Anglophone School District - North

Grade 4 Science - Unit Lesson Guide

Rocks, Minerals, and Erosion

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The Aim of Science Education - Scientific Literacy

The aim of science education in the Atlantic Provinces is to develop scientific literacy.

Scientific Literacy is an evolving combination of the science-related attitudes, skills, and knowledge students need to develop inquiry, problem-solving, and decision-making abilities; to become lifelong learners; and to maintain a sense of wonder about the world around them. To develop scientific literacy, students require diverse learning experiences that provide opportunities to explore, analyze, evaluate, synthesize, appreciate, and understand the interrelationships among science, technology, society, and the environment.

The Three Processes of Scientific Literacy

An individual can be considered Scientifically Literate when he/she is familiar with, and able to engage in, three processes: Inquiry, problem solving, and decision making.

Inquiry

Scientific inquiry involves posing questions and developing explanation for phenomena. While there is a general agreement that there is no such sing as the scientific method, students require certain skills to participate in the activities of science. Skills such as questioning, observing, inferring, predicting, measuring, hypothesizing, classifying, designing experiments, collecting data, analysing data, and interpreting data are fundamental to engaging science. These activities provide students with opportunities to understand and practise the process of theory development in science and the nature of science.

Problem Solving

The process of problem solving involves seeking solutions to human problems. It consists of proposing, creating, and testing prototypes, products, and techniques to determine the best solution to a given problem.

Decision Making

The process of decision making involves determining what we, as citizens, should do in a particular context or in response to a given situation. Decision-making situations are important to their own right, and they also provide a relevant context for engaging in scientific inquiry and/or problem solving.

Science Assessment Overview

Science is a hybrid term that houses different disciplines such as: Physics, Chemistry, Biology, Environmental Studies, Engineering, Math, etc. Given this broad spectrum, it is not realistic that we can paint science assessment with a single brush in terms of probes that work for every science activity. However, regardless of school subject, let alone science, the frequency of assessment should be unbalanced with formative assessment occupying 80% of practise and summative with the remaining 20%.

80% Formative - 20% Summative

Formative Assessment
Formative assessment is a range of formal and informal assessment procedures employed by teachers during their learning process in order to modify teaching and learning activities to improve student attainment. It typically involves qualitative feedback (rather than scores) for both students and teacher that focuses on the detail of content and performance. Feedback is the central function of formative assessment. It typically involves a focus on the detailed content of what is being learnt.

Science Formative Assessment falls into 2 distinct categories, and they are divided about how feedback is given. Please be aware that an activity could be informal or formal, it is the purpose of the task that determines purpose.

Informal Formative
Informal Formative Science Assessment acts as a monitoring probe and is distinct because it is not graded.

Formal Formative
Formal Formative Science Assessment provides specific feedback to students, the teachers corresponds via anecdotal feedback, rubrics, and written responses to offer progress to student attainment.

Summative Assessment
Summative assessment seeks to monitor educational outcomes, often for the purposes of external accountability. Usually occurring at the end of a learning unit and determines if the content being taught was retained.

Rocks, Minerals and Erosion

Focus and Context

The unit provides many opportunities for students to practice inquiry skills. From observing, recording descriptions, and classifying rocks and minerals in their local habitat, to exploring the make-up of soil and the fossils found in it, students can hone their inquiry skills.

This unit can be set in the context of social studies. In this context, students can explore the impact of both humanity and nature on the Earth, and will come to realize the Earth is a dynamic, ever-changing planet.

Unit Instructional Overview

Collecting and Comparing Rocks and Minerals	Properties of Rocks and Minerals	Uses for Rocks and Minerals	Erosion and Weathering	Soil Formation and Composition	Record in Rocks	Sudden and Significant Changes in the Land
Differentiating Rocks and Minerals	Prior Knowledge	Practical Uses of Rocks and Minerals	Understanding How Rocks are Broken Down and How they Move	Exploring How Soil is Formed	Making Fossils	Understanding How Natural Events Can Changed Landscapes
	Access Prior Knowledge	Evaluating Mining's Effects				
	1st Cycle - Classifying Rocks					
	2nd Cycle - Building Rocks					
	3rd Cycle - Testing Rocks and Minerals Activity					

* - EECD Grade 4 Inquiry package - available at https://portal.nbed.nb.ca/tr/lr/k-8Science/Pages/default.aspx

Rocks, Minerals, and Erosion - Curriculum Outcomes

<table>
<tr><td>Collecting and Comparing Rocks and Minerals</td><td colspan="2">108-3 demonstrate respect for the habitats of animals and the local environment when collecting rocks and/or minerals from their local area</td><td>104-6 describe the distinction between minerals and rocks</td></tr>
<tr><td>Properties of Rocks and Minerals</td><td>204-8, 205-5, 300-6 Use appropriate tools while making observations and collect information to describe rocks and minerals according to physical properties</td><td>205-7 record observations of their rocks and minerals in chart form, using notes in point form</td><td>300-5 compare different rocks and/or minerals from their local area with those from other places</td></tr>
<tr><td colspan="2">206-1, 207-2 classify their rocks and minerals according to several properties and create a chart or diagram that shows the method of classification</td><td colspan="2">104-4 compare their classification schemes of the rocks/minerals to those of others and recognize that results may vary</td></tr>
<tr><td>Uses for Rocks and Minerals</td><td colspan="2">107-1 describe how rocks and minerals are used</td><td>300-8 relate the characteristics of rocks and minerals to their uses</td></tr>
<tr><td colspan="4">104-6, 108-1 use appropriate terms to describe the positive and negative effects of the extraction and/or utilization of rocks and minerals</td></tr>
<tr><td>Erosion and Weathering</td><td colspan="2">301-5 describe the effects of wind, water, and ice one the landscape</td><td>301-6 demonstrate a variety of methods of weathering and erosion</td></tr>
<tr><td>Soil Formation and Composition</td><td colspan="3">301-4 describe ways in which soil is formed from rocks</td></tr>
<tr><td>Records in Rocks</td><td colspan="3">300-7 identify and describe rocks that contain records of the Earth’s history</td></tr>
<tr><td>Sudden and Significant Changes in the Land</td><td colspan="3">301-7 describe natural phenomena that cause sudden and significant changes to the landscape</td></tr>
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Rocks, Minerals, and Erosion
Strand - Collecting and Comparing Rocks and Minerals

General Curriculum Outcomes	Specific Curriculum Outcomes
108-3 describe how personal actions help conserve natural resources and care for living things and their habitats	108-3 demonstrate respect for the habitats of animals and the local environment when collecting rocks and/or minerals from their local area
104-6 demonstrate that specific terminology is used in science and technology contexts	104-6 describe the distinction between minerals and rocks

Differentiating Rocks and Minerals

Outcomes:
108-3 demonstrate respect for the habitats of animals and the local environment when collecting rocks and/or minerals for their local area
104-6 describe the distinction between minerals and rocks

Lesson Activity Overview
The focus of this lesson if for students to differentiate the difference between a rock and a mineral. Although his does not have a knowledge based outcome, being able to understand the differences is critical success in this unit.

To begin students can go on a rock hunt around the school grounds. This outside excursion presents an opportunity to reinforce outcomes from the unit on Habitats studied in Grade 4. Students can take the time to explore plants and animals in the habitat from which they are collecting rocks, while taking care not to disrupt this habitat.
Note: Rocks may not be removed in provincial and federal parks. (108-3)

This will only generate a few different types of rock because of the construction of the school, parking lot, playground. These rocks have been brought in. A way to expand the sample size it to have students bring rock samples to school from their driveway, backyard, and gardens. Encourage them to bring as wide an assortment as possible.
If students live near a beach or lake, they can bring in samples of beach rocks. They can compare and contrast the differences between beach rocks and the silty soil usually found in lakes. Later in the unit they will be exploring erosion and the effect of water on the land. This would be a good lead-in to the topic. They can also bring in rocks from mountainous areas, building lots, and farmland.

Start a collection of different rocks and minerals. Plan a way to display your rocks. You may decide to leave space for written notes under each rock or you may decide to do a display with your own field guide. At this time, note where each rock was found, and, if possible, identify which are rocks and minerals.

This lesson is intended to be the introduction into the identification of rocks and minerals. This lesson is not intended that students be able to look at a rock and identify it. Rather it is that students begin to build the capacity to understand the difference between a rock and a mineral.

Using a variety of mineral and rock samples, students will investigate the similarities and differences between them. ***Rocks are made up of one or more minerals.*** Students should look through their collection to try and identify which ones they think are rocks and which ones they think are minerals. This will only be obvious when a rock is visibly composed of more than one mineral. Some rocks are composed of only one mineral (e.g., limestone is composed of calcite or calcium carbonate). Field guides may help students to identify the

rocks and minerals; however, many rocks and minerals can be difficult to identify when they are weathered.

