Activity–Soil Profile

Standard III

Objective 3

Connections

Standard III
Students will understand the basic properties of rocks, the processes involved in the formation of soils, and the needs of plants provided by soil.

Objective 3
Observe the basic components of soil and relate the components to plant growth.

Intended Learning Outcomes
4. Communicate effectively using science language and reasoning.

Background

A soil profile can consist of two or more layers. Most often a soil profile consists of four different layers known as horizons. Each layer may differ in thickness depending on where the soil is found. Each layer differs in color, texture, structure, consistency, and water absorbency. The characteristics of different soil determine what the soil is used for. Soil that is rich in organic materials and fairly water absorbent is good for growing plants.

A normal soil profile consists of three layers: topsoil, subsoil, and bedrock. Topsoil is the top layer. It is generally looser than the lower layers. It is made up of the smallest grains of rocks and minerals. The topsoil layer is usually darker in color because it contains the most dead and decayed organisms. These provide nutrients that plants need for growth. This is where plants can absorb water, nutrients and air. Subsoil is the layer below the topsoil. It is usually lighter in color because it has less living and once-living organisms. It is denser and grittier than the topsoil. It sometimes has larger rocks or pebbles mixed with small particles. Minerals in this layer are not easy for plants to use. Plants grow poorly in subsoil. Bedrock is the lowest layer or the solid rock that lies underneath the soil. It is the parent material from which much of the soil originally formed. Bedrock can be within a few inches of the surface or many feet below the surface.

Invitation to Learn

Show the students a picture of a road cut or construction site (photos can be found on the Surweb).

Instructional Procedures

1. Review with students what they observed in their soil samples in the activity "What Is In Soil?" Tell them that that is the kind of soil found on top. Record color, texture, and kinds of materials on their profile log (dark, loose, moist, full of organic material).
2. Give students samples of subsoil. Have them examine it with a hand lens. They should make comparisons. Record color, texture, and kinds of materials on their profile log (light color, denser, grittier – more stones and pebbles, little or no organic matter).
3. Give students samples of bedrock (stones or gravel).
4. Have students place gravel in bottom of jar. Then a layer of subsoil. On top place a layer of topsoil.
5. Students should draw their soil profile model and label the parts. Record characteristics and kinds of materials found in each layer.

Materials

- ❑ Jar (narrow with straight sides – spice jars work well and don't require as much material)
- ❑ Chunks of rocks (if using spice jars, gravel will work)
- ❑ Sample of soil from garden (or sample saved from "What Is In Soil?" Activity)
- ❑ Sample of soil from bottom of a big hole (perhaps at a construction site)

Possible Extensions/Adaptations/Integration

Soil Shake Activity as follows: The way a soil "feels" is called the soil texture. Soil texture depends on the amount of each size of particle in the soil. Sand, silt, and clay are names that describe the size of individual particles in the soil.

- Sand has the largest particles and they feel "gritty."
- Silt are medium-sized, and they feel soft, silky or "floury."
- Clay are the smallest sized particles, and they feel "sticky" and they are hard to squeeze.

Size comparison/Scale

Sand	2.00 - .05 mm	Would be the size of a barrel
Silt	.05 - .002 mm	Would be the size of a plate
Clay	< .002 mm	Would be the size of a coin in comparison to silt and sand

Activity

1. Place samples of each type of soil in small bowls. Invite students to use their fingers to feel and compare the textures of each.
2. Add water to the samples. Have students feel each sample. They should rinse their fingers between each test so as not to cross contaminate the samples.
3. Which soil holds water? Cut the top off of three 2-liter bottles. Invert the top and put inside the opening of the bottle. Line each inverted top with cheesecloth. Fill each top 1/2 full with a soil sample (clay in one, sand in another, silt in the third). Pour water over each soil sample. (Make sure it goes through the soil and does not spill over the edge.) Observe the speed the water goes through each sample. (It will pour through the sand. It will go more slowly through the silt. Very little may get through the clay.) When it dries, notice what happens to each sample. The sand is still loose. The silt sticks together but can easily be crumpled back into dust. The clay is hard. Show students a clay flowerpot.
4. Ask students why it would be important to know what kind of soil is in a garden. Tell them that one test that is done is called a soil shake. Put a sample of soil in a jar. Add water until 2/3 to 1/2 full. Shake for two minutes. Ask which particles would settle first and be on the bottom? (sand because it is the largest and heaviest) Which would be on top? (clay)

Additional Resources

The Amazing Earth Model Book: Easy-to-Make, Hand-on Models that Teach by D.M. Silver & P.J. Wynne (Scholastic Professional Books)

Name_____

Soil Profile: The Layers of Soil

Make your own soil profile.

