



Science Unit: *Plants*

Lesson 7: *Soil Composition*

School year: 2004/2005
Developed for: Queen Alexandra Elementary School, Vancouver School District
Developed by: Paige Axelrood (scientist) and Janet Vesterback (teacher)
Grade level: Presented to grade 3; appropriate for grades 2 – 4 with age appropriate modifications.
Duration of lesson: 1 hour and 20 minutes

Objectives

1. Learn about the living and non-living components of soil.
2. Learn that soil is composed of different layers (surface organic matter, humus layer, mineral soil layer).
3. Discover that the mineral components of soil settle (sediment) into different layers when mixed with water.
4. Discover that soils can have different components and textures by comparing different soil types.

Background Information

Most of the surface layer of land on Earth is covered with soil. Soil is made of sand, silt, clay, minerals, chemicals, and decomposing organic matter (such as dead plants and animals). The upper layer of soil is called humus and it is comprised of organic matter in different states of decomposition. The mineral soil layer is below the humus layer. Soil also contains rocks of different sizes (including very small rocks called gravel), air and water. There are many types of soil, which contain different amounts of rock, sand, silt, clay, and humus. Many plants, animals, insects and microorganisms live in soil. Soil is continuously forming and is always changing.

Vocabulary

Soil: The surface layer of the Earth formed by the erosion of rocks and the decomposition of organic matter.

Humus: The organic matter in soil, comprised of the decomposing remains of plants, animals, insects, and other organisms; many organisms help form humus including bacteria, fungi, worms and insects.

Decompose: To break up or separate into parts.

Rock: A large stone previously detached from a larger mass of stone; made of minerals.

Mineral: Nonliving substances found naturally in the Earth; minerals have their own shape, color and chemical composition.

Gravel: Small pieces of rock sometimes mixed with clay.

Sand: Small grains of ground rock.

Clay: Very tiny particles made of minerals that are approximately 100x smaller than grains of sand.



Materials

The following items are needed for each group of students:

- sieve
- magnifying glass and a spoon for each student
- 1 bag of forest soil (containing surface organic matter, humus and mineral layers)
- large sheet of white paper to cover working area on table; or a large plastic tub for each group
- 3 large plastic zip lock bags to keep different soil components separate after soil sorting and sieving
- 1 large glass jar for soil sedimentation
- plastic container and lid with punched holes
- dissecting microscope

In the Classroom

Introductory Discussion

1. Begin the discussion by talking about walking through a forest or neighbourhood, and highlight a comment about soil. Then ask students: what is soil?
2. Continue the discussion by asking questions about what is on the surface of soil and in the soil. Highlight living organisms and non-living components of soil. Give hints if needed to encourage students to comment on missing soil components and to help extend the discussion. Capture key words on a flip chart.
3. Time permitting: discuss why the different components are important to soil. Discuss vocabulary words that relate to terms that are brought up by students.
4. Remind students to use their observation skills while examining the soil sample (sight, smell and touch).
5. Safety: wash hands before lunch.

Science Activity/Experiment

Day 1: Examine soil

1. Collect a volume of forest soil that fills the surface of a small shovel and place the soil in a plastic bag (prepare 6 bags of soil). Include surface organic matter (leaves, twigs, decomposing plant material, etc.), humus, and underlying mineral soil layer in the sample and try to retain layers if possible. Also collect small insects (such as ants and beetles) and arthropods (such as sow bugs, centipedes, and spiders) to add to each bag. Return forest soil, insects and arthropods to the forest after the lesson is completed.
2. Place a large piece of white paper (or light colored paper) over most of the table area or use large plastic tubs (this works best to contain insects). Cut open the plastic bag to retain the soil layers.
3. Have students use spoons to spread the soil sample over the paper and discover what is in the sample. Encourage use of the magnifying glasses (and dissecting microscopes if they are available).
4. Have students collect rocks, twigs, leaves, moss, etc., on different parts of the paper and gently place insects and arthropods in a plastic container with some soil.
5. Students will take the remaining soil sample, place it on a sieve, shake the sieve back and forth to pass the soil through the holes, and examine what passes through the sieve and what is retained on the sieve.
6. Students record all the different components that they observed while examining the soil sample (pictures with descriptive words). If time does not permit students to finish recording all observations



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or conduct the soil sedimentation activity, place the rocks, twigs, leaves etc. into 1 bag, the sieved soil into a second bag, and the soil components retained on the sieve in a third bag until the next session.