Assessment:Informal Formative
Ensure that students are able to differentiate that a rock is made up of many different minerals (104-6)

Use an Observation Checklist that could be used when watching students collect rocks.
– Student takes care not to leave garbage.
– Student does not unnecessarily damage plants, trees, and shrubs while rock hunting on school grounds or other suitable location. (108-3)

Rocks, Minerals, and Erosion
Strand - Properties of Rocks and Minerals

General Curriculum Outcomes	Specific Curriculum Outcomes
204-8 identify appropriate tools, instruments, and materials to complete investigations	204-8, 205-5, 300-6 use appropriate tools while making observations and collect information to describe rocks and minerals according to physical properties
205-5 make observations and collect information relevant to a given question or problem	
300-6 describe rocks and minerals according to physical properties such as colour, texture, lustre, hardness, and crystal shape (minerals)	
205-7 record observations and collect information relevant to a given question or problem	205-7 record observations of their rocks and minerals in chart form, using notes in point form
300-5 compare different rocks and minerals from the local area with those from other places	300-5 compare different rocks and/or minerals from their local area with those from other places
206-1 classify according to several attributes and create a chart or diagram to show the method of classifying	206-1, 207-2 classify their rocks and minerals according to several properties and create a chart or diagram that shows the method of classification
207-2 communicate procedures and results, using lists, notes in point form, sentences, charts, graphs, drawings, or oral language	
104-4 compare the results of their investigations to those of others and recognize results may vary	104-4 compare their classification schemes of the rocks/minerals to those of others and recognize that results may vary

New Nouveau Brunswick
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Science Resource Package: Grade 4

Rocks, Minerals and Erosion:

Properties of Rocks and Minerals

ⓘ Background Information

Prior Knowledge:

Students are not expected to have specific prior knowledge related to this unit. Students may:

- Know that rocks can be found in various locations.
- Know that rocks do not all have the same size, color or shape.
- Have rock collections or samples.
- Be able to name a few rocks or minerals.
- Realize there is a relationship between fossils and rocks.
- Have their own classification scheme based on size – e.g. pebbles, boulders

Common Misconceptions:

- All rocks are hard.
- All rocks are the same.
- Rocks stay the same.
- Rocks are big.

Did You Know?

A lot of teachers are not comfortable teaching rocks and minerals, mostly because of the enormous number of "unidentifiable" rocks and minerals their students may bring in. Here are some websites that you can use with your students to help them identify the rocks and minerals they may bring it. These sites may not yield the "right" answer but are excellent resources for showing students steps taken by geologists when trying to identify rocks and minerals and also prompts them to make very careful observations.

Natural Resources NB provides the key (the list of rocks) for the Rocks and Minerals kits every school received from DNR. The website also provides some ideas for activities that can be done using the samples provided by Natural Resources. http://www.gnb.ca/0078/Hey_Kids/TeachersRocks-e.asp (bilingual)

DNR also has a website with a list of NB minerals. Each mineral has a pdf file with pictures and descriptions of the mineral and its uses. http://www.gnb.ca/0078/minerals/Mineral_Wealth-e.aspx

Also available is a poster of rocks all around us in New Brunswick. http://www.gnb.ca/0078/minerals/PDF/2005_23-e.pdf

Note that DNR will replace lost rock and mineral samples from the kit if they have them available. They may also be contacted to obtain a geological map of New Brunswick. Contact Pam Dickinson Pam.Dickinson@gnb.ca or Toon Pronk Toon.Pronk@gnb.ca in the Fredericton office. They are also willing to be a guest speaker in classes if their schedules allow it.

http://www.classzone.com/books/earth_science/terc/content/investigations/es0610/es0610page01.cfm - This website has some wonderful pictures to help students determine the characteristics of their samples, making it easier to narrow down what the sample likely is.

http://cgq-qgc.ca/tous/terre/template/minerodex/minerodex.cfm helps identify minerals step by step by answering questions about the mineral. (French)

http://www.minsocam.org/MSA/collectors_corner/id/rock_key.htm helps identify rocks step by step by answering questions about the rock.

http://www.gac.ca/PopularGeoscience/ contains a series of “Popular Geoscience” fact sheets (French or English). These are downloadable fact sheets through the Geological Survey of Canada about a variety of rocks, minerals and gemstones.

Rocks versus minerals

Rocks are made up of minerals. If minerals are cut into pieces or thin slices, they will look the same throughout and those same elements will always make up that mineral. There is an even distribution of the particles that make up minerals. Some minerals are made from only one element and you can find that element on the periodic table; for example, graphite is made from Carbon atoms. Some minerals are made from more than one element, such as salt (sodium chloride) but those particles bond together chemically the same way over and over again to make a large repeating structure that is the same regardless of how you look at it or cut it. There are over 2000 different minerals, but only about 12 are commonly found in the crust of the Earth.

A useful analogy for understanding rocks and minerals is to think about different kinds of salads. A Caesar salad has romaine lettuce, croutons, and parmesan cheese. Depending on who makes the salad, there may be more or less of the different ingredients giving it a different look and flavour. If that salad is pulled from the bowl and placed into 3 separate dishes, each dish, when you dig through it and examine it, will look slightly different and may have different amounts of ingredients or at least have those ingredients mixed around in the bowl. Take a fork full of salad and each bite will be a little bit different.

In this analogy, the salad is the rock and each ingredient is a mineral. While the type of salad is defined by the ingredients, much like a rock is defined by its minerals, the ingredients can me mixed around and are not always found in the same place in the salad. Each rock sample will look similar to another rock of the same kind, but the distribution of the minerals will be slightly different.

Looking at the individual minerals, they will always be the same. The romaine lettuce will always look like romaine lettuce, regardless of how it is mixed or chopped. The parmesan cheese may be slightly clumpy or spread around unevenly in the salad, but it will always look the same when you look closely at the structure.

Testing for Properties of Minerals

A useful way to identify minerals is to do a series of tests.

1) Colours of minerals are not typically useful indicators since many minerals come in a variety of colours.
2) Streak tests use an unglazed ceramic tile to determine the colour of the streak left behind when a mineral is rubbed on the tile. Every mineral has a characteristic streak colour. For example, pyrite or fool's gold has a dark green streak while real gold has a yellowish streak. Doing streak tests on rocks is not very useful since depending on how you hold the rock, you may get different colours as the minerals in rocks are not evenly distributed.
3) Lustre is the way a mineral looks when light reflects off of it. Minerals can be metallic or non-metallic with the non-metallic minerals being further divided into waxy, glassy, pearly, greasy or earthy.
4) Cleavage is how a mineral breaks or cleaves into pieces. Most minerals will cleave in predictable patterns and can be flaky, cubic, rhombic or step-like.
5) Hardness comes in the form of Moh's hardness scale with the softest mineral, talc, being a "1" and the hardest mineral, diamond, being a "10". Any mineral will scratch a mineral that falls lower on the hardness scale. In your kit there is quartz which is a 7 and gypsum which is a 2 and calcite which is a 3. A fingernail ranks about a 2.5, a penny is about 3.5 and a nail is about 5.
6) Effervescence or "fizziness" is determined by an acid test. If it fizzes then it is a calcium carbonate-based mineral.

Rocks

Rocks are always changing. Similar to the life cycle, rocks go through the rock cycle. They break down due to erosion and can form through lava or magma cooling (making igneous rocks), through intense heat and pressure changing a rock to a different kind of rock (metamorphic rock) or could be formed by the cementing together of particles that were eroded from other rocks, from the particles left behind by evaporation or by secretions from animals that lived in the sea (sedimentary rocks). These processes are continuous and ongoing, making rocks and minerals an interesting and informative way to learn about the past.

If most rocks are cut into pieces, each piece would look a little bit different since the minerals are not distributed uniformly throughout. It may take a magnifying glass or a microscope to see this unequal distribution. Some rocks, such as sandstone or limestone, look very uniform, but when examining the properties (such as texture, cleavage, hardness, etc.) of the rocks more closely, there will be variations in the way it forms, the elements that make up the same type of rocks and the way the elements bond together.

For our purposes, the samples chosen to illustrate the differences between rocks and minerals have been chosen to simplify the differences between rocks and minerals and to illustrate tests that can be done.

Observations to Help Identify Rocks

1) Size of the grains (visible or not)
2) If the grains are visible, if they look melted together or glued together
3) If the grains are scattered or if they seem to be in patterns
4) If the rock is glassy, bubbly, hard, layered, brittle or shiny
5) If it feels gritty
6) If it fizzes with acid

Instructional Plan

Access Prior Knowledge

✪ Curriculum Outcomes

108-3 Describe how personal actions help conserve natural resources and care for living things and their habitats
205-5 Make observations and collect information relevant to a given question or problem
205-7 Record observations using a single word, notes in point form, sentences, and simple diagrams and charts
300-6 Describe rocks and minerals according to physical properties such as colour, texture, luster, hardness, and crystal shape (minerals)

Materials:

Rock samples from home
Index cards/paper

- Ask students to bring in an interesting rock from home. (You may wish to have some extra rocks available in case students forget.)

