

## **Unit Plan**

# **Earth and Space Science: Exploring Soils Grade 3**



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## Unit Introduction

This unit should be taught in the spring, when the ground has thawed and students are able to explore easily outside. It could be taught in combination with the plant unit, since some of the topics overlap.

Centers will be set up in the classroom and will remain there for students to explore independently throughout the unit. The centers will be discovery-based without specific directions so that students can ask their own questions and build their own knowledge. The first station will have several types of soil that students can explore using magnifying glasses, sifters and other tools. They will discover bugs, decomposing material, rocks and shells in the various types of soil. In the second station, students will experiment with what happens when water is added to various types of soil. They may attempt to build things with the soil, observing which soils hold together best. The third station will include several activity sheets related to soil, such as word searches, and crossword puzzles. The fourth station will have students complete a Webquest. Students will explore “What’s cool about soil” on the Internet by visiting the Brain Pop Jr. Website and watching the video about soil at : <http://www.brainpop.com/science/earthsystem/soil/>. Students will then explore the links at the bottom of the page, including the Word Wall, games and quizzes. They will then write an entry in their Science Journals. In the final station, students will take a virtual tour of what’s found underground, aboard the Soil Safari. We will also have a large selection of books for students to read throughout the lesson.

Books which could be included:

- *Dirt: The Scoop on Soil* by Natalie M. Rosinsky
- *Microlife That Lives in Soil* by Steve Parker
- *Scary Creatures: Scary Creatures of the Soil* by Gerard Cheshire
- *Using Soil* by Sharon Katz Cooper

From the first lesson, students will be discovering and experimenting with soil. Several lessons related to other subject matters such as: Physical Education, Mathematics, Social Studies and Language Arts.

Students will begin writing in their science journals from the beginning of the unit. They will have the opportunity to write in observations, diagrams, explanations, predictions and other relevant information throughout each lesson. The journals will be used to formally evaluate student learning and students will have the opportunity to revise and update their journals as required. The journals will be collected at the end of the unit for summative assessment and will be graded based on the attached rubric. Formative assessment will be on-going throughout the unit, in the form of conferencing, observations, participation and engagement in the activities.

For the purposes of accommodations, we will assume that “Jimmy” is a student in our class who has some visual impairment and the lessons will be accommodated as necessary.

### **Outcomes Covered in our Unit**

All lessons relate to NSES Content Standard D: Earth and Space Sciences (Properties of earth materials).

#### **Initial Exploration:**

- Ask questions and make predictions that lead to exploration and investigation about the composition of soil (200-1, 200-3)
- Explore and describe a variety of soils and find similarities and differences among them (100-36)
- Make and record observations and measurements in investigations related to soil composition (201-5)
- Investigate and describe soil components using appropriate tools such as spoons, magnifying glasses, jars, and filters (100-37, 201-3)
- Propose an answer to initial question related to soil composition based on their investigations (202-7)

#### **Water Absorption:**

- Describe the effect of moisture on characteristics of the soils. (100-38a)
- Make predictions about which conditions will be the best for plant growth (200-3)
- Make and record relevant observations and measurements of plant growth during their investigations (201-5)
- Construct and label bar graphs that show plant growth under different conditions (202-4)
- Communicate procedures and results of investigations related to the testing of water absorption of soils, using drawings, demonstrations, and/or written and oral descriptions. (203-3)
- Make predictions about the absorption of water by different types of soil and test these through exploration and investigation (200-3)
- Compare the absorption of water by different soils (100-38b)
- Construct and label bar graphs to show the amount of water absorbed by different soil samples (202-4)

#### **Effects of Moving Water on Soil:**

- Observe and describe the effects of moving water on different soils (100-39)

#### **Living Things in the Soil**

- investigate and describe how living things affect and are affected by soils (100-35)

- identify and use a variety of sources of science information to gather information about how living things affect and are affected by soils (201-7)

## **Lesson Plans:**

<b>Subject Area(s):</b>	<b>Science</b>
<b>Grade Level:</b>	<b>3</b>
<b>Lesson Duration:</b>	<b>1 hour</b>

**Lesson Plan Title:** Investigating Soils

### **Curriculum Outcomes:**

- Ask questions and make predictions that lead to exploration and investigation about the composition of soil (200-1, 200-3)
- Explore and describe a variety of soils and find similarities and differences among them (100-36)

### **Content to Be Taught:**

Students will explore and investigate the components of soil and investigate the properties of different types of soil.

### **Children’s Prior Knowledge and Misconceptions:**

Children have had prior experience with soil. They have just completed the unit on plants so they are familiar with the top layer of soil. A misconception may be that students think there is only one type of soil.

### **Performance Objective:**

In this lesson students will explore different types of soil and I will inform them of the different layers and elaborate on each layer.

### **Materials:**

- Large jar
- Samples of different types of soil
- Magnifying glasses
- Stop-watches or timers
- Coffee filters with baskets
- Photocopied charts
- Water
- Measuring jugs
- Jars which the coffee filters will fit

### **ENGAGEMENT**

Start this lesson by finding out what the students know about soil. Have students complete a KWL chart about soil in their notebooks. They will complete the boxes: “What I know” and “What I want to know.” After the lesson, students will begin the “What I learned box”.

<b>EXPLORATION</b>
Several samples of different types of soil will be prepared and students will examine them. They can feel the textures and look at them through the magnifying glasses to observe color and consistency. Students will either write or draw what they see and record the differences between each one.
<b>EXPLANATION</b>
We will have a class discussion about what they think the soil is made from and what they noticed from exploring the soils. Their ideas will be noted for future use. Then, put a sample of soil into a large jar with some water, screw the lid on firmly and shake the jar until the soil is fully suspended in the water. Set the jar aside so the contents can separate and settle during the remainder of the lesson. We will come back to this at a later time.
<b>ELABORATION</b>
<p>Divide the students into small working groups and show the students the various soil types and get them to think about the differences between them. Each group can then choose one type of soil to investigate more closely.</p> <p>Have each group measure the samples carefully so they are all equal and then place them into the coffee filters and their baskets. These will then be put onto glass jars and water will be added. The children will then predict which groups' water will filter through more quickly or more slowly. Record these predictions as a class.</p> <p>Each group will then observe how long it takes for the water to filter through using the stopwatches and will record the results. They can compare their results with their earlier predictions and discuss the possible causes of the different times.</p> <p>After this activity, go back to the jar of soil and water that was shaken. Hopefully, the soil will have separated and the children can see the various components. They can then compare what they observe with what their predictions were at the beginning. Students can measure the layers to compare the amounts of the various components (e.g., clay, silt, sand, gravel, humus) in each soil sample.</p> <p>This can lead into a discussion and students can draw pictures or describe the differences of the different soils' properties and how this could be caused by where they were obtained and how much plant matter each soil had been observed to contain in their science journal. You can also get them thinking of places where soil might be different. You can get them to write or draw places where they think soil might differ. For example, soil from a pasture or soil from a mountain.</p> <p>Students will then record the "What I have learned" component of their KWL chart.</p>
<b>EVALUATION</b>

Students will be assessed based on their participation throughout the class and also upon completion of their KWL chart.

