

Connecting with the Natural World Junior Division Integrated Curriculum

Grade 4 Rocks and Minerals Activities



in partnership with



*This resource has been developed by the
Science Teachers' Association of Ontario/L'Association des professeur de science de l'Ontario with funding
and technical support from
Ontario Teacher's Federation/Fédération des enseignantes et des enseignants de l'Ontario*

STAO Writing Team

Sheila Rhodes, Project Manager, Instructor, Faculty of Education,
University of Ontario Institute of Technology

Kimberly Arfo, Curriculum and Instruction, Peel District School Board

Sarah Feddema, Durham District School Board

Jocelyn Paas, Science and Biology Teacher, Peoples Christian Academy

Judy Wearing, Senior Editor, The Critical Thinking Consortium

Reviewers

Bonnie Anderson, Peel Field Centres, Peel District School Board

Corrine Brook-Allred, Pickering (Retired)

Victoria Winchester, Russell Public School

Care has been taken to trace the ownership of copyright material contained in this document. STAO will be pleased to receive and information that will enable it to rectify any errors or omissions in subsequent editions. Send comments to info@stao.ca

Teachers are permitted to make copies of this document for their classroom use.

©STAO/OTF 2012 The material in this document shall not be copied nor reproduced beyond a classroom without the permission of Science Teachers' Association of Ontario/L'Association des professeur de science de l'Ontario [STAO/APSO]

Table of Contents

Overview for Grade 4 Rocks and Minerals Activities.....	4
Safety.....	4
Lesson #1 - How Do Rocks and Minerals Influence Our Lives?.....	5
Lesson #2 - Identification and Classification of Rocks.....	5
Lesson #3 - Discovering Human Made Items Which Contain Rocks and Minerals.....	5
Lesson #4 - Repurposing Items.....	5
Scenario Approach.....	6
Junior Geologists.....	6
Related Activities that assist with integration and use of technology.....	7
Additional ideas.....	8
Student Field Guide	8
Fossil Dig – Introduction to Geology.....	9
Lesson 1 - How do rocks and minerals influence our lives?.....	10
Minds On.....	12
Connections.....	12
Action.....	12
Connections.....	13
Consolidation.....	13
Extensions.....	14
How do rocks and minerals influence our lives?.Worksheets.....	16
Lesson 2 - Identification and Classification of Rocks	19
Part 1: Lesson.....	21
Minds On.....	21
Connections.....	21
Action.....	22
Connections.....	24
Consolidation.....	24
Part 2: Lesson.....	25
Background.....	25
Minds On.....	26
Connections.....	27
Action.....	27
Connections.....	28
Consolidation.....	28
Connections.....	29
Let’s Rock! Worksheet.....	30
Part 1 of Lesson Worksheet.....	31
Part 2 of Lesson Worksheet.....	32

Lesson 3 - Discovering Human Made Items Which Contain Rocks and Minerals.....	34
Minds On.....	36
Connections.....	36
Action.....	36
Connections.....	37
Consolidation.....	37
Connections.....	38
Extensions.....	38
Resources.....	38
Discovering Human Made Items Which Contain Rocks and Minerals. Worksheet.....	39
Lesson 4 - Repurposing Items.....	40
Minds On.....	41
Connections.....	42
Action.....	42
Connections.....	43
Consolidation.....	44
Connections.....	45
Resources.....	45
Repurposing items containing rocks and minerals – Project Sheet	46
Part 2: Action Worksheet.....	47
Part 3: Consolidation Worksheet.....	49

Overview for Grade 4 Rocks and Minerals Activities

The series of lessons provided for the Rocks and Minerals topic of the Science and Technology curriculum have been developed with the perspective that students learn best when they are able to: interact with their environment, particularly in the out of doors; consider the broader implications of their learning; and, work in a collaborative atmosphere of shared knowledge, which furthers the group as a whole rather than select individuals.

The lessons support the 'Big Ideas' of this strand, which are:

- Rocks and minerals have unique characteristics and properties that are a result of how they were formed.
- The properties of rocks and minerals determine society's possible uses for them.
- Our use of rocks and minerals affects the environment.

Concepts that are developed in these lessons include:

- the earth contains rocks and minerals, which are mined from the ground;
- rocks and minerals can be identified using various physical characteristics and all rocks will fall into one of three classification categories;
- rocks and minerals are used to create things for use in our human environment;
- there are social and environmental benefits and costs to the extraction, processing, and use of rocks and minerals; and,
- there are various options for rock- and mineral-containing items once they can no longer be used for their original purpose. By re-using or re-purposing these items, we are promoting environmental stewardship.