For safety purposes, you may wish to specify the maximum size of the rock and/or the manner in which you wish the rock to be transported to school.

Students should also understand their impact on the environment and how to collect rocks while not disturbing the surrounding area. For example, they should take care not to leave garbage, nor damage plants, trees, or shrubs while collecting samples. In addition, the safe collection of samples should be discussed, such as avoiding rocks near the edge of the road, or that are in piles that may slide or topple.

- Give each student an index card on which to list descriptive words, draw a picture of and/or write a description of his/her rock.

As a cross curricular link to literacy, a writing mini-lesson on effective, descriptive word choice can be completed. After the following group activity, students may need to add to or revise their rock descriptions.

- In small groups: Have students put their rocks into the same open container and their index cards into a pile. (You may wish students to label their rocks with a lettered or numbered sticker.) Each student picks a card from the pile and, using the drawing/description of the rock, picks out the rock that corresponds with the description.

Cross-curricular links:
ELA

2. Students will be expected to:
a) Contribute to conversations, small-group and whole-group discussion, showing an awareness of when to speak and when to listen
b) Use word choice, tone of voice, facial expressions, and gestures appropriate to the speaking occasion
c) Give and follow instructions and respond to questions and directions

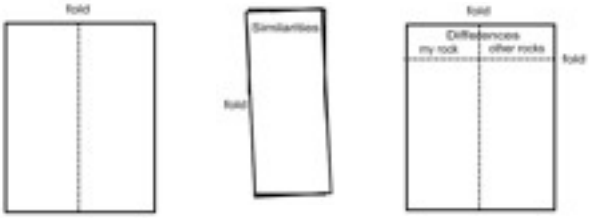
3a. Students will be expected to:
Show basic courtesies of conversation in group interactions

8c. Students will be expected to:
Experiment with language appropriate to audience, purpose, and form that enhances meaning and demonstrates imagination in writing and other ways of representing.

9a. Create written and media texts, collaboratively and independently, in different modes and in a variety of forms
- Recognize that particular forms require the use of specific features, structures, and patterns

b) Invite responses to early drafts of their writing/media productions
- use audience reaction to help shape subsequent drafts

Similarities and differences among the rocks in their groups can be recorded on a foldable. Folds can be used to separate the difference comparisons making a grid chart.



- As a class, create a chart of useful words for describing different rocks. Useful words may include rough, smooth, shiny, dull, colourful, flaky, translucent, streaked, layered, speckled, sparkly, glassy, and so on.

The following website has some words used to describe rocks and minerals. Some of these words are too sophisticated for grade 4, but provides some ideas of how to guide students in describing what they are observing. http://www.rocksforkids.com/RFK/identification.html#difference

This activity could be taken another step by having students revise their descriptions and then in a larger group or as a whole class, place all of the rocks together. Can individual rocks be identified from the descriptions alone? This would help students hone their observation skills and augment their vocabulary when trying to improve their rock descriptions.

✓ **Assessment:**
Note the concepts and misconceptions students are expressing. You will need to know these to plan effective questions for subsequent activities and discussions so that students will examine and adjust their alternate conceptions.

Storage options for foldables:

- Insert into a large zippered plastic bag. The bag can be hole-punched and put inside a duotang or binder. A strip of wide tape folded over the left edge of the bag before punching the holes will keep the bag from ripping.
- Glue into notebooks or duotangs.
- Display them on bulletin boards.

Post student versions of curricular outcomes on chart paper (see page 26). Inform students that these outcomes will be addressed over the next portion of the unit. Point out to students which outcomes are being addressed in each activity.

1st Cycle

✪ Curriculum Outcomes

104-4 Compare the results of their investigations to those of others and recognize results may vary
205-5 Make observations and collect information relevant to a given question or problem
206-1 Classify according to several attributes and create a chart or diagram to show the method of classifying
206-9 Identify new questions or problems that arise from what was learned
207-2 Communicate procedures and results, using lists, notes in point form, sentences, charts, graphs, drawings, and oral language
300-6 Describe rocks and minerals according to physical properties such as colour, texture, luster, hardness, and crystal shape

Activity: Classifying Rocks

Materials:

NB Natural Resources samples

Samples brought in by students

Quartz

Rose quartz

Gypsum

Hematite

Calcite

Copper wire

Granite

Gneiss

Magnifying glasses

Students can use the samples they brought in plus other samples you have available (the NB Natural Resources Kit samples and the Dept of Education kit samples) to examine the samples closely.

Cross-curricular links:
ELA
2. Students will be expected to:
a) Contribute to conversations, small-group and whole-group discussion, showing an awareness of when to speak and when to listen
b) Use word choice, tone of voice, facial expressions, and gestures appropriate to the speaking occasion
c) Give and follow instructions and respond to questions and directions

3a. Students will be expected to:
Show basic courtesies of conversation in group interactions

8c. Students will be expected to:
Experiment with language appropriate to audience, purpose, and form that enhances meaning and demonstrates imagination in writing and other ways of representing.

9a. Create written and media texts, collaboratively and independently, in different modes and in a variety of forms
- Recognize that particular forms require the use of specific features, structures, and patterns

Tell students: *Classifying objects helps scientists identify samples that they find and figure out how different samples may be related to each other. You are going to develop a classification system using "have/ does not have" sorting rules.*

For example: *If we had a pile of buttons, we could start sorting them by using "a round shape/does not have a round shape", then "has 2 holes/ does not have 2 holes", etc.* Ask students to suggest other characteristics that could be used to sort buttons. See an example of a possible classification on page 27.

Have students work in small groups and decide on several different characteristics they will use to sort their samples to 3-4 levels. Remind students to refer to the list of descriptive words generated in the Access Prior Knowledge activity and the written descriptions of their rock samples to determine what descriptive words would be useful for sorting.

Students should make a list of their sorting rules. This could be done on an index card or sticky note. This paper will be used later when another group takes the samples and rules and tries to sort them. Students should also draw and label a diagram showing their sorting rules and how they sorted their samples. This will be the answer key that they give to the group they exchange samples with.

ⓘ Teacher note: To do this activity, students do not need to know the names of the samples they are using. The focus should be on classifying and sorting samples using good descriptive vocabulary rather than the actual names of the samples. To make the answer key, students can use descriptive words, measurements, coloured pencils and/or trace samples.

Next, have groups exchange their samples and sorting rule list. The answer key should not be shown to the group until after each group has done the sorting activity. Each group will use the sorting rules provided to try to sort the samples. Do they get the same results?

The sorting rules are to be used as provided. Students are not allowed to ask the "authors" questions that help clarify the sorting rules. Similar to how they recorded the answer key, students should draw and label a diagram showing the results of the sort. This diagram can be compared to the results of the "authors".

✓ **Assessment:**
During the student activity, make notes on outcomes (or parts of outcomes) you observe being addressed. Process skill outcomes are part of the curriculum and should be assessed. Using the observation chart or the checklist (see pages 32 to 34) on a clipboard may be helpful to you. Develop your own code for quick notes.

A suggested code:
√ for observed and appropriate,
WD with difficulty,
A absent.

This chart may be used on multiple days, using a different coloured pen or pencil each day and putting the date in the corner. You may not have a symbol or note for every child every day. Some teachers like to focus on a group or two each time. However you choose to make note of your observations, you will always have a sense of who you need to take more notice of and who might need extra support. The information will also help you when it is reporting time.

Reflection: Class Discussion

Have each group share their classification system. What sorting rules did they use to sort their samples? Did every group use the same rules?

When you used another group's samples and rules, did you get the same results?

Why would some people get different answers?

Would the same sorting rules make sense to use for your samples?

Spend some time talking about the nature of science and the importance of common vocabulary that everyone understands and uses. Tell students: *While everyone sorted their samples, everyone used slightly different rules. Not having a common system could make it more difficult for scientists to explain what they found and for other people, especially those who are not in the room, to look at samples and come up with the same results. We'll need to look at our samples more carefully to see if there are other observations that could be made to help classify rocks.*

Revisit the Accessing Prior Knowledge activity (page 7). Ask: *Are there any items that should be added to or revised? Is there other information we could add?* Have students edit their rock descriptions. Remind your class about respectful discussion. The discussion tips on pages 23-24 may be helpful.

Cross-curricular links:
ELA
1. Students will be expected to:
a) Explore and discuss their thoughts, ideas, and experiences and consider those of their peers
b) Ask and respond to questions to clarify information and explore solutions to problems
d) Listen critically to others' ideas or opinions expressed

2. Students will be expected to:
a) Contribute to conversations, small-group and whole-group discussion, showing an awareness of when to speak and when to listen
b) Use word choice, tone of voice, facial expressions, and gestures appropriate to the speaking occasion
c) Give and follow instructions and respond to questions and directions
d) Engage in and respond to oral presentations

3a. Students will be expected to:
Show basic courtesies of conversation in group interactions

Reflection: Journaling

Use another group's classification system to sort **your** samples and draw a diagram showing the results. Did their classification system work for classifying your samples? What was one positive thing about their system?