**ACCOMMODATIONS**

For this lesson, there will be a student sitting beside Jimmy to guide him and let him know when he is touching a different soil. They will give him one type of soil then let him feel another one and so on for all of the soils.

<b>Subject Area(s):</b>	Science+ LA+ Social Studies
<b>Grade Level:</b>	3
<b>Lesson Duration:</b>	1 hour

**Lesson Plan Title:** Layers of Soil

**Curriculum Outcomes:**

- Ask questions and make predictions that lead to exploration and investigation about the composition of soil (200-1, 200-3)
- Make and record observations and measurements in investigations related to soil composition (201-5)

**Content to Be Taught:**

In this lesson students will explore the different layers of soil. They will build and physically show the different layers using edible materials.

**Children's Prior Knowledge and Misconceptions:**

Students have prior knowledge on planting soil (topsoil) but may think there is only one type of soil. They may not realize there are different types and different components to each one.

**Performance Objective:**

In this soil lesson, children will be able to name and label the layers of soil, using food as a representation of the layers.

**Materials:**

- Cups
- Napkins
- Spoons
- Oreos
- graham crackers
- chocolate pudding
- gummy worms
- cool whip

<b>ENGAGEMENT</b>
Begin this lesson by asking students if they can name any of the layers of soil or if they know anything about the layers of soil.
<b>Essential Questions:</b> What are the names of the soil layers, and what role do the layers play in determining the quality of the soil?
<b>EXPLORATION</b>
Discuss with children the expectations of the lesson and what materials will be needed.

(Behavior is expected to be excellent or the lesson will not be productive. Explain that the children will need to determine the use of cups, napkins, spoons, Oreos, graham crackers, chocolate pudding, gummy worms, cool whip.) Have the students look at each material to see if they can determine which material is going to be which layer. I will have materials for each group of students to look at closely and to look at the texture and color of the different materials.

#### **EXPLANATION**

Display a diagram of the soil layers and discuss with the class and teach/describe the various layers, the name and what might be found in that layer of the soil. After having the children predict which material is going to be for each layer, we will go over each layer as a class and I will let them know which materials are going to be used for which layer and why. The end result will be the following:

Cup -a holding place of soil sample  
 Spoon - used for eating the sample at the end  
 Oreos - bedrock and parent material  
 Graham crackers - topsoil  
 Chocolate pudding - sub soil  
 Gummy worms - help for the organic layer to the subsoil  
 Cool whip - organic layer/plant

#### **ELABORATION**

The class will now begin putting the layers together, as they determined in the discussion. After the layers have been completed and everyone is in agreement that the model is completed correctly, they can eat their soil sample. Review the soil layers, by naming and describing each. I will ask each student to share one fact they learned about soil today.

After finishing the activity, give the students the option to write about each layer of soil or to draw and label each layer of soil in their science journal.

#### **EVALUATION**

Students will be assessed by participation during the activity and upon completion of the activity. During the activity, I will be walking around asking individual student's questions about soil. Also, I will be assessing the students on their diagram or writing about soil in their science journal.

#### **ACCOMMODATIONS**

Students can research the various types of soil to see in which region they are found. Students can build a model of the soil layers using play dough, or actually collecting soil samples.

Jimmy will have assistance from a classmate. His classmate will let him feel the difference between each layer and will help him in layering the different materials.

**Cross Curricular Extension: Writing:** How does soil affect our lives? Would life be different without soil? (They could write this with a partner.) **Social Studies:** Collect soil samples in individual neighborhoods for homework. Share, look at the samples, compare, and discuss how the types differ depending on what region you live in. **Math:** Create word problems related to one ton of sand being delivered to China Grove Elementary. Ex. What areas of the school could use the sand, and how much would be needed at each area. **Reading:** Conduct research on the Internet about the soil layers and see what information can be found that we did not study in the previous lesson. Find out if there are interesting facts about the different soil layers. Find out if various regions have different types of soil.

<b>Subject Area(s):</b>	Science
<b>Grade Level:</b>	3
<b>Lesson Duration:</b>	1 hour

**Lesson Plan Title:** Identification of Layers

**Curriculum Outcomes:**

- Investigate and describe soil components using appropriate tools such as spoons, magnifying glasses, jars, and filters (100-37, 201-3)
- Propose an answer to initial question related to soil composition based on their investigations (202-7)

**Content to Be Taught:**

Students will explore and investigate the components of soil and investigate the properties of different types of soil through a murder mystery.

**Children’s Prior Knowledge and Misconceptions:**

Children have had prior experience with soil. They have just completed the unit on plants so they are familiar with the top layer of soil. Some misconceptions may be that students think there is only one type of soil. They have had prior lessons on the different types and layers of soil so students should be quite familiar with these types and layers.

**Performance Objective:**

Given different soil samples, the students will be able to observe and record the different characteristics and make logical guesses of where each soil is taken from. (Either a field, construction site, a lake, woods, and a driveway.) The students will use the observations and information about the soil samples, which was collected from their group discussion and the picture of Jack Hanson’s boot, to make an inference as to where Joe Frisbee’s body is located.

**Teacher Materials:**

- Joe Frisbee’s drawn body outline (made up by the teacher)
- A drawing of Joe Frisbee’s estate (made up by the teacher)
- Jack Hanson’s boot and worksheet
- Overhead projector
- Overhead transparencies

**Student Materials:**

- Science Journals
- 5 soil samples for each group
- Soil A-taken from lake
- Soil B-taken from driveway
- Soil C-taken from woods
- Soil D-taken from field

- Soil E-taken from construction site

### **ENGAGEMENT**

**Management Strategies:** Students should work in groups of 3 or 4 and can present their findings individually or as a group. This activity may lead to a great deal of debate therefore; the teacher should address the issue of how to disagree with a student politely. Students need to be reminded to be patient.

