

Grade **3** Exploring Soils

TEACHER'S GUIDE

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Exploring Soils

Table of Contents

- 3 Welcome to the *Exploring Soils* Unit
- 6 Planning Guide
- 10 Preparing for the Unit

Individual Teaching Plans

- 11 How Are Soils Different?
- 20 What Is Soil Made of?
- 30 How Does Soil Change When It Gets Wet?
- 37 Does Soil Absorb Water?
- 46 Soil and Living Things
- 56 How Does Moving Water Affect Soil?
- 63 How Do Humans Use Soil?
- 69 Caring for Soil

Assessment

- 75 Specific Curriculum Outcomes Checklist
- 76 My Inquiry
- 77 Student Self-Assessment of Inquiry Process
- 78 Teacher Assessment of Inquiry Process
- 79 Inquiry Process Rubric

- 82 Additional Resources
- 84 Letter to Parents and Caregivers

Let's Do Science, Newfoundland and Labrador

Grade 3 Unit 1: Exploring Soils Teacher's Guide

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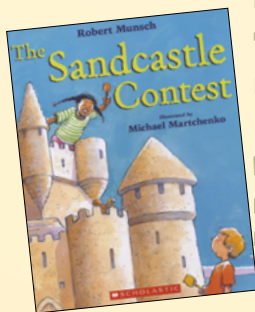
Welcome to the *Exploring Soils Unit*

In this unit, students develop their understanding of soil—what it's made of, how it changes when wet, how it affects and is affected by living things, and how we use soil to make useful products—through a variety of explorations and investigations. Multiple program components will engage students and support learning of the specific science concepts.

Student Magazine

The Student Magazine will support students' exploration of soils. The bright, colourful photographs, detailed illustrations, and different text features will engage students and give them multiple opportunities to explore a variety of concepts. A digital version of the magazine is available on the Teacher's Website to be used with an Interactive Whiteboard.

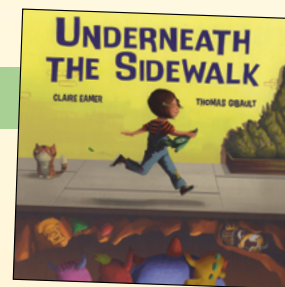




Science Read Alouds

Two Read Aloud texts allow you to introduce and engage students with science concepts. *The Sandcastle Contest* by Robert Munsch and Michael Martchenko is an amusing story that explores the concept of how soil changes when it gets wet.

Underneath the Sidewalk by Claire Eamer and Thomas Gibault uses a delightful rhyming pattern and encourages students to imagine the “beasts” which live underground. This is a wonderful introduction to the various living and non-living things that can be found in soil.



Anchor Video



The Anchor Video: *Exploring Soils*, found on the Teacher’s Website, introduces students to essential questions about concepts including the similarities and differences between different types of soil, and how soil affects and is affected by living things. The video gives a number of examples to activate students’ thinking and to promote questions

Poster

The *What Is the Inquiry Process?* poster will support students as they follow the steps for guided and open inquiries throughout the unit and learn to question, observe, and explore.



Interactive Whiteboard Activities

There are 9 interactive activities for the Interactive Whiteboard (IWB) found on the Teacher’s Website. These activities provide students with a variety of hands-on learning experiences and the opportunity to apply learning in a supported environment. The IWB Activities are tied to the teaching plans to ensure that the learning is done in context.



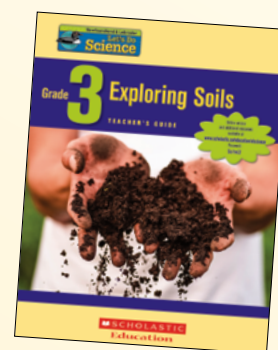


Science Library

The Science Library provides a collection of colourful and engaging non-fiction and fiction texts at a variety of reading levels. These texts support students as they explore various science concepts and skills. See the *Science Library Guide* in the Teacher's Guide Binder or online for brief summaries, science connections, and suggested reading approaches (e.g., Independent Reading and Read Aloud).

Teacher's Guide

This guide provides detailed suggestions for using all of the program components including the Student Magazine, Anchor Video, reproducible Blackline Masters (BLMs), and IWB Activities with your students. Visual cues such as book covers, thumbnail images, and icons highlight the use of each program component along with tools such as Science Folders and Journals, the Word Wall, and the I Wonder Wall. Strategies and tools you need to assess students' learning, such as rubrics and checklists, are also included.



Embedded within the teaching plans are connections to Guided and Shared texts from *Literacy Place for the Early Years*, Grade 3 that relate to the concepts in *Exploring Soils*.

Teacher's Website



In addition to the Student Magazine, Anchor Video, and IWB Activities mentioned above, the Teacher's Website provides a digital copy of the Teacher's Guide for this unit along with access to an image bank containing the variety of photographic images found in the Student Magazine and IWB Activities. These images may be used by teachers to create new IWB Activities or for students to incorporate into presentations. Find the Teacher's Website at

scholastic.ca/education/nlscience

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Planning Guide for *Exploring Soils*

Teaching Plans	Specific Curriculum Outcomes	Components	Materials	Literacy Place Connections
How Are Soils Different? Students will begin to explore soil and use scientific terminology when communicating their understanding.	Skills [GCO 2] • 1.0 • 2.0 • 4.0 STSE/K [GCO 1/3] • 3.0	• Student Magazine, pages 2–7 • Anchor Video: <i>Exploring Soils</i> • BLM <i>Venn Diagram</i> • IWB Activity 1	• students' Science Journals • variety of soil samples • document camera (optional) • sealable plastic bags • small digging tool, such as a trowel or spade, small shovel, an old spoon, or a measuring cup • variety of tools, such as magnifying glasses, tweezers, and small paintbrushes • egg cartons	
What Is Soil Made of? Students will examine the composition of soil by looking at magnifications and using special tools.	Skills [GCO 2] • 6.0 STSE/K [GCO 1/3] • 5.0	• Student Magazine, pages 8–9 • BLM <i>Sense Chart</i> • BLM <i>Foldable Template</i>	• egg carton soil samples or the bagged soil samples from <i>How Are Soils Different?</i> (pages 11–19) • students' Science Folders • paper plates or clean Styrofoam trays • magnifying glasses • small paintbrushes • straws • small sponges • students' Science Journals • tweezers • graduated cylinders • spray bottles • measuring cups • strainers • very fine mesh screens, window screen, or colanders • funnels • jars • sifters or sieves • trowels • several wide-mouth containers • supply of earth from a garden (not potting soil) • elastic bands or duct tape • plastic water bottle (1 per group) • samples of soil • handmade funnel made of paper • pencil and coloured pencils • Lego pieces (assorted colours) • variety of craft materials (e.g., string, twine, buttons, glitter, markers, white glue, tape, construction paper, clean pebbles, card stock, or bristol board) • container (e.g., a glass jar, a tumbler, a fishbowl, or a small terrarium) • spruce or fir needles, leaves, twigs, and/or compost • digital camera (optional)	<i>Dr. Bufflehead Explores Dirt</i> (Guided Reading, Level L)

Teaching Plans	Specific Curriculum Outcomes	Components	Materials	Literacy Place Connections
How Does Soil Change When It Gets Wet? Students will explore through investigations how the properties of soil change when it is moistened. They will make observations, compare data, analyze the results, and discuss.	Skills [GCO 2] • 8.0 STSE/K [GCO 1/3] • 7.0	• Student Magazine, pages 10–13 • <i>The Sandcastle Contest</i> (Read Aloud) • IWB Activity 2	• students' Science Journals • basin or small wading pool with sand • small and large yogurt containers • spray bottles • variety of different soil samples • basins of soil (1 for each group) • protective plastic sheeting • selection of cookie cutters • clay soil • variety of tools (e.g., sponges, eyedroppers, watering cans, measuring cups, paper towels, lamps, hair dryers) • funnels • jars or graduated cylinders • tissue paper • bowls • spoons or paint stir sticks	
Does Soil Absorb Water? Students will investigate the water-holding properties of different soil samples and make conclusions about which mixtures absorb the most water.	Skills [GCO 2] • 10.0 • 11.0 STSE/K [GCO 1/3] • 9.0	• Student Magazine, pages 14–17 • BLM <i>Which Soil Absorbs Water the Best?</i> • <i>What Is the Inquiry Process?</i> poster	• sponges • graduated cylinders • containers of water • buckets • paper towel tubes • stopwatch, smartphone, or watch with a second hand • different samples of soil including sand, clay, and also some loam samples with varying levels of sand, silt, and clay • water • measuring cups • graph paper • round objects that represent different-sized particles (e.g., small beads, marbles, super balls, tennis balls) • funnels • container or jar • bristol board • spoons or scoops • paper towel • fine cotton cloths or pieces of fabric • plastic containers • electric fan, hair dryer, heat lamp, or oven • four to six clear jars • mixtures of soil (potting soil, peat moss, potting soil and gravel, gravel, soil from the schoolyard) • beakers filled with water • few drops of food colouring • students' Science Journals	

Continued on next page...

Planning Guide for *Exploring Soils* (continued)

Teaching Plans	Specific Curriculum Outcomes	Components	Materials	Literacy Place Connections
Soil and Living Things Students will investigate how living things affect and are affected by soil, and develop their understanding of composting.	Skills [GCO 2] • 12.0 • 14.0 STSE/K [GCO 1/3] • 13.0	• <i>Underneath the Sidewalk</i> (Read Aloud) • Student Magazine, pages 18–21 • IWB Activity 3 • IWB Activity 4 • <i>What Is the Inquiry Process?</i> poster • IWB Activity 5	• students' Science Journals • clipboards and paper (optional) • clear container or aquarium • nutrient-rich soil • 100–500 live worms (e.g., red wigglers) • food scraps (e.g., cut-up banana peels, orange peels, apple cores, grape stems, etc.) • black paper • 2 L bottles (1 per group) filled with gravel and soil (added using a funnel) • 20–30 live earthworms, insects, spiders, or grubs • bristol board • non-toxic (edible) coloured sand (optional) • materials for making musical instruments (optional)	<i>Explore! Magazine: Nature Up Close</i> ("The Forest Man of India," pp. 21–23, Shared Reading – Nature Watch Inquiry Unit)
How Does Moving Water Affect Soil? Students will observe and explore how different samples of soil react to moving, or poured, water.	Skills [GCO 2] • 16.0 • 17.0 STSE/K [GCO 1/3] • 15.0	• Student Magazine, pages 22–25 • <i>What Is the Inquiry Process?</i> poster	• paint tray or shallow basin • large yogurt or plastic ice cream container • small yogurt container • sand • watering can, water • modelling clay • variety of materials such as spray bottles, squeezable water bottles, straws, watering cans or perforated yogurt containers, liquid measuring cups, graduated pitchers, buckets • variety of soil samples (sand, clay, pebbles) • piece of wood (i.e., plank) • cardboard carton • students' Science Journals • various materials such as yogurt containers, masking tape or duct tape, craft sticks, plastic berry baskets, Styrofoam trays, alfalfa sprouts • poster board (optional) • video camera, digital camera, or tablet (optional)	

Teaching Plans	Specific Curriculum Outcomes	Components	Materials	Literacy Place Connections
How Do Humans Use Soil? Students will explore the many ways in which soil is used to enrich our everyday lives. They will conduct research, create and complete a chart, share information, discuss their ideas, and communicate their findings.	Skills [GCO 2] • 12.0 STSE/K [GCO 1/3] • 18.0	• Student Magazine, pages 26–29 • IWB Activity 6	• variety of small objects made from soil (e.g., pottery vase or bowl, clay flowerpot, empty medicine container, brick, tile, glass jar, picture of fruits and vegetables or some “play” foods made of wood or plastic, twine, pair of cotton socks, potted plant, peat pots/ pellets) • students' Science Journals • old magazines or pictures from the Internet • digital camera or tablet (optional) • coloured pencils or markers • tactile items, such as small samples of string, yarn, fabric, pottery and jewellery, tape, or small snack bags (optional) • paintbrushes • soil samples (sand, silty loam, clay loam, potting soil, humus, or organic materials) • water and white glue (or other binder) • art paper	
Caring for Soil Students will investigate why it's important to protect the health of soil. They will listen, research, discuss, and discover ways in which they can take action to keep soil clean.	Skills [GCO 2] • 12.0 STSE/K [GCO 1/3] • 13.0 • 18.0	• Student Magazine, pages 30–31 • IWB Activity 7 • IWB Activity 8 • BLM <i>Soil Footprint</i> • IWB Activity 9	• sample or photo of contaminated soil • students' Science Journals • materials for bulletin board display (e.g., construction paper, coloured pencils, markers, and pictures from old magazines or the Internet— optional)	

Preparing for the Unit

1. Curiosity Centre

The Curiosity Centre gives students an opportunity to investigate science ideas and tools through active participation, free exploration, and independent play. In this hands-on centre, students can touch and explore soil and other objects related to soil.

The Curiosity Centre could have

- various soil samples such as sand, clay, silt, humus, loam, gravel, pebbles, rocks, organic matter
- magnifying glasses, tweezers, rulers, balances, small paintbrushes, straws, small sponges
- measuring cups, trowels, spoons, strainers, colanders, mesh screens, window screens, funnels
- sealable plastic bags, plastic containers, jars, plastic flower pots, beakers, basins, watering cans, spray bottles, plastic bags, paper plates or Styrofoam trays, baking pans, baking sheets
- potted plants, seeds
- an ant farm or vermicomposter (worm composting)
- paper and coloured pencils
- items made from soil such as a pottery vase or bowl, clay flowerpot, a brick, a tile, a glass jar, and, if possible, a traditional Indigenous item such as a food vessel made from soil
- soap, water, paper towels

Check the centre frequently to ensure it is well stocked with items. Invite students to contribute to the centre by bringing in items or photographs related to soil. Remind students to wash their hands thoroughly with soap and water after handling soil.

Note: You may choose to display new items every few days or introduce items one at a time throughout the unit.

2. Science Journals and Folders



Demonstrate for students how to record observations, questions, ideas, results, notes, and so on, by writing or drawing pictures in their Science Journals. Encourage students to add new questions or ideas to their Journals as often as they like.

Science Journals along with completed BLMs, drawings, stories, etc. related to the unit can be stored in the students' Science Folders.

3. Word Wall



Add any relevant science terminology to the Word Wall throughout the unit.

4. I Wonder Wall

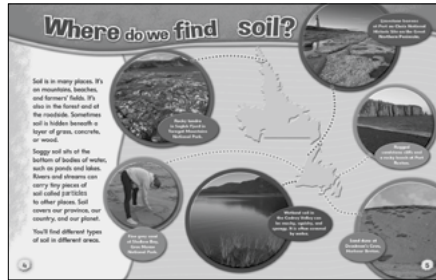


Build the I Wonder Wall throughout the unit by posting students' questions as they arise. Refer to the I Wonder Wall often and select questions that students may be ready to answer.

5. Reading Centre

Add texts (books, magazines, and photographs) relating to soils to the Reading Centre. Or, you may choose to include these texts in the Curiosity Centre. The titles in the Science Library will help start off a collection of books. Also refer to the lists of texts pertaining to *Exploring Soils* in the Additional Resources section of this guide (pages 82–83).

How Are Soils Different?



Focus: Students will begin to explore soil and use scientific terminology when communicating their understanding.

Specific Curriculum Outcomes

Students will be expected to:

- 1.0 pose questions that lead to exploration and investigation [GCO 2]
- 2.0 communicate using scientific terminology [GCO 2]
- 3.0 investigate a variety of soils and find similarities and differences among them [GCO 1/3]
- 4.0 communicate while exploring and investigating [GCO 2]

Performance Indicators

Students who achieve these outcomes will be able to:

- pose and post “I Wonder” questions to the classroom I Wonder Wall
- use scientific terminology to communicate their observations
- contribute to the completion of a Venn diagram comparing two different soil samples

NOTES:

Attitude Outcome Statements

Encourage students to:

- show interest in and curiosity about objects and events within their immediate environment [GCO 4]

Cross-Curricular Connections

Social Studies

Students will be expected to:

- locate and describe major landforms and bodies of water [2.2.1]

Math

It is expected that students will:

- collect first-hand data and organize it using charts [3SP1]

English Language Arts

Students will be expected to:

- communicate information and ideas effectively and clearly, and to respond personally and critically [GCO 2]
- select, read, and view with understanding a range of literature, information, media, and visual text [GCO 4]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• Student Magazine, pages 2–7 • Anchor Video: <i>Exploring Soils</i> • BLM <i>Venn Diagram</i> • IWB Activity 1	• students' Science Journals • variety of soil samples • sealable plastic bags • small digging tool, such as a trowel or spade, small shovel, an old spoon, or a measuring cup • variety of tools, such as magnifying glasses, tweezers, and small paintbrushes • egg cartons	• Display a KWLM chart in the classroom. • Create a Wordle or another word-cloud puzzle using unit terminology. • Collect soil samples from a variety of locations.	• clay • particles • pebbles • rock • sand • silt

Safety

- Have students wash their hands thoroughly with soap and water after handling soil.

Science Background

- Soil is a non-renewable natural resource.
- Soil is composed of rock that is breaking down. Weather events, such as rain, thunderstorms, tornadoes, floods, and erosion all help create soil.
- Most soil is a mixture of sand, silt, and clay.