Or

Give an example of a good rule for classifying rock samples and say why it is good.

Give an example of a bad rule for classifying rock samples and say why it is not useful.

Cross-curricular links:
ELA
8. Students will be expected to:
a) Use strategies in writing and other ways of representing to
- formulate questions and organize ideas
- record experiences

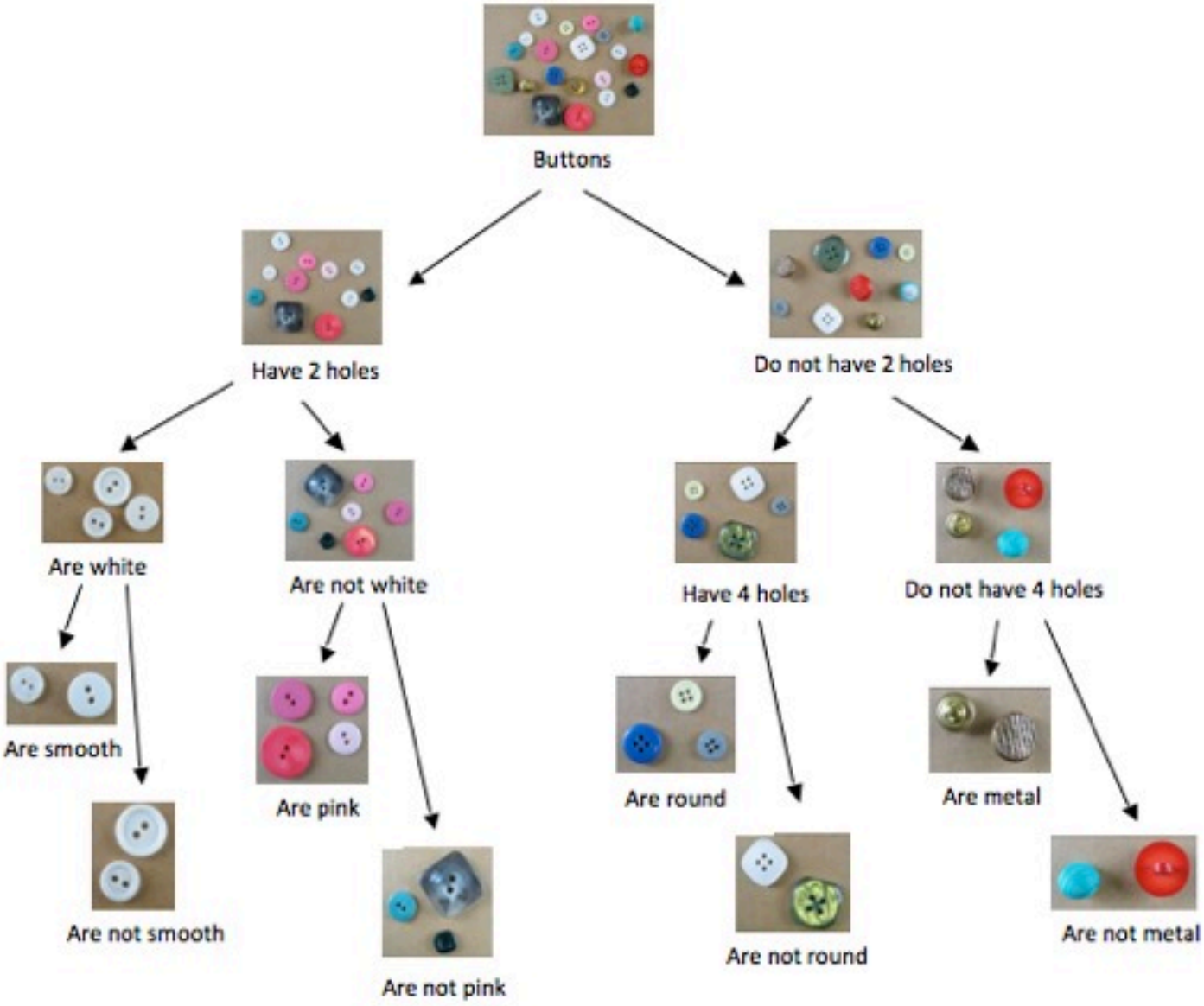
b) Experiment with different ways of making their own notes

c) Experiment with language appropriate to purpose, audience, and form, that enhances meaning and demonstrate imagination in writing and other ways of representing

✓ **Assessment:**
Journal entries should not receive a score or mark. A positive comment followed by a question to refocus attention or suggest the next step in learning is very effective.

Note whether students were able to identify one challenge and one positive aspect of using another group's classification system or provided examples of a good and a bad rule for classifying rock samples.

Button Classifying



2nd Cycle

✪ Curriculum Outcomes

104-4 Compare the results of their investigations to those of others and recognize results may vary
104-6 Demonstrate that specific terminology is used in science and technology contexts
205-5 Make observations and collect information relevant to a given question or problem
205-7 Record observations using a single word, notes in point form, sentences, and simple diagrams and charts
206-1 Classify according to several attributes and create a chart or diagram to show the method of classifying
207-2 Communicate procedures and results, using lists, notes in point form, sentences, charts, graphs, drawings, and oral language

Activity – Building Rocks

To help students distinguish between rocks and minerals (at a very basic level), students will use materials to create their own "rock" or "mineral" from a variety of different supplies. At this point, telling students they will be making their own fake rocks will be sufficient. The vocabulary and ways to distinguish between rocks and minerals will be developed during the discussion.

Suggested materials are listed below. To determine the number of ingredients each student gets to use, have each roll a die. This will help ensure there is some diversity in the rocks produced.

Materials:

Several dice
Stickers to modify dice numbers

For "rocks"

Various breakfast cereals
Raisins
Beads
Use materials that come in one colour (e.g. Cheerios, not Fruit Loops)

For bonding: (use one of the following)

Cornstarch and water;
Flour and water; or
White Glue

Cross-curricular links:
ELA

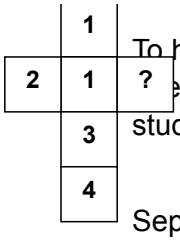
1. Students will be expected to:
a) Explore and discuss their thoughts, ideas, and experiences and consider those of their peers
b) Ask and respond to questions to clarify information and explore solutions to problems
d) Listen critically to others' ideas or opinions expressed

2. Students will be expected to:
a) Contribute to conversations, small-group and whole-group discussion, showing an awareness of when to speak and when to listen
b) Use word choice, tone of voice, facial expressions, and gestures appropriate to the speaking occasion
c) Give and follow instructions and respond to questions and directions
d) Engage in and respond to oral presentations

3a. Students will be expected to:
Show basic courtesies of conversation in group interactions

ⓘ Teacher note: **Be aware of any student allergies** when choosing “rock” and bonding materials.

If using a bonding material, it should be a minimal amount (barely visible). If you are not interested in using a bonding material (Flour/Water or White Glue), which may become messy, you may want to distribute a rubber glove or clear plastic baggie to each student for them to use to keep their “rock” together. However, students will not be able to take “sections” (slices) of their samples to have a closer look inside the samples.



To help ensure there is a greater chance of getting “minerals”, you will need a die that has been altered. Cover the numbers 5 and 6 with “1” and a “?”. The question mark allows the student to choose as many ingredients (1 to 4) as he/she would like to use.

Separate various supplies into individual containers in order to show students what is available for use and place the bonding material in a central location for every student to access.

Tell students that they will be constructing their very own “rock”. Each student will roll the die. The number they roll represents the number of materials they may use (aside from their bonding material) when constructing their sample. For example, if a student rolls a 1, they may use some bonding material along with one other supply (cereal or raisins).

Once students know the number of materials they are allowed to use, they may begin constructing their “rock”. They may squeeze and mould their “rock” together by either mixing it with a bonding material or by placing their ingredients in a rubber glove or plastic baggie.

Several small slices should be cut off a variety of different samples (particularly the “1 ingredient” rocks and multiple ingredient creations with exactly the same ingredients) in order to compare how the ingredients are distributed in each. Samples may need to be cut before they harden depending on the bonding agent used. (**Note**: Extra samples could be made by students or the teacher. These samples could be used instead of students’ samples).

Corn Pops and Frosted Flakes “rock”

Rice Krispies, Corn Pops and Frosted Flakes “rock”

Rice Krispies “mineral”

✓ **Assessment:**
On observation chart (or other record), note how students are performing on the skill outcomes.

Reflection: Small Group Discussion

In groups of 3 or 4, have students examine each other’s creations to identify similarities and differences between them. Each student should record 2 similarities and 2 differences between their sample and the other group members’ samples.

Carefully examine slices taken from the different samples.

Students should form new groups at least once more and repeat the similarities/differences. This will allow students to see a variety of samples.