Days 2-3: Sediment soil and filter water after sedimentation

7. Students will mix the contents of their three bags together in one bag, place one cup of soil and 2 cups of water in a glass jar and swirl the sample gently while keeping the glass jar on the table. Students will draw their observations of the soil suspension.
8. The next day, the students will examine the contents in the bottle and look for sedimentation layers in the glass jar. Students will draw their observations of the soil layers, the water, and what is floating on the water. The water may be tan colored and there may be organic matter floating on the water. The layers of soil in the bottle from bottom to top may include gravel, sand, silt, and clay.
9. Students will then place filter paper on the sieve, pour the water through the filter paper, and examine what is retained on the filter paper and how the water looks before and after filtration. Students will record their results. The filter paper can be dried in the classroom overnight and examined the next day.

The scientist or teacher will return the insects, arthropods, and forest soil to the forest.

Closure Discussion

After examining the soil:

What was discovered while examining the soil? Were there any surprises?

- A check can be placed next to the words on the flip chart describing living and non-living components of soil that were found by students.
- Additional words can be added as needed.
- Vocabulary words can be introduced and discussed for soil components that were discovered by students.

After the soil sedimentation and filtration activities

10. Discuss observations after the soil settled in the jar overnight.
11. What was at the bottom of the jar? What was floating on the water? Why did layers form as the soil settled? What is in the layers?
12. Discuss what was retained on the filter paper.
13. Discuss any surprising things that were discovered during these activities.
14. Discuss the remaining vocabulary words.

Lesson Review:

Examples of questions to start discussion with the students:

- What non-living things are in soil?
- What living things are in soil?
- How is soil formed?
- Why is soil important?

References

15. Acorn, John and Ian Sheldon. 2001. Bugs of British Columbia. Lone Pine Field Guide. Lone Pine Publishing, Edmonton, AB.



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20. <http://www.nhptv.org/natureworks/nwep11b.htm> New Hampshire Public Television, Nature Works, [Organisms that play a role in decomposition].
21. http://www.funsci.com/fun3_en/exper1/exper1.htm#composition Fun Science Gallery, Giorgio Carboni, March 2001, Science Experiments on Environmental Education and Biology, [Soil composition, soil moisture and permeability, soil erosion, and soil profile].

Teacher Assessment of Learning

22. On a journal page in their duotangs (or as a group with a larger piece of paper), ask students to draw pictures of their activities with soil, and to summarize their learning by answering the sorts of questions posed in the lesson review.
 - Encourage students to add their own comments or questions depending on the discoveries they have made. They may refer to any of the charts with recorded information gathered by the class.
 - How perceptive and detailed are their observations?
 - Are their statements logical (evidence of critical thinking skills)?
23. Watch the students as they engage in their soil studies. Think:
 - How well did students work together and use observation skills to discover what is in soil?
 - Were students able to describe what is in soil, and to find reasonable explanations for the different layers of the soil once it had been mixed with water and allowed to settle?