- Soil also contains organic matter, such as bits of twigs, decaying leaves, grass, bark, fungi, dead insects, and so on.
- Different types of soils have different colours. Soil is often brown, black, or grey, but it can be yellow, red, or white.
- Newfoundland and Labrador has two distinct types of beach soils: 1) rocky (cobbles and boulders) and 2) sandy.
- Typically, most soils are composed of mainly mineral particles. Below are some useful definitions of soil-related terms as reference for exploring soils:
 - **sand** = small rock fragments; much coarser than silt and clay
 - **silt** = very fine rock fragments, much smaller than grains of sand; 50x magnification or higher required to see them
 - **clay** = extremely fine rock fragments that can only be viewed at 200x magnification
 - **boulders** = large rocks that are larger than cobbles
 - **cobbles** = fist-sized rocks that are larger than pebbles yet smaller than boulders
 - **pebbles** = tiny rocks that are larger than grains of sand yet smaller than boulders
 - **gravel** = a mixture of sand, silt, and pebbles
 - **humus** [hyoo-muhs] = thick black or brown living material from plants or animals that is partially decayed; makes up the nutrient-rich, organic matter part of soil; often forms the top layer of soil, especially in forests; humus can be created by composting food scraps and garden waste
 - **loam** = a fertile soil composed of varying amounts of clay, silt, sand, and humus—ideal for growing plants
 - **marsh or fen** = a low-lying, flooded area
 - **organic matter** = living organisms and dead or decaying organisms (e.g., insects, leaves, bark, twigs, feathers, fungi, etc.)

Possible Misconceptions

- Students often think that all soil must be fine textured, like potting soil. Help students understand that a rocky beach that has large-sized rocks is still considered soil. By sharing many examples of soil, looking at photos, and exploring outdoors, student will adjust their understanding of soil.
- Some students may equate the term “soil” with “dirt.” Direct students to see that soil is a nutrient-rich mixture of living material that will clump together in your hand. Soil is an excellent medium in which to grow plants. Dirt, on the other hand, doesn’t contain nutrients. It’s considered dead and doesn’t have a useful purpose.

ACTIVATE



Introducing Soils

Introduce the Student Magazine to students. Discuss the features of the magazine including the Contents page and the Glossary and explain the purpose of each feature. Point out the note on the Contents page that informs students that words in a bold, red font can be found in the Glossary.



Have the students examine pages 2–3 of the Student Magazine. Give students time to look at the pictures of different settings in Newfoundland and Labrador and read the text. Then ask:

- **Where do you see soil in these images?**
- **What do you notice about the soil?**
- **Are all soils the same?**
- **How are they the same?**
- **How are they different?**
- **Newfoundland and Labrador is sometimes referred to as “The Rock.” Do you think that is a good nickname? Why or why not?**

After students have pointed out the different types of soil pictured (sand, rock, pebbles, etc.), have them describe the soil in other places they know. As they consider this, jot down any questions students ask and post them on the I Wonder Wall. For example, students may ask:

- **I wonder where can soil be found?**
- **I wonder what soil is made of?**
- **I wonder how soil is formed?**
- **I wonder how deep soil is?**
- **I wonder if we need soil?**

You might create a KWLM (Information we know/What we want to know/What we learned/More questions we have) chart for recording the class’ exploration of soil. Place the chart in an accessible place so it can be added to and revised to reflect learning throughout the unit. As terms such as “clay,” “sand,” “silt,” “rock,” “pebbles,” and “particles” arise, add them to the Word Wall.

Anchor Video

Play the Anchor Video: *Exploring Soils*, which is located on the Teacher’s Website. Set a focus for viewing by asking students to look for differences and similarities in soils. You may choose to pause the video to allow students to answer questions or to discuss any questions which students may have.

Soil Words

Create a Wordle using unit terminology that came up during discussion, or any of the unit-related terms, such as: rock, pebbles, silt, sand, clay, humus, loam, organic matter, particles, compost, composter, decompose, decay, soil erosion, moisture, absorption, living, non-living, question, explore, investigate, observe, predict, measure, record, sequence, group, conclude, and communicate.

Make copies of the Wordle and share it with the students. Have students circle any words they don’t know, and let them know they will have the opportunity to learn these words as they progress through this unit. Have students keep the Wordle to refer back to throughout the unit.

If you have used all of the terms in the unit, ask students to try to guess (predict) what topics they will explore in this unit. Alternatively, have



students suggest categories they could use to sort the terms on the Wordle (e.g., soil components, composting soil, soil erosion, wet, dry, living and non-living, and science inquiry words, such as question, investigate, and observe).

Places With Soil

Share pages 4–5 of the Student Magazine with the class. Give students time to examine this spread and read the question: *Where do we find soil?* Read the text with the students, then ask students if they are familiar with any of the places pictured. Invite students to share what they know about these locations.

Encourage students to observe and then describe what they see. Point to specific visuals in the magazine and ask:

- **What do you observe about the soil?**
- **How would you describe it?**

Ask students to help you create a list of describing words (adjectives) that can be used to describe soil. For example:

crumbly	firm	silky	spongy
dry	gritty	smooth	squishy
earthy	loose	soft	sticky



Post the list of words in a prominent position where students can refer to it easily. Continue to add to this list as you work through the teaching plan. Alternatively, students can add these terms to personal dictionaries or their Science Journals.



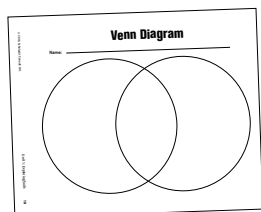
What Do You See?

Introduce pages 6–7 of the Student Magazine to the class. Read the title question aloud: *What does soil look like?* Give students time to examine this spread by reading the text and looking at the wide variety of soils pictured. Draw their attention to the close-ups of different types of soil and have students discuss similarities and differences they see with a partner. Invite a few students to share their observations with the class. Add any new words to the list of words used to describe soil.

Exploring Soils

Show students a few different soil samples that you have collected. The samples could be from a gully, a flower or vegetable garden, the roadside, a bog, a forest, a beach, a compost bin, or the bottom of a small river or stream.

Divide the class into small groups and create stations where each group can work to investigate the samples. Provide tools such as magnifying glasses, tweezers, and small paintbrushes at each station. Ask students to use the appropriate senses to describe the samples at their station and to record their observations using BLM *Venn Diagram* or a T-chart, Kidspiration, etc. Next, have students sketch their samples in their Science Journals and label any



materials they observed in the samples, such as a twig, an insect, or a blade of grass. Prompts for discussion might include:

- **How do these soils look different?**
- **Do you think these soils came from the same place? Why do you think that?**



To support collaboration among students and sharing of information, have a spokesperson from each group present the samples to the class. You might use a document camera to share an example of a student's sketch with the whole class.

Encourage students to ask questions and make comparisons about the soil samples. Add any new questions to the I Wonder Wall.

CONNECT

The Big Dig

Organize a big dig in the school grounds and area near your school. Explain that the students' task is to collect their own soil sample. Supply each student with a sealable plastic bag and have them label the bag with their name. Students will also need a small digging tool such as a trowel or spade, a small shovel, an old spoon, or a measuring cup. Tell students that the soil samples can come from a field, a ditch, a path, a stream, a puddle—or any number of locations. (Remind students to ask permission if they are taking a sample from private property.) They are not restricted to obtaining soil from a potted plant or flower garden. In fact, the more diverse the location and the type of soil, the better. Have students record both the location and the depth of their sample. Provide a few examples to make this task more tangible and easy to understand. The location and depth information should be recorded in students' Science Journals for later use in future investigations.

Encourage students to dig for soil samples deeper under the ground (up to 30 cm) as well as near the surface (i.e., ground level). Having samples from both near the ground and far below will ensure that a full range of soil types are captured for exploration in the classroom. Be sure to collect a few deep samples yourself to ensure students have some to investigate. Remind students to wash their hands with soap and water after touching soil.

Alternatively, to get a larger variety of samples, students can collect a soil sample with a parent or guardian and bring these into the classroom for further investigations. Ensure students label their sample with their name and record the location and depth from which the sample was taken.

Comparing Samples

Step 1: Have students display their soil samples around the classroom in five designated stations. Encourage students to walk slowly around the room, observing the samples. Tell students they can touch the bags, but they shouldn't open the bags at this point.

Step 2: Ask students to choose a sample from each station, describe it, and predict where the sample may have come from. Have students create a



IWB Activity:

- Challenge students to
- identify types of soil
- using Activity 1: *What is it?* (see the Teacher's
- Website).





chart in their Science Journals to record their descriptions and predictions. Encourage them to provide the reasoning or justification for their prediction. (Make sure all students' samples are considered.)

Step 3: Then have each student add a label to his or her sample describing where the sample was found (e.g., in a flower garden) and at what depth (e.g., at the surface).

Step 4: Next, have each student check the five samples they chose to see if their predictions were close.

Step 5: Invite some students to share what they discovered with the whole class. Prompt by asking questions such as:

- **How do the soils look different?**
- **What clues told you where the soil samples may have come from?**
- **What do you think the soils are made of?**

CONSOLIDATE

Soil Scientists

Using egg cartons, have students carefully spoon some soil from different samples into five egg compartments. Ask them to label the compartments by number and then create a three- or four-column chart that describes the sample in each compartment. Encourage students to add other observations about the soil in the other columns. For example, they might include headings for colour, texture, and dryness/moisture content. Students should compare similarities and differences of the soil samples and communicate their findings with a partner.

Touch and Feel Soil

Divide the class into three large groups. Tell the class each group will investigate three different samples of soil, collected from different places. If you have soil samples containing sand, silt, or clay, include these in the investigation. Students may work independently, in pairs, or in small groups within each large group. If possible, have samples of each material in a basin for students to feel. Have clean water and paper towels close by, and have students wash their hands thoroughly with soap and water after investigating the soil.

Draw a mural-sized Venn diagram with three circles on the board. You may wish to use a different colour for each circle. In a full-class discussion, have students contribute ideas about the soils and fill out the Venn diagram together. Ask:

- **What is in the soil?**
- **What size are the different pieces?**
- **What makes one soil different from another?**
- **Why are the samples different colours?**

- **What are the main differences between these samples of soil?**
- **What are their similarities?**

Students should determine that soil is made up of different materials and different types of soil.

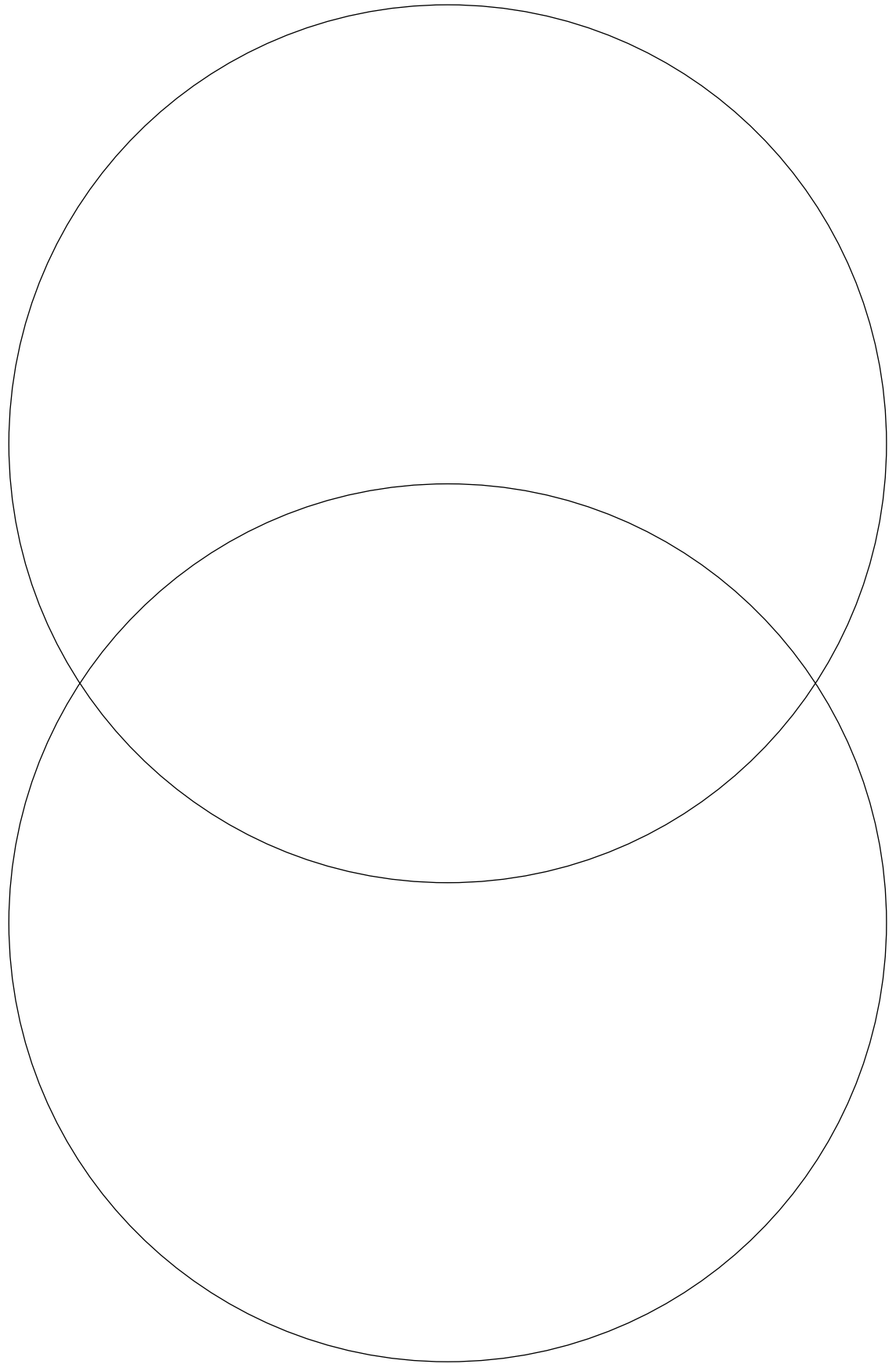
EXPLORE MORE

Rainbow of Soil

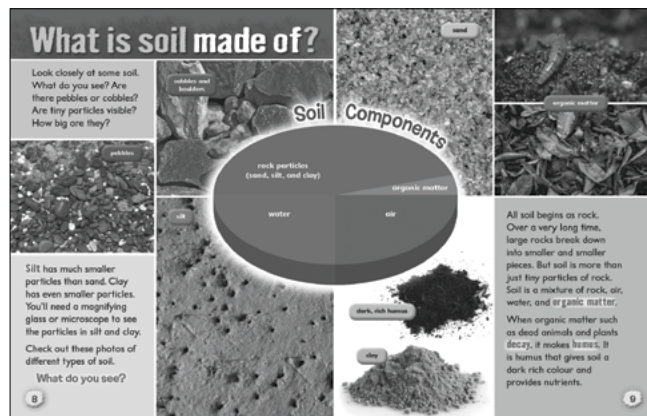
Have students investigate how many different colours of soil exist. They can research using books, magazines, and online sources. Students may also glean information from photos in the Student Magazine and from examining soil samples in the classroom. Have students report back to the class with their findings.

Venn Diagram

Name: _____



What Is Soil Made of?



Focus: Students will examine the composition of soil by looking at magnifications and using special tools.

Specific Curriculum Outcomes

Students will be expected to:

- 5.0 investigate and describe soil components [GCO 1/3]
- 6.0 use appropriate tools [GCO 2]

Performance Indicators

Students who achieve these outcomes will be able to:

- create a bulletin board display, a digital presentation, or a foldable about the composition of soil
- explain their choice of tool for exploring soil, and evaluate its appropriateness

NOTES:

Attitude Outcome Statements

Encourage students to:

- work with others in exploring and investigating [GCO 4]
- show concern for their safety and that of others in carrying out activities and using materials [GCO 4]

Cross-Curricular Connections

Art

Students will be expected to:

- investigate the elements of design (colour, shape, line, texture, space, value, and form) in the visual environment [1.3.1]

English Language Arts

Students will be expected to:

- explore, extend, clarify, and reflect on their thoughts, ideas, feelings, and experience [GCO 1]
- use writing and other forms of representation to explore, clarify, and reflect on their thoughts, feelings, experiences, and learnings; and to use their imaginations [GCO 8]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• Student Magazine, pages 8–9 • BLM <i>Sense Chart</i> • BLM <i>Foldable Template</i> Literacy Place: • <i>Dr. Bufflehead Explores Dirt</i> (Guided Reading, Level L)	• egg carton soil samples or the bagged soil samples from <i>How Are Soils Different?</i> (pages 11–19) • students' Science Folders • paper plates or clean Styrofoam trays • magnifying glasses • small paintbrushes • straws • small sponges • students' Science Journals • tweezers • graduated cylinders • spray bottles • measuring cups • strainers • very fine mesh screens, window screen, or colanders • funnels • jars • sifters or sieves • trowels • several wide-mouth containers • supply of earth from a garden (not potting soil)	• Have graphic organizers such as the following available for students who may want to use them: web, describing wheel, or a four-column sense chart. • Tape plastic tablecloths or large garbage bags to student work areas before examining soil samples.	• decay • humus • living • non-living • organic matter

Continued on next page...

Getting Organized *(continued)*

Components	Materials	Before You Begin	Vocabulary
	• elastic bands or duct tape • plastic water bottle (1 per group) • samples of soil • handmade funnel made of paper • pencil and coloured pencils • Lego pieces (assorted colours) • variety of craft materials (e.g., string, twine, buttons, glitter, markers, white glue, tape, construction paper, clean pebbles, card stock, or bristol board) • container (e.g., a glass jar, a tumbler, a fishbowl, or a small terrarium) • spruce or fir needles, leaves, twigs, and/or compost • digital camera (optional)		

Safety

- Remind students not to taste anything in the science classroom.
- Have students wash their hands with soap and water after handling soil.

Science Background

- The texture of soil can vary. It can be dry, crumbly, moist, mucky, sticky, fine, grainy, or coarse.
- Sand is granular in texture. It is made up of small particles—or pieces—of rocks and minerals.
- Clay usually contains more water than other soil types. Its minerals are very fine-grained. It has a silky texture.
- Silt is granular and comes from powdered rock or rock dust.
- Soil is made up of solids, liquids, and gases. The solid portion of soil contains pieces of different minerals and organic or living matter, which are called particles. The particles can vary in size, texture, and composition. The liquid part of soil is water, while the gas portion is air found in spaces or pores in between the particles.
- Pores in soil are important for holding water for the growth of healthy plants. Pores also make room for animals, plants, and micro-organisms.

Possible Misconceptions

- Students at this age may think that soil can only be found in certain areas, such as gardens and on farms. In truth, soil is found everywhere from construction sites, abandoned lots, and cracks in the sidewalk to roadsides, beaches, and mountain tops.