Explain to the children that there is a problem and the student's have to be detectives to help solve the problem. Tell them that there has been a murder! Joe Frisbee, a rich millionaire inventor of the Frisbee has been killed and it is the student's job to collect data. Show them the drawing of the estate and explain to them that the police found Jack Hanson's shoe on the estate with several soil samples on it. Somehow the samples have been wiped clean from the shoe. The police took soil samples from around the estate but forgot to label them.

### **EXPLORATION**

It is the student's job to actively observe the five different types of soil and decide which soil goes to what part of the estate. The students work together in their groups, discussing possible solutions and stating their evidence for their findings. In this phase, the students will record their findings in their science journal and label them detective notes.

### **EXPLANATION**

Using the overhead projector, the transparencies and the estate map, I will record the student's ideas about each soil. Possible questions the teacher could ask:

- Who has a guess about where soil A is taken from? Where do you think?
- What characteristics have you found about soil A that makes you guess that is where it is taken from?
- Could the soil have been taken from somewhere else? Anyone have any other possible ideas?
- What do we notice that is similar about Soil C and D? (Both are dark soil) What are different about the two soils? (One has leaves, twigs, acorns etc. other doesn't) What can this tell us?
- Soil E is rather different than any other soil. Who can tell me what type of soil this is?

If the students disagree with an answer the teacher tells them, they have to find information to prove their findings. If a student gives an answer without appropriate evidence, the teacher tells the student that it will be thrown out of court and the student's ideas will not be able to help solve the case.

### **ELABORATION**

Once the students have identified the soil types, pose a new problem for the students to solve. They look at the picture of the boot and decide which soil sample goes with which layer on Jack Hanson's boot. Give a description of each layer of soil because the drawing is hard to read.

I will ask students for an example:

- The first layer on the boot has medium size rocks and parts of plastic in it. What possible soil sample could this be? Why do you think so?
- The next layer has big chunks of a light brown material so, where could this sample be from and why?

Do this for each layer. Then students will look at the footprints I have drawn onto the map and discuss possible solutions to where Joe Frisbee's body is buried. The students can take turns coming up to the enlarged picture of the estate and discussing possible solutions in their groups. After the discussion, each group should agree on one possible solution. This means that there will be a great deal of problem solving and debating skills used.

The students could record their findings and ideas about the murder in narration form. The estate could be given accurate measurements in which the students would have to manipulate to solve various math problems.

### **EVALUATION**

Teacher observations- Are students participating in discussion? Are they making logical guesses based on information found?

Detective Notes in science journal- are the student's responses logical and sufficient evidence given for their findings? Did the student's discover the correct soil samples?

### **ACCOMMODATIONS**

During this lesson, Jimmy will have a partner to discuss with and help him feel the different soils and will have someone describing the different soils that appear on the shoe. This activity is done in groups so Jimmy's group can help him in identifying the different soils.

<b>Subject Area(s):</b>	Science
<b>Grade Level:</b>	3
<b>Lesson Duration:</b>	1 hour

**Lesson Plan Title:** Do water and soil mix?

**Curriculum Outcomes:**

Describe the effect of moisture on characteristics of the soils. (100-38a)

**Content to Be Taught:**

Students will discover the effects that water has on the characteristics of clay, sand, and topsoil.

**Children’s Prior Knowledge and Misconceptions:**

Students have previous experience with exploring the characteristics of different types of dry soil (i.e., color, texture, size). Students may believe that *all* soils will be the same color and have the same texture and/or will hold together better when wet.

**Performance Objective:**

Students will work in groups to discover the effects that water has on different types of soil. Each student will record their observations (written, drawn, or graphed) in their science journal.

**ENGAGEMENT**

Review the characteristics of clay, sand, and topsoil. Have students predict how they think each soil sample will look (i.e., is it a different color?) or feel when water is added.

**EXPLORATION**

Materials:

- Samples of clay, sand, and topsoil
- Water
- Science journals
- Pencils
- Paper towel

*Safety: Have paper towel nearby in case water spills on the floor.*

Students will first record the color and texture of each soil sample before adding water. After adding the same amount of water to each soil sample, students will compare the characteristics of dry soil and wet soil through comparison drawings and/or written descriptions in their science journal. Students can also begin to explore how well each soil sample holds together when wet.

<b>EXPLANATION</b>
<p>As a whole class, discuss any observations of changes in color or texture of the soil samples as well as which ones held together well when water was added.</p> <p>Each soil sample gets a bit darker when water is added. Topsoil feels the same but moister, sand feels sort of like brown sugar, and clay feels kind of slimy.</p> <p>Sand allows water to easily pass through and therefore does not hold together very well. Clay holds together well because the water does not drain away. Although it does allow water to pass through, topsoil also holds together really well.</p>
<b>Elaboration</b>
<p>Materials:</p> <ul style="list-style-type: none"><li>• Samples of clay, sand, and topsoil</li><li>• Water</li><li>• Building tools (pudding cups, buckets, etc.)</li><li>• Science journals</li><li>• Pencils</li></ul> <p>Students will test each soil samples' ability to hold together when wet by using the building tools to build something with each sample and recording their observations (written or drawn) in their science journal.</p>
<b>EVALUATION</b>
<p>Students will be formally assessed through observation, group and individual conferencing, and participation. Science journals will be handed in at the end of the unit as a summative assessment.</p>
<b>ACCOMMODATIONS</b>
<p>Jimmy will work with a partner, who can help him determine the colors of the soil samples.</p>

<b>Subject Area(s):</b>	Science and Mathematics
<b>Grade Level:</b>	3
<b>Lesson Duration:</b>	1 hour

**Lesson Plan Title:** Measuring Absorption

**Curriculum Outcomes:**

- Describe the effect of moisture on characteristics of the soils (100-38a)
- Make predictions about the absorption of water by different types of soil and test these through exploration and investigation (200-3)
- Compare the absorption of water by different soils (100-38b)
- Construct and label bar graphs to show the amount of water absorbed by different soil samples (202-4)
- Communicate procedures and results of investigations related to the testing of water absorption of soils, using drawings, demonstrations, and/or written and oral descriptions (203-3)

**Content to Be Taught:**

Students will make predictions about the absorption of different types of soil, test these hypotheses, and compare their findings by constructing and labeling bar graphs, other drawings and written/oral descriptions.

**Children’s Prior Knowledge and Misconceptions:**

Students have previous knowledge of the characteristics of soil. Students may believe that water easily passes through or does not pass through all soils.

**Performance Objective:**

In groups, students will investigate the water absorption of clay, sand, and topsoil. Each student will compare their individual hypotheses to their group’s findings in their science journal.