Cross-curricular connections include Visual Arts in the Repurposing Items lesson.

These lessons specifically align to the Grade 4 Science and Technology Rocks and Minerals topic, however there are also connections to big ideas in the Social Studies curriculum, particularly: that human activity and the environment have an impact on each other; and, that human activities should balance environmental stewardship with human needs/wants. Other cross-curricular connections include visual arts in the Repurposing Items lesson

The lessons vary in time required and complexity, ranging from approximately one hour in length to between two and three hours in length. There are opportunities in the lessons for differentiating instruction, as well as possible ways to extend the lesson and deepen the students' understanding.

Safety

Safety in the outdoors should be reviewed in each lesson. A detailed explanation is given in the Overview Section of the entire document, but the following is a brief summary of safety instructions you will need:

- Take a walk around the area where you would like to bring your class or group and look for safety issues, both natural (e.g., poison ivy, stinging nettles, etc.) and/or human made (e.g., barbed wire fences, broken glass, etc.).
- Instruct your students on dressing appropriately for the terrain and weather, e.g., proper hiking shoes, sunscreen, hats, backpacks, etc.
- Have students bring water, if you are planning to be outside longer than 30 minutes.
- Have students organized in partners and have them work together or in small groups, never alone.
- Organize your class activity so that all students are visible to you or are in a clearly marked area within hearing distance of your whistle or bell.

Lesson #1: How Do Rocks and Minerals Influence Our Lives?

This lesson uses student-centred inquiry-based learning to develop an understanding of where rocks and minerals come from; how they are extracted; the effects on the environment of rock and mineral extraction; and the plethora of products in our surrounding environment that are comprised of rocks and minerals.

Lesson #2: Identification and Classification of Rocks

In this activity, students will observe and test local rocks in order to identify similarities and differences, and to determine if local rock is classified as sedimentary, igneous or metamorphic. This will be achieved using performing and recording and analyzing and interpreting skills for scientific inquiry/experimentation. Students will utilize a Knowledge Building Circle at the end of the lesson to consolidate learning and engage in further rock and mineral related inquiry.

Lesson #3: Discovering Human Made Items Which Contain Rocks and Minerals

Students will go into the schoolyard or local neighbourhood and try to identify human-created items that contain rocks or minerals. They will then further consider the advantages and disadvantages of the items to the local environment and to the environment in which it was mined. Their work will be peer reviewed.

Lesson #4: Repurposing Items

Students will bring an item from home containing rocks and minerals that was destined for disposal and will repurpose it for a new use. The first part of the lesson will take place outside and the students will identify ways that nature reduces-reuses-recycles (herein referred to as “the 3-Rs”). The class will then discuss the 3-Rs from a human perspective. The students will brainstorm new purposes for their item and propose an idea, which will receive peer and teacher feedback. During the following class, students will create their new item and the lesson will culminate with a knowledge-building circle, where the students’ creations are shared and the concept of reusing/repurposing is further discussed as a class.

Scenario Approach

A very effective way of engaging students is through the use of scenarios or story lines as the “hook”. Students really buy into it and it is a great way to integrate many different subjects and topics. Create the scenarios to take into account different subject areas as well as real-world examples so that students can make connections to what is happening in their local neighbourhood as well as the larger global community.

Grade Four Rocks and Minerals: Suggested scenario based on becoming “Junior Geologists”

Junior Geologists

Come in dressed like a field geologist with a hard hat, pick, and clipboard. Explain that you received a text message over the weekend from the Ministry of Northern Development and Mines asking for your help. You were really not sure what it was all about but you were pretty pumped at this opportunity to get involved in real science. When you arrived at school this morning, there was a package in the office and it had all these really cool objects inside.

Carry in a banker’s box or similar large box that contains books on rocks and minerals, rock samples, tools for digging and excavating rocks, magnifying glasses, and the special letter addressed to the class. Decorate the outside of the box as if it belonged to a field geologist. Have an email, text or letter ready to read to the class. Explain that the letter was sent to you since this grade 4 class is training to become “Junior Geologists”.

Create a separate email account for the project. This allows you to send and receive important messages from the “Senior Geologist” throughout the activities.