- Grade 3 students often believe all soil is brown. Soil lies in layers and these layers often have different colours. As well as brown, soil can be red, yellow, orange, or black. Wetland areas such as marshes or fens can have blue, purple, or greenish soils due to the different minerals found there.
- Students may think soil is sterile or germ-free. This is not true. Soil contains a huge number of micro-organisms.
- Many students consider soil to be a solid. In fact, soil is composed largely of empty spaces for air, water, plants, animals, and micro-organisms.

ACTIVATE

Imagination Vacation

Have students sit comfortably and close their eyes if they wish. With a soft voice, explain they are going to take a trip around the province using their imagination. They will visit different places and experience the sight, smell, texture, and feel of many different soils. Begin in a familiar local environment, such as a nearby conservation area or a provincial park. Describe a hiking path up a steep hill. Ask:

- **What does the soil feel like beneath your shoes or hiking boots?**
- **Are there small objects that slide under your feet as you climb the hill?**
- **Is there dust in the air that you are kicking up as you walk?**
- **Is the air heavy with moisture, and the trail slick with mud?**
- **What else do you observe?**

Guide students down the other side of the hill toward a rocky beach. Have them imagine the feel of the loose stones under their shoes. Suggest some students may want to remove their shoes and feel the size of the stones and pebbles under their bare feet. Kneeling down, they can pick up some stones. Ask:

- **Are the stones sharp or smooth?**
- **Are all the pebbles the same size?**
- **What else do you notice?**

Have students approach the water's edge and scoop their hands down into the water. Prompt them to investigate the soil by asking:

- **What do you feel at the bottom of the lake?**
- **How do the pebbles and small particles of crushed rock feel?**
- **Are the particles hard-packed in place, or do they move easily and loosely?**

Next, describe that they are travelling to their favourite sandy beach. Have students imagine they are crouching down on the sand and feeling its texture.

Continue this type of guided imagery throughout the unit, taking students' imaginations to a variety of places, including a farmer's field, an urban flower bed, a marsh or fen, a clay riverbank, and underground to a cave or a mineshaft. You may choose to show short videos of various locations to spark discussion.



Up Close With Soil

Direct students to pages 8–9 of the Student Magazine. Allow students time to examine the spread closely and look at the magnifications. Read the title question aloud to the class: *What is soil made of?* Invite students to read the text and share what they know about rocks, cobbles, pebbles, sand, clay, and so on. Define the terms “organic matter,” “decay,” “humus,” “living,” and “non-living” and add them to the Word Wall.

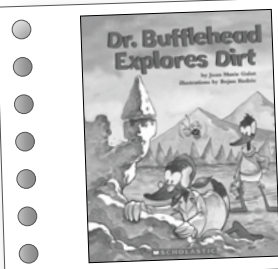
Have students view the close-up photos depicting the different types of soil. The photos show examples of boulders, pebbles, cobbles, silt, sand, clay, humus, and organic matter. Ask:

- In what ways do these soil samples look different?
- How could you describe them?
- What size are the particles in each type of soil? Small? Medium? Large?
- What colours do you observe?

Discuss the pie chart of soil components. Prompts for discussion might include:

- What is the greatest component of soil?
- What is the least?
- Do you think the amounts are always the same?

Explain to students that this chart shows an average breakdown of components. Different soils will vary somewhat in the amounts of each component.



Literacy Place Connection:

Dr. Bufflehead Explores Dirt (Guided Reading, Level L) explores the characteristics of different types of soils. Read the text aloud but pause before reading page 16 and ask students to describe the components of good garden soil and which characteristics make these components most suitable.

CONNECT

Sense Chart			
Look	Touch	Smell	Taste

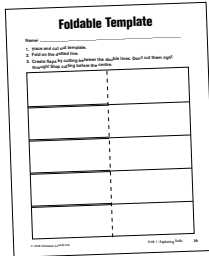


Look, Touch, Smell!

Using either the egg carton soil samples or the bagged soil samples from *How Are Soils Different?* (pages 11–19), have students work in pairs to describe five soil samples. Students can create charts with three or four columns or use a graphic organizer (e.g., web, describing wheel, or a four-column sense chart). Provide copies of BLM *Sense Chart*, if desired. Completed BLMs and other graphic organizers can be stored in the students’ Science Folders.

Archaeologists

Provide students with paper plates or clean Styrofoam trays. Spoon a small sample of soil onto each student’s plate or tray. Encourage students to



choose an appropriate tool from a wide variety of tools such as magnifying glasses, small paintbrushes, straws, and small sponges to examine their samples. Using the tool or tools, students can manipulate the particles in the soil and investigate its composition. Complete this activity by having students record their findings in their Science Journals. Have them explain their choice of tool (or tools) and evaluate how appropriate it was for the task.

Word Builder

Have students choose five adjectives to describe different kinds of soil. Provide copies of BLM *Foldable Template* and have students create a foldable with the descriptive words on the front and the definitions inside (under the flap) with a picture of the type of soil. This interactive, student-made organizer can be referred to throughout the unit and will help students remember these words.

What Are the Components?

Provide students with a wide selection of tools, such as magnifying glasses, tweezers, graduated cylinders, spray bottles, measuring cups, spades, strainers, very fine mesh screens, window screen, colanders, funnels, jars, and paintbrushes or have them choose appropriate tools from the Curiosity Centre. Have students choose a question to investigate as they examine a soil sample using some of the tools provided and analyze the different components. Students can create their own questions or you may provide more scaffolding by suggesting question-format sentence stems such as:

- **I wonder about ...**
- **How many ...**
- **What size ...**
- **How could I describe ...**

Alternatively, if some students require more guidance, you might suggest they use one of the questions from the Imagination Vacation activity in the Activate section of this teaching plan.

Encourage students to make jot notes and sketch their observations in their Science Journals. Then invite students to share key observations with the class. You may wish to create a web diagram to display students' observations and discoveries. Add any new questions to the I Wonder Wall.

Sort It, Sift It

Have students work in groups of two or three to divide soil from a garden (not commercial potting soil) into piles of differently sized pieces with the aid of a sifter, a trowel, and several wide-mouth containers. Tell students the aim is to display four different sizes of soil pieces: large, medium, small, and fine. For the largest pieces, students can dig into the hard-packed soil to break off some large chunks.

To separate out the other three sizes, a sifter or sieve can be used. You might provide several squares of standard window screening from a hardware store, at least one for each group of students. Provide some elastic bands



or duct tape for students to secure the screen over the top of a container. Using this handmade sieve, students can sift a sample of soil to separate out and capture the finer particles. They will need to shake the container gently to encourage the small particles to pass through the mesh of the window screening material. The chunks of soil that are left on top of the screen (too large to pass through) can be collected for the medium-sized soil pieces. Have students sift some more of the soil to collect the particles in the bottom of the container. Pour out this sifted soil—the small particles. Then, have students sift once more to separate out the finest particles of soil. Remind students to wash their hands with soap and water after handling soil.

To conclude, challenge students to come up with their own method for displaying the different-sized pieces of soil. They may wish to photograph the results and use them in an instructive bulletin board display, digital presentation, or foldable about soil.

Shake It Up

Have students work in groups of two or three to explore how soil particles settle. Each group will need a plastic water bottle, a sample of soil, and a handmade funnel made of paper. Have students pour soil into the funnel on top of a bottle that is already half-full of water. Have students shake up the bottle for 30 seconds, and then let its contents settle. At this point there will be distinctive layers of different types of soil visible in the bottle. The heavy particles—composed of rocks, pebbles, and coarse sand—sit at the bottom. Above is finer sand and then silt. Next is water with particles of clay. Bits of decaying plants and animals (organic matter) float at the surface. Remind students to wash their hands with soap and water after handling soil.

To communicate their understanding, have students use pencils and coloured pencils to make a diagram in their Science Journals showing the layers in the bottle. Remind them to label the layers and include a title.



Lego Layers

Provide Lego pieces in assorted colours. If possible, provide pieces in green, dark brown, light brown, beige, white, and grey to resemble the colours of layers that appear naturally in soil. Have students create a 3-D model in the shape of a cube showing layers in soil with the coloured Lego pieces. After, ask students to explain their model or provide a legend with colours corresponding to the Lego pieces in the model (e.g., grey = pebbles; white = sand).

CONSOLIDATE

Get Arty

Have a variety of craft materials available such as string, twine, buttons, glitter, markers, white glue, tape, construction paper, and clean pebbles. On small sheets of card stock or bristol board, have students create an artistic picture of soil. Encourage them to add labels describing the various parts in their soil, such as “larger particles like pebbles,” “small particles of sand,” and “bits of dead plants and animals.”

Soil Layers

Students can use the different sizes of soil collected and sifted from Sort It, Sift It (see the Connect section of this teaching plan) to create a model showing the layers in soil. They will need a glass jar, a tumbler, a fishbowl, or a small terrarium to use as a container. Have students add gravel to the bottom. Next, have them add the large chunks of soil, followed by the medium, small, and fine particles. Last, have students sprinkle some spruce or fir needles, dried leaves, twigs, and/or compost to the topmost layer. Again, after handling soil, remind students to wash their hands with soap and water.

Invite students to share their soil models and discuss what they found interesting—or challenging—about making them. This may be a good time to check in with students to see if their thinking about soil has changed through this investigation and others. If so, how?

EXPLORE MORE

Local Soil

Have students imagine that a family friend from the Prairies is coming to visit their family. Explain that this friend lives on a wheat farm and is interested in learning about soils. Students will need to describe the different types of soils this visitor is likely to find in some popular Newfoundland and Labrador tourist destinations, such as a favourite beach or a scenic hiking trail. Encourage students to use descriptive adjectives from the list created during *How Are Soils Different?* (pages 11–19). Students may wish to work in partners and set this up as a role-playing dialogue, which could be audio recorded or filmed. For students who require more scaffolding or guidance, provide sentence stems such as “If you travel to _____, you will find _____ soil” or “Most beaches have either _____ or _____ soil.”

Magnified Soil

Using print resources (books or Web-based materials), have students investigate soil that has been magnified 200 times. Point out clay particles and organic materials—living plants and animals, non-living or decaying plants and animals, nutrients—that may be evident. Have students discuss why there are pores between particles in the soil and what these pores might fill up with (e.g., air, water, insects, plant roots).

Sense Chart

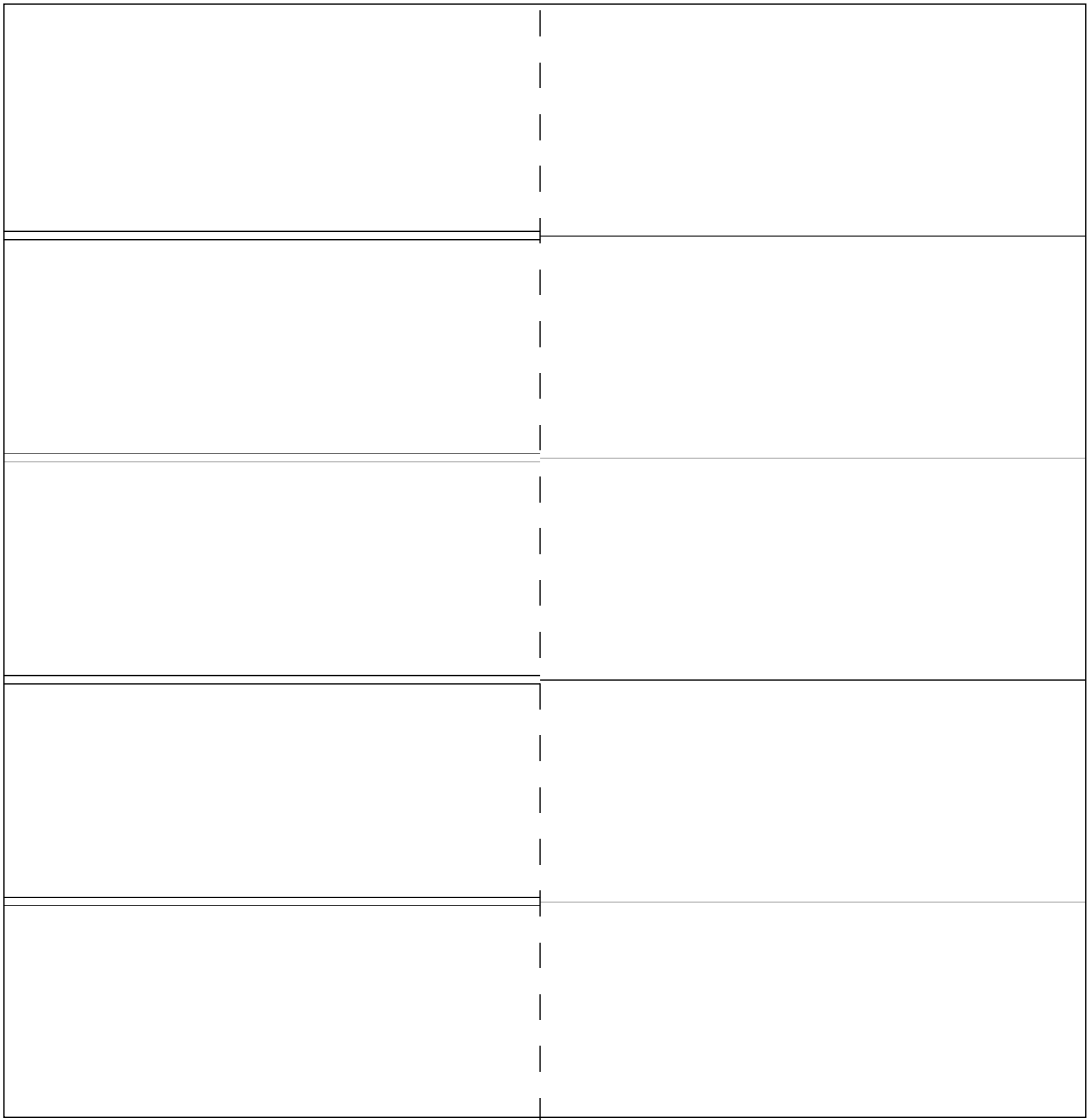
Name: _____

See	Touch	Smell	Hear

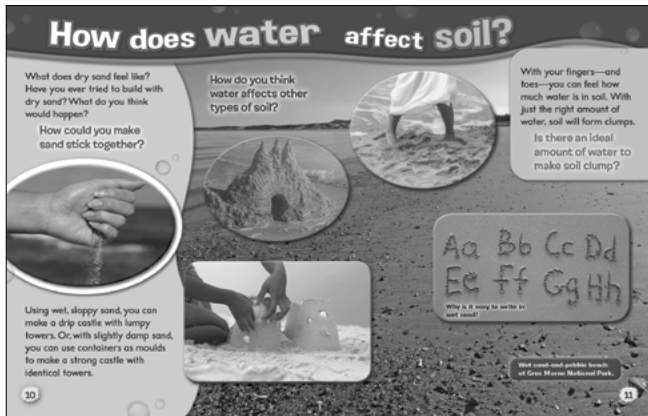
Foldable Template

Name: _____

1. Trace and cut out template.
2. Fold on the dotted line.
3. Create flaps by cutting between the double lines. Don't cut them right through! Stop cutting before the centre.



How Does Soil Change When It Gets Wet?



Focus: Students will explore through investigations how the properties of soil change when it is moistened. They will make observations, compare data, analyze the results, and discuss.

Specific Curriculum Outcomes

Students will be expected to:

- 7.0 describe the effect of moisture on the characteristics of soil [GCO 1/3]
- 8.0 sequence or group materials and objects [GCO 2]

Performance Indicators

Students who achieve these outcomes will be able to:

- sequence given soil samples from wettest to driest by using appropriate senses

NOTES:

Attitude Outcome Statements

Encourage students to:

- be open-minded in their explorations and investigations [GCO 4]

Cross-Curricular Connections

English Language Arts

Students will be expected to:

- interact with sensitivity and respect, considering the situation, audience, and purpose [GCO 3]
- respond personally to a range of texts [GCO 6]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• Student Magazine, pages 10–13 • <i>The Sandcastle Contest</i> (Read Aloud) • IWB Activity 2	• students' Science Journals • basin or small wading pool with sand • small and large yogurt containers • spray bottles • variety of different soil samples • basins of soil (1 for each group) • protective plastic sheeting • selection of cookie cutters • clay soil • variety of tools (e.g., sponges, eyedroppers, watering cans, measuring cups, paper towels, lamps, hair dryers) • funnels • jars or graduated cylinders • tissue paper • bowls • spoons or paint stir sticks	• Make arrangements to visit a classroom with a sandbox or an outdoor sand pit (optional). • Invite an Elder or Indigenous Knowledge Keeper to visit the class and share oral traditions such as stories, myths, and songs related to healthy soil.	• absorption • moisture • particles

Safety

- Remind students of the procedure of washing their hands with soap and water after handling soil.
- Have students wipe up any spills, especially with water, to prevent slip hazards.
- Ensure students exercise caution around any electric devices such as electric fans or hairdryers.

Science Background

- Adding water to soil can help it hold its shape. By adding water to sand, for example, people can form sand into structures (i.e., sandcastles) that will hold their shape.

- As moisture is added to the soil it will appear darker and become easier to clump, provided the soil components are small enough.
- Different compositions of soil hold water in different ways. For instance, water flows through sand quickly and sand doesn't retain water very well. In contrast, clay has a very high water-holding capacity. Silt has a good capacity for holding water. Soil mixtures with a high percentage of clay and silt will hold a high quantity of water. In this way, common soil mixtures such as sandy loam soils have low water-holding capacities, while clay loam soils have high water-holding capacities.

Possible Misconceptions

- Students may think that soil that contains organic matter, such as leaves, will repel, rather than absorb water. This is not true. Soil that contains a large amount of organic matter and humus will have a high water-holding capacity.

ACTIVATE

Read Aloud: *The Sandcastle Contest*



Summary

When Matthew enters the sandcastle contest at the beach, he builds something unbelievably amazing.