Extension of Lesson Plan

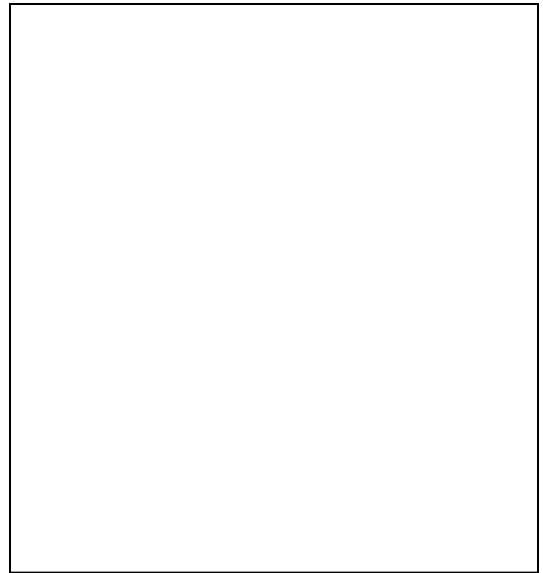
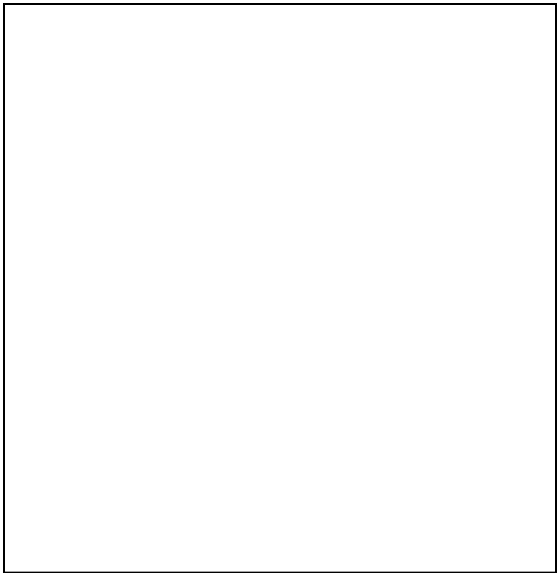
24. Students can collect different types of soil samples and repeat hands-on activities to compare results and discuss how soils are similar and different.

Soil Sample My Discoveries

Name of Scientist _____

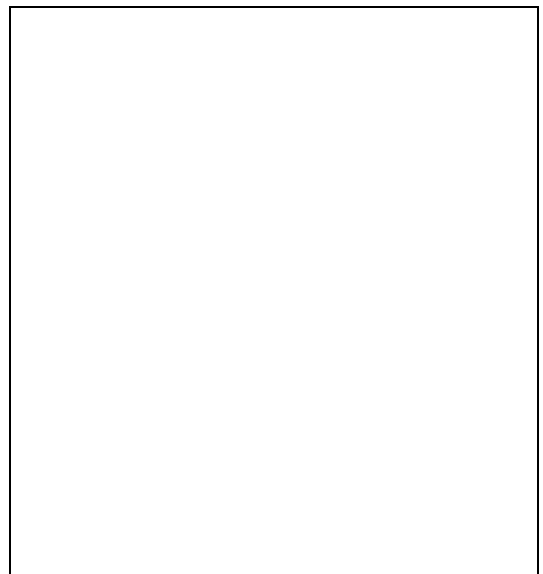
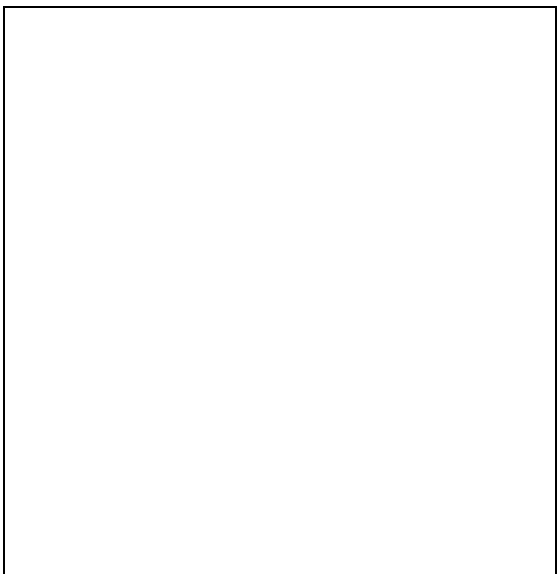
My Discovery: _____ My Discovery: _____