*“Good morning boys and girls of ** School. I understand that your class is studying all about rocks and minerals. That is a fascinating topic, I must admit. You see, I am a Senior Geologist from the Geological Survey of Canada and we have had a problem over the weekend. I sent a text message to your teacher who agreed that this class might be able to assist us. Our computer system crashed on Friday night and we have lost all our data as well as some very valuable samples. We need your help in determining what rocks and minerals are in your area so that we can start to rebuild our collections and database. We need to do some field work to find the answers. Hopefully, you will be able to conduct some scientific experiments and assist us. These lost samples must be retrieved.”*

Related Activities that assist with integration and use of technology

- Read the book, *“Everybody Needs a Rock”* by Byrd Baylor
- On one of the outdoor activities described in the unit, students will be collecting a variety of rocks from the local area. Students can bring in other samples that they might have collected while on vacation or visiting in other parts of the province or country
- After reading the book, have students select their favourite rock from the collection on the table and ask them to “Adopt a Rock”
- Have them write about their rock. Create a riddle or poem to describe their rock. Another person in their group will try and guess their rock based on their creativity
- Create a poster of their favourite rock, including a story or poem using the Voices From the Land project <http://www.sharingvoices.org/>
- Conduct a sample “Fossil Dig” using chocolate chip cookies (described in Additional Ideas section) to get them into the swing of being geologists (check for food allergies first)
- Make “Mock Rocks” for students to examine to help them understand the composition of rocks <http://fossweb.com/modules3-6/EarthMaterials/index.html>
- Have students create a song about their “favourite” rock <http://www.songsforteaching.com/geologyearthscience.htm>
- Create a geologist field book to record information while outside – use Notes on the iPad or a program, such as Dragon Dictation or Voice Recorder, to record information
- Use apps on the iPad while outside to try and identify rock samples
 - Rocks and Minerals
 - Rock Hounds
 - Gems and Minerals
- Take pictures of rocks while outside for use back in the classroom
- Incorporate the GPS aspect of the camera and record these rock samples on a map of the school area or where excavation took place
- Map the route taken to find the rocks and draw the route on return to the class
- Add the map and route to programs such as Google Earth or ArcGIS
- Hide “special rocks” that the students must find in the school yard or local park. Use GPS and mapping skills to locate them. The students must determine if these are the lost samples based on research they have done.
- Have another teacher or parent volunteer act as the “geologist”. Use actual geologists from **Prospectors and Developers Association of Canada Mining Matters**
- This person is in another location as students send back pictures via iPad or Skype. Confirmation can be sent to students in the field
- Complete the scenario by writing to “scientists” to explain their findings. Must use scientific data
- Create class Blog each day to show what students have discovered and the research they have carried out (writing and research skills)

Additional ideas

Student field guide

Develop a student field guide for future students from a locality of choice. Future classes will use this and contribute. Enlisting the assistance of local geologists to help identify features could also be done. To encourage mapping skills and use of technology, you could use a GPS tool to mark the exact location of rocks and minerals.

Use of rocks and minerals

Students do an inventory of human uses of rocks and minerals visible in a locality – schoolyard, city block, and park. They then consider which use has had the most impact on the environment or which has been most important for human progress. Different groups could make different judgments and see if there is a relationship between human progress and impact on environment. Additionally, they could specify relationship to children's uses or school's uses – all the rocks and minerals visible to the school's building and operation.

Fossil Dig – Introduction to Geology

Materials:

- Cookies - one of each type for each person (check food allergies!)
 - Hard chocolate chip cookie
 - Soft chocolate chip cookie
 - Hard raisin cookie
 - Soft raisin cookie
 - Hard cookie
- Paper towels or foam plates
- Toothpicks
- Homemade cookies to eat at end of class!!

Procedures:

1. Take one of each type of cookie, two paper towels/plates, and six toothpicks.
2. Start by excavating in the hard cookies to extract the chocolate chips or raisins using only the toothpicks. If you break a toothpick so that it is no longer sharp, you can no longer use it. It must be discarded.
3. After 3 to 5 minutes, stop and find out if anyone was successful in extracting anything. As a class, review the Discussion Questions below.
4. Now excavate with the soft cookies using the same rules.
5. After 3 to 5 minutes, stop and find out if you were more or less successful in extracting chips or raisins.

How did the results differ between the hard and the soft cookies?

Discussion Questions:

1. What is the condition of the chips and raisins extracted? Were they whole or broken? Are there bits of cookies still clinging to them or are they relatively clean?
2. What was it like trying to remove the raisins and/or chips from the extremely firm cookie?
3. Did you get different results from the chips versus the raisins?
4. Has anyone used up all their toothpicks already?

Extension:

Excavating raisins or chocolate chips from a cookie is similar to the work paleontologists do in the field, but working in a classroom is much different from excavating fossils on your hands and knees in the hot sun. To get a more realistic feel for paleontology fieldwork, bury some items in a school garden or other area where digging is acceptable, and excavate the items. This time, instead of toothpicks, provide them with screwdrivers and a garden trowel.