<b>ENGAGEMENT</b>
<p>Materials:</p> <ul style="list-style-type: none"> <li>• Dry erase board/markers</li> <li>• Science journals</li> <li>• Pencils</li> <li>• Rulers/straightedges</li> </ul> <p>Have students predict which type of soil will absorb the most water. Make a tally on the whiteboard and have students create a bar graph of the predictions in their science journal.</p>
<b>EXPLORATION</b>
<p>Materials:</p>

- Styrofoam cups
- Pie plates
- Samples of clay, sand, and topsoil
- Water
- Science journals
- Pencils
- Ruler
- Paper towel

*Safety: Have paper towel nearby in case water spills on the floor.*

Each group will have a Styrofoam cup (with holes in the bottom) of each of the soil samples. Students will pour the same amount of water into each soil sample and determine which one absorbs the most water by subtracting the amount of water that dripped through the holes into the pie plates from the amount that was originally poured into each sample. Students will then complete a bar graph showing how much water each soil sample absorbed in their science journal along with drawings and/or written descriptions of their observations and comparisons of their predictions and what actually happened.

#### **EXPLANATION**

As a whole class, discuss which soil absorbed the most water and why.

Clay is made of the smallest particles of broken rock; it is a fine dust. When wet, these particles stick together, forming a solid mass. Unlike the topsoil and sand, clay does not have pores that allow the water to drain away and therefore absorbs the most water.

#### **ELABORATION**

Materials:

- Science journals
- Pencils

Have students think of times when wet soil may be preferred and times when dry soil may be preferred draw and/or write about these instances in their science journals.

#### **EVALUATION**

Students will be formally assessed through observation, group and individual conferencing, and participation. Students will be further assessed on their science journal.

#### **ACCOMMODATIONS**

Since the numbers on a ruler may be difficult for Jimmy to see, members of his group can help him with the measurement of the water that dripped through into the pie plates.

<b>Subject Area(s):</b>	Science
<b>Grade Level:</b>	3
<b>Lesson Duration:</b>	2 lessons at 1 hour each

**Lesson Plan Title:** Water Absorption and Plants

**Curriculum Outcomes:**

- Make predictions about which conditions will be the best for plant growth (200-3)
- Make and record relevant observations and measurements of plant growth during their investigations (201-5)
- Construct and label bar graphs that show plant growth under different conditions (202-4)
- Communicate procedures and results of investigations related to the testing of water absorption of soils, using drawings, demonstrations, and/or written and oral descriptions. (203-3)

**Content to Be Taught:**

Students will make predictions, observations, and measurements and then communicate the procedures and results of the plant growth investigation.

**Children’s Prior Knowledge and Misconceptions:**

Students have previous knowledge of plant growth. Students may believe that *all* plants need lots of water to grow.

**Performance Objective:**

In groups, students will plant seeds in clay, sand, and topsoil and will record observations about the growth of the plants and the growing conditions in their science journal.

<b>ENGAGEMENT</b>
Review how plants grow. Have students predict how fast their plant will grow and how much water will be needed and why.
<b>EXPLORATION</b>
<p>Materials:</p> <ul style="list-style-type: none"> <li>• Various types of plant seeds</li> <li>• Styrofoam cups</li> <li>• Samples of clay, sand, and topsoil</li> <li>• Water</li> <li>• Science journals</li> <li>• Pencils</li> <li>• Ruler</li> <li>• Camera</li> </ul>

Each group will be given different types of seeds and will plant one in each of the three soil samples. At the beginning of class each day, students will check on their plant, measure its growth, and determine whether or not it needs more water. Students will prepare a short presentation of their findings and share it with the class at the end of the month. A combination of pictures, written information (including how many times the plant needed to be watered and with how much water) and bar graphs should be included in the presentation.

### **EXPLANATION**

#### ***2<sup>nd</sup> lesson – 1 month later***

Begin class by conducting a whole class discussion about observations that were made over the course of the month.

Reinforce the fact that not all plants require a lot of water to grow. Different plants grow better under different conditions.

Students will then present their group's findings to the class.

### **ELABORATION**

Materials:

- Science journals
- Pencils

Ask the students to recommend [in their journal] a type of soil to neighbors who are going away, have no one to water their plants and wish to change the type of soil they use. This assignment may be completed at the beginning of next class or for homework if some presentations run long.

### **EVALUATION**

Students will be formally assessed through observation, group and individual conferencing, and participation. Students will be further assessed on their presentation and science journal.

### **ACCOMMODATIONS**

Since the numbers on a ruler may be difficult for Jimmy to see, members of his group can help him with the measurement of their plant's growth.

<b>Subject Area(s):</b>	<b>Science</b>
<b>Grade Level:</b>	<b>3</b>
<b>Lesson Duration:</b>	<b>1 hour</b>

**Lesson Plan title: Effects of Moving Water on Soil**

**Curriculum Outcomes:**

100-39 Observe and describe the effects of moving water on different soils

**Content to Be Taught:**

Students will learn that moving water takes some soil with it. Larger particles of soil may stay behind, but smaller particles may be carried away with the water.

**Children’s Prior Knowledge and Misconceptions:**

Students will have learned that soils can absorb water in varying degrees. A common misconception might be that any extra water will run off without affecting the soil or it may remain in the soil to make mud.

**Performance Objective:**

Using trays of soil, students will examine the effects of moving water. Observation skills are necessary to be able to explain the effects.

**ENGAGEMENT**

Materials:

- cup of water
- container of soil

Have students brainstorm ideas in their groups about what might happen if I pour the cup of water onto the container of soil. Share students’ ideas as a group and record students’ thoughts, regardless of their answers.

Essential Question: What happens when water hits soils?

**EXPLORATION**

Materials: Per group of 3 students:

- 1 pan of soil
- a cup of water
- 1 extra pan to catch runoff material

Part 1: Ask students to make predictions in their science notebook about what they think is going to happen during the experiment. Have them generate ideas about how they might conduct the experiment.

Share student ideas as a group and identify specific experiments that are plausible and could be experimented by the students- flat surface and tipped surface (like it was on a hill)

Part 2: Distribute materials to each group. Students should note what happens when they pour the water on the pan when it is flat and when the pan is tipped (as if it was soil on a hill side. All observations should be noted or drawn in their notebooks. Teacher should spend time with each group, encouraging them and questioning them on their observations.

### **EXPLANATION**

Ask the essential question: What happens when water hits soil?  
Listen to student responses. Allow students to explain what they believe is happening.

Individual reflection: Ask students to create a descriptive model to try to explain *why* some of the soil moved when the water hit the surface of the soil.