Reflection: Class Discussion

- Ask: *Do all of the “rocks” look the same?*
  What were some of the similarities?
  What kinds of differences did you notice?
- *Did the one-ingredient samples all look the same?* Take two of the one-ingredient samples and look at a slice or small portion of each with the digital microscope. They should look fairly similar to each other and each should look the same regardless of where you slice them to look at them.
- Now look at a one-ingredient sample that used a different ingredient. This one looks different from the 1st samples they just looked at, but looks the same throughout.
- Tell students: *Scientists would call these samples with 1 ingredient that look pretty much the same any way you slice them “minerals”. There are different kinds of minerals just like we could have a Rice Krispies one-ingredient sample or a Cheerios one-ingredient sample. The samples look different from each other since they are made from different ingredients, but they each have one ingredient and they mix or bond in the same way whenever they are bonded.*

Cross-curricular links:
ELA
1. Students will be expected to:
   a) Explore and discuss their thoughts, ideas, and experiences and consider those of their peers
   b) Ask and respond to questions to clarify information and explore solutions to problems
   d) Listen critically to others’ ideas or opinions expressed
2. Students will be expected to:
   a) Contribute to conversations, small-group and whole-group discussion, showing an awareness of when to speak and when to listen
   b) Use word choice, tone of voice, facial expressions, and gestures appropriate to the speaking occasion
   c) Give and follow instructions and respond to questions and directions
   d) Engage in and respond to oral presentations

3a. Students will be expected to:
Show basic courtesies of conversation in group interactions

- Now look at a “rock” sample. Find 2 samples made with the exact same ingredients (multiple ingredients). Use the digital microscope to look at a slice or small piece of the samples. *Do they look the same?* (They should look slightly different since the multiple ingredients can mix in different ways every time they are mixed).
- Tell students: *Scientists would call these samples (with more than one ingredient) that look different depending on how you slice them “rocks”. There are different kinds of rocks depending on what you mix together. Rocks are made up of minerals, but minerals are not made up of rocks. The ingredients that get mixed together when making rocks are different kinds of minerals. So the Rice Krispies, the Cheerios, etc. are like different kinds of minerals that mix together to make rocks.*
- Another way of thinking about the difference between rocks and minerals is to think about cookies. There can be oatmeal cookies – these would be like minerals, or there can be chocolate chip oatmeal – these would be like rocks. The chocolate chips and oatmeal would be the minerals that mix together to make the rock. Since the oatmeal and chocolate chips don’t bond together in exactly the same, predictable way every time, they make a rock.
- Revisit the Accessing Prior Knowledge activity (page 7). Ask: *Are there any items that should be added to or revised? Is there other information we could add?* Ask students to edit the cards with their descriptions to incorporate new knowledge. Remind your class about respectful discussion. The discussion tips on pages 23-24 may be helpful.

Reflection: Journaling

Draw a picture of your creation and label the parts. Tell whether it is a rock or a mineral and why.

Cross-curricular links:
ELA
8. Students will be expected to:
a) Use strategies in writing and other ways of representing to
- formulate questions and organize ideas
- record experiences

b) Experiment with different ways of making their own notes

c) Experiment with language appropriate to purpose, audience, and form, that enhances meaning and demonstrate imagination in writing and other ways of representing

✓ **Assessment:**
Journal entries should not receive a score or mark. A positive comment followed by a question to refocus attention or suggest the next step in learning is very effective.

Note whether students can identify the difference between rocks and minerals.

The concepts in this cycle can be extended by using the video “Rocks: the Solid Earth Materials I.”, “Rocks: The Solid Earth Materials II”, the sections “The Definition of a Rock” and “Minerals that Make up Rocks.” from http://learning.aliant.net/.

Use this as an introduction and do not expect that students will understand all of the details. Ideas and terms are introduced that will be addressed throughout the rocks and minerals unit.

To access the video, type the title into the search box. Videos are available free of charge at this site. You will need to register, however registration is free. If you try to watch the video without logging in, you will be prompted to do so. Note that a table of contents opens beside the video so that you may select only certain sections for viewing if you wish. There is also the option to watch the video full screen.

Possible Extension:

The “rocks” made from cereal could be “mined” for their minerals. What strategies could be used to take rocks apart? Are these sorts of strategies used by actual companies in the mining of certain minerals?

Research what sorts of strategies can be used in mining to separate minerals, or to extract a specific mineral.

3rd Cycle

✪ Curriculum Outcomes

104-4 Compare the results of their investigations to those of others and recognize results may vary
204-8 Identify appropriate tools, instruments, and materials to complete investigations
205-5 Make observations and collect information relevant to a given question or problem
205-7 Record observations using a single word, notes in point form, sentences, and simple diagrams and charts
206-1 Classify according to several attributes and create a chart or diagram to show the method of classifying
206-9 Identify new questions or problems that arise from what was learned
207-2 Communicate procedures and results, using lists, notes in point form, sentences, charts, graphs, drawings, and oral language
300-6 Describe rocks and minerals according to physical properties such as colour, texture, luster, hardness, and crystal shape
300-8 Relate the characteristics of rocks and minerals to their uses

Testing Rocks and Minerals Activity

Part 1

To help students discover properties of rocks and minerals that scientists use to classify and identify samples, revisit the descriptive words list from the Access Prior Knowledge section. Ask students to work in small groups to group the words. To help students get started, ask them: *Are there words that are kind of about the same thing? What thing is each group of words about?* Try to get the students to establish headings for the different groups of words.

As a class, share the headings each group came up with. Introduce the word “property” as something about a sample that is measurable and is always the same from sample to sample regardless of where that sample comes from.

The scientific terms for properties used to distinguish between different rocks and minerals, such as lustre, can be introduced. Students will likely come up with properties such as colour and texture and maybe even hardness and lustre (appearance). The remaining properties, magnetism and streak colour, can be given to them. Explain how scientists use these terms to make it easier for people talking about rocks and minerals to understand each other and to be consistent. These terms do not have to be mastered.

Cross-curricular links:
ELA
1. Students will be expected to:
a) Explore and discuss their thoughts, ideas, and experiences and consider those of their peers
b) Ask and respond to questions to clarify information and explore solutions to problems
d) Listen critically to others’ ideas or opinions expressed

2. Students will be expected to:
a) Contribute to conversations, small-group and whole-group discussion, showing an awareness of when to speak and when to listen
b) Use word choice, tone of voice, facial expressions, and gestures appropriate to the speaking occasion
c) Give and follow instructions and respond to questions and directions
d) Engage in and respond to oral presentations

3a. Students will be expected to:
Show basic courtesies of conversation in group interactions
8c. Students will be expected to:
Experiment with language appropriate to audience, purpose, and form, that enhances meaning and demonstrates imagination in writing and other ways of representing.

Ask students if they can think of different ways to test samples for these different properties.

Testing Rocks and Minerals Activity – Part 2

Materials:

Quartz
Rose quartz
Gypsum
Hematite
Calcite
Copper wire
Granite - rock
Gneiss - rock
Optional samples from older rock kits that could be used: marble, conglomerate, limestone, black granite, coal, base metal ore

A kit of testing materials for each group containing:
Streak plate (unglazed ceramic tile)
Water and cloth to wipe streak plates
Magnifying glasses and/or digital microscope
Metal nail
Penny
Magnets (Grade 3's study magnets, if you need a source)
Optional: vinegar for chemical reaction test

At each station, the students will test a different rock or mineral sample using the following tests: Streak test, magnetism, hardness/scratch, lustre, texture, colours. The instructions for each test as well as a student sheet can be found on pages 28 and 30. The teacher's key can be found on page 29. Doing the same experiments several times and using the same methods each time ensures a fair test. It also means other people should also be able to repeat the experiments as you did them and find similar results.

Optional: Chemical Reaction – To do this test requires powder or small pieces be used. To get the powder, samples can be filed with a metal file or chipped. Since this means the samples will disappear more quickly and it can be slightly messy, it may be more feasible for the teacher to carry it out on one or two samples instead of having the students do it.

To do a Chemical reaction or Acid test, use a small amount of powder from the sample, place it in a small pie plate then add a few drops of white vinegar. Use the digital microscope and project on a SMART board or with an in-focus machine so all can see. Look for bubbles and/or listen for fizzing. This test indicates the presence of carbonates. The Calcite sample in your kit should bubble.

✓ **Assessment:**
On observation chart (or other record), note how students are performing on the skill outcomes.

Reflection: Class Discussion

Create a Class Observation Table and fill it in as you discuss what each group found with the different samples tested.

Ask students

- *Which samples had more than one colour? Why do they think that is?* (Rocks can have more than one colour)
- *Did any samples have more than one streak colour? If yes, why do they think that is? If no, did that surprise you?* (Not all rocks or minerals streak or leave a streak that is visible. One area on a rock may streak but another may not leave anything depending on what minerals are in the rock).
- *Which samples did you identify as rocks and which as minerals? Why?*
- *Do you think a scientist needs to do all the tests to identify a mineral? Which test(s) are most important for identifying quartz?*
- *What would be useful in helping to identify unknown rocks?*

Did every group get the same results? For minerals, the results should be fairly similar if they used the same methods. For rocks, there may be a little more variety.