Grade 4 Rocks and Minerals

Lesson 1 - How do rocks and minerals influence our lives?

Lesson Overview

This lesson uses student-centred inquiry-based learning to develop an understanding of where rocks and minerals come from; how they are extracted; the effects on the environment of rock and mineral extraction; and the plethora of products in our surrounding environment that are comprised of rocks and minerals.

This lesson will take approximately one hour to complete.

Connections to Environmental Education

- *The positive and negative consequences, both intended and unintended, of the interactions between human-created and natural systems*

Curriculum Expectations

Science - Grade 4 Understanding Earth and Space Systems: Rocks and Minerals

- SE1.1 assess the social and environmental costs and benefits of using objects in the built environment that are made from rocks and minerals
- SE2.1 follow established safety procedures for outdoor activities and for working with tools, materials, and equipment (*e.g., when working outdoors, leave the site as it was found*)
- SE2.6 use a variety of forms (*e.g., oral, written, graphic, multimedia*) to communicate with different audiences and for a variety of purposes (*e.g., use a graphic organizer to show how rocks and minerals are used in daily life*)
- SE3.1 describe the difference between rocks (composed of two or more minerals) and minerals (composed of the same substance throughout), and explain how these differences determine how they are used

Social Studies - Grade 4 People and Environments: Political and Physical Regions of Canada

- OE B2. **Inquiry:** use the social studies inquiry process to investigate some issues and challenges associated with balancing human needs/wants and activities with environmental stewardship in one or more of the political and/or physical regions of Canada (FOCUS ON: *Perspective*)
- SE B1.1 analyze some of the general ways in which the natural environment of regions of Canada has affected the development of industry
- SE B1.2 assess aspects of the environmental impact of different industries in two or more physical and/or political regions of Canada
- SE B1.3 describe some key actions taken by both industries and citizens to address the need for more sustainable use of land and resources

- SE B2.1 formulate questions to guide investigations into some of the issues and challenges associated with balancing human needs/wants and activities with environmental stewardship in one or more of the political and/or physical regions of Canada
- SE B2.2 gather and organize information and data from various sources to investigate issues and challenges associated with balancing human needs/wants and activities with environmental stewardship in one or more of the political and/or physical regions of Canada

Learning Goals

- At the end of this lesson, students will devise answers to the inquiry question that show that critical thinking skills were employed. Students could use their own personal experiences as comparison (e.g., at my house, we dug out a big pit to make a swimming pool and it disturbed a bunch of squirrels living in a nearby tree; I think that the impact of a massive pit would affect even more animals), or they may take previously gathered knowledge and apply it (e.g., I know that when I look at the pavement in the playground, it has rocks in it, so I would say that it contains rocks).
- At the end of this lesson, through inquiry and collaborating with group members, students will attempt to determine where rocks and minerals come from; how they are extracted; the effects on the environment of rock and mineral extraction; and the plethora of products in our surrounding environment that are comprised of rocks and minerals.
- At the end of this lesson, students will have participated co-operatively with group members, engaging in constructive debate.

Instructional Components and Context

Readiness

- Understand the difference between living and non-living things
- Define the difference between a rock and a mineral
- Know the potential uses for rock and minerals (e.g., glass, bricks, asphalt, metal, pencil lead, nails, staples, pop cans, tetra paks, etc.)

Materials

- Shovels
- Material on which the students can lay out their dirt piles. Examples could be a sheet of thick plastic, plastic bags, construction paper, etc.
- Project sheet

Terminology

- rock
- mineral
- living vs. non-living things
- mining

Minds On

To be done in partners, triads or groups of 4. Can be done inside or outside.

Give the students a certain amount of time to answer the following questions on their individual project sheets. Ideally, they should work collaboratively to answer the questions. This should activate thinking and prior knowledge. At the completion of the lesson, the students will go back to their initial thoughts and compare them with their thinking at the end of the lesson.

Questions

- What is the difference between a rock and a mineral?
- How do we benefit from rocks and minerals? Give two examples of how we do or do not benefit from rocks and minerals
- How do humans get the rocks out of the ground for use?

Connections

Assessment for learning

Categories addressed: knowledge and understanding; thinking; and communication

This activity will be filled out on students' project sheets and will show their initial understandings.

Action

Considerations prior to starting the activity

As it is not advisable to leave the school yard littered with little pits, the dirt could potentially be removed from: a portion of the yard which is generally unused; underneath a tree where the grass doesn't grow and students don't play; a section of garden; the perimeter of the yard; or an off-site location and brought to school in a few pails. If the dirt is removed from the school yard, ensure that it is put back in its original location when the lesson is done, ideally before the area is used again by the school community. If there are pits which pose a tripping hazard, ensure that they are marked and students are aware of their presence. Do not have tripping hazards present any longer than required. Check with school principal and custodian for assistance and permission.