Materials

a jar (such as a pickle jar)

chunks of rocks, sample of soil from the garden

sample of soil from the bottom of a big hole (perhaps at a construction site)

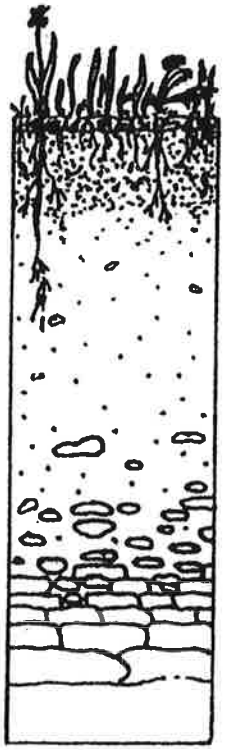
Procedure

Place large pieces of rocks and gravel in the bottom of your jar - (2 - 3 inches)

Pour 2 - 3 inches of subsoil on top of the rocks.

Place 1 - 2 inches of garden soil on top of the subsoil.

Label the parts of the soil profile below. Describe the traits of each layer. Tell what kinds of material are in each layer.



Which layer of soil is the most important for plant growth?_____

Why is the topsoil darker than the other layers? _____

Which soil layer has the largest rocks? _____

About how thick is the layer of topsoil in most areas of Utah? _____

About how many years does it take for nature to create one inch of new topsoil?_____

Name_____

Soil Percolation

Percolation means how fast water runs through something such as soil.

Question: Which type of soil - sand, silt, or clay - percolates the fastest. That means they hold the least amount of water.

Hypothesis: _____

Experiment: Day 1

Materials:

3 two-liter bottles; cheesecloth; sample of sand, silt, and clay beaker, water

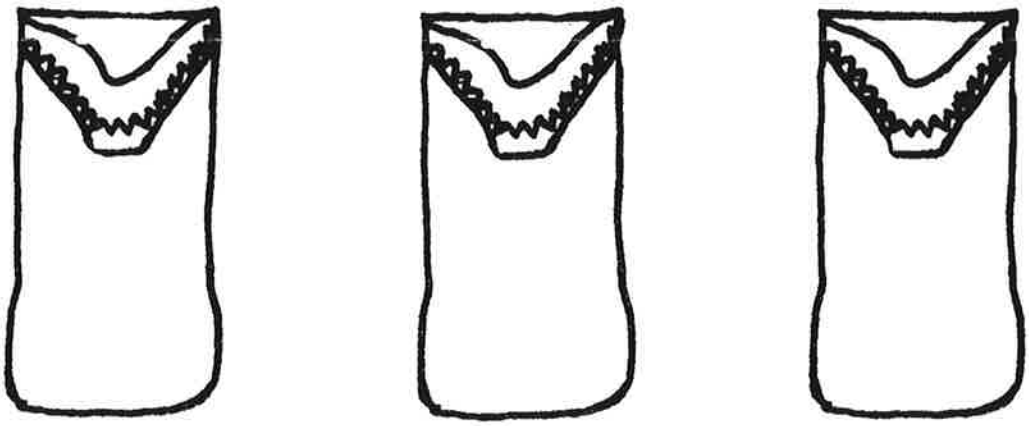
Procedure:

1. Cut the top part of each bottle off (just below the shoulder)
2. Turn the top upside down and fit it into the bottom of the bottle
3. Line the top with cheesecloth
4. Place 2 cups of each soil sample on the cheesecloth.
5. Pour 200 ml of water over each sample. Make sure it only goes through the soil sample - not around the edge
6. Measure how much water is in the bottom of each bottle

Results:

Draw what happens in the diagrams below. Under each bottle write how many ml of water percolated through the sample and dripped onto the bottom.

Sand Silt Clay



Conclusion: _____

Day 2.

Examine your percolating bottles from the day before.

A. Describe the condition of each soil sample. Include what happens when you pick up the soil.

a. The sand is _____

_____

b. The silt is _____

_____

c. The clay is _____

_____

Which kind of soil dries out the fastest? _____

Which kind of soil dries out the slowest? _____

B. Applying what you learned to your garden

a. Every time you water the garden, the water seems to disappear. No matter how much you water your plants still look dry and thirsty.

What kind of soil do you probably have? _____

Why would the plants be thirsty? Where did the water go? _____

_____

What could you do to help solve this problem? _____

_____

b. When you water the garden the water seems to sit on top of the ground. You frequently have flooding. Despite all the water your plants still look dry and thirsty.

What kind of soil do you probably have? _____

Why would the plants be thirsty if they are standing in water? _____

_____

How could you solve this problem? _____

_____