Cross-curricular links:
ELA
1. Students will be expected to:
a) Explore and discuss their thoughts, ideas, and experiences and consider those of their peers
b) Ask and respond to questions to clarify information and explore solutions to problems
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2. Students will be expected to:
a) Contribute to conversations, small-group and whole-group discussion, showing an awareness of when to speak and when to listen
b) Use word choice, tone of voice, facial expressions, and gestures appropriate to the speaking occasion
c) Give and follow instructions and respond to questions and directions
d) Engage in and respond to oral presentations

3a. Students will be expected to:
Show basic courtesies of conversation in group interactions

Students can be provided with the name of each sample they tested. The table found at http://geology.com/minerals/mineral-identification.shtml can be used to show how scientists use results from these tests to help identify unknown minerals. The website has a link to a printable or online version of mineral properties. The link brings up an Excel page that can be modified to suit the vocabulary of your students.
What new questions about minerals can you think of that could be investigated?

Revisit the Accessing Prior Knowledge activity (page 7). Ask: *Are there any items that should be added to or revised? Is there other information we could add?* Have students edit their rock descriptions. Remind your class about respectful discussion. The discussion tips on pages 23-24 may be helpful.

http://www.ehow.com/video_4997356_identifying-minerals.html. This clip is a geologist highlighting tests done to distinguish between different minerals. He also shows a variety of samples.

Since the students will have tested gypsum, the following website may be of interest to them. It has amazing pictures of gigantic gypsum crystals found in caves in Mexico. http://www.crystalinks.com/mexicocrystals.html . Students can also be told that we have gypsum in the Atlantic provinces, but it looks more like the samples they have been working with.

Cross-curricular links:
ELA
8. Students will be expected to:
a) Use strategies in writing and other ways of representing to
- formulate questions and organize ideas
- record experiences

b) Experiment with different ways of making their own notes

c) Experiment with language appropriate to purpose, audience, and form, that enhances meaning and demonstrate imagination in writing and other ways of representing

Reflection: Journaling

You are given an unknown mineral. Describe the tests you might use to identify this mineral.

Or

Given a group of samples, how could you determine the hardness so they could be ranked from hardest to least hard.

✓ **Assessment:**
Journal entries should not receive a score or mark. A positive comment followed by a question to refocus attention or suggest the next step in learning is very effective.

Note whether students can explain one of the tests when testing for mineral properties.

Think like a scientist

Asking good questions is an important skill in science. Initially students will need support. Model the skill with the whole class and students will begin to have the confidence to contribute. After some practice, students will be able to generate questions successfully individually.

Cross-curricular links:
ELA
8a. Students will be expected to:
Use writing and other forms of representation to
- formulate questions

Present students with a situation and ask them to generate questions that could be investigated scientifically. (These situations and questions do not have to be limited to those that can be done in a classroom.)

Situation:

> Headstones in a cemetery are often made from rock so that they will last for a long time. Different kinds of rock have been commonly used at different times in history.

What is one question concerning the kind of rock used for a headstone that could be investigated scientifically?

For example:

Which sort of rock will last the longest?
Will acid rain gradually damage certain headstones made of sandstone faster than one made of granite?
Which kinds of rock can be polished?
Which rocks are easier to cut and shape?

Possible Extension:

Granite is currently often used for headstones. Additional information on the uses of granite can be found at http://geology.com/articles/granite.shtml

Ideas for next steps:

- Provide students with a list of 30 items. Ask them to sort the list into “Made from Rocks and Minerals” and “Not made from Rocks and Minerals”.
- Tell students that they will research an item from the list below and determine what types of rocks and/or minerals are used to make that item. *Why are those rocks and/or minerals used for that item?* Also ask students to determine if the rock/mineral is mixed with other materials and if yes, why?

Arrow heads	Pencil	Wall board/gyp rock
Fireworks	Rechargeable batteries	Electrical wiring
Sandpaper	Saw blades	Drill bits
Toothpaste	Eye glasses	Magnets
Nickels	Fertilizer	Eye shadow/cosmetics
Glass	Shampoo	Soap
Pottery	Paint	Antacid tablets
Expensive jewellery	Computer chips	Classroom chalk
Soapstone carvings	Grindstones	Statues
Stone buildings		

- (Possible Extension) Research how the properties of gold make it suitable for many uses. http://geology.com/minerals/gold/uses-of-gold.shtml

Testing Mineral Properties

Do these tests at each of the stations and record your observations in the table.

Test 1) Streak

Rub the sample on an unglazed ceramic tile. What colour is the streak? Clean the plate between tests. Test 2-3 different sides of each sample. Do you get the same results?

Test 2) Magnetism

Is the magnet attracted to the sample?

Test 3) Hardness

Try to scratch a line into each sample

a) using a fingernail,

b) a penny,

c) and a metal nail.

NOTE: It must leave a dent in the sample. Chipping off little pieces is not the same thing.

Test 4) Lustre

Use a magnifying glass to examine each sample closely. Which word best describes how it looks?

Shiny and metallic
Sparkly like a diamond
Looks like glass
Like wax
Like pearl
Greasy
Dull like clay

Test 5) Texture

Use your fingers to feel the sample. Is it:

Smooth, a little rough or very rough?

Test 6) Number of Colours

How many different colours can you see in the sample?

Teacher's Key for Cycle 3

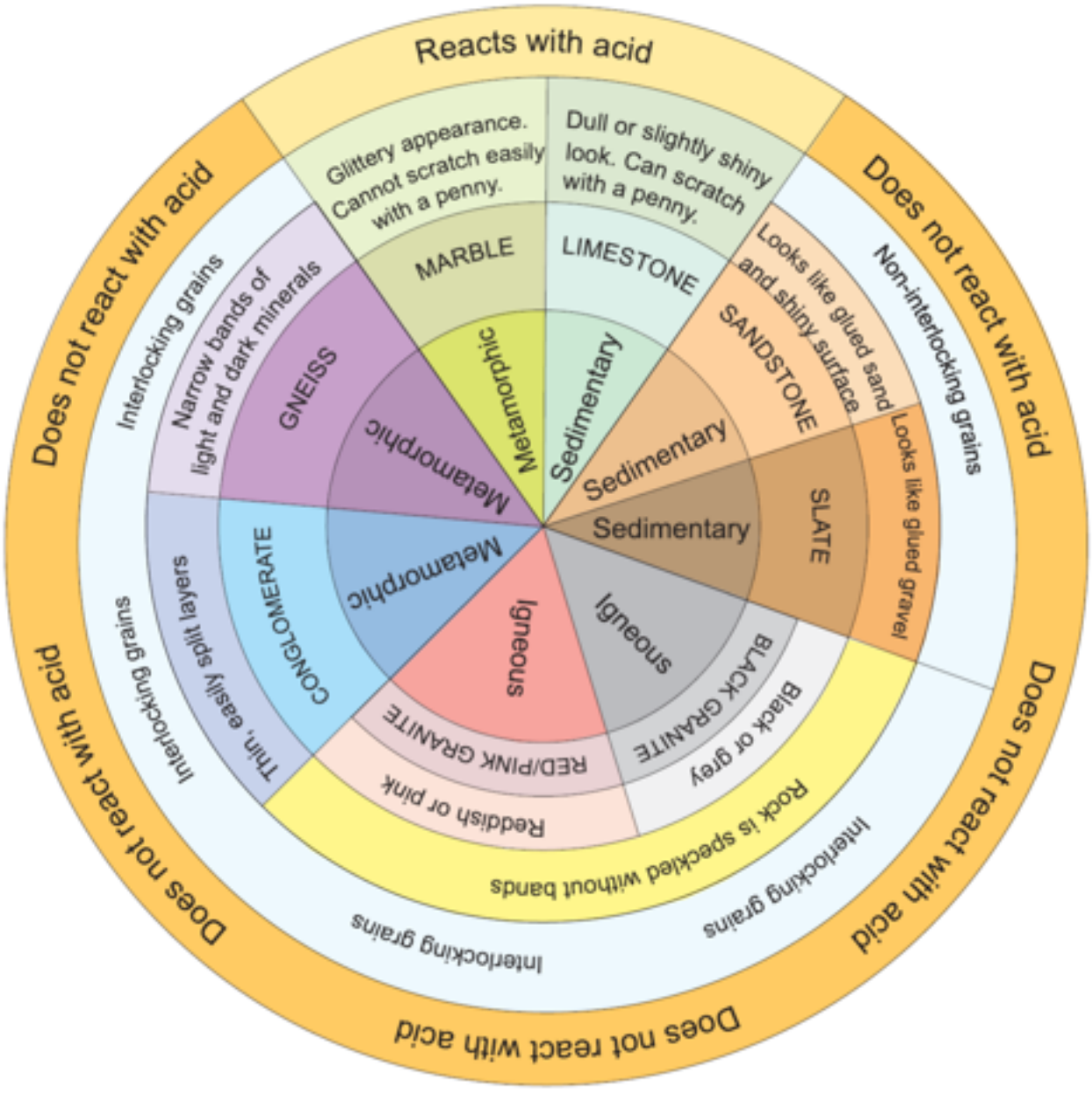
Sample	Streak colour	Magnetic? (yes/no)	Hardness	Lustre/ appearance	Texture	# of colours	Rock or mineral?
Calcite	White	No	Fingernail (n) Penny (y) Metal nail (y) 3	Glassy/pearly and transparent to translucent	Slightly rough	1 (2)	Mineral
Gypsum	White	No	Fingernail (y) Penny (y) Metal nail (y) 1.5-2	Dull and opaque	Slightly rough but silky, powdery	1 (2)	Mineral
Quartz and Rose Quartz	Colour-less	No	Fingernail (n) Penny (n) Metal nail (n) 7	Glassy to greasy and transparent to translucent	Somewhat smooth	1 (2)	Mineral
Hematite	reddish	Yes	Fingernail (n) Penny (n) Metal nail (should) 5-6.5	Dull and opaque	rough	1 (2-3)	Mineral but they may say rock since it has multiple colours
Gneiss	Cannot streak	No	Depends on which minerals are scratched in the sample – harder like quartz	Dull with shiny flecks	rough	2	rock
Granite	Doesn't really steak. May get black or white	No	Depends on which minerals are scratched in the sample – overall harder like quartz	Dull with shiny flecks	rough	3	rock
Fluorite	white	No	Fingernail (n) Penny (n) Metal nail (y) 4	Glassy	Somewhat smooth	1 (2-3)	mineral