Before Reading

Show students the cover of the book and explain that you are going to read a book about a sandcastle contest. Ask:

- **Has anyone ever built a sandcastle before?**
- **If so, where did you build it?**
- **Did you use any tools to help you build it?** (shovel, pail)
- **What do you think the criteria might be for winning a sandcastle contest?**

If possible, have students examine some dry sand. Have them describe the sand's properties. Ask:

- **How does the sand feel? Is it wet or dry?**
- **Does it pack together or fall apart?**
- **Could you build a sandcastle with dry sand?**

During Reading

As you read the story to students, pause frequently to discuss the text and illustrations. Alternate by asking students to respond in a whole group or with a partner. Prompts for discussion could include:

- What do you think Matthew might build with his sandbox?
- What tools do people use to help them build with sand?
- How did Matthew's sand house fool the judges?
- Do you think it's possible to build all the items (including a dog) from sand?
- Why did kicking the sand house make it collapse? (the sand had probably begun to dry out and hitting it caused the dry grains of sand to fall apart)

After Reading

Discuss with students how they could make sand stick together. Ask:

- How does water affect sand?
- Does it make it easier or harder to build with? Why do you think that?
- Can you build with other types of soil? What can you build?
- Do all types of soil need to be wet in order to clump together?
- Why do you think that building sandcastles, and other items, is popular at the beach? (sand by the water is wet and it clumps together making it easy to build with)
- What would happen to a sandcastle over time? (unless it is washed away by water, it will dry out over time and collapse)



Sandy Beach

Have students read pages 10–11 of the Student Magazine. Read the title question aloud: *How does water affect soil?* Invite students to respond to this question, based on what they already know. Permit some class time for sharing stories about wet sand and mud.

Sandcastle Fun

If possible, have students visit a classroom with a sandbox or an outdoor sand pit. Alternatively, half fill a basin or small wading pool with sand and provide an area for students to build sandcastles. Using small and large yogurt containers, have students create their own sandcastle. Have a spray bottle available so students can dampen the sand to produce different effects. Ask:

- How did the dry sand feel?
- Did it feel different after it was wet?
- How does wetting the sand make it easier or harder to build with?



Invite students to share their recipes for the best combination of sand and water and compare them. Add the terms “moisture” and “absorption” to the Word Wall.

Feel It

Provide students with 2–4 different soil samples. Have students feel and describe the soils. Ask:

- What do the soils look like?



- **What do they smell like?**
- **How do they feel?**

Then have students add a small amount of water from a spray bottle to each soil sample and describe the soils. They will observe that sandy soil, when moistened, feels gritty. This is because the particles are spaced far apart from each other, leaving lots of space for water to flow freely. In contrast, clay soil, for example, feels sticky and clumps together. The particles in clay are small so they stick together easily.

Muddy Trail

Introduce pages 12–13 of the Student Magazine by reading the title question aloud: *What happens when soil is too wet?* Have students examine the photos and read the captions. Then have students share their own stories about walking or hiking in the rain or in mud. Ask:

- **What is the soil like?**
- **What do you need to protect in these conditions?** (clothing from mud stains; try not to slip and fall)

Contrast this with walking in dry conditions. Ask students what they need to protect when it's dry and dusty. (their eyes)

Mud Pies

In an outdoor area or using basins of soil in the classroom (1 basin per group) with protective plastic sheeting, have students make mud pies. Have them observe what happens to the shape of their pie as they add water to the soil. Remind students to wash their hands with soap and water after handling soil. Ask:

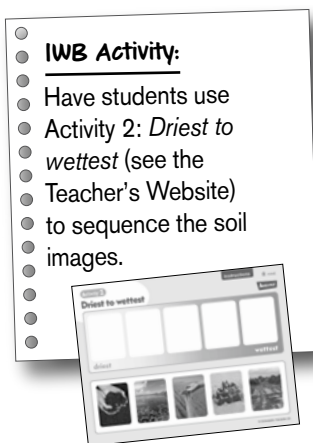
- **Does the soil that is really wet hold its shape?**
- **What do you observe happening to the edges of the mud pie?**
- **Where does the wet mud go?**
- **What do you observe in the runoff?** (water and bits of soil)

CONNECT

Cookie Cut-Outs

Supply students with an array of cookie cutters in different shapes. Have students manipulate a sample of clay-like soil, adding just enough water to make it workable. Next, have students pat the soil smooth, flattening it to about the thickness of their hands. Then cut out cookie shapes and put them on a tray. Ask:

- **How did the amount of moisture in the soil affect the “cookies”?**
- **Did they hold their shape?**
- **How could you change the soil to make it more firm?**



Quick-Dry Soil

In small groups, have students place a measured sample of soil into a funnel at the mouth of a jar or graduated cylinder. Students then pour a measured amount of water into the funnel and leave this set-up for a day to let the water collect in the jar or cylinder.

The next day, have students use tissue paper to test the moisture content of their soil sample by touching the tissue to the soil. Does the tissue paper dissolve? (very wet soil) Does the tissue paper stay dry? (dry soil) As a class, devise a descriptive (or numbered) scale to describe the soil, for example: wet (1), moist (2), slightly moist (3), dry (4), very dry (5). Have students create a chart for their sample and record the moisture rating each day for a week. After the initial watering, students should not add more water to the soil.

CONSOLIDATE

You Crack Me Up!

Have students roll out a slab of clay into a round, flat shape. (Or, you may use the cookie cutter shapes from the Cookie Cut-Outs activity.) They can carve their names into the top, if desired. Next, bake the clay in an oven or leave it to dry on a sunny windowsill, until it hardens. Let the clay cool. Have students analyze the baked clay. Ask:

- **How much moisture is in this clay?** (none)
- **What did heating the clay do to the moisture content?** (took it away)
- **What do you observe about the clay now that it has been baked?** (it feels dry and contains cracks)
- **Have you seen soil that looks like this? Where?** (dry, cracked mud at a construction site)

Wet and Dry Soil

Provide a variety of tools, such as sponges, eyedroppers, spray bottles, watering cans, measuring cups, paper towels, lamps, and hair dryers for students to moisten and dry soil samples. Invite students to explore and observe changes in appearance/colour, texture, and coherence (ability to clump) as the soils are moistened and dried. Ask:

- **What happens when water is added to different soil samples?**
- **Does their colour or texture change?**
- **Does the moist soil clump or stick together?**
- **Can you add too much water to soil?**
- **What happens to the soil samples when they dry?**

Have students sequence the soil samples according to one or more attributes such as lightest to darkest or least to most sticky.



Enough Is Enough!

Have small groups of students mix soil in a bowl with a spoon or a paint stir stick. After mixing, have them add a measure of water. Have them observe the difference in the soil and record their observations with notes in their Science Journals. Ask them to add another measure of water and stir again. Now what happens? Has anything changed? Encourage students to observe the clumping stage where soil binds together in small clumps or balls. Have them add another measure of water and continue doing this until the soil is quite watery.

Have students repeat this investigation with a soil high in humus. Again, have students record what they observe. Ask:

- **What is different?**

Have students collect the observations from their own investigations and those of other groups so they can work together to create a sequence of soil samples, based on the amount of water or moisture in each. Encourage students to think of a way to represent this sequence visually. Remind students to consider a variety of factors in sequencing the amount of moisture in the soil samples including colour (lightest to darkest), ability to clump (least to most sticky), and particle size (smallest to largest). Have students label their visual representations using science vocabulary, such as moisture, absorption, particles, sand, clay, loam, and silt.

Stories, Myths, and Songs

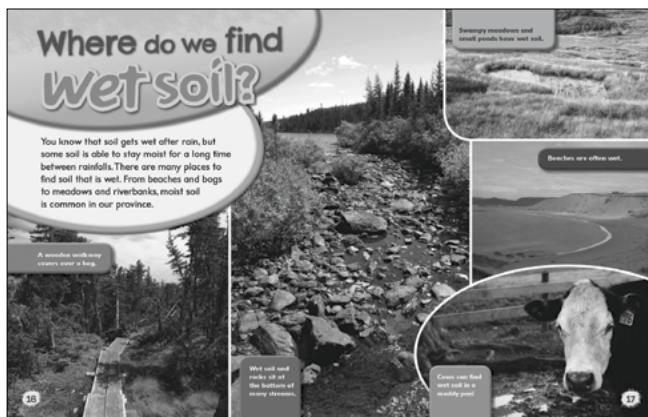
Indigenous peoples often have close relationships to the land and may have stories, myths, songs, and other oral traditions that speak to the impact and importance of soil. Invite an Elder or Indigenous Knowledge Keeper to share with the class any oral traditions relating to soil.

EXPLORE MORE

Too Much or Not Enough?

Discuss as a class the effects of too much water, or too much heat and a lack of water, on soil and the environment. Encourage students to share stories about soil and water from their own gardens, from family or friends, or from the news.

Does Soil Absorb Water?



Focus: Students will investigate the water-holding properties of different soil samples and make conclusions about which mixtures absorb the most water.

Specific Curriculum Outcomes

Students will be expected to:

- 9.0 compare the absorption of water by different soils [GCO 1/3]
- 10.0 make and record observations and measurements [GCO 2]
- 11.0 construct and label concrete-object graphs, pictographs, or bar graphs [GCO 2]

Performance Indicators

Students who achieve these outcomes will be able to:

- complete a graph to display the results of their investigation about the water capacity of different soils

NOTES:

Attitude Outcome Statements

Encourage students to:

- appreciate the importance of accuracy [GCO 4]

Cross-Curricular Connections

Math

It is expected that students will:

- demonstrate an understanding of measuring mass (g, kg) by measuring and recording mass [3SS4]
- construct, label, and interpret bar graphs to solve problems [3SP2]

English Language Arts

Students will be expected to:

- interpret, select, and combine information using a variety of strategies, resources, and technologies [GCO 5]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• Student Magazine, pages 14–17 • BLM <i>Which Soil Absorbs Water the Best?</i> • <i>What Is the Inquiry Process?</i> poster	• sponges • graduated cylinders • containers of water • buckets • paper towel tubes • stopwatch, smartphone, or watch with a second hand • four different samples of soil including sand, clay, and also some loam samples with varying levels of sand, silt, and clay • water • measuring cups • students' Science Folders • graph paper • round objects that represent different-sized particles (e.g., small beads, marbles, super balls, tennis balls) • funnels • container or jar • bristol board • spoons or scoops • paper towel • fine cotton cloths or pieces of fabric • plastic containers • electric fan, hair dryer, heat lamp, or oven • four to six clear jars • mixtures of soil (potting soil, peat moss, potting soil and gravel, gravel, soil from the schoolyard) • beakers filled with water • few drops of food colouring • students' Science Journals	• The activities Seeping Through Dry Soil (page 42) and Seeping Through Moist Soil (page 43) both require some teacher set-up prior to beginning them.	• absorption • loam • moisture

Safety

- Remind students of the procedure of washing their hands with soap and water after handling soil.
- Have students wipe up any spills, especially with water, to prevent slip hazards.
- Ensure students exercise caution around any electric devices such as electric fans or hair dryers.

Science Background

- Water is held in soil inside the pores between soil particles. If the moisture content is low, the spaces will be filled with air, as well as some insects, plant roots, and micro-organisms. If there is too much water, the water flows out and leaches into a lower area, farther under the ground.
- Too much water in soil will harm plants. Insufficient water will also harm plants. The moisture content of soil has an impact on the environment and food production.
- Farmers strongly prefer well-draining sandy loam soil. It's ideal for growing the majority of vegetables, including potatoes, tomatoes, peppers, green beans, carrots, and corn. Those who have clay loam soil have much more of a challenge. It is difficult to cultivate and dig in this hard-packed—often cement-like—soil. Clay loam gardeners can have some success growing vegetables with shallow roots such as lettuce, chard, squash, and pumpkins.

Possible Misconceptions

- After learning about the water-holding capacity of different types of soil, students may think that soil that contains a lot of clay—and holds the most water—will be best for growing plants. In fact, soil mixtures with a high concentration of sand are best for growing plants because they hold some water, but also drain well.

ACTIVATE



Holding Water

As a class, examine pages 14–15 of the Student Magazine. Allow students time to read the text and examine the photos. Discuss the fact that different types of soil hold varying amounts of water after a rainfall. Reread the final questions on page 14 aloud and share ideas as a class. Add the word “loam” to the Word Wall.

Sponge Demo

Demonstrate for the class a sponge absorbing water. Dip a sponge into a container of water. Hold up the sponge over a bucket and then squeeze. Pour the water into a graduated cylinder and have a student measure the amount of water.



Ask:

- **What did you observe?**
- **What does this tell you about the absorption of water?** (lots of water was held in the sponge)
- **Where was this water held?** (inside the pores or air holes in the sponge)

Invite students to investigate absorption using different-sized containers and sponges.

Wet Locations

Introduce pages 16–17 of the Student Magazine. Read the title question aloud: *Where do we find wet soil?* and then read the introduction together with the students. Invite students to examine the photos on the spread and to read the caption text. Discuss marshes, fens, or other wet soil that students are familiar with, or have seen.

Time It

In groups of three or four, have students fill two or three paper towel tubes with different types of soil. (If possible, put a different soil type or different mixture in each tube.) Have them pour a measured amount of water into the tube. Using a stopwatch, smartphone, or watch with a second hand, challenge them to time how long it takes for the water to reach the bottom and flow out of the tube. Have them draw a conclusion about which sample lets the most water pass through and which sample absorbs the most water.

CONNECT

Which Soil Absorbs Water the Best?

Invite students to investigate four different samples of soil in small groups of three or four. Ideally, include sand, clay, and also some loam samples (mixtures) that have varying levels of sand, silt, and clay.

Have students place a scoop of dry soil into a colander placed over a bowl or other container. Students can then pour a measured amount of water on top of the soil. After several minutes, students measure the amount of water that has collected in the container below the colander. (Students might measure using mL, cm, or non-standard units.)

Have students compare the amount of water poured over the soil to the amount of collected water. Provide students with copies of BLM *Which Soil Absorbs Water the Best?* to record their results and observations. This procedure can be repeated for each soil sample, ensuring that the size of the sample and the amount of water poured is the same for each test. Encourage students to discuss the results of their investigations. Ask:

- **Which soil sample held the most water (was the most absorbent)?**
- **Which held the least?**



Remind students to store their completed BLMs in their Science Folders.

Graph It

Working in the same groups, have students construct a graph, such as a bar graph, to display the results of their investigation to show which sample holds the most water. Compare the graphs as a class. Sand will be the least absorbent, then silty loam, then clay loam, and finally clay.

Dr. Dirt's Best Pie

You may have had students make mud pies in the previous teaching plan, *How Does Soil Change When It Gets Wet?* (pages 30–36), where students added more and more water to observe the effect. For this activity, have students explore which soil mixture that you have available in the classroom makes the best mud pies. Explain that the best mud pie should hold its shape very well and contain some moisture.

Supply students with a variety of soil samples, including some loam soils. Divide the class in four, and have each group create a recipe for mud pie with one of the four mixtures or types of soil. Compare and discuss. Next, have students share portions of soil from other groups in the classroom to come up with a unique recipe for a blend of soil and water. Again, compare and discuss. Determine, as a class, through sharing and effective communication, which soil blend made the best mud pie.

Soil Modelling Demo

Teacher Set-Up:

Find a collection of round objects that will represent different-sized particles. For example, small particles in soil, such as grains of sand, can be represented by small beads. Medium-sized particles can be represented by marbles. Large particles can be represented by super balls. Very large particles, such as boulders, can be represented by tennis balls.

To begin, ask students to predict what they think will happen when they pour water through the different round objects. After they have recorded their predictions, have students put the smallest object—for example, the beads—into a narrow-necked funnel over a container or jar. Have students slowly pour water into the funnel.

Ask students to observe how quickly the water flows through the beads. Repeat with the next size of object. You may need to create your own large-size funnel out of bristol board for the largest objects (e.g., tennis balls). Ask:

- **How did water flow through the smallest size of particle?** (more slowly)
- **How did water flow through the largest size of particle?** (more quickly)
- **How do the different sizes of particles affect the flow of water?** (water flows more slowly through smaller particles, but more quickly through larger particles)
- **Do the results match your prediction?**
- **How do the sizes of the particles relate to the spaces between the particles?** (the bigger the particles, the bigger the spaces between the particles)

- **Before I added the water, what was in between the particles?** (air)
- **What can this demonstration tell us about soil?** (Soil with small particles seems to hold onto water more than soil with large particles. Soil with large particles lets the water just gush through it.)

Ensure students understand that this demonstration used a magnified, not an actual-sized, model. In real life, sand particles look tiny—much smaller than the beads, or smallest “particles” in the demo. But this doesn’t mean sand particles are tiny! At the particle or microscopic level, grains of sand may be relatively large compared to other particles of soil, such as those found in clay.

CONSOLIDATE

Show Me the Water

Have available some graduated measuring containers, spoons or scoops, paper towel, fine cotton cloths or pieces of fabric, and plastic containers. Have students re-use their mud pie soil and measure the amount of water in a 100 g sample of the soil. Encourage students to explore and find their own method of measuring the amount of water in the soil. Some students may put a sample on a piece of paper towel, fold the towel, and squeeze out the water over a container. After, they can measure the amount of water in mL (alternatively, students can measure using cm or non-standard units). Other students may measure the mass of the wet soil and then dry out their sample by using an electric fan, hair dryer, or heat lamp; putting the sample in an oven; or drying it out in the sun. Advise students to request assistance from you, or another adult, to use any electric devices. When the sample is sufficiently dry, students can take its mass and find the difference in mass between the wet sample and the dry sample. The difference will be the amount of water in grams.

Seeping Through Dry Soil

Teacher Set-Up:

- 1) Fill four to six clear jars with various mixtures of soil. For example, fill one with sand. Fill another with potting soil. Fill a third with peat moss, a fourth with potting soil and gravel, and a fifth with gravel. Put soil from the schoolyard in a sixth jar.
- 2) Place each jar at a separate station in the classroom.
- 3) Have some beakers filled with a solution of water and a few drops of food colouring next to each jar.

