3070-4 / SCREEN SIEVES

Soil is composed of various particles that can be separated and identified. Soil particles range from gravel to sand to clay, and each particle has its own identifiable characteristics. The investigation of soil particles is part of soil science, which is sometimes called pedology.

The Screen Sieve Kit is designed for the easy separation of soil into the various sizes of its particles. Porosity, permeability, and capillarity are all greatly affected by the particle size of earth materials. The screen sieves are also used to investigate these properties.

SPECIFICATIONS OF MATERIALS

4 plastic sieves (6" diameter)
Bottom pan
Lid

ADDITIONAL MATERIALS NEEDED:

Soil samples	Beakers
Paper towels	Cotton
Sand	Stopwatch or timer
Funnels	Balances

INVESTIGATIONS - TIME: 120 MINUTES

PART 1
SEPARATING SOIL PARTICLES

PROCEDURE

The students should bring to class soil samples from a level grass-covered surface and also a sandy area. Before taking the soil sample from the grassy area, all vegetation should he carefully removed. In the classroom, the samples should be spread on paper towels and allowed to dry. After drying, the soil aggregates should be crushed into individual soil particles by the students, using only their fingers. The weight of both soil samples is then obtained.

The screen sieves should be arranged with the largest screen size on top, proportionately decreasing in screen size to the closed-bottom container.

Place one of the soil samples in the uppermost sieve, cover it, and lightly shake it using a back and forth motion. Carefully remove the particles from each sieve and obtain their separate weights. The sieves should contain the following particles.

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

The masses of each particle size can be converted into a percentage by dividing the previously obtained total mass into the mass of each individual size. When this has been done, the sieve should be cleaned and the same procedure should be followed for the other soil sample.

EVALUATION QUESTIONS

1. Which of the soil samples contains the greatest amount of coarse particles? (The soil from a sandy area should contain more coarse material.)

2. Why does this occur? (The soil along a shoreline is usually a younger soil, and the topsoil has not had time to develop completely.)

3. What range of particle sizes seems to dominate the soil sample from a level grass-covered surface? (Most of the particles will sift completely through to the bottom pan, indicating silt and clay are the predominant particles.)

4. Is there a way to separate the silt from the clay? (If the mixture is placed in a jar of water, stirred, and allowed to settle for 30 minutes, the finer clay particles will still remain suspended in the water. If the suspension is poured off, silt will remain at the bottom of the jar. The clay can be collected by evaporating the water.)

5. How would the size of particles affect the ability of soils to hold moisture? (The soil with the finest particles takes the longest to dry. This can be observed when the soil samples are set out to dry in the classroom before the investigation actually begins.)

PART 2
EXAMINING PERMEABILITY AND CAPILLARY WATER IN EARTH MATERIAL

PROCEDURE

Arrange the screen sieves in the same order as they were assembled in Part 1. A quantity of mixed sand should be placed in the top chamber and shaken gently for several minutes. The cover should be used to prevent excessive dust.
The particles should then be taken from the second sieve (fine gravel), the third sieve, (coarse sand), and the bottom container (silt and clay).

The particles in the first and fourth sieves are not used in this investigation. Three funnels should be placed side by side with a loose wadding of cotton in the neck of each. (They should be tested beforehand to see if water effectively drains through each.)

Place equal amounts of the fine gravel in the first funnel, the coarse sand in the second funnel, and the silt and clay particles in the third funnel. Three separate beakers should be filled with 50 milliliters of water.

The speed with which water moves through a material is termed permeability. This speed can be determined with the aid of a stopwatch by measuring the length of time it takes the water to drain through each funnel. Measure the amount of water in the beaker below. By subtracting the amount left in each beaker from the original 50 milliliters, the amount of water trapped between the particles as capillary water or soil water can be determined.

The results should be organized into a chart.

EVALUATION QUESTIONS

1. Which funnel of particles takes the shortest time to drain? What does this illustrate about the permeability of the particles? (The funnel containing the fine gravel will drain in the shortest time, and thus have the greatest permeability.)

2. Why does this happen? (Because the individual pore spaces between each particle are larger, providing an easier and more direct path through them for the water.)

3. Which of the materials has the greatest amount of capillary water remaining? (The clay and silt particles)

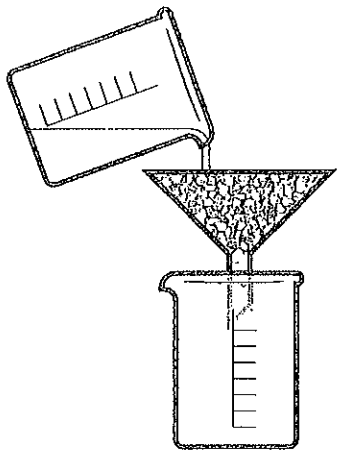
4. Why would crops have difficulty growing in an area of sand and gravel? (Crops need a continuous supply of water in the soil. Sand and gravel retain very little of this capillary water.)

5. Provided all other conditions are equal, if the three types of particles in this investigation formed the ground cover for three different areas, under which would the ground water be the highest? Which would experience the most surface flooding or runoff? (Under fine gravel the ground water would be the highest. A ground cover of silt and clay would have the most surface flooding or run-off.)

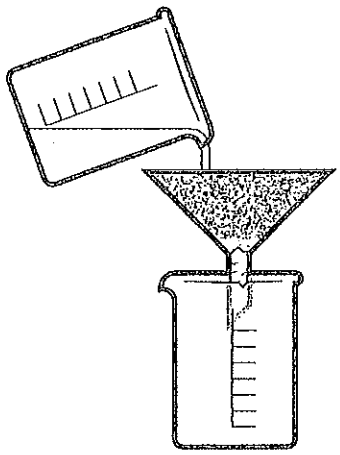
SUPPLEMENTARY MATERIALS

Soil profile kit
Earth materials kit
Rock composition kit
Plastic column kit
Stream table
Stream table film loops

FINE GRAVEL



COARSE SAND



CLAY AND SILT