The hardness of rocks is not based on Moh's scale since rocks are made of different minerals. When the students do the scratch test, depending on the mineral/place being scratched, they may get different results. Rock formation can involve heat, pressure and the addition of cementing materials which makes using minerals properties to identify them a bit more difficult. The hardness description is the general hardness based on the more typical composition of that kind of rock.

Testing Rocks and Minerals Recording Sheet

Sample	Streak colour	Magnetic? (yes/no)	Hardness	Lustre	Texture	Number of colours	Rock or mineral?
Station 1			Fingernail (y/n) Penny (y/n) Metal nail (y/n)				
Station 2			Fingernail (y/n) Penny (y/n) Metal nail (y/n)				
Station 3			Fingernail (y/n) Penny (y/n) Metal nail (y/n)				
Station 4			Fingernail (y/n) Penny (y/n) Metal nail (y/n)				
Station 5			Fingernail (y/n) Penny (y/n) Metal nail (y/n)				
Station 6			Fingernail (y/n) Penny (y/n) Metal nail (y/n)				
Station 7			Fingernail (y/n) Penny (y/n) Metal nail (y/n)				
Station 8			Fingernail (y/n) Penny (y/n) Metal nail (y/n)				

Mineral Identification Wheel



Identification of Minerals

Dichotomous Key

Does the mineral have metallic luster?	Yes	Does the mineral have a gray or silver streak?	Yes	Is the mineral harder than glass?	Yes	Does mineral attract a magnet?	Yes	**Magnetite**
							No	*Go back to the beginning and start again!*
					No	Does the mineral have cubic cleavage?	Yes	**Galena**
							No	**Graphite**
			No	Is the mineral harder than glass?	Yes	**Pyrite**		
					No	Is the mineral goldish green?	Yes	**Chalcopyrite**
							No	**Copper**
	No	Is the mineral white or clear?	Yes	Does the mineral show cleavage?	Yes	Does the mineral react with acid?	Yes	**Calcite**
							No	**Halite**
					No	Does the mineral scratch glass?	Yes	**Quartz**
							No	**Talc**
			No	Does the mineral scratch glass?	Yes	**Corundum**		
					No	Is the mineral yellow?	Yes	**Sulfur**
							No	*Go back to the beginning and start again!*

Rocks, Minerals, and Erosion
Strand - Uses for Rocks and Minerals

General Curriculum Outcomes	Specific Curriculum Outcomes
107-1 describe examples, in the home and school, of tools, techniques, and materials that can be used to respond to their needs	107-1 describe how rocks and minerals are used
300-8 relate the characteristics of rocks and minerals to their uses	300-8 relate the characteristics of rocks and minerals to their uses
104-6 demonstrate that specific terminology is used in science and technology contexts	104-6, 108-1 use appropriate terms to describe the positive and negative effects of the extraction and/or utilization of rocks and minerals
108-1 identify positive and negative effects of familiar technology	

Practical Uses of Rocks and Minerals

Outcomes:
107-1 Describe how rocks and minerals are used
300-8 Relate the characteristics of rocks and minerals to their uses

Lesson Activity Overview
This lesson should focus on the uses of rock and minerals products in construction should be highlighted. Students should be provided with samples of ores and finished goods then asked to match the ore with the correct item (e.g. talc and powder).

Make a display of ores that contain iron, nickel, zinc, and other commonly used metals together with samples of goods made from these metals (e.g. bauxite with aluminum).

Classroom activity
Have students explore around the school, using a variety of sources, determine which mineral material is used in the various parts of your school. (107-1)
pipes:
roof:
floors:
walkways:

Add three items of your own choosing:
1.
2.
3.

Students should explore the variety of ways rocks and minerals are used. They should try to connect properties of the rocks/minerals and their major uses.

Activity
Investigate the ores below and try to match them to the given products. (300-8)
Ores: nickel, gypsum, halite, limestone, granite, clay, talc
Products: five-cent piece, wall board, table salt, cement mix, memorial stone, brick, powder

Journal
Make lists of objects in your home that are made from rocks and minerals and objects that are not made using rocks and minerals. Do you think other materials could be used to make these objects? Ask older people in your household and/or community if something that was made with rocks and minerals in the past is now made with different materials. (107- 1, 300-8)

Assessment:Informal Formative
Ensure that students have been exposed to how minerals appear in finished products 107-1

Ensure that students have worked with various ores and have matched them to end products 300-8

Assessment:Formal Formative
Ensure that students have participated in a classroom activity in which they explore the school and determine which minerals appear in various parts of the school. 107-1

Ensure that students have journaled about materials in their house and make the connection between the minerals and rocks and their practical use. 300-8

Evaluating Mining's Effects

Outcomes:
104-6, 108-1 use appropriate terms to describe the positive and negative effects of the extraction and/or utilization of rocks and minerals

Lesson Activity Overview
This lesson is focused on the social aspect of of extracting rock and minerals products from the earth. Students should explore the effects of mining/refining on the surrounding land and air quality as well as the effect of run off from slag (mineral residue) on natural habitats. Students should explore the positive and negative effects resulting from the extraction and/or utilization of rocks and minerals.

Simulation Activity: (with each activity, ask what are the positives and negatives)
1. Panning for Gold - a separation technique that was used during the gold rush. Give students a mixture of silt, soil, and one or two dense objects (e.g., painted ball bearings) in a metal pie pan. Using a plastic dishpan with water, have the students swirl water around their pan, draining off the silt and larger gravel into the dishpan, until the coloured ball bearings appear.
2. Mineral Layering - Simulate mineral deposits by layering various rocks in a paper cup alternately with plaster of Paris. When the mixture dries, remove it from the cup. Students can use toothpicks and popsicle sticks to try to retrieve the rocks.
3. Holding Ponds - using vinegar to dissolve one component of a mixture of earth materials, while leaving the wanted material for easy extraction. Students could add vinegar to a mixture of powdered baking soda and gravel. In this simulation, the gravel is the part of the soil that is wanted, while the baking soda will be discarded once they have been separated. When the vinegar is added, the baking soda will fizz and seem to disappear or dissolve, leaving the gravel. The gravel is now easily removed from the mixture. Students could reflect on the vinegar/ baking soda mixture that is left and how it could be disposed. Parallels to the mining process (e.g., tailings, holding ponds) could be made. The problem of what to do with the vinegar mixture can highlight the difficulties in disposing or storing the waste (slag) products from refining ores.

If possible, a field trip to a mine or have a representative of a mine come to the class to explain how ores are retrieved. As an alternative, video may be used if first hand experience is not possible.