Student Hands-On Activity:

In small groups, have students discuss and record their own questions before they begin this activity. Have students make predictions about what they think will happen and record their predictions in their Science Journals.

Have students work in small groups, with each group working at one station and focusing on one of the jars. Have them slowly pour a measured amount of the coloured water solution into a jar. Have them use a stopwatch, smartphone, or watch with a second hand to time how long it takes for the





water solution to reach the bottom of the jar. Students can pick up the jar gently to observe the coloured water, but it's best if they don't shake the jar and disturb its contents. If the water is absorbed into the soil and doesn't reach the bottom, have students add another measured amount and try again. Ask students to record their findings in their Science Journals and note whether their prediction was supported.

Have students take a gallery walk around the classroom to visit other groups, chat with group members, and copy down other groups' data and observations. Encourage students to look for similarities in their group's results with those of others. Also have students explore and discuss any differences in results. Create a large chart with the whole class and talk about what each group observed. Ask:

- **Did you notice anything surprising or unexpected?**
- **Why do you think the water seeped through so slowly/quickly in your sample?**

Invite students to add any new questions they may have to the I Wonder Wall.

Seeping Through Moist Soil

Tell students you'll be repeating the previous activity, but with soil that has been pre-moistened. Ask students to make predictions about what might happen. Ask:

- **Will the coloured water solution seep through the soil sample more quickly or more slowly? Why?**

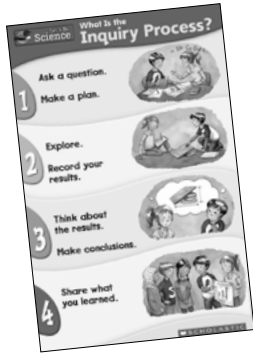
Teacher Set-Up:

- 1) Drain out the coloured water solution from each jar used in the previous activity, Seeping Through Dry Soil.
- 2) Then pour some water (about 50 mL) into each jar.
- 3) Wait for the water to be absorbed.
- 4) Add some more water if the soil still appears to be dry.
- 5) Pour off any excess water that may be sitting at the surface.

Student Hands-On Activity:

Have students re-do the activity with the moistened soil samples. Again, have them add another measure of coloured water solution (50 mL) and have them time how long it takes for the water to seep through to the bottom. Again, have some beakers filled with water and a few drops of food colouring.

Ask students to share their results with other groups through a gallery walk. Encourage them to discuss what they observed and whether their prediction was supported.



This activity can also be performed through a more open-inquiry approach by making the various materials available to students and posing a question to focus their experimentation. If you choose this approach, be sure to direct students' attention to the classroom poster about inquiry, entitled *What Is the Inquiry Process?* Ask:

- **What happens when water and soil mix?**
- **Where does the water go?**

Science Sketchers

Have students sketch a comparison drawing showing water being absorbed in two different types of soil. Have students label the drawings using science vocabulary, such as “particle” and “absorption.” Ask a few volunteers to share their drawings with the class. Discuss the drawings and review the key terms.

EXPLORE MORE

Best-of-the-Best Soil

In small groups of two or three, have students research the absorbing qualities of the ideal soil for growing crops. Then have them present their findings to the class.

Which Soil Absorbs Water the Best?

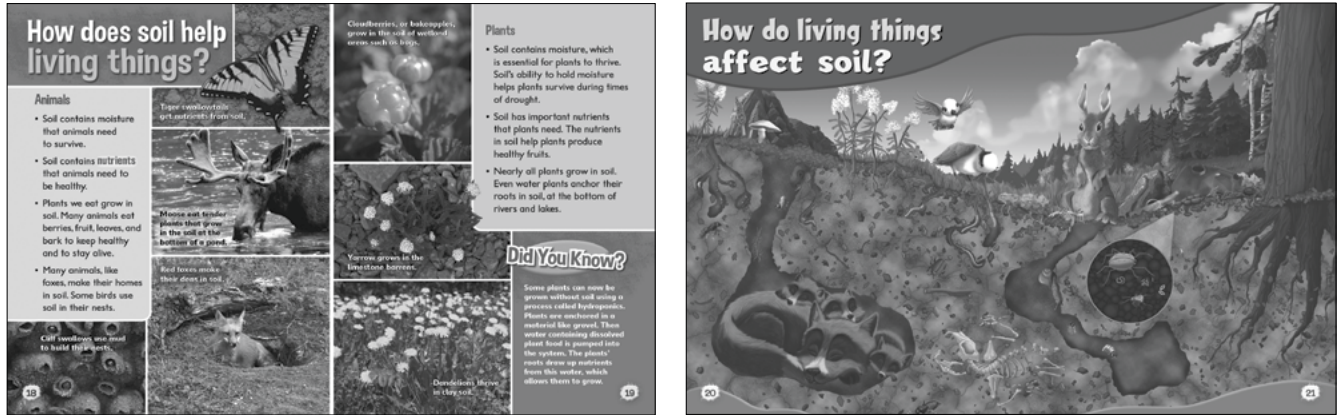
Name: _____

Sample #	Amount of Water Absorbed	Other Observations
Sample 1		
Sample 2		
Sample 3		
Sample 4		

Record the samples in order from least to most absorbent.



Soil and Living Things



Focus: Students will investigate how living things affect and are affected by soil, and develop their understanding of composting.

Specific Curriculum Outcomes

Students will be expected to:

- 12.0 use a variety of sources of science information and ideas [GCO 2]
- 13.0 investigate and describe how living things affect and are affected by soils [GCO 1/3]
- 14.0 propose an answer to an initial question or problem and draw a simple conclusion [GCO 2]

Performance Indicators

Students who achieve these outcomes will be able to:

- question, predict, observe, collect data and research, analyze, and make a conclusion about plants and soil
- make a conclusion about the role or the impact of worms on the process of decay
- make sketches and discuss how living things (i.e., plants and animals) interrelate with soil

NOTES:

Attitude Outcome Statements

Encourage students to:

- consider their own observations and ideas when drawing a conclusion [GCO 4]

Cross-Curricular Connections

English Language Arts

Students will be expected to:

- interpret, select, and combine information using a variety of strategies, resources, and technologies [GCO 5]
- use writing and other forms of representation to explore, clarify, and reflect on their thoughts, feelings, experiences, and learnings; and to use their imaginations [GCO 8]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• <i>Underneath the Sidewalk</i> (Read Aloud) • Student Magazine, pages 18–21 • IWB Activity 3 • IWB Activity 4 • <i>What Is the Inquiry Process?</i> poster • IWB Activity 5 Literacy Place • <i>Explore! Magazine: Nature Up Close</i> (“The Forest Man of India,” pp. 21–23, Shared Reading—Nature Watch Inquiry Unit)	• students' Science Journals • clipboards and paper (optional) • clear container or aquarium • nutrient-rich soil • 100–500 live worms (e.g., red wigglers) • food scraps (e.g., cut-up banana peels, orange peels, apple cores, grape stems, etc.) • black paper • 2 L bottles (1 per group) filled with gravel and soil (added using a funnel) • 20–30 live earthworms, insects, spiders, or grubs • bristol board • non-toxic (edible) coloured sand (optional) • materials for making musical instruments (optional)	• Invite an Elder or Indigenous Knowledge Keeper to share how everything on Earth is connected. • Invite an expert such as a local composter, a worm farmer, or an ecologist to visit the classroom. • Gather Internet and print resources related to animals and plants from Newfoundland and Labrador. • Gather Internet and print resources for poems or songs about animals that are suitable for students.	• compost • composter • decay • decompose • humus • living • moisture • non-living • nutrients • organic matter

Safety

- Have students wash their hands thoroughly with soap and water after handling soil.
- Ensure that students wipe up any spills, especially with water, to prevent slip hazards.

Science Background

- Plants and some animals depend on the moisture and nutrients in soil for their survival.

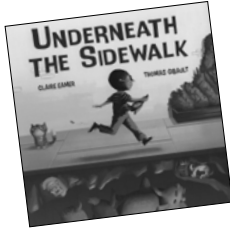
- Many animals make their homes in soil and some birds use soil in their nests.
- Plants absorb minerals from the soil. Examples of minerals include carbon, calcium, iron, nitrogen, sulfur, and phosphorus.
- Soil found in different areas of Newfoundland and Labrador is suitable for growing different types of plants and trees. For example:
 - Aquatic: **Yellow water lily** grows in ponds and lakes that are nutrient-rich. Its leaves and flowers float on top of the water, while the stem stretches down to the bottom of the pond/lake, and its roots are in the soil under the water.
 - Bogs: Wetland areas have soils in which many plants thrive. The **pitcher plant** is Newfoundland and Labrador’s provincial flower. It is a carnivorous plant (or insectivore) that traps insects and digests them. Pitcher plants live in poor-quality soils in wetland areas (bogs). The prey that they consume boosts the plant’s nutrient levels. Another common wetland plant is the **blue flag iris**. It has purple flowers and narrow leaves. **Cranberries** thrive in bogs as well.
 - Boreal forest: This nutrient-rich, moist soil features many berry plants in sunlit clearings, such as **bakeapple**, **crowberry**, **blueberry**, and **bunchberry**. Other plants include **coniferous** and **deciduous trees**, **Labrador tea**, **moss**, **fungi**, and **lichen**.
 - Limestone barrens/Tundra: **Yarrow**, **partridgeberry**, **yellow dwarf orchids**, **sageleaf willow**, **Laurentian primrose**, **yellow lady’s slipper**, **harebell**, **alpine chickweed**, and **dwarf spruce trees** grow (slowly) in this exposed environment.
 - Meadows: **Goldenrod**, **dandelion**, **fireweed**, **alders**, **lupins**, and **pearly everlasting** can all be found thriving in meadows or along roadsides.
 - Pebble beach: **Oyster plant** creeps along the stones on beaches. **Seaside plantain** and **silverweed** grow well on rocky beaches as well.
 - Sand/Forest: **Bunchberry** has four white petals and red berries that grow in a “bunch.” It can be found on sandy beaches and also in forests. **Sea Pea** and **oyster plant** are two flowering plants that thrive in beach sand.
 - Clay-based soil: **Dandelions** thrive.

Possible Misconceptions

- Students may think that soil is dead and doesn’t contain living organisms. In fact, soil is filled with living organisms such as bacteria, fungi, earthworms, spiders, beetles, grubs, and also plant roots.
- Some students in grade 3 may think that nothing can grow in some types of very poor-quality soil. This is incorrect. Even poor soils will still allow for some specialized plants to grow—the plants are just less diverse. For example, these plants thrive in clay-based soil: **alder**, **goldenrod**, **yarrow**, **sea holly**, and **sedum**. The barrens host **partridgeberry**, and **yellow dwarf orchids** grow on high limestone cliffs on the west coast of Newfoundland. Saltwater marshes and tidal areas are a haven for **red glasswort**, which is a type of **pickleweed**. In sand, along the coast, **seaside sandplant** (or **sea sandwort**) thrives.

ACTIVATE

Read Aloud: *Underneath the Sidewalk*



Summary

A girl falls through a crack in the sidewalk and meets the “beasts” who live underground.

Before Reading

Show students the cover of *Underneath the Sidewalk* and ask:

- **What is a sidewalk built on?** (the ground, soil)
- **What do you see in the soil beneath this sidewalk?**
- **What do you think this story is going to be about?**

Tell the students that as you read the text aloud, they should listen to find out what lives in the soil underneath this sidewalk.

During Reading

Read the story aloud fluidly and expressively. Then read the story again, pausing to discuss the text and illustrations. Clarify any new vocabulary as necessary. Prompts for discussion might include:

- **What would we actually find living in the soil underneath the sidewalk? Would there be “beasts”?** (There would be “beasts” such as earthworms, insects, spiders, grubs, etc., but no monsters.)
- **Would there be spaces in the soil? Would they be big enough to play in?** (Yes, there would be small spaces such as those created by plant roots and the digging of earthworms and ants. There might also be burrows of animals.)
- **The spread with “OH NO!” shows other things besides living things in the soil** (rocket ship, bones, jewels, remains of old cities). **What might you find in the soil around you?** (e.g., organic matter, animals bones, rocks)
- **Could you really slide down tree roots and swing from grass shoots?** (No, but they would be there in the soil.)

After Reading

Have students write and illustrate a short story about another adventure the girl has with her friends underneath the sidewalk. Encourage students to make their stories rhyme. Invite students who are interested to read their stories aloud to the rest of the class. Post all of the students’ stories in the classroom or create a class book.

Soil-Centred Walkabout

Take students outside to examine the soil and turn over rocks. (If there has been a recent heavy rainfall, invite students to look for earthworms.)



Encourage students to take note and make their own sketches of any living organisms they see in soil in their Science Journals. (Alternatively, students may wish to take clipboards and then, when they are back in the classroom, cut and paste the sketches into their Science Journals.) Ensure that students put all rocks, sticks, and natural materials back as they found them so as not to harm the ecosystem.

Soil and Living Things

Invite students to discuss with a partner how they think soil helps living things. Create a web on the board, or on chart paper, to show students' thinking. Then share pages 18–19 of the Student Magazine. Allow students time to examine the animal and plant pictures and to read the text. Ask:

- **What do plants and animals need to live?** (food, clean water, shelter, air)
- **How can soil help with these needs?** (provides food/nutrients; shelter; contains water/air; filters water)

Add any new ideas to the web.

Vegetation Visualization

Have students close their eyes and ask them to visualize a sandy beach. Say:

- **You know what the soil is like at beaches. You see a wide expanse of sand. You might see some hills or cliffs.**

Ask:

- **What plants do you see?**

Then take students on an imaginative trip, high in the hills. Describe a rocky, exposed landscape, such as the limestone barrens on the west coast of Newfoundland—which hosts many rare and endangered plants—and/or the tundra (and permafrost) of the Torngat Mountains in northern Labrador. Ask:

- **What plants or flowers grow here?**
- **Are they large or small?**

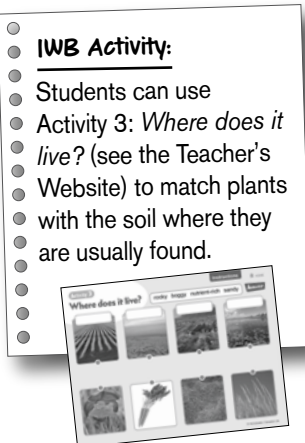
Next, travel to a marshland or bog. Ask:

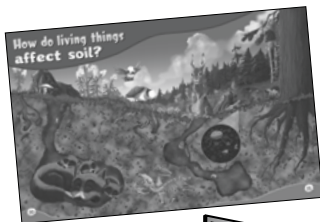
- **What do you see and smell?**
- **Can you hear anything?**
- **What kinds of plants and flowers do you see?**

Finally, journey to a forested region. Ask:

- **What plants do you see on the forest floor?**
- **What kinds of trees grow here?**
- **How tall are the trees?**
- **What animals make their homes here?**

If students are unsure of the vegetation for the various landscapes, you could provide visuals to stimulate discussion.





Living Things Affect Soil

Invite students to look at pages 20–21 of the Student Magazine. Give students 5–10 seconds to quickly preview this spread and look at the illustration. Ask students what their brief preview makes them wonder about, and add their questions to the I Wonder Wall.

Read aloud the title question: *How do living things affect soil?* Spend a few moments brainstorming possible responses together as a class. Jot down students' ideas on the board or on chart paper. If the following responses are not mentioned, add them to the list of ideas:

- Plant roots help to drain water from the soil. This keeps the soil from staying too wet.
- Plant roots dig down into the soil and create spaces for air and water.
- Roots can help to make soil by splitting rocks into smaller pieces that become soil.
- Ants, earthworms, and other animals dig and mix the soil. They also create tunnels and burrows in the soil which help to create spaces for air and water.
- Earthworms eat decaying plant materials that pass through the animals and fertilize the soil.
- Living things help soil by recycling nutrients—when living things die in the soil, they are broken down by tiny bacteria and fungi. The minerals are released into the soil. Living plants need these nutrients to grow.
- Humans can affect soil negatively by leaving garbage and contaminating the soil with toxic products such as gasoline and motor oil.

Classroom Visit

You may wish to invite an Elder or Indigenous Knowledge Keeper to share with students the belief that everything on Earth—humans, plants, animals, water, air, the land—is connected. They can explain how air, water, plants, animals, and people can all affect the health of soil.

CONNECT

It's Alive ... With Creepy Crawlers

Discuss the fact that soil contains small living organisms. Tell students you are going to play an active game. You will need to do this activity in the gym, the hallway, or in a large, open area outside. Assign numbers to students from 1 to 5. Students who are numbered 1, 2, 3, or 4 represent rock, clay, silt, and sand, respectively. Students who are numbered 5 represent a small living organism, such as an ant, a worm, or a vole. Have students who are numbered from 1 to 4 link arms or hold hands. Students' arms can cross, forming a web or grid of students. The number 5 students—the ants, worms, or voles—are then challenged to make their way through the web of soil particles in the same way that these living organisms create tunnels and burrows under the ground.

IWB Activity:

- Invite students to identify components of soil as living, once-living, or non-living using Activity 4:
- *Components of soil* (see the Teacher's Website).





Let's Investigate Plants

Plants thrive in different types of soil. Have students work in small groups and devise a rich inquiry question of their own to investigate plants and soil. Each member of the group may suggest a question and add it to a list. Students are to consider each question and ask each other further probing questions. Have students find a way to narrow down their discussion and choose just one question from the list to explore further. Some groups of students might debate in order to select one question, while others will draw randomly from the list. Some sample questions might include:

- **What does soil need to stay healthy?**
- **How do plants help soil?**
- **What do plants take from the soil?**
- **How does soil help plants?**

Guide students to keep their group's question narrow and ask them to focus on a particular plant and a specific soil type.

Read aloud the steps of the *What Is the Inquiry Process?* poster. This will assist students as they progress through the steps of this student-led investigation.

Next, have students make a prediction. This will be a proposed answer to the question they will focus on during this investigation. Students may wish to begin their prediction with the sentence stem: "I predict that _____."