Get a shovel full of dirt from your proposed digging location prior to implementing the activity, as you may find it does not contain the content you desire. For example, if you are digging from a garden, there may be a thick layer of mulch, organic matter, and/or topsoil, which will need to be removed in order to get to the dirt more likely to contain rocks. Also, many areas are covered in a layer of soil that may not be native and unlikely to contain the variety of rocks often present in native soils of Ontario. So keep digging, as long as it's permitted by the school.

If you are encountering difficulty obtaining soil samples from your school yard or local area, landscaping companies would be a great place to inquire, as they have all sorts of material, including soil fill. It would, however, be advisable to inquire about where the fill has come from, as there may be contamination present in soil obtained from commercial, industrial or historic orchards. Parents of students can also be of help in this topic.

Can be done inside or outside, but greatest benefit to students would occur outside.

Previously arranged groups will each get a chunk of dirt (about a shovelful), which contains dirt and rocks.

Ask each group to spread out their pile of dirt and list on their project sheet all the non-living things they observe. This will require an understanding of the difference between living and non-living things.

Pose the following questions to engage students in thinking and investigation; communication; and application. Encourage them to look around their surroundings to get ideas. Teacher may provide scaffolding as required, but it is preferred that the students work out their thinking on their own.

Answers to go on their project sheets.

- Do you think that any of the non-living materials in your dirt pile could be used for the constructed materials in our surrounding, observable environment? If yes, which ones? What features do you think make the non-living material in your pile suitable or not suitable for use in construction?
- How could this material be removed from the ground on a large scale? Would there be any waste material? If so, what would be in the waste material? Do you think that the waste material could be used for another purpose,; if so, what would the use be?
- Would there be any effects on the environment from removing this material from the ground? What might they be?
- Compare the potential effects on the environment from the rock/dirt removal to a situation in your life where the environment was affected due to human influence.

Connections

Assessment

Categories addressed: thinking; communication; application

Assessment for learning

Give scaffolding as required. Note students' collaborative learning and provide modelling, such as letting an opinionated student hold their answer until the other members have given an opinion.

Assessment of learning

The project sheets are all independently submitted. There can be some links between group members' answers but they cannot be verbatim.

Consolidation

How Has Our Thinking Changed Over This Lesson?

Students are to do this task independently. They are to look over their answers to the questions in **Minds On** and explain if any of their answers would change or if they would add extra details to any of their answers based on what they have learned during the lesson.

Assessment as learning

Students are looking back at their thoughts at the beginning of the lesson and are reflecting on their learning.

Differentiated Instruction

- Chunking of tasks;
- Extra time to complete task. Allow students to put their pile of dirt aside and finish the task at a later time;
- If writing is an issue, put the student with a partner who is proficient at writing and they can work together to write down the most essential points for the exceptional student;
- Use an iPad program, such as Dragon Dictation or Voice Recorder, to record the information.

Extensions

To further understand the positive and negative aspects of rock and mineral extraction on local communities and the environment, the class can create further inquiry into specific towns that are involved in rock and mineral extraction.

You could organize a class trip to a mining operation nearby.

Teacher could try to arrange a connection between a class of students in a mining town using technology, such as video conferencing, a web based discussion forum, or emails.

Create an outdoor demonstration to outline the effects of mining on the environment. In the school yard, students will list or observe all the types of habitats present. Then the teacher will mark off a large area, using tarps or marks or something else that the students can see. Indicate that area is now used for mining, with a large pit and trucks moving in and out, and buildings for storing things, and roads. Have students discuss what would be the potential impacts on the creatures and their habitats from the change in land use.

How do rocks and minerals influence our lives?

Part 1

In your answer, try to use examples from your own life. Example answer: I have benefited from rocks and minerals as my house is covered in bricks, which help keep out the cold in the winter.

Question

What is the difference between a rock and a mineral?

How do we benefit from rocks and minerals? Give two examples of how we do or do not benefit from rocks and minerals.

How do humans get the rocks out of the ground for use?

Part 2

List of non-living things found in your shovel of dirt

What are the potential uses for this non-living material?

Do you think that any of the non-living materials in your dirt pile could be used for the constructed materials in our surrounding, observable environment?
If yes, which ones?

What features make the non-living material in your pile suitable or not suitable for use in construction?

How could this material be removed from the ground on a large scale? Would there be any waste material? If so, what would be in the waste material?