Group Project:
In groups, do a presentation (written, oral, or web page) of a mine in your province or region. The following aspects should be researched and each person in the group should choose one aspect as his/her part in the group project.
– What rocks or minerals are mined? Describe their properties.
– What are the rocks or minerals used for?
– What is the economic benefit to the community?
– What, if any, are the environmental issues associated with the mine? (108-1, 300-8)

Assessment:Informal Formative
Ensure that students have participated one or more of the simulation activities 108-1

Ensure that students have evaluated each of the activities in terms of the positive and negatives effects 104-6, 108-1

Assessment:Formal Formative
Ensure that students have completed a group project in which they describe a mine in the province (use a formal rubric that is created with student input to evaluate the project) 104-6, 108-1

Rocks, Minerals, and Erosion
Strand - Erosion and Weathering

General Curriculum Outcomes	Specific Curriculum Outcomes
301-5 describe the effects of wind, water, and ice on the landscape	301-5 describe the effects of wind, water, and ice on the landscape
301-6 demonstrate a variety of methods of weathering and erosion	301-6 demonstrate a variety of methods of weathering and erosion

Understanding How Rocks Are Broken Down And How They Move

Outcomes:
301-5 Describe the effects of wind, water, and ice on the landscape
301-6 Demonstrate a variety of methods of weathering and erosion

Lesson Activity Overview
This lesson is focused on differentiating weathering from erosion, the processes for each, and where they occur. Keeping with the concept of learning by doing, try to avoid just giving the definition of each and build authentic experiences for your students to differentiate on their own.
Weathering, the process of wearing down and breaking up of rocks. Erosion, the movement of rocks and other materials.

Begin with a prior knowledge discussion of what students perceive the two terms to mean. Obviously, since they have been working with rocks and minerals they should make a connection that these two terms are connect in that way.

From discussion, create simulations of both weathering and erosion.

Weathering Simulations -
Weathering of Waves and Rain - Use a piece of shale rock (or another type of rock that is easily broken and produces sand), have students record observations of the original form of the rock. Next, expose the rock to a stream of water until there is a noticeable change or put it in a hard plastic container and shake it for 10 min. Have students record the new form of the rock. What has changed? The water is a simulation of rain hitting exposed rock. Students may make a better connection that rain is a form of weather to connect the names.

Weathering of Ice- Have students observe the original form of the rock. Use a blunt object to collide with the rock, this simulation could be ice crashing against it. Have students observe the changes to the rock as the objects hits it.

Weathering of Freezing - The effects such as water freezing in cracks of rocks can be simulated by filling a plastic container with water and freezing it. Students can place a balloon filled with water in Plaster of Paris. When the plaster has set, put in a freezer, and observe how the plaster splits open.

Erosion Simulations - Take a flat bottom pan and put it on a slight (10 degree) angle. Fill the pan up with as much sand as possible. Pour water from the top of the pan down. Have students record what happens to the sand as the water moves.

From these simulation activities, students should be able to conceptualize how a rock is weathered (broken down into smaller parts) and how erosion moves pieces or rock.

Students can examine the ground near an eaves trough runoff. There should be a indentation of the ground where the force of the runoff has swept away loose gravel and soil (erosion). Larger gravel should be much more pronounced. In cases where the runoff is directly on concrete, the concrete should be worn so that the larger stones are most pronounced (weathering).

Take Home Activity
Have students take pictures around their home that are evidence of both weathering and erosion. These pictures can either be shared in a printed collage or they could be shared digitally and categorized and shared on the teacher page. 301-6

Journal
What would happen to pavement if water seeps into its cracks and then freezes during the winter? 301-5

Where does the sand on the beach come from? Use the terms “weathering” and “erosion” in your answer. 301-5

Assessment:Informal Formative
Ensure that students have participated one or more of the simulation activities 301-6

Ensure that students have participated by taking photos of evidence of weathering and erosion around their home or local area 301-5

Assessment:Formal Formative
Ensure that students have completed a journal in which they explain what happens to pavement that freezes with water in the cracks 301-5

Ensure that students have completed a journal that uses the terms weathering and erosion in the case of sand on the beach 301-5

Rocks, Minerals, and Erosion
Strand - Soil Formation and Composition

General Curriculum Outcomes	Specific Curriculum Outcomes
301-4 describe ways in which soil is formed from rocks	301-4 describe ways in which soil is formed from rocks

Exploring How Soil is Formed

Outcomes:
301-4 describe ways in which soil is formed from rocks

Lesson Activity Overview
This lesson is an extension of weathering from erosion and it focusses on understanding how these processes lead to soil production.

In keeping with the spirt of doing science, students should conceptualize how larger rocks are broken down to eventually form soil. A good model to use would be to use a large cylindrical container, students could mix samples of shale or sandstone rock, chalk and granite. Roll the container for a period of time, the rock samples will exhibit many of the features of weathered rocks in nature. By repeating the activity with water added to the container, students will see the effects of water weathering on rocks.
If all the different rock samples are not available you can simplify by putting three or four small shale or sandstone samples in a plastic jar with some water. Shake the jar vigorously. Describe what happens to the pieces of shale. Pour the water from the jar through a coffee filter, and record your observations.

Journal
Explain, using the terms weathering and erosion, how soil can be formed from larger rock

Once students have observed how large rocks can be weathered into smaller rocks, they should take a closer look at soil. Soil is composed of rocks and minerals of various sized particles, and humus (decayed organic material).

Students could explore the composition of soil. Students could take soil samples, mix them with water in a clear plastic jar, and then let the mixture settle into its components. Before students do this activity, ask them to make predictions about what is likely to happen:
Will all the particles sink at the same rate?
Will some sink faster than others?
Which ones do they think will sink the fastest (perhaps the biggest, heaviest)?
The various layers should be quite pronounced. Students should see from this activity soil is composed of particles of various sizes and types, that results from weathering and erosion.

Journal
Are smaller pieces of weathered rocks the only components of soil? Explain

Assessment:Informal Formative
Ensure that students have recorded observations of the effects of water and agitation on rocks 301-4

Ensure that students have made predictions about soil sample components 301-4

Assessment:Formal Formative
Ensure that students have completed a journal in which use the terms weathering and erosion to describe how soil is formed from larger rock 301-4

Ensure that students have completed a journal that the components of soil 301-4

Rocks, Minerals, and Erosion
Strand - Record in Rocks

General Curriculum Outcomes	Specific Curriculum Outcomes
300-7 identify and describe rocks that contain records of the Earth's history	300-7 identify and describe rocks that contain records of the Earth's history

Making Fossils

Outcomes:
300-7 Identify and describe rocks that contain records of the Earth's history

Lesson Activity Overview
This lesson is focussed on showing students how fossils leave a lasting image in nature. Students should simulate the various ways fossils are formed. Pictures or displays of fossils can be used to illustrate different ways of forming fossils. But this should not be the focus of the lesson.

Imprints are the simplest type of fossil, and differ from others in that the organism leaves evidence it was there (e.g,, footprints or tracks, burrowed holes) but then moves on. Using wet clay, students can make imprint fossils of their foot or hand print and let them dry and display them.

Moulds are similar to imprints in that an impression of the organisms is left, but in this case, the organism was actually left in the soil or sediment. The impression or cavity left after the organism slowly decays and washes away is called a mould. If this cavity fills with rocks and minerals, it makes a fossil cast. Students can make fossil casts by firmly pressing a shell or some other hard object into soft clay to make an impression of the shell in the clay. Pour a plaster mixture into the indention in the clay, and allow the plaster to dry. When the plaster is dry, carefully remove the clay from the plaster, this represents the fossil cast.

Now that students have had the chance to explore how fossils are created, they should be given the opportunity to explore for fossils. students should reexamine their collection of rocks to look for evidence of fossils. Students should identify and describe any fossil evidence they find.
If possible, visit a site where fossils are present. As an alternative, some students are local community members may have fossils at home that can be brought in to be shared.

Assessment:Informal Formative
Ensure that students have made clay imprints of their hand or foot as evidence of a fossil 300-7

Ensure that students made a mould and a fossil cast of an organism. 300-7

Rocks, Minerals, and Erosion
Strand - Sudden and Significant Changes in the Land

General Curriculum Outcomes	Specific Curriculum Outcomes
301-7 describe natural phenomena that cause sudden and significant changes to the landscape	301-7 describe natural phenomena that cause sudden and significant changes to the landscape

Understanding How Natural Events Can Change Landscapes

Outcomes:
301-7 Describe natural phenomena that cause sudden and significant changes to the landscape

Lesson Activity Overview
This lesson is focussed on showing students how natural events like flash floods and hurricanes can dramatically change the landscape. There should be a local focus on the issue first. Students should look around their own region to see if they can identify features of the land that may have been caused by drastic events.
If possible, students can bring in pictures of the before and after of the site. Web-tools like history pin can be used to show how the landscape has changed in the local area.
As a compliment students can view this video from Maine to show how a spring flash flood can cause so much damage to a road.
https://www.youtube.com/watch?v=NTbhyHNA1Vc

Next, students can look at other parts of North America that may experience earthquakes (San Francisco), volcanoes (Mt. St. Helen's in Washington State), avalanches (in Rocky Mountains in BC), and tornadoes (Mid-Western USA). Students should have discussion to make sure they understand geographically how these places differ from Eastern Canada. If needed show them video to explain the phenomena and dialogue with students to note differences in landscape

Students can work in groups to research these different local and global events to present evidence to the class of the effects on the landscape. 301-7 (A class Rubric would be the best way to evaluate this project)

Assessment:Formal Formative
Ensure that students have completed group research and a presentation on one natural phenomena that shows evidence of sudden and significant changes to the landscape 301-7