After gathering and recording their observations, data, and research, students will analyze this material and make a conclusion. The conclusion should be a statement that explains what they learned or discovered about plants and soil. Their conclusion should also relate back to their original prediction by saying whether or not the prediction is supported or justified by their research findings or results.

Calling All Soils!—A Competition

Tell students there is going to be a soil competition. Who will be the winner: Sandra Sand, Milton Silt, Roman Loam, or Clayton Clay? Have students start off by ordering different types of soil, from the best kind for growing things to the worst kind for growing things. Ask them to justify the reasoning behind their ranking system. Be sure to point out that even poor soils can be the perfect environment for specialized species of plants. This is why harsh environments like the limestone barrens still have unique flowering plants growing there.

After working through this first example, students can come up with their own criteria for winning soils with other notable features or qualities. Students can make badges to highlight the winning qualities of different types of soil. Encourage students to connect the winning qualities of soil to plants, if possible, and then to explore other creative winning qualities, such as nutrient-rich, best colour, holds shape, or grittiest. Challenge students to include each type of soil as a winner for some quality. Ask:

- **Which type of soil is the best for gardening and farming?** (sandy loam—soil that contains some sand, silt, and clay, but more sand than silt and clay)

- **How do decaying plants help form soil?** (Plants break down into organic matter, decompose, and are eaten by animals, micro-organisms, and fungi, which breaks them down further. They become mixed into the soil, which increases the volume of soil on the ground.)

CONSOLIDATE

Worm Farm

Start with a clear container or aquarium. Add nutrient-rich soil, live worms, and food scraps such as those from students' lunches (cut-up banana peels, orange peels, apple cores, grape stems, etc.), or add some compost that students bring from home. Make sure students understand that the compost must be made up entirely of vegetable waste. No fats, oils, meats, dairy, paper towel, or cardboard should be included. Water the soil daily to keep it moist.

Help students to wrap the clear container in black paper to keep the worm farm dark. This will promote more activity in the worms. When students want to observe the worms, they can remove the paper and put it back in place when they are finished.

Allow students, working in small groups, to take the lead in developing their own group investigation based on the role or the impact of worms in the worm farm. Encourage them to begin by creating a question or stating a problem. Some student groups may choose to investigate by sketching the worm farm and adding labels to the tunnels, some of the worms, and the layers of compost and newly formed soil—made up of “castings” or the waste that worms produce. Others may wish to collect data by taking the mass of the worm farm on day 1 and then at two-week intervals—even continuing to collect data for two or three months, if possible—to measure how much new soil has been created. Still other groups may want to record the temperature of the top layer of compost each day for two weeks and graph the results. Some student groups may opt to examine samples from different layers in the worm farm and look at them under a magnifying glass. You may wish to offer suggestions for graphing or charting data as necessary to help propel students' learning. Have students make a conclusion based on what they have learned.



The worm farm can become a classroom composter and students can observe the process of decay over several weeks or months. Explain that this is called vermicomposting. Discuss the words “compost,” “composter,” and “decompose” and add these terms to the Word Wall.

Expert Interviews

Invite an expert from the community to visit the class to talk and answer students' questions. The expert could be a local composter, a worm farmer, or an ecologist. Encourage students to develop a list of questions in advance that they would like to ask the expert.

Mini-Biosphere in a Bottle

In small groups, students can construct a terrarium using clear, 2 L bottles filled with gravel and soil (added using a funnel), and earthworms, insects,

spiders, or grubs. Ensure that living organisms have adequate oxygen, water, and food to survive.

Note: Students should take care with living organisms, such as insects and spiders, and treat them with respect.

Have students make sketches and discuss how the living organisms interrelate with the soil. Ask:

- **How do earthworms help the soil?** (burrow through it, mix it, pull dead leaves down into it, add air to it, help break down decaying organic matter, leave behind castings that nourish the soil like fertilizer)
- **How does the soil help the earthworms?** (They find food—organic matter—in the soil and it helps them survive.)
- **How do soil and plants help spiders?** (The plants that grow in soil provide structures for spiders to build webs and lay their eggs. The plants also provide a shelter for the spiders to rest and wait for an insect to get stuck in their web.)
- **How do spiders help plants?** (They capture and eat insects that harm plants. This allows the plants to thrive and be healthy.)
- **How do spiders help the soil?** (By eating the pests it means farmers and gardeners won't have to use pesticides to keep their plants healthy. This keeps dangerous chemicals out of the soil, which keeps the soil healthy.)

Discuss answers as a class.

Animals Dig Earth

Have students choose an animal from Newfoundland and Labrador that lives in soil. Have them research the animal and explore its relationship with and its dependence on soil. Ask:

- **Does this living organism affect soil? How?**
- **Is this living organism affected by soil? How?**

In diary format, have students make a bristol board display to tell the story of the animal from its point of view. Be sure students include information about water, nutrition, and shelter. Have students add pictures from the Internet, their own sketches, and fun facts about the living organism. Ask students to list their sources (books, magazines, Websites, videos, etc.) on the back of their display board. Some animals for students to consider are cliff swallows, butterflies, mosquitoes, worms, voles, mice, rabbits, and beavers.

Ask questions such as the following to prompt a class discussion about animals and soil:

- **What animals live in soil?** (e.g., earthworms, ants, potato bugs, earwigs, millipedes, voles, mice, rabbits, gophers/groundhogs, foxes)
- **How do animals change soil?** (mix it up, add air to it, add their waste to it)
- **What is compost?** (decomposing organic matter that is being broken down and mixed by earthworms and micro-organisms; compost contains humus)
- **How do decaying animals help form soil?** (Animals break down into organic matter, decompose, are eaten by animals, micro-organisms, and fungi,

IWB Activity:

- Challenge students to use Activity 5: *What is its role in soil?* (see the Teacher's Website) to identify how different living things affect soil.



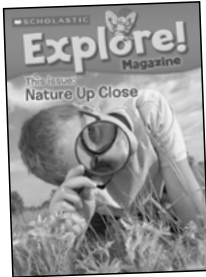
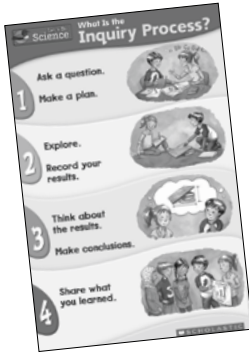
which breaks them down further. They become mixed into the soil, which increases the volume of soil on the ground.)

Do Worms Mix Soil?

Pose this question to the class and have students investigate and explore in whatever way they wish. Most likely, student groups will investigate by creating a worm farm and adding some objects to the surface.

Circulate around the classroom to check in with individuals and small groups of students. Make sure students understand that the word “mix” can mean stir, combine, turn over, churn, or blend. For students who may be veering off topic or would benefit from more structure, you might recommend a graphic organizer and/or review the steps of the Inquiry Process using the *What Is the Inquiry Process?* poster.

If you wish, purchase some non-toxic (edible) coloured sand for worm farms. Place a thin layer of red sand on top of a layer of soil. Add a layer of soil and then add a thin layer of yellow sand. Repeat a few times to create striped layers in the worm farm. When the worms wriggle and burrow in the soil, they will leave a trail of coloured sand.



Literacy Place Connection:

“The Forest Man of India,” on pages 21–23 of *Explore! Magazine: Nature Up Close*, describes how one man has spent over 30 years growing a forest on a large, empty sandbar. Revisit or read the text with students and ask:

- How do you think the termites, ants, earthworms, and insects helped to improve the condition of the soil?

EXPLORE MORE

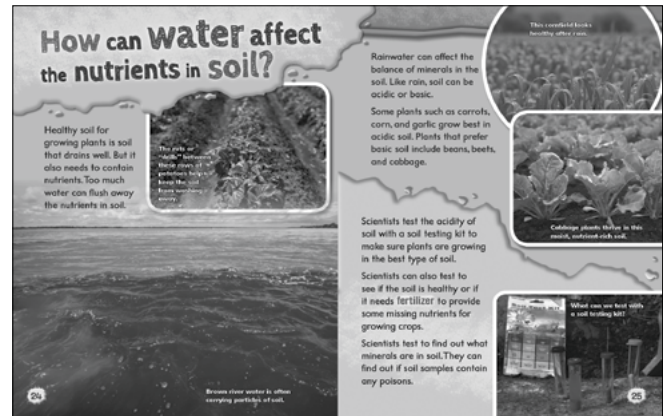
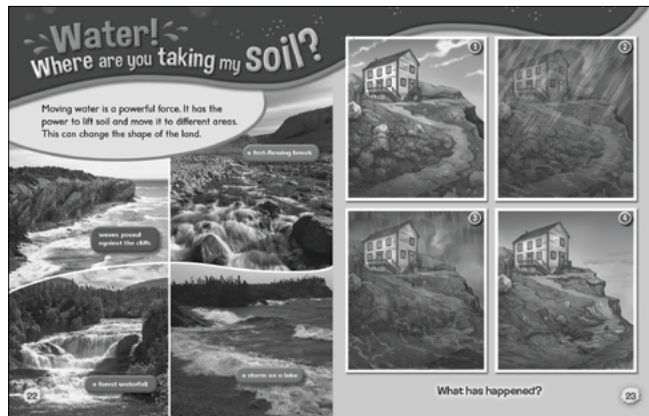
Above and Below

Have students draw an “above and below” soil picture that includes living things (plants and animals) that are found locally both in and above the soil. Students can add labels and/or captions to explain how these living things help soil.

Animals in Soil

Have students write a poem or song about an animal (e.g., worm, groundhog, mouse) that lives in soil. Alternatively, have students research poems or songs that have been published about underground animals or soil. Host a literacy fest with a kindergarten or grade 1 class to share poems and songs. If they wish, students could make musical instruments, such as shakers containing small pebbles, sand, or loamy soil.

How Does Moving Water Affect Soil?



Focus: Students will observe and explore how different samples of soil react to moving, or poured, water.

Specific Curriculum Outcomes

Students will be expected to:

- 15.0 investigate the effects of moving water on different soils [GCO 1/3]
- 16.0 predict based on an observed pattern [GCO 2]
- 17.0 communicate procedures and results [GCO 2]

Performance Indicators

Students who achieve these outcomes will be able to:

- use their prior knowledge about soil to create predictions when initiating science inquiry investigations
- choose an effective method to communicate their procedures and results about the effects of moving water on soil

NOTES:

Attitude Outcome Statements

Encourage students to:

- willingly observe, question, and explore [GCO 4]
- show interest in and curiosity about objects and events within their immediate environment [GCO 4]

Cross-Curricular Connections

English Language Arts

Students will be expected to:

- explore, extend, clarify, and reflect on their thoughts, ideas, feelings, and experiences [GCO 1]
- create texts collaboratively and independently, using a variety of forms for a range of audiences and purposes [GCO 9]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• Student Magazine, pages 22–25 • <i>What Is the Inquiry Process?</i> poster	• paint tray or shallow basin • large yogurt or plastic ice cream container • small yogurt container • sand • watering can, water • modelling clay • variety of materials such as spray bottles, squeezable water bottles, straws, watering cans or perforated yogurt containers, liquid measuring cups, graduated pitchers, buckets • variety of soil samples (sand, clay, pebbles) • piece of wood (i.e., plank) • cardboard carton • students' Science Journals • materials such as yogurt containers, masking tape or duct tape, craft sticks, plastic berry baskets, Styrofoam trays, alfalfa sprouts • poster board (optional) • video camera, digital camera, or tablet (optional)	• Prepare slips of paper with questions about soil being washed by water. • Contact a local farmer or gardener and invite this expert to speak to the class about nutrients in soil, testing soil, and crop rotation.	• soil erosion • nutrients

Safety

- Have students wash their hands thoroughly with soap and water after handling soil.
- Ensure that students wipe up any spills, especially with water, to prevent slip hazards.

Science Background

- When water moves or flows across the ground, it has an impact on the soil. Fast-moving water—from heavy rainfall or from forceful waves—can

shift soil to a different area. It can wash away soil from the sides of cliffs, hills, or mountains. It can dislodge the soil that keeps trees' roots secure, making trees topple over. It can carve deep crevices in soil and, over many years, create deep valleys.

- Sloped areas can keep their soil in place much better when they are covered in plants and trees. The plants and trees, with their extensive root system, act as a sort of “net” that blankets the soil and holds it in place.
- Soil that is washed away from farmers' fields, mining areas, or industrial sites can dump toxins into bodies of water, such as rivers, lakes, and oceans.
- Coastal erosion is an issue of concern in Newfoundland and Labrador. Forceful waves can cause damage to low-lying coastal roads and disturb delicate dune landforms, carrying sand out to sea. Over time, this can lead to a shrinking beach, island, or land mass, with more and more of the “land” being carried out under the seawater.
- Green roofs take unused space (i.e., flat rooftops) and transform it into a green space using local plants that are adapted to the weather and exposed conditions. The plants and grasses used in the green roofs help reduce greenhouse gases. Like all plants, they absorb carbon dioxide and produce oxygen. This leads to better air quality in urban centres. Green roofs are good insulators, so they help reduce the costs of heating and cooling structures. They have a waterproof membrane below the soil or sod to prevent leaks.
- Green roofs are an increasingly popular feature seen in some modern sustainable buildings. A 12-storey office tower called Fortis Place is a commercial structure in St. John's that has a green roof. Corner Brook City Hall also has a green roof. Historically, there are roofs made from sod that can be seen at L'Anse aux Meadows National Historic Site. These thick sod coverings, with an underlayer of wood framing, insulate the building from cold-weather conditions. Root cellars—basement or underground cold storage areas that are excavated into hillsides—are very common in traditional homes in Newfoundland and Labrador. Vegetables kept in root cellars stay cool throughout the winter months, but don't freeze because they are insulated by the soil under the ground.

ACTIVATE



Force of Water

Share pages 22–23 of the Student Magazine with the class. Read aloud the title question: *Water! Where are you taking my soil?* Give students some time to examine the photos on page 22, then ask:

- **How do you think the water is affecting the soil in these pictures?**
- **Can you think of other situations where water affects soil?** (e.g., floods, hurricanes)



Then, examine each panel of the cartoon on page 23 with the class and discuss what has happened. Introduce the term “soil erosion” and add it to the Word Wall.

Invite students to share some stories about heavy rainfalls. Prompts for discussion could include:

- **Where was the water running?**
- **Was there anything being carried away by the water?**
- **Was the water a different colour?**

High on a Hill

Tell students you're going to do a demonstration about moving water. Ask them how moving water can affect soil. Record students' ideas on the board.

Set-up: In a paint tray or shallow basin, place a large, upside-down yogurt or plastic ice cream container. Explain that this represents the hill. Fill a small yogurt container with moistened sand. Turn the container over so that the small form of sand makes a shape on the hill. Ask:

- **What do you think will happen when rain falls on the sand at the top of the hill?** (The sand will collapse or change shape.)

After students have had an opportunity to make predictions, begin the demonstration. Use a watering can to gently sprinkle water on the sand. Students will observe that lots of the packed sand washes away and flows with the water down the sides of the hill to the valley below. Sprinkle more rainwater until little rivers begin to form below the sand.

Have each student come up close to observe the rivers and rivulets of water. They may wish to use magnifying glasses to see tiny particles of sand in some of the water. If necessary, point out that very little sand remains on top of the hill. Explain that this demonstration models what can happen to landforms during heavy rainfalls.

Collapsing Models

Have students make a small figure or structure from modelling clay. Have them test some of the figures by putting them on top of an upside-down yogurt container and sprinkling them with water. Have students compare this to the previous teacher demonstration with sand (High on a Hill). Ask:

- **What happened to the clay figure?** (its shape changed; it slowly collapsed into a lumpy shape)
- **How does this compare to the sand we tested earlier?** (it kept its shape better than the sand)
- **Can you make a conclusion about how moving water affects clay?** (less clay washes away, collapses, or dissolves compared to sand)

In both this activity and the High on a Hill activity (above), students can see how moving water takes away some of the particles in the soil. Discuss as a class what effect the moving water is having on the soil. Help students to understand that the moving water is washing away the soil. Invite students to add any new questions they may have to the I Wonder Wall.



CONNECT



Mudslide

Provide a variety of materials such as spray bottles, squeezable water bottles (e.g., those used by cyclists), straws, watering cans or perforated yogurt containers, liquid measuring cups, graduated pitchers, buckets, and a variety of soil samples. Have students fill a “mess area” in which to investigate soil and water.

Ask students to build a ramp from a piece of wood (i.e., a plank) and a cardboard carton. Have them coat the wood in a layer of soil about 2 cm deep, 5 cm wide, and 20 cm long. Have three different samples of soil available (e.g., sand, clay, and pebbles).

Students can select the materials they would like to investigate, making and recording their predictions about what will happen to the soil samples. Then have students add water, using the different types of containers to represent rainfalls ranging from light to heavy. Students will observe what happens to the soil. Encourage them to record their observations in their Science Journals. Repeat with each sample of soil. Discuss their results as a class. Were their predictions supported?

Rooftop Garden

Provide or have students find pictures of rooftop gardens. Ask:

- **Can you see the soil?**
- **How does the soil stay on the roof and not wash away onto the ground below?** (Plants and small stones hold it in place. There is a low “wall” around the outside that keeps the soil inside a sort of tray-like structure, similar to a sandbox.)

Have students create model rooftop gardens in the classroom. Materials may include upside-down yogurt containers, masking tape or duct tape, craft sticks, plastic berry baskets, Styrofoam trays, soil mixtures, sand, small stones, and alfalfa sprouts.

CONSOLIDATE

You Asked It

Have a collection of questions about soil washing away written on slips of paper. Have students work in pairs or groups of three to answer the question. The questions can include the following:

- **What happens to soil when it rains?** (it gets wet; it absorbs some water; it changes shape; it gets mucky; it washes away)
- **How does water move soil?** (bits of soil are carried along by flowing water)
- **How can erosion be prevented?** (by planting trees or putting rocks on slopes to hold the soil in place)
- **Why do farmers plant trees around their fields?** (to stop the soil from blowing away)

Have students explore the question, conduct research, and then communicate their results in a method of their choice. Three options are provided below, but students may wish to choose other presentation methods.