Shoulder partner: Have students share their ideas with the person beside them.

Class discussion:

1. What was the same between the flat soil and the tipped soil? \*Some parts of the soil moved in both cases
2. What was different between the flat soil and the tipped soil? \*The soil on the flat area moved some, but still stayed in the same general spot. The soil on the tipped surface left the area completely.
3. How much soil moved when you poured the water? What parts of the soil were left behind? \* Student answers will vary. The rocks and the larger components of soil remain in place, but the smaller pieces of soil will be washed away.

Reinforce that only some of the soil moves and that the soil goes to different places depending on the angle of the soil. Introduce the term “erosion” which means that soil is carried away when water hits it.

### **ELABORATION**

Have students explore outside of the school and identify where soil has been carried away outside (water that has dripped off of the roof, water that has carried water off of a bank. Ask students how they can explain this based on what they learned in the classroom.

### **EVALUATION**

Based on what students saw outside, have them draw what they saw in their science notebooks. They should describe the erosion and explain *why* the erosion happened.

### **ACCOMMODATIONS**

Jimmy will be able to repeat the exploration as needed and will have support during the explanation. Highly descriptive language will be used to help Jimmy visualize how moving water effects soil.

<b>Subject Area(s):</b>	Science and Physical Education
<b>Grade Level:</b>	3
<b>Lesson Duration:</b>	2 lessons for 1 hour each

**Lesson Plan Title: How do plants prevent erosion?**

**Curriculum Outcomes:**

Observe and describe the effects of moving water on different soils (100-39)

**Content to Be Taught:**

Students will investigate how plants effect the movement of water flowing over soil. Students will compare the rates of erosion with on soil alone and on plant-covered soil. Students will identify ways to prevent erosion.

**Children’s Prior Knowledge and Misconceptions:**

Students know that moving water carries soil away, especially on a hillside. Students may not know what happens when moving water hits soil that is growing something.

**Performance Objective:**

Students will act out the process of water moving down a slope with and without plant material. Students will identify erosion-prone areas in the school yard and suggest ways to prevent erosion.

**ENGAGEMENT**

**Lesson 1 for Day 1**

Materials:

- Pictures of hillsides that are covered with plants and hillsides without any plants

Warm-up

Show picture of hillside with plants. Ask them to imagine a gentle rain falling on these slopes. What do they think would happen to the water?

Show the picture of the hillside without plants. Ask students how they think rainfall would affect these areas, compared to the previous sites?

Essential questions:

What is the effect of plants on erosion?

**EXPLORATION & ELABORATION**

Materials:

- large activity area (outdoor field is ideal)
- rope or yarn

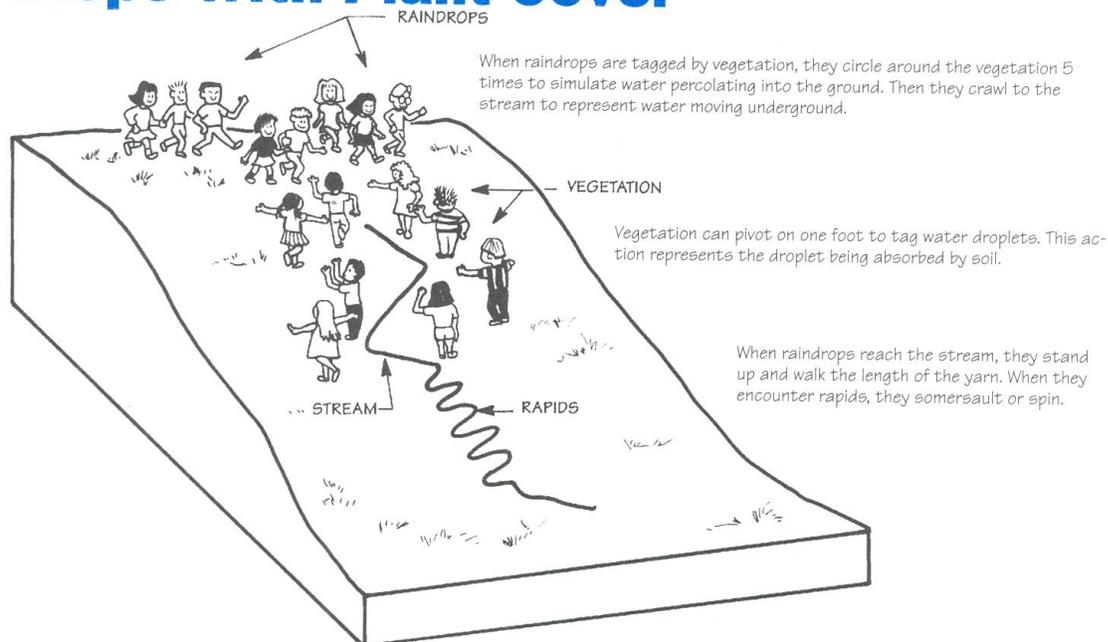
Safety: Grass should be dry. Students should walk during the activities.

Part 1:

### Exploration

1. Inform students that they are going to act out the role of water as it flows down a hill and into a stream. Arrange the playing field according to the diagram “Slope with plant cover” (attached).

## Slope With Plant Cover



Lay the rope down the middle of the field to indicate the stream. Have half of the students assemble at one end of the field. These students represent the “raindrops.” The remaining students represent “vegetation” and should stand in between the raindrops and the stream.

2. Set the scene: “The thunderstorm”. Remind students that during a thunderstorm, it rains really hard and the water moves quickly. The raindrops should take the most direct route to the stream.

3. Vegetation on the slopes slows water down. During the activity, students representing the vegetation must keep one foot in place, but can pivot and stretch their arms. This stretching represents roots that are “catching” the water.

4. If a raindrop is tagged, the student simulates water that is slowed by the roots of plants by circling around the “plant” 5 times and then crawling toward the rope. (in the activity, students can only be tagged once). The raindrop can then “flow” down the rest of the stream.

5. Record the time it takes for all of the raindrops to pass through the site. Students may exchange roles and repeat the activity if desired.