Do you think that the waste material could be used for another purpose? What would the use be?

Would there be any effects on the environment from removing this material from the ground?
What could they be?

Compare the potential effects on the environment from the rock/dirt removal to a situation in your life where the environment was affected due to human influence.

Part 3

Look over your answers in Part 1 and explain if any of your answers would change or if you would add extra details to any of your answers based on what you have learned during the lesson.

Grade 4 Rocks and Minerals

Lesson 2 - Identification and Classification of Rocks

Lesson Overview

In this activity, students will observe and test local rocks in order to identify similarities and differences and to determine if local rock is classified as sedimentary, igneous or metamorphic. This will be achieved using performing and recording and analyzing and interpreting skills for scientific inquiry/experimentation. Students will utilize a knowledge-building circle at the end of the lesson to consolidate learning and engage in further rock and mineral related inquiry.

This lesson is split into two parts, which will likely occur over 2 to 3 hours.

Connections to Environmental Education

- *The earth's physical and biological systems*

Curriculum Expectations

Science - Grade 4 Understanding Earth and Space Systems: Rocks and Minerals

- SE2.1 follow established safety procedures for outdoor activities and for working with tools, materials, and equipment (*e.g., use scratch and streak test materials for the purposes for which they are intended; when working outdoors, leave the site as it was found*)
- SE2.2 use a variety of tests to identify the physical properties of minerals (*e.g., hardness [scratch test], colour [streak test], magnetism*)
- SE2.3 use a variety of criteria (*e.g., colour, texture, lustre*) to classify common rocks and minerals according to their characteristics
- SE2.5 use appropriate science and technology vocabulary, including hardness, colour, lustre, and texture, in oral and written communication
- SE2.6 use a variety of forms (*e.g., oral, written, graphic, multimedia*) to communicate with different audiences and for a variety of purposes (*e.g., use a graphic organizer to show how rocks and minerals are used in daily life*)
- SE3.2 describe the properties (*e.g., colour, lustre, streak, transparency, hardness*) that are used to identify minerals
- SE3.3 describe how igneous, sedimentary, and metamorphic rocks are formed (*e.g., Igneous rocks form when hot, liquid rock from deep below the earth's surface rises towards the surface, cools, and solidifies, for instance, after a volcanic eruption. Sedimentary rocks form when small pieces of the earth that have been worn away by wind and water accumulate at the bottom of rivers, lakes, and oceans and are eventually compacted and consolidated into rock; they can also be formed when sea water evaporates and the dissolved minerals are deposited on the sea floor. Metamorphic rocks form when pre-existing rocks are changed by heat and pressure.*)
- SE3.4 describe the characteristics of the three classes of rocks (*e.g., Sedimentary rocks often have flat layers, are composed of pieces that are roughly the same size with pores between these pieces that are commonly filled with smaller grains, and sometimes contain fossils. Igneous rocks*

generally have no layers, have variable textures, and do not contain fossils. Metamorphic rocks may have alternating bands of light and dark minerals, or may be composed predominantly of only one mineral, such as marble or quartzite, and rarely contain fossils.), and explain how their characteristics are related to their origin

Learning Goals

- At the end of this lesson, students will have made careful observations using five senses and appropriate tools.
- At the end of this lesson, students will be able to outline similarities and differences between rocks on-site.
- At the end of this lesson, students will have used appropriate terminology in latter part of lesson, including hardness, colour, texture, lustre, magnetism, sedimentary, igneous, metamorphic.
- At the end of this lesson, students will be able to classify site rocks as sedimentary, igneous or metamorphic.

Instructional Components and Context

Readiness

- No previous knowledge required

Materials

- rocks gathered by students
- chart paper
- safety goggles
- gloves (scratch and streak test)
- unglazed white and black tiles (streak test)
- pennies
- steel nail or tool files
- sandpaper
- Depending on the location where students are collecting samples, it would be useful for the teacher to have a set of simple mineral samples, such as graphite, calcium carbonate, iron ore, obsidian, gypsum, and maybe some “fake” minerals too, like glass and coal.

