches that are alike in all measurable respects except that one is used in a way that is stratified by size and the other is shaken back together first. The percentage occupancy is readily compared if the sorted column has the fines on the bottom and progressively larger particles as one goes up the column. Differences in percolation and capillarity are easily observed and compared with student predictions.

Important Note:

For the long-term usefulness of the apparatus, samples that have been heated to dry them should have cooled to room temperature before using the sieve set. The sieves, individually and collectively, should be kept dry at all times. Water will tend to promote corrosion and salt deposits on the finer wires of the mesh, effectively blocking the openings