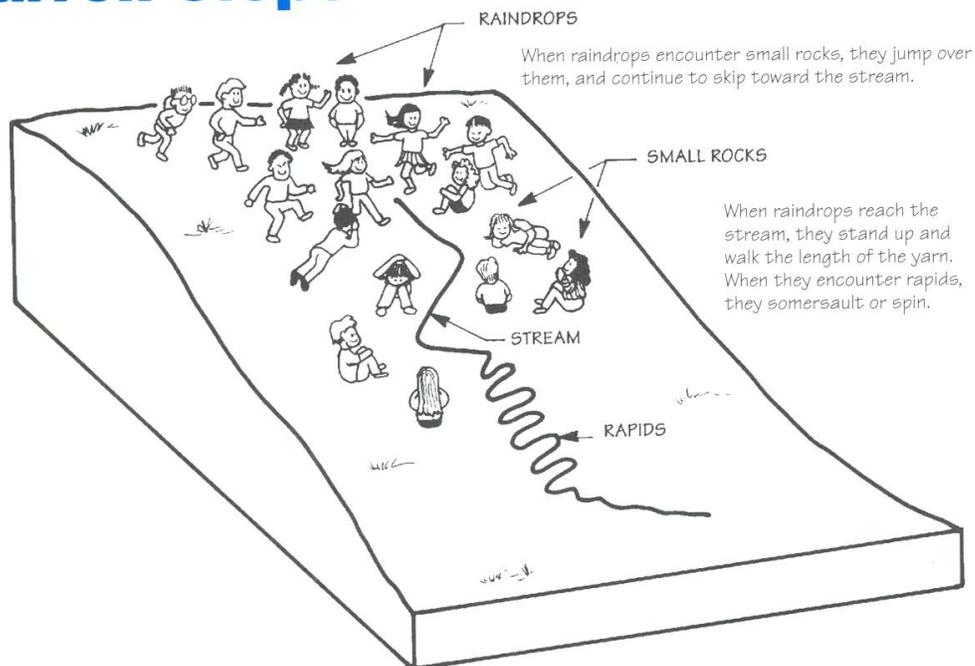
### Explanation:

Discuss the results of the activity as a group. Ask students to describe water’s movement. Help students to understand how vegetation slows water down and makes the water stay in the soil for a little while.

**Part II:****Exploration:**

1. Ask students how the results of the activity will differ when plants are removed. Have students perform the second version of the activity (See attached diagram).

## Barren Slope



Half of the class simulates raindrops and the other half represents “small rocks”. Students representing rocks should sit or lie down, curling into tight balls. When raindrops move near a rock, they can walk around the rock and continue their flow down the slope.

**Explanation:**

Compare the time required for raindrops to flow through sites with and without plant cover. Discuss the implications of water racing down a barren slope. This course had rocks that were not moved by the water, but would happen to any small pieces of soil that were on the slope?

### Lesson 2 for day 2

**Part III:****Materials:**

- pan of soil
- cup of water
- rope/yarn
- large activity area(Outdoor field is ideal)
- small twigs/rocks/piles of soil

**Engagement:**

Prior to the third simulation, have students reflect on the previous lesson and on their experiments pouring soil on water. Flowing water loosens parts of soil and can transport them great distances. Demonstrate by using a pan of soil and a cup of water.

**Exploration:**

1. Set up the playing field as in Part I. Distribute small twigs, rocks, piles of soil near the starting point. As raindrops flow through the site, they can pick up some of the sediment (rocks, twigs and soil). If tagged, they must drop all of the tokens they have collected. After this they must circle around the plant five times and crawl to the stream and head to the bottom of the slope.
2. After raindrops make it through the site, have them count the number of items that they are still holding.
3. Arrange the playing field as in Part II and have raindrops flow through the site picking up sediment. At the conclusion, students should find that a larger amount of sediment has been collected by the raindrops than in the previous simulation.

**Explanation:**

Have students sit on the ground. Discuss what happened during the activity and how the plants helped keep the soil/twigs/rocks in place. Discuss problems associated with erosion. Brainstorm ideas for controlling erosion: Planting grass, flowers or trees, etc.

**ELABORATION**

Have students explore the school yard, looking for land areas that compare to those demonstrated in the activity, i.e. areas that could be affected by erosion. Students should try to predict where erosion might occur during a rain storm.

Ask students to create a plan to help reduce the erosion that could occur in that area. If there are no erosion problems on the playground, brainstorm ideas of places where erosion may occur, such as next to the ocean or the river.

**EVALUATION**

Students will demonstrate their learning through their choice of:

- a) An interview with the teacher
- b) Writing a letter to the principal to explain what was learned and what the student suggests should be done in the school yard to prevent erosion
- c) Note their learning in their Science notebook

After this activity, students should be able to:

- Demonstrate how water flows down a slope and into a stream
- compare water's movement through sites that have and that lack plants
- identify the areas around the schoolyard where erosion may occur and suggest ways that this erosion could be prevented.

**ACCOMMODATIONS**

For enrichment, students will be able to use Virtual Garden Designer, found at

<http://www.bbc.co.uk/gardening/design/> under the “Virtual garden” heading to create a plan for how to prevent erosion in a specific area(on the playground, next to the river, etc.)

For this activity, Jimmy will be paired with another student in the class who can help him to be in the correct place. The teacher will ensure that all directions are clear and that he/she does not rely of hand or body motions to give the directions.

For the elaboration, Jimmy will search the school grounds with the teacher or another student who is able to describe the surroundings. For evaluation, Jimmy will be able to use a computer to increase the font size.

Adapted from Project WET, p. 166-169. Diagrams from Project WET.

Because there are several parts to this activity, there are 3 explorations and 3 explanations before any elaboration occurs.

<b>Subject Area(s):</b>	<b>Science</b>
<b>Grade Level:</b>	<b>3</b>
<b>Lesson Duration:</b>	<b>2 Lessons – 2 hours total</b>

**Title of Lesson:** Limewater and Soil

**Curriculum Outcome(s):**

- investigate and describe how living things affect and are affected by soils (100-35)
- identify and use a variety of sources of science information to gather information about how living things affect and are affected by soils (201-7)

**Content to Be Taught:**

Students will learn that there are living organisms in the soil that may be affecting it that you cannot see with the naked eye. They will learn this through the limewater experiment, and by looking at the soil they are given under a microscope.

**Children’s Prior Knowledge and Misconceptions:**

Students may believe that if you cannot see living things in the soil that no living organisms are present, and therefore there is nothing in the soil that is affecting it in any way.

**Performance Objective:**

Through taking part in the limewater and soil experiment, students will discover that there are organisms affecting the soil that cannot be seen by the naked eye.

### **ENGAGEMENT (1<sup>st</sup> lesson)**

Materials Needed:

- Soil sample (with no bugs) per pair of students.
- Give students soil samples (ensure there are no bugs in the sample – this is necessary for the activity).
- Ask students if there are any living organisms in the soil. They will likely say “No” because they do not physically see anything in the soil.
- Ask: What if I were to tell you there are living things in the soil, would you believe me? Some students will likely say “No” again because they did not physically see anything in their soil samples.