Terminology

- scratch test
- streak test
- hardness
- colour
- texture

- lustre
- magnetism
- sedimentary
- igneous
- metamorphic

Part 1: Lesson

Minds On

1. Ideally done outside in warmer months
2. Each student finds a rock from the school yard or local environment that they like. The rocks should easily fit in the student's hand. It is alright if some of the rocks are fairly similar. Have a selection of rocks and minerals available for the students.
3. The students sit in a circle with a maximum of twelve children and spend a few minutes getting to know their rock with their senses - sight, touch, smell, taste (at teacher's discretion), sound of tapping, etc. Students should feel for grooves, shape, texture, and so on.
4. To further reinforce their understanding of their particular rock, they will draw a picture of the rock and make any descriptive notes they wish on their inquiry sheets.
5. After the pictures are done, all the rocks are collected in the centre of the circle and the students are blindfolded. The teacher remains un-blindfolded to supervise the activity.
6. The teacher picks up one rock from the centre pile and hands it to the student on the right. The student uses all senses, except for sight and taste, to discern if it is their rock. If they believe it is their rock, the student quietly puts it in their lap. If not they pass it on to the next student.
7. After all the rocks have gone around the circle, the blindfolds are removed and students check to see if they have chosen the right rock.
8. A discussion is held about how they found their rock and the importance of using our senses for observation.
9. In addition to verbally discussing the process of identifying their rock, the teacher may also have the students write down their findings on their investigation work sheets. Question: Did you correctly identify rock? Why or why not?

Connections

Assessment

Categories addressed: thinking and investigation; communication

Assessment for learning

The depth of the student's observation skills will be demonstrated on their drawing and descriptive notes.

Assessment as learning

The student's ability to indicate why they were or were not able to identify their rock while blindfolded will demonstrate their ability to reflect on their personal observational skills.

Action

Overview

This next part of the lesson is directed at using an inquiry-based approach to determine the common tests and criteria used to identify similarities and differences between rocks, and then getting into groups and implementing the tests and criteria to compare their rocks to their group members' rocks. The students will be in groups of 4 and will compare their rocks with the rocks of their group members using the scratch and streak tests (procedure outlined below) and criteria, such as colour, texture, magnetism, and lustre. The teacher can contact a local mineral club to find a visiting geologist. The teacher's role in this part of the lesson is the following:

- guide the group in determining the tests and criteria used in identifying rocks
 - guide the group in discovering the proper terminology used in rock and mineral testing
 - demonstrate how to do the scratch and streak test and outline the safety procedures
 - provide support to groups as required
 - make anecdotal notes of students' inquiry and discovery processes to supplement the written component of the activity
1. Inquiry into how to test rocks
 2. Teacher to pose the following question: Besides using our senses, what other tests could we use out in the field to help us identify a type of rock?
 - a. List all the answers and try to categorize them.
 - b. Put proper terminology to the answers. Example: shiny = lustre
 3. Then bring out the tools (see below for streak and scratch test materials, as well as, a magnet). Pass them around and ask if any of the possibilities on our list fit with what these tools might do.
 4. Take the information provided by the students and introduce the different tests that they will be doing. Demonstrate the procedure and outline the safety considerations.
 5. Advise students that they will be put into groups of 4 and will be testing their rocks and their group members' rocks to identify the similarities and differences between them. The students are to bring their rocks and inquiry sheets to their group.
 6. After the students have assembled into their groups, they can come up to the teacher as a group to collect their testing materials and safety equipment, primarily safety goggles. Before the teacher gives the group their tools, the group is asked a safety or procedure question. They are provided their gear when they correctly answer the question. For example: when you do the scratch test, should you scratch the nail towards your body or away from your body and why?; why is it important that we wear safety goggles when doing scientific inquiry?; how should you transport scientific tools and should you be walking around while holding your tools ?

7. The students will go back to their groups and begin testing their rocks. Students should be encouraged to contribute to the group activity. This can be facilitated by having students take turns being the overseer of at least one of the identification tests (i.e., Student A oversees describing the colour of each rock; Student B oversees the scratch test). This activity should be collaborative with students working together and reaching a common consensus on findings, rather than each student testing their rock and then the other group members copying the findings onto their inquiry sheets. Also, the group members should all be working with the same rocks under the same rock number. For example, Rock #1 should be Student A on all the group members' inquiry sheets.
8. If students' rocks are fairly similar and they start to mix them up, the teacher can direct the students back to reviewing their initial drawings and descriptions to determine the rock owner.
9. The streak and scratch tests are outlined below and the rock comparison table is found on the inquiry sheet at the end of this document.
10. The teacher will collect all rocks, placing them in the groups, as they will be used next class.

Mineral Streak Test

A mineral's streak is the color it has when ground to a powder. The great majority of minerals have a white streak, but there are a few well-known minerals for which the streak is an important property for identification.

The simplest way to make a powder is to grind the mineral on a small rectangular piece of unglazed ceramic called a streak plate. An old kitchen tile or even a sidewalk can also serve as a streak plate. Mineral streaks can usually be wiped off easily with a fingertip.