Observations: _____ Observations: _____



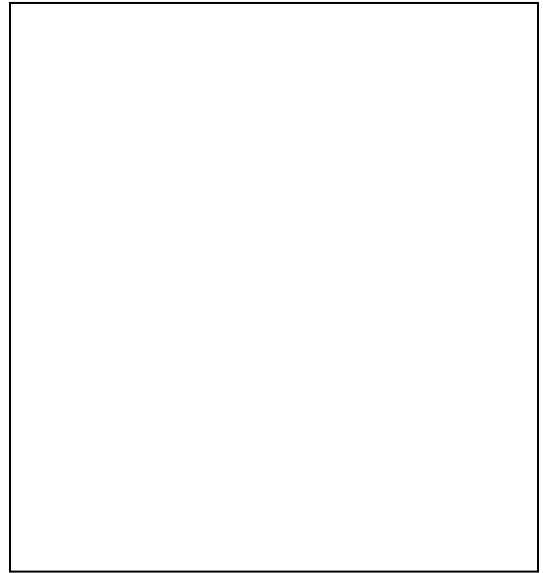
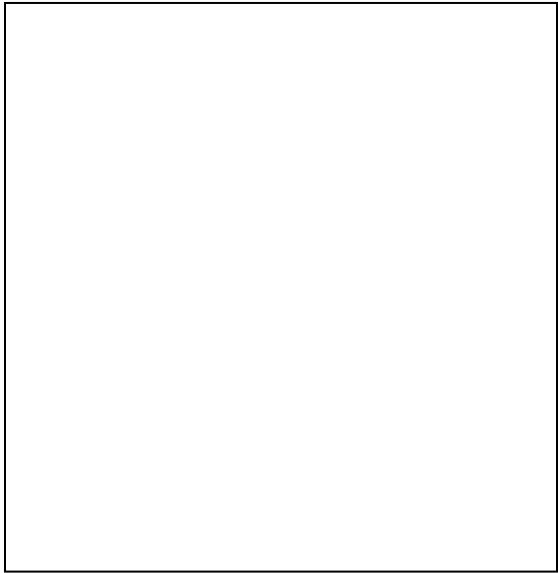
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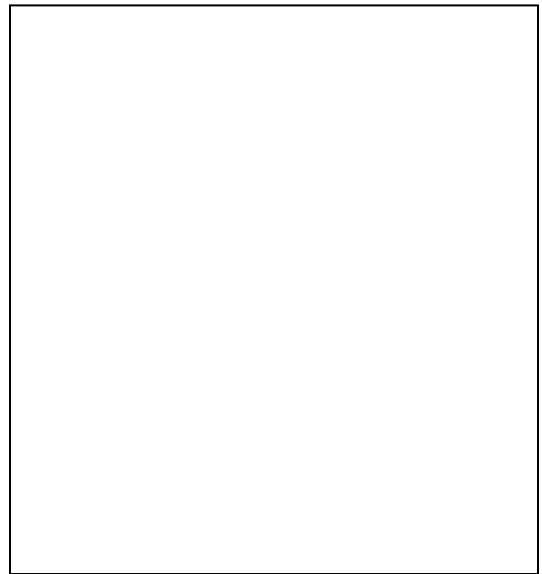
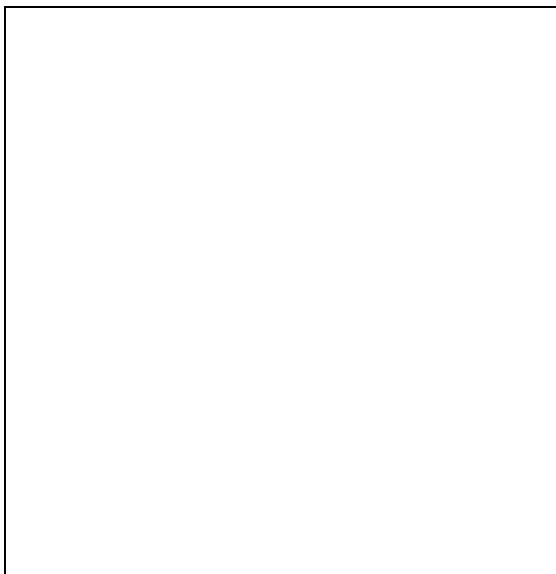
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My Discovery: _____
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My Discovery: _____
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