Essential Question: Are there any living things in the soil that you cannot see with the naked eye that may be affecting the soil?

### **EXPLORATION**

**Materials Needed:**

- Garden soil
  - Jar with lid (large mason jar)
  - Limewater (available at drug stores)
  - Small container (baby food jar)
  - Observation Journal
- 
- Students will be put into groups of 2 or 3 and will be given a large handful of garden soil, a large mason jar, limewater, and a baby food jar.
  - Students will look through the soil, in search of living organisms that may be affecting the soil.
  - They will be given the following instructions:
    - Put the garden soil into the large jar.
    - Put the limewater into the small jar.
    - Set the container of limewater (uncovered) inside the large jar so it sits on top of the soil.
    - Put the lid on the large jar (make sure it's on tight!).
  - When students are finished setting up their experiments, they will be instructed to write and/or draw what they see in the beginning stage of their experiment. They will also be expected to make a prediction as to whether or not they believe there are living organisms in the soil that we cannot see with the naked eye.

**2-3 days later: (2<sup>nd</sup> Lesson Begins)****Materials Needed:**

- Observation Journal
- 
- Engagement: Since it has been a few days since students have begun this experiment, we will do a quick re-cap of what we did during the last class.
  - Have a class discussion about what their experiment (the contents of the jar) looked like when they first set it up.
  - Remind students will be looking for any signs that there are organisms living in the soil that they cannot see with the naked eye.
- 
- Students will take a look at what the contents of the large jar looks like now (2-3 days after they initially set up the experiment).
  - Students will make observations as to what they see now and compare it to the picture they drew (or from what they might remember) of what the content of the jar looked like a few days prior.
  - Students will explore the contents and discuss findings with partner.
  - Students will fill out an entry in their observation journal, as they did last during the first lesson. This time, instead of noting their predictions, they will be expected to note their final beliefs with reasons as to why they

believe there are organisms in the soil that we cannot see, or why they do not believe there are living organisms in the soil that we cannot see.
<b>EXPLANATION</b>
<ul style="list-style-type: none"> <li>○ Conduct a class discussion on what they found.</li> <li>○ <u>Explanation of Experiment for Class</u>: The soil contains many microscopic animals. These animals take in oxygen and release carbon dioxide as a waste product, just as you do when you breathe. The limewater turned a milky color because the carbon dioxide produced by the organisms in the soil combined with the lime-water to produce chalk. Your garden soil may contain bacteria, protozoans, and threadlike worms called nematodes.</li> <li>○ <u>Answer to Essential Question</u>: There are microscopic organisms that can affect the soil, even though we can't see them!</li> </ul>
<b>ELABORATION</b>
<ul style="list-style-type: none"> <li>○ Students will look at their soil samples (the same one used in the experiment) under a microscope and will look out for microscopic organisms (ie. bacteria, nematodes, protozoans) that are found in the soil. This will further show students that there are microscopic organisms underground that we are not able to see with the naked eye.</li> <li>○ After students have been given the chance to look at their soil through their microscope, you will discuss with students what they saw.</li> <li>○ When the class discussion is over, show students a slide of possible things (ie. bacteria, nematodes, etc) that they may have encountered through the microscope. Ask students if they saw any of these things without the microscope? Did they see these things with the microscope? Which ones?</li> </ul>
<b>EVALUATION</b>
<ul style="list-style-type: none"> <li>○ Teacher will gather information about student learning through observation and conferencing with each group as they explore microscopic organisms.</li> <li>○ Students will also be formatively assessed using the worksheets, which will be collected after the final observations during the second lesson.</li> </ul>
<b>ACCOMMODATIONS</b>
Jimmy will be accommodated in this lesson by being given a magnifying glass to look at the soil through in the beginning.

Note: In the first lesson, students will have covered the first “E” (Engagement) and a little bit of the second “E” (Exploration). They have only set themselves up for the actual exploration in the first lesson, by putting the experiment together and making note of what the content of the jar looks like. Students will draw what they see in the jar in their observation journals. They will also use their observation journal to note their prediction as to whether or not they believe there are living organisms in the soil that they cannot see with the naked eye.

The second lesson begins 2-3 days after students set up their experiments, and covers the rest of the “E’s”, which include exploration, explanation, elaboration, and evaluation (students will be formatively assessed through observation and the completion of their journal entries for this lesson).

**Resource:** <http://tlc.howstuffworks.com/family/science-projects-for-kids-soil-experiments.htm>

<b>Subject Area(s):</b>	Science
<b>Grade Level:</b>	3
<b>Lesson Duration:</b>	3 Lessons (3+ hours)

**Lesson Title:** Landfills and Decomposition

**Curriculum Outcomes:**

- investigate and describe how living things affect and are affected by soils (100-35)
- identify and use a variety of sources of science information to gather information about how living things affect and are affected by soils (201-7)

**Content to Be Taught:**

Students will learn that the things they put in the garbage will soon end up in a landfill. They will learn that some of the things they put in the garbage could instead be composted (because they decompose quickly) or recycled, rather than adding to the vast amount of garbage already put into landfills, which are damaging for the environment (soil).

**Children’s Prior Knowledge and Misconceptions:**

Students may think that their garbage is brought to a “dump” that is a large pile of garbage that is on top of the ground. They may also think that if the items cannot be recycled then they belong in the garbage bin. Students are often unaware that there are things that can be composted rather than sent to a landfill with the rest of their garbage.

**Performance Objective:**

Through “planting” different pieces of garbage, digging them up, and visiting an actual landfill, students will discover how landfills are harmful to the environment, and how they can reduce the amount of garbage they send to a landfill by understanding which items could be composted or recycled instead.

**ENGAGEMENT – 1<sup>st</sup> Lesson**

Materials:

- Google Earth (Staten Island landfill)
- In order to engage students in this lesson on landfills and decomposition, I will show students a picture of a landfill on Google Earth.  
→ Fresh Kills Staten Island Landfill

**Essential Question:** What kinds of garbage in the landfill can be composted

(the items that decompose) and which can be recycled? What items will take a long time to decompose (if at all)?