- Each group gets one black and one white tile.
- The rocks should be placed in order from Rock #1 to Rock #4.
- Take the first sample and rub a straight line, or streak, down the length of the tile. Students should see a streak of colour(s) on the tile.
- Record result on inquiry sheet.
- Return rock to its place in the ordered line-up and continue to perform the streak tests in order.

Mineral Scratch Test

- Scratch each rock with a fingernail. On the Mohs' Scale for rating hardness, a fingernail scratch indicates a hardness of 2 or less. Students to note findings on inquiry sheet.
- Scratch the rocks with a penny. On the Mohs' Scale for hardness, a coin scratch indicates a hardness of less than 3. Students to note findings on inquiry sheet.
- Scratch the rocks with a steel file or nail. On the Mohs' Scale for hardness, a steel nail or file indicates a hardness of less than 7. Students to note findings on inquiry sheet.
- Prompt students to determine if they notice that a rock that is scratched by fingernail will also be scratched by each subsequent test and see if they can come up with any conclusion about that.

Connections

Assessment

Categories addressed: knowledge and understand; thinking and investigation; communication

Assessment for learning

Teacher to note students' progress, how well they are achieving success criteria, and what supports need to be put in place to support students not achieving the success criteria.

Assessment of learning

The students' ability to make careful, accurate observations will be demonstrated in their table, but also through notes made by teacher while students are working.

Consolidation

The final component of this first part of the lesson will involve the students comparing the rocks to determine which are most similar and which are most different. A table for this can be found on the inquiry sheet.

Assessment of learning

Categories addressed: thinking and investigation; communication

Look at the students' ability to compare two sets of data and determine the similarities and differences.

Part 2: Lesson

This part of the lesson demonstrates that rocks are classified into three types which are based on how the rock was formed. Students will use some of the identifying features of each class of rock to attempt to classify their rock as sedimentary, igneous or metamorphic. This lesson would likely be conducted inside.

This two-part lesson will then conclude with a Knowledge Building Circle where students will discuss what they have learned and what they still have questions about.

Background for teachers

Difference between a rock and mineral

- A mineral is a naturally occurring, inorganic solid with a definite chemical composition and crystal structure with specific colour and hardness. Examples include diamond, copper, lead, and emerald.
- Rocks are an aggregate of one or more minerals which are locked together to form a hard solid. They are classified into three basic rock families: igneous, sedimentary, and metamorphic.

How rocks are formed/classification of rocks

- Rocks are categorized into three groups according to how they form.
- Igneous rocks are formed when magma cools. The rate that the magma cools determines what type of igneous rock is formed. Igneous rocks generally have no layers, have variable textures, and do not contain fossils. Samples of pumice and obsidian could be useful for a discussion of how they were formed.
- Metamorphic rocks are formed when rocks are exposed to heat and pressure. When the earth's plates collide and rub against each other, the pressure creates heat and the rocks can change. Rocks are also exposed to extreme heat when they are deep in the earth or when they come in contact with hot molten material. Metamorphic rocks may have alternating bands of light and dark minerals, or may be composed predominantly of only one mineral, such as marble or quartzite, and rarely contain fossils.
- Sedimentary rocks are formed when sediments are deposited and squeezed together. Weathering from wind, ice, water, plants, and even pollution will break up rocks into small pieces called sediment. This sediment is then eroded, transported, and deposited into layers that are cemented together to form sedimentary rocks. Sedimentary rocks often have flat layers, are composed of pieces that are roughly the same size with pores between these pieces that are commonly filled with smaller grains, and sometimes contain fossils. A sample of conglomerate could be used to show students its composition.
- The processes that create the three different types of rocks make up what is called the rock cycle. Although it takes an extremely long period of time, all rocks can change into different types of rocks through this cycle.
 - Heat and pressure = Metamorphic rocks
 - Weathering, erosion, deposition, and cementation = Sedimentary rocks
 - Cooling of magma = Igneous rocks

Link to geology map of Ontario which shows the major rock classes across the province. This may help the teacher determine what classes of rocks they are likely to encounter from their student samples:

<http://atlas.nrcan.gc.ca/auth/english/maps/environment/geology/majorrockcategories>

Link to a picture of the rock cycle: <http://www.geolsoc.org.uk/rockcycle>.

If teachers would like to purchase samples of the different types of rocks, this company has an affordable kit and it is Canadian: <http://boreal.com/common-rock-collection/p/IG0023159/>

MiningMatters@pdac.ca has samples that you can get and also a workshop for teachers.

Minds On

Students get back into their groups and write down the ways that rocks could be classified into groups. This should