1. Infographic Poster

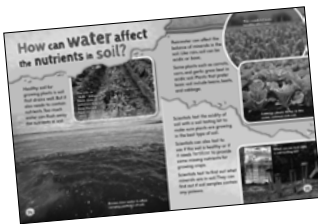
Have students present information about moving water and soil erosion using the format of an eye-catching poster with pictures, graphics, words, captions, and photos. Their poster should be focused on the effects of moving water on soil, and which types of soil are most resistant to the effects of moving water. It should contain science vocabulary, such as “rock,” “pebbles,” “silt,” “sand,” “loam,” “particles,” “soil erosion,” and “moving water.”

2. Infomercial

Have students present information about moving water and soil erosion through a government-sponsored infomercial. Their infomercial should be focused on the effects of moving water on soil, and which types of soil are most resistant to the effects of moving water. It should contain science vocabulary, as listed in 1) above.

3. Documentary Video

Have students present information about moving water and soil erosion through a short video. Their video should be focused on the effects of moving water on soil, and which types of soil are most resistant to the effects of moving water. Students may wish to include outdoor footage of flowing water that contains soil particles, and/or clips from interviews with members of the community. The video should contain science vocabulary, as listed in 1) above.



Water Flows, Soil Goes

Introduce pages 24–25 of the Student Magazine to the class by reading the title question aloud: *How can water affect the nutrients in soil?* Ask students to keep their ideas to themselves while they examine the visuals and read the text. Then, in small groups, have students discuss the question. Prompts for discussion may include:

- **How do nutrients help plants?**
- **What happens if these nutrients are taken away?**
- **How can moving water, or too much water, affect the nutrients?** (wash away soil and carry nutrients away; water contaminated by industrial waste can add acid to the soil)

Protecting Our Soil

Invite a local farmer or gardener to speak to the class about nutrients in soil, testing soil, contour plowing, and crop rotation. After the talk, have students suggest ways to keep soil healthy and full of nutrients. Together, come up with a class action plan to protect soil. For example, students might decide to start a compost program at school and use the compost to enrich the soil in the school’s garden.

EXPLORE MORE



The Effects of Heavy Rainfall on Soil

Challenge students to conduct an independent inquiry investigating the effect of heavy rainfall on soil in their region. Have them interview local farmers (or property owners), or find information in the newspaper about how people are protecting soil from erosion. Review the *What Is the Inquiry Process?* poster and have students focus on one question for their inquiry, such as:

- How do farmers prevent soil from washing away in a specific area?
- What do farmers do to protect soil from erosion?
- How do property owners stop soil from washing into lakes, rivers, and/or the ocean?

Have students communicate their findings in a short write-up or newspaper-article format with illustrations and quotations to support their conclusions.

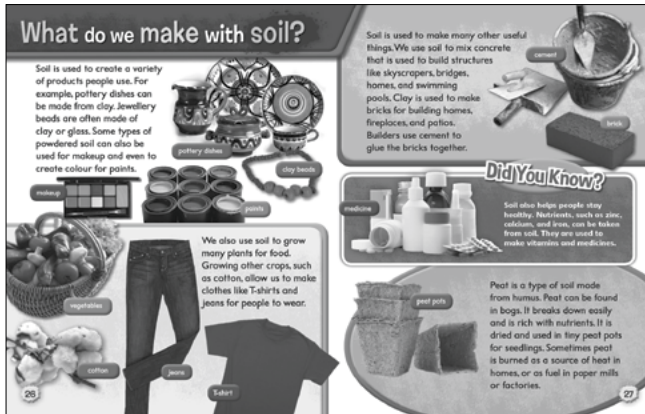
Local Disasters

Have students research local natural disasters involving moving water such as Hurricane Igor and the resultant flooding in 2010.

Claymation

Have students use a video camera, digital camera, or tablet to make a short animated video featuring clay figures, which they have modelled themselves. Students may want to demonstrate in the video what happens when a clay figure encounters too much water.

How Do Humans Use Soil?



Focus: Students will explore the many ways in which soil is used to enrich our everyday lives. They will conduct research, create and complete a chart, share information, discuss their ideas, and communicate their findings.

Specific Curriculum Outcomes

Students will be expected to:

- 12.0 use a variety of sources of science information and ideas [GCO 2]
- 18.0 demonstrate and describe ways humans use soils to make useful objects [GCO 1/3]

Performance Indicators

Students who achieve these outcomes will be able to:

- select reputable sources for factual information
- create a detailed poster that highlights one of the key uses of soil

NOTES:

Attitude Outcome Statements

Encourage students to:

- work with others in exploring and investigating [GCO 4]

Cross-Curricular Connections

English Language Arts

Students will be expected to:

- interact with sensitivity and respect, considering the situation, audience, and purpose [GCO 3]
- interpret, select, and combine information using a variety of strategies, resources, and technologies [GCO 5]

Art

Students will be expected to:

- create art for a variety of purposes and recognize there are many kinds of visual art [2.3.1]
- respectfully view their own and others' artwork and discuss the artists' intentions [4.3.2]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• Student Magazine, pages 26–29 • IWB Activity 6	• variety of small objects made from soil (e.g., pottery vase or bowl, clay flowerpot, empty medicine container, brick, tile, glass jar, a traditional Indigenous item made from soil such as a vessel for food, picture of fruits and vegetables or some “play” foods made of wood or plastic, pair of cotton socks, potted plant, peat pots/pellets) • students' Science Journals • old magazines or pictures from the Internet • digital camera or tablet (optional) • coloured pencils or markers • tactile items, such as small samples of string, yarn, fabric, pottery and jewellery, tape, or small snack bags (optional) • paintbrushes • soil samples (sand, silty loam, clay loam, potting soil, humus, or organic materials) • water and white glue (or other binder) • art paper	• Collect books about soil to display in your classroom Reading Centre (optional). • Gather some printed handouts from reputable sources on the Internet with information about soil.	

Safety

- Follow school protocol for Internet safety while researching.
- Ensure students wear protective goggles and take precautions when using fine pigments or powders that could irritate eyes.

Science Background

- Soil is a medium for growing crops that provide us with food and trees that provide us with wood and paper. Clay is used to make pottery dishes and clay beads for jewellery. Powdered soil is mixed with water to make paint and makeup. Cotton and hemp are harvested from fields and used to make thread that is woven to create fabric to make clothing. Sand, gravel, and other soils are used to create concrete, cement, and glass—building materials used for construction projects and art. Nutrients such as zinc, calcium, and iron can be extracted from soil and used in the production of vitamins. Soil is also the source for nearly all of our antibiotics. Kitty litter is made from clay.
- The Beothuk people, who inhabited Newfoundland from 5500–1000 BCE, used red ochre—a natural pigment containing iron oxide—to decorate artifacts, paint their canoes, and adorn the dead. They also used red ochre to paint their bodies. They are known as “Newfoundland’s Red Ochre People.”

Possible Misconceptions

- At the grade three level, many students may think that soil is only used to grow plants and crops for food. Without a doubt, crop production is an important use of soil, but there are many others. Help students to recognize that soil is used in pottery dishes, stoneware dishes, jewellery, paints, peat pots, peat pellets, makeup, clothing, medicine, and building materials (e.g., brick, concrete, glass) for construction.

ACTIVATE



Soil in Our Daily Lives

Ask students to think about how we use soil in our daily life. Begin a list on the board with students’ ideas. Then have students look at pages 26–27 of the Student Magazine. Read the title question: *What do we make with soil?* Then, point out the different text features, including photos, labels, and the *Did You Know?* information.

Set up a table or shelf with small objects made from soil or direct students to the objects at the Curiosity Centre. You might include a pottery vase or bowl, a clay flowerpot, an empty medicine container, a brick, a tile, a glass jar, a traditional Indigenous item made from soil such as a vessel for food, a picture of fruits and vegetables or some “play” foods made of wood or plastic, and a pair of cotton socks. Include a potted plant to complete the display. After reading the spread, and looking at the pictures, direct students to examine (and touch!) the objects you’ve collected in the classroom.



Explain that these items represent objects made from soil. Encourage students to brainstorm and suggest other items that could be included.

Make an Organizer Chart

Have small groups of students create an organizer in their Science Journals such as a two-column chart to organize and show the information they have gathered about the different ways in which people use soil. Students can add to this organizer as they work through the activities in this teaching plan.

Sample two-column chart:

Topic (Area of Use)	Examples of Use
Farming	- potatoes, carrots, cabbage, turnips - blueberries, cranberries, strawberries - hay, oats - herbs
Building	- clay used in construction to make adobe brick (mudbrick) - clay used to make adobe plaster to cover walls - sand used to make glass for windows

CONNECT



Research How People Use Soil

Tell students they will be working in small groups to research one area in which people use soil. Have them look back at pages 26–27 of the Student Magazine to see the variety of ways in which people use soil. On the board, display questions such as the following to prompt group discussion:

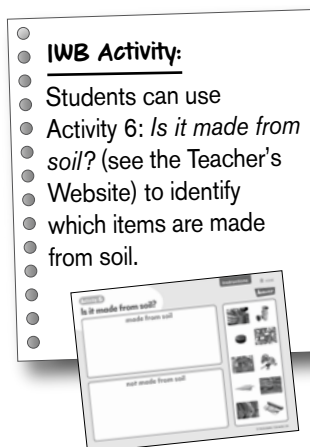
- What types of things are made from soil?
- Which ones are the most useful? Why do you think so?
- Do different types of soil have different uses?

Encourage each group to choose a different topic (area of use). This may require some negotiating between groups. If possible, allow students to resolve topic disputes themselves.

Have students work together in their group asking questions and then conducting research using books and the Internet. You might arrange a trip to the school or public library to find suitable resources. Circulate among the groups as they work, asking questions as necessary to prompt thinking.

Stay and Stray

After students have analyzed the information they gathered by researching, have them record their information on the organizer chart showing the topic and examples of use. Then have one student stay with a copy of the chart while the other members stray and visit other groups. Students can move throughout the classroom and engage actively with one another, sharing information and ideas. Continue until each group has gathered information



from all the other groups, and everyone has added the new information to their organizer charts.

CONSOLIDATE



Made From Soil

Introduce pages 28–29 of the Student Magazine and challenge students to work in pairs to find as many of the products made from soil as they can. Encourage students to keep a list of the products found to discuss as a group at the end of the activity. Read the Answer Key provided in the inside back cover of the magazine to confirm responses.

Poster Perfect

Have students work independently to create a poster that highlights one of the key uses of soil: agriculture, building, pottery/dishes, medicine, clothing, artwork, jewellery. Students can cut out pictures from old magazines, print pictures from the Internet, draw pictures, or take photos with a digital camera or tablet. Have students include some text and labels on their posters. Some students may wish to make their posters tactile, by including small samples of string, yarn, fabric, pottery, and jewellery, taped in place or enclosed in small snack bags and affixed to the poster.

Art Show

Invite students to paint their own artwork using natural pigments by adding a combination of water and white glue (or another binder such as egg white—ensure there are no egg allergies—linseed oil, or even milk) to dry soil samples of different colours. Make sure students wear protective goggles to keep their eyes safe from blowing powders or fine grains.

Once the artwork is completed, hold a Gallery Walk where students move through the classroom, viewing other students' artwork, asking questions, and providing descriptive feedback. Prompts for discussion could include:

- Which colour is your favourite?
- How did you make it?
- Which soil sample was the easiest to make into paint?
- How much water did you add?

Then, display the artwork in the hallway so that other students can see all the colours and textures that are possible when painting with soil.

EXPLORE MORE

Family Survey

Students can conduct a survey at home of their family's many uses of soil.

Community Interview—Uses of Soil

Invite students to interview a community member or family friend about how this person uses soil on a regular or daily basis. For example, students could interview a vegetable or grain farmer, pottery artist, tailor, window

installer, landscaper, gardener, horticultural club member, sod business representative, biologist, geologist, soil scientist, environmentalist, bulldozer operator, mine worker, plant nursery employee, plasterer, brick layer, T-shirt salesperson, fence installer, pharmacist, or medical doctor. Have students prepare a list of questions before the interview, and then have them record detailed notes during the interview. After, students can prepare a one-page report (written or oral) to present to the class.

Caring for Soil



Focus: Students will investigate why it's important to protect the health of soil. They will listen, research, discuss, and discover ways in which they can take action to keep soil clean.

Specific Curriculum Outcomes

Students will be expected to:

- 12.0 use a variety of sources of science information and ideas [GCO 2]
- 13.0 investigate and describe how living things affect and are affected by soils [GCO 1/3]
- 18.0 demonstrate and describe ways humans use soils to make useful objects [GCO 1/3]

Performance Indicators

Students who achieve these outcomes will be able to:

- describe ways in which people can take steps to improve and protect the health of soil

NOTES:

Attitude Outcome Statements

Encourage students to:

- recognize the role and contribution of science in their understanding of the world [GCO 4]
- be sensitive to the needs of other people, other living things, and the local environment [GCO 4]

Cross-Curricular Connections

English Language Arts

Students will be expected to:

- select, read, and view with understanding a range of literature, information, media, and visual text [GCO 4]
- create texts collaboratively and independently, using a variety of forms for a range of audiences and purposes [GCO 9]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• Student Magazine, pages 30–31 • IWB Activity 7 • IWB Activity 8 • BLM <i>Soil Footprint</i> • IWB Activity 9	• sample or photo of contaminated soil • students' Science Journals • materials for bulletin board display (e.g., construction paper, coloured pencils, markers, and pictures from old magazines or the Internet—optional)	• Invite a geologist, soil scientist, farmer, ecologist, naturalist, wetland advocate, or conservationist to your classroom to speak to students about their work with soil and the importance of keeping soil clean. • Invite an Elder or Indigenous Knowledge Keeper to speak about the need to protect soil.	• compost • composter • contamination

Science Background

- Soil is an important part of a healthy ecosystem and environment. People benefit enormously from products made from soil. For example, food is essential for our survival and we couldn't survive without eating foods grown in soil or animals raised from grasses, grains, and vegetables grown in soil.
- Human activities such as mining, gravel pitting, road construction, forestry, industry, and landfills can disturb and harm the soil. The extraction of gravel from parts of the limestone barrens in the 1970s, for example, had a negative impact on the fragile habitat—as did the construction of a new highway on the Northern Peninsula. When soil becomes toxic due to hazardous waste, fuel spills, heavy metals, etc., it can have long-lasting effects. For example, a sports field in Botwood, central Newfoundland, contains carcinogens in the soil. Poisonous runoff from contaminated land can, in turn, pollute ponds, rivers, lakes, and oceans.
- World Soil Day is an annual celebration held on December 5 that began in 2002. Its aim is to educate and increase awareness about soil and soil issues in order to protect soil and keep it healthy for future generations.

- Actions that people can take to protect soil include planting trees and plants to prevent soil from washing or blowing away. Putting organic waste in a backyard compost container and making nutrient-rich humus to spread on gardens help to keep soil healthy—it also reduces the amount of garbage sent to landfills. Another good idea is to reduce the number of paved surfaces that prevent rainwater from penetrating. A gravel driveway, or an interlocking brick driveway, is preferable to an asphalt driveway. Another plan is to create a “rain garden”—a shallow depression in which rainwater can collect. This feature prevents soil from washing away after heavy rainfalls, keeping it intact in the yard or garden.

Possible Misconceptions

- Some students and many adults think that if they add nutrients and fertilizers to soil, it will be healthy. But even if the soil contains lots of nitrogen, for example, it doesn’t mean it is the optimal soil for growing crops. How well it absorbs water is very important, as is its ability to allow water to flow through it and seep down into plant roots below. The amount of organic matter in the soil is also vital. The presence of organic matter means there is a high level of carbon, which, in turn, means the soil contains living things, like earthworms, that are mixing and aerating the soil. Well-mixed soil will contain many pores and the pores provide space for water, air, and organisms. When soil has a high capacity to hold water, the plants growing in it are better protected from drought. Well-mixed, porous soil also offers protection against soil loss from runoff caused by heavy rains and flooding.

ACTIVATE

World Soil Day

As a class, look at the Website for World Soil Day. (See <https://www.daysoftheyear.com/days/world-soil-day/>.) Discuss why such a day exists and why it is important. You might take some time to talk about caring for our Earth and explain that this includes caring for our soil, as well as our air and water, which might be more obvious.

Share pages 30–31 of the Student Magazine with the class. Give students time to examine this spread and look at the visuals. Share-read the text with the students, clarifying any concepts as necessary. Have students discuss the question: *Why should we protect our soil?* with a partner. Ask volunteers to share their thinking with the group. Then challenge students to think of some suggestions for how to take care of our soil.

If possible, show students a sample or photo of contaminated soil. Point out that the poisons in soil are often invisible. Toxic soil must be tested to reveal that it isn’t healthy. Explain that St. John’s is one of many areas that has a serious problem with lead in the soil. Ask students what visible signs might be clues that soil is not healthy. (soapy scum on soil; litter and garbage on surface of soil; near a pipe that is emitting toxic water; oil, gasoline, paint, or hazardous chemicals spilled on soil; batteries, refrigerators, motors, computers, and electronics leaking chemicals into soil)





Soil Experts—Visitor Talk

Invite a geologist, soil scientist, farmer, ecologist, naturalist, wetland advocate, or conservationist to your classroom to speak to students about their work with soil and the importance of keeping soil clean. Before the talk, encourage students to write down one or two questions each in their Science Journals.

Alternatively, or in addition, you might invite an Elder or Indigenous Knowledge Keeper to speak about the traditional belief of protecting that which provides life and health, including healthy soil, clean air, and safe water.

IWB Activity:

- Students can use Activity 7: *Mystery object* (see the Teacher's Website) to identify and learn about soil-related items.



CONNECT

IWB Activity:

- Challenge students to identify which activities are harmful or helpful to soil using Activity 8: *Harmful or helpful?* (see the Teacher's Website).



Soil Keepers

Have students research careers for people who care about and protect soil. They can use a graphic organizer of their choice to present the information they gather. For example, they may include people who clean up small or large oil or gas leaks from snow machines, lawn mowers, or ATVs. (Useful Internet search terms may include “chemical cleanup,” “hazardous chemical cleanup services,” or “hazardous waste management.”) They might research people who preserve vegetation and tree growth on steep slopes and actively plant more trees in vulnerable areas to hold soil in place and reduce the effects of erosion. (Internet search terms may include “erosion prevention volunteers,” “hillside protection,” “cliff face protection,” “wetland protection volunteers,” “habitat protection,” “environmentalists,” “ecologists.”) Students might also gather information about farmers who install windbreaks (i.e., trees, hedges, shrubs) to prevent soil from blowing away from their fields.

Soil Footprint

Talk about the fact that when we walk in soil we often leave behind a footprint. Connect this to the impact humans have upon the soil and Earth. Ask students what it means to “leave no footprint.” Have students examine how their own actions affect soil. Ask:

- Do you compost food scraps?
- What do you recycle?
- Do you let soapy or toxic water drain into soil?
- Do you put used batteries in the garbage (landfill) or take them to a recycling location?
- Do you pick up rocks from hillsides and throw them in the river, leaving the hillside more exposed and vulnerable to erosion?

Soil Footprint

Name: _____

1. Answer each of the questions below by circling “Yes” or “No”.

2. Score 1 point for each “Yes” answer and 0 points for each “No” answer.

3. Total your score and find your Soil Footprint!

Question	Yes	No
1. Do you compost food scraps?	☐	☐
2. Do you recycle?	☐	☐
3. Do you let soapy or toxic water drain into soil?	☐	☐
4. Do you put used batteries in the garbage (landfill) or take them to a recycling location?	☐	☐
5. Do you pick up rocks from hillsides and throw them in the river, leaving the hillside more exposed and vulnerable to erosion?	☐	☐

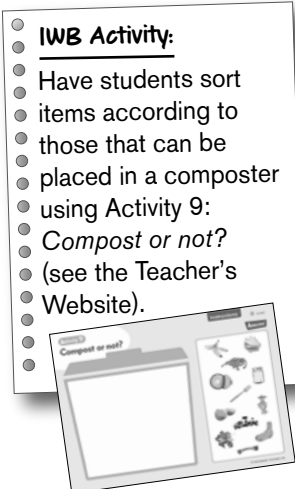
My Soil Footprint is: _____

4. Draw a picture of your Soil Footprint in the box below.

5. Write a sentence about your Soil Footprint in the box below.

6. Share your Soil Footprint with a friend.

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Have students use copies of BLM *Soil Footprint* to create a questionnaire to determine how the actions of people affect soil. Hand out copies of the BLM and have students choose three questions to record on their questionnaire. Once the questionnaire is complete, students can record their answers to the questions and find their soil footprint. Then they can have a partner try their questionnaire and compare the results. Ask:

- **Is there room for improvement?**
- **What changes could you make at school to improve the health of soil.**

Students can work together to create a class questionnaire and share it with other classes in the school or in the province to encourage more people to lessen their soil footprint.

CONSOLIDATE

Inform Others

Have students create a bulletin board display or decorate a hallway display case with information about World Soil Day or simply to share information about soil. They may wish to use construction paper, coloured pencils, markers, and pictures from old magazines or printed from the Internet.

EXPLORE MORE

National Soil Concerns

Have students investigate soil issues in other regions of Canada. Students might conduct research and interview students or other people who live in other provinces. Have students find out what others are doing to protect soil. Students might consider how farmers prevent soil from blowing away in Saskatchewan where it is very flat. Others might explore ways in which mining companies in Alberta can prevent toxic chemicals from seeping into the soil. Still others might look at how forestry companies in B.C., Quebec, and/or New Brunswick need to take action to prevent erosion after cutting down many trees in a large area.

WRAPPING UP THE UNIT



Revisit any remaining questions posted on the I Wonder Wall and have students discuss answers in small groups or with a partner. If there are questions that cannot be answered, these can remain on the wall to be discussed and researched further. Discuss what students have learned about the properties and uses of soil, how water changes soil, the ways that soil affects and is affected by living things, and actions to protect soil.

Soil Footprint

Name: _____

1. Answer each of the questions below by circling “Yes” or “No.”
2. Score 1 point for each answer that promotes healthy soil and 10 points for each answer that doesn’t promote healthy soil.
3. Total your results and find your soil footprint.

Question: _____	
Yes	No

↓

Question: _____	
Yes	No

↓

Question: _____	
Yes	No

What’s your soil footprint?



3 Congratulations! You are doing good work to keep soil healthy.

12 Good job. You are making an effort. Look for more ways to help soil.

21–30 Yikes! Find ways to be kind to soil. You can do it!

Specific Curriculum Outcomes Checklist

Name: _____ Date: _____

Rating: 1 – not evident; 2 – with assistance; 3 – mostly on own; 4 – on own consistently

Specific Curriculum Outcomes	Rating and Observations
1.0 pose questions that lead to exploration and investigation [GCO 2]	
2.0 communicate using scientific terminology [GCO 2]	
3.0 investigate a variety of soils and find similarities and differences among them [GCO 1/3]	
4.0 communicate while exploring and investigating [GCO 2]	
5.0 investigate and describe soil components [GCO 1/3]	
6.0 use appropriate tools [GCO 2]	
7.0 describe the effect of moisture on the characteristics of soil [GCO 1/3]	
8.0 sequence or group materials and objects [GCO 2]	
9.0 compare the absorption of water by different soils [GCO 1/3]	
10.0 make and record observations and measurements [GCO 2]	
11.0 construct and label concrete-object graphs, pictographs, or bar graphs [GCO 2]	
12.0 use a variety of sources of science information and ideas [GCO 2]	
13.0 investigate and describe how living things affect and are affected by soils [GCO 1/3]	
14.0 propose an answer to an initial question or problem and draw a simple conclusion [GCO 2]	
15.0 investigate the effects of moving water on different soils [GCO 1/3]	
16.0 predict based on an observed pattern [GCO 2]	
17.0 communicate procedures and results [GCO 2]	
18.0 demonstrate and describe ways humans use soils to make useful objects [GCO 1/3]	

My Inquiry

Name: _____

My question:

My plan:

My results:

My conclusion:

How I will share what I learned:

Student Self-Assessment of Inquiry Process

Name: _____

Check the box that applies to each statement.

	I'll do better next time	Okay	Awesome
Step 1			
I asked a question.			
I made a plan.			
Step 2			
I followed my plan.			
I recorded my results.			
Step 3			
I thought about my results.			
I made a conclusion.			
Step 4			
I shared what I learned.			

Teacher Assessment of Inquiry Process

Name: _____ Date: _____

	1	2	3	4
Initiating and Planning				
• poses a question that leads to exploration or investigation				
• makes a prediction based on an observed pattern				
• makes a simple plan				
• identifies materials and suggests a plan for how they will be used				
Performing and Recording				
• carries out the plan/follows a simple procedure				
• uses appropriate tools				
• makes and records observations				
• estimates and records measurements				
• uses a variety of sources of science information and ideas				
• follows safety procedures and rules				
Analyzing and Interpreting				
• sequences or groups materials and objects				
• identifies the most useful method of sorting for a specific purpose				
• constructs and labels concrete-object graphs, pictographs, or bar graphs				
• identifies and suggests explanations for patterns and discrepancies in objects and events				
• distinguishes between useful and not useful information when answering a science question				
• proposes an answer to the initial question and draws a simple conclusion				
• poses new questions that arise from what was learned				
Communicating and Teamwork				
• communicates while exploring and investigating				
• communicates using scientific terminology				
• communicates procedures and results				
• responds to ideas and actions of others and acknowledges their ideas and contributions				

Comments:

Inquiry Process Rubric

	Level 1	Level 2	Level 3	Level 4
INITIATING AND PLANNING	talks about things that are of interest makes guesses about the outcome of an inquiry with prompting, offers ideas for a procedure with prompting, identifies some materials which could be used to carry out the plan	asks simple questions about objects and events that are observable makes simple predictions about the outcome of an inquiry, but they may be hoped-for outcomes contributes ideas for a procedure but they may not be complete identifies some materials and describes how they could be used to carry out the plan	uses observations to ask questions to investigate, but questions are not always realistic makes simple predictions about the outcome of an inquiry based on prior observations provides ideas for a simple procedure selects materials and describes how they will be used to carry out the plan	uses observations and prior knowledge to ask questions to investigate makes thoughtful predictions about the outcome of an inquiry based on prior observations and knowledge provides clear, sequential steps for a simple procedure selects appropriate materials to carry out the plan and explains reasons for choice
PERFORMING AND RECORDING	carries out the plan/ follows a simple procedure with prompting with prompting, uses some appropriate tools with assistance makes simple observations using senses and, with prompting, records observations in provided charts or in drawings needs help to estimate measurements and, with prompting, records simple measurements gets information from a teacher-chosen science source needs help to follow safety procedures and rules	carries out the plan/ follows most of a simple procedure selects and uses common tools makes some relevant observations using senses and records observations in provided charts or in drawings estimates measurements but units may not be appropriate, and records measurements which may be incomplete uses some relevant information from familiar science sources needs occasional prompting to follow safety procedures and rules	carries out the plan/follows a simple procedure selects and uses some appropriate tools makes relevant observations using appropriate senses and records observations using suitable method estimates measurements using appropriate units and records measurements accurately uses relevant information from science sources of the same type follows most safety procedures and rules	carries out the plan/ follows a simple procedure, making adjustments as necessary selects and uses all appropriate tools makes relevant, detailed observations using appropriate senses and chooses an effective method for recording observations consistently estimates measurements using the most appropriate units and records measurements accurately in a variety of ways uses relevant information from a variety of science sources follows all safety procedures and rules and explains why they are needed

Continued on next page...

Inquiry Process Rubric (Continued)

	Level 1	Level 2	Level 3	Level 4
ANALYZING AND INTERPRETING	sequences or groups materials and objects based on simple teacher-chosen attributes	sequences or groups materials and objects based on a few simple attributes	sequences or groups materials and objects based on multiple attributes	accurately sequences or groups materials and objects based on multiple attributes
	needs help to sort materials according to simple criteria	sorts materials according to some of the criteria	identifies a method of sorting materials according to the criteria	identifies the most useful method of sorting materials according to the criteria
	with prompting, constructs a concrete-object graph, pictograph, or bar graph	constructs a concrete-object graph, pictograph, or bar graph but title and labels may be missing or inappropriate	constructs a concrete-object graph, pictograph, or bar graph with appropriate title and labels	constructs a concrete-object graph, pictograph, or bar graph with appropriate title and labels to accurately reflect results
	with prompting, identifies some patterns and discrepancies in objects and events	identifies and suggests simple explanations for some patterns and discrepancies in objects and events	identifies and suggests explanations for most patterns and discrepancies in objects and events	identifies and suggests clear explanations for patterns and discrepancies in objects and events
	with prompting, distinguishes between some useful and not useful information when answering a science question	distinguishes between some useful and not useful information when answering a science question but not all information may be relevant	focuses on relevant information and distinguishes between useful and not useful information when answering a science question	consistently distinguishes between useful and not useful information by focusing on strictly relevant information when answering a science question
	describes what happened	draws a simple conclusion based on observations but may not link conclusion to the initial question	draws a conclusion based on observations which link to the initial question	draws a conclusion based on observations and states if it supports or refutes their prediction
	with prompting, identifies some new questions but they may not be about this inquiry	identifies some simple new questions on the topic of this inquiry	identifies some new questions on the topic of this inquiry that could be investigated	identifies new questions on the topic of this inquiry and suggests how they could be investigated

Inquiry Process Rubric (Continued)

	Level 1	Level 2	Level 3	Level 4
COMMUNICATING AND TEAMWORK	willingly asks for help and accepts help from other group members understands some scientific terminology but rarely uses it with prompting, describes the result and some of the procedures listens to others and learns from their observations	makes suggestions to group members as to what should be done understands simple scientific terminology but does not always use it correctly communicates basic information about the result and most of the procedures listens to others and learns from their observations, and draws on their language use	communicates with group members, sometimes with problems usually uses scientific terminology appropriately communicates most of the information about the result and procedures considers and responds to the ideas of others and learns from their observations and descriptions	communicates and works effectively with group members consistently uses scientific terminology appropriately accurately communicates the information about the result and procedures considers and responds to the ideas of others and applies the observations and descriptions to their own ideas and understandings

Additional Resources

Non-fiction Books

Different Kinds of Soil, by Molly Aloian (Crabtree Publishing Company, 2010)
Dirty Science, by Shar Levine and Leslie Johnstone (Scholastic, 2013)
Science and Craft Projects with Rocks and Soil, by Ruth Owen (PowerKids Press, 2013)
The Dirt on Dirt, by Paulette Bourgeois (Kids Can Press, 2008)
Yucky Worms, by Vivian French (Candlewick, 2012)

Picture Books

Charlie's Dirt Day, by Andrew Larsen (Fitzhenry & Whiteside, 2015)
Compost Stew: An A to Z Recipe for the Earth, by Mary McKenna Siddals (Dragonfly Books, 2014)
Composting: Nature's Recyclers, by Robin Koontz (Picture Window Books, 2007)
Marshes & Swamps, by Gail Gibbons (Holiday House, 1998)
Miss Rumphius, by Barbara Cooney (Puffin Books, 1985)
Mud Puddle, by Robert Munsch (Annick Press, 2012)
Stepping Stones: A Refugee Family's Journey, by Margriet Ruurs (Orca Books, 2016) - See the stone collage illustrations.

Chapter Books

Timo's Garden by Victoria Allenby (Pajama Press, 2015)

Websites for Students

DragonFlyTV: Worm Farm
<http://pbskids.org/dragonflytv/show/wormfarm.html>
Geology for Kids, The Study of Our Earth: The Earth's Soil
<http://www.kidsgeo.com/geology-for-kids/0002-the-earths-soil.php>
Love to Know: 10 Ways to Conserve Soil
http://greenliving.lovetoknow.com/10_Ways_to_Conserve_Soil
National Geographic Kids: Earthworm
http://kids.nationalgeographic.com/animals/earthworm/#earthworm_1_closeup.jpg
Topic 5: Soils Under the Microscope
http://www.soil-net.com/primary/ks2/topic5/topic5_factsheet.pdf
Types of Soil
<https://www.youtube.com/watch?v=dsfJRwZXaVk>
Types of Soil: Clay, Sandy, Loam—Activity & Quiz
<https://www.youtube.com/watch?v=uS7zfeK4OTQ>

Websites for Teachers

Apply Effective Conservation Methods: 20 + Remarkable Ways to Conserve Soil
<http://www.conserve-energy-future.com/remarkable-ways-to-protect-soil.php>

Buzzle: These Facts about Soil Will Make You Marvel at Its Importance
<http://www.buzzle.com/articles/facts-about-the-soil.html>

Days of the Year: World Soil Day
<http://www.daysoftheyear.com/days/world-soil-day/>

Uses of Soil
<http://www.hunker.com/12586014/5-uses-of-soil/>

From the Ground Up: The Science of Soil
<http://www.thescienceofsoil.com/teacher-resources>

How Stuff Works: How Vermicomposting Works
<http://home.howstuffworks.com/vermicomposting1.htm>

Modern Farmer: How to Build a Worm Farm
<http://modernfarmer.com/2013/05/how-to-build-a-worm-farm/>

My Agriculture Information Bank: Soil Moisture
<http://www.agriinfo.in/?page=topic&superid=4&topicid=274>

National Geographic: Soil
<http://nationalgeographic.org/topics/soil/>

Scientific American: Soil Science—How Moist Is that Mud?
<https://www.scientificamerican.com/article/soil-science-how-moist-is-that-mud/>

Soil Facts
<http://agverra.com/blog/soil-facts/>

Soil Science Society of America: Soil and Products We Use
<https://www.soils.org/files/sssaiys/october-soils-overview.pdf>

The Beothuk Indians—“Newfoundland’s Red Ochre People”
http://www.historica.ca/the_beothuk.php

The International Year of Soils: Soils and the Products We Use
<https://www.ksre.k-state.edu/news/news-stories/2015-news-releases/october/soil-products102915.html>

USDA: Natural Resources Conservation Service Kansas—Soil Does More Than Get You Dirty
http://www.nrcs.usda.gov/wps/portal/nrcs/detail/ks/newsroom/?cid=nrcs142p2_033573

Dear parents and caregivers,

We are about to start an interesting new unit in science where we will be investigating soils.

Through a variety of hands-on explorations and investigations, your child will be learning about the differences and similarities between types of soils, the various components of soil, the way water changes the properties of soil, how soil affects and is affected by living things, and the numerous ways in which people use soil. Your child will also be challenged to think of ways to protect and improve the quality of soil.

You can talk to your child at home about how your family uses soil and benefits from soil. You may be able to explain the ways in which soil enriches your life, perhaps through growing a flower or vegetable garden, visiting the beach, or by pointing out the products you use that come from soil (i.e., fruits, vegetables, and grains) that nourish your family. You can also help your child to conduct a survey of your family's many uses of soil.

To ensure a wide range of experiences and make connections between this topic and your child's world, he/she may choose to bring one or more personal items to school for exploration during in-class activities. These items will be returned home once explorations are completed. To determine whether the item(s) is appropriate please contact me, your child's teacher.

Sincerely,



Grade **3** Components

- **Overview Guide**
- **Read Aloud Collection**
- **4 Unit Guides**
- **4 Student Magazines**
- **Science Library Collection and Guide**
- **Teacher's Website**
 - Interactive Whiteboard Activities
 - 4 Anchor Videos
 - Image Bank
 - Digital version of: Overview Guide, 4 Unit Guides, 4 Student Magazines, and Science Library Guide
- **2 Classroom Posters**
 - What Is the Inquiry Process?
 - What Is the Design Process?



 **SCHOLASTIC**
Education