### **EXPLORATION**

#### Materials Needed:

- Apple core
  - Piece of material (100% cotton)
  - A nail
  - Baby food jar (or another small glass jar)
  - Pieces of lettuce
  - News paper
  - Styrofoam
  - Plastic bag
  - Aluminum foil
  - Crushed empty pop can
  - Egg shells
  - Banana peel
  - Shovel
  - Popsicle sticks
  - Markers
- Give students bags of garbage (that would have been brought to a landfill), which the items in bold under “Materials” section below.
  - Students will sort through garbage (wearing latex gloves). For each piece of garbage found, labels will be made of Popsicle sticks with the word (ie. plastic bag) on it, along with their names.
  - Students will then put their items back into the garbage bag, grab their labels and then head outside to bury the items in the school yard (find designated area where not much activity takes place).
  - Students will dig a hole in the soil, bury one of the items, and then stick the corresponding label in the ground where they buried that item. Students will continue this process until all of their items are buried.

### **1 Month Later – 2<sup>nd</sup> Lesson**

#### Materials Needed:

- Gardening shovels (1 per student)
  - Observation journal
  - Bags to carry their pieces of garbage in
- Have a list of the items was buried a month ago on the smartboard. Ask students to get in their groups and “guess” what items they believe would have decomposed (rotted) within the last month. Students will note observations in their journal.
  - Students will then go outside and dig up their items.

- After laying the items aside, students will cover up the holes they dug and collect their Popsicle sticks.
- Students will then pick a place in the schoolyard to conduct their observations.
- Students will work together to note what items decomposed and which didn't. They will note their observations in their journals.

### **EXPLANATION**

- Conduct a class discussion on their findings. Make a list of what they found.
- Ask students questions such as “What kinds of garbage are thrown into landfills that will decompose quickly? Which take a longer time to decompose, if they decompose at all? What items could be recycled or composted instead?”

**Answer to Essential Question:** There are pieces of garbage sent to the landfills that could be composted or recycled instead.

### **ELABORATION – 3<sup>rd</sup> Lesson**

#### Materials Needed:

- Observation journal and pencil
- Plan for transportation and visiting privileges to a landfill (field trip)
- Show students an aerial view of the landfill they will be visiting that day (on Google Earth).
- Tell students that we will be getting a closer look of this landfill today.
- Before going on the fieldtrip, students will be reminded of what they are to note in their observation journals. Students should take note of things they see in the landfill that could have been composted or recycled rather than sent to the landfill.
- Students will take a class field trip to a landfill near by.
- While on the field trip, students will answer the question above (what items do they see in the landfill that could have been composted or recycled instead of sent to the landfill) in their observation journals.

### **EVALUATION**

- Students will be formatively evaluated on their observations after lesson two, and again on their observations on the field trip in lesson three.
- Students will also be formatively assessed through teacher observation and conferencing.

### **ACCOMMODATIONS**

- Jimmy may have difficulty seeing into the landfill. He will be permitted to work with a buddy, who will describe what they see to Jimmy, working with him and helping him complete his observation journal.

- Jimmy could also be permitted to use binoculars to get a closer look at the landfill before him.

**Note:** This lesson plan template is made up of 3 days worth of lessons. In the first lesson, students will cover the engagement activity and will essentially prepare for the exploration part of their learning experience. In the second lesson, which takes place one month later, the remainder of the “exploration” section, along with the explanation section, will be covered. Students will explore the items they buried in lesson one, discovering which items decomposed and which did not and then will discuss their findings with the class. The third lesson will cover the remainder of the five E’s. Students will go on a field trip to a landfill nearby, applying their knowledge of landfills and decomposition in a different context. The field trip may take longer than 1 hour (with traveling and tour of the entire landfill) and that is why the 3+ hours is indicated in lesson duration section above. It should also be noted that some of the E’s might be repeated within the lessons.

## **Summary**

Since these lesson plans do not completely fulfill the unit requirements, further lessons will be needed to finish the unit. The subsequent lessons will cover the following outcomes:

Students will be expected to:

- Demonstrate and describe ways of using earth materials to make useful objects (101-12)
- Communicate questions, ideas, and intentions while using earth materials to make useful objects (203-1)

To satisfy these outcomes, we will use clay to make pottery and experiment with different types of soil to see how we are able to build with them, like in the science centers. We would also have a display of different tools and such that are made of different materials. Students could also investigate soils by creating soil paint and comparing it to traditional paint.

## Science Journal Rubric

Name: \_\_\_\_\_

	Exemplary	Proficient	Developing
Quality Writing	<ul style="list-style-type: none"> <li>- Organized, neat, well thought out ideas</li> <li>- Scientific Vocabulary</li> <li>- Detailed, descriptive, complete notes/explanations</li> </ul>	<ul style="list-style-type: none"> <li>- Ideas are somewhat organized and neat</li> <li>- Occasional use of scientific vocab.</li> <li>- Notes/Explanations are not totally complete</li> </ul>	<ul style="list-style-type: none"> <li>- Organization or neatness needs attention</li> <li>- Uses little scientific vocabulary</li> <li>- Notes/Explanations are incomplete</li> </ul>
Use of diagrams & illustrations to communicate ideas	<ul style="list-style-type: none"> <li>- Accurate and complete</li> <li>- All labeled</li> <li>- Neat</li> </ul>	<ul style="list-style-type: none"> <li>- Accurate but not complete</li> <li>- Some labels</li> <li>- Neat</li> </ul>	<ul style="list-style-type: none"> <li>- Not totally accurate</li> <li>- Missing quite a few labels</li> <li>- Not too neat</li> </ul>
Understanding of information	<ul style="list-style-type: none"> <li>- Accurate scientific explanations</li> <li>- Able to generate unique questions that relate</li> </ul>	<ul style="list-style-type: none"> <li>- Mostly accurate explanations</li> <li>- Questions apply but do not show much creativity</li> </ul>	<ul style="list-style-type: none"> <li>- Explanations not too accurate or missing information</li> <li>- Questions not relative or showing much thought</li> </ul>
Extended thinking	<ul style="list-style-type: none"> <li>- Has many examples of individual &amp; creative ways of thinking of information i.e. unique questions, illustrations, observations, problem-solving descriptions, ideas for projects or experiments, etc</li> </ul>	<ul style="list-style-type: none"> <li>- Has some creative examples of individual work and ideas</li> <li>- Did the minimum requirements for each lesson</li> </ul>	<ul style="list-style-type: none"> <li>- Not too many examples of creative, individual thinking</li> <li>- Did not meet all the minimum requirements of the lesson</li> </ul>

Adapted from <http://www.arcus.org/>

**References**

Hot Chalk Lesson Plans: <http://www.lessonplanspage.com/sciencesoiltypes-htm/>  
Project Wet Curriculum and Activity Guide. *Just Passing Through*. P. 166-169.  
TLC.ca : <http://tlc.howstuffworks.com/family/science-projects-for-kids-soil-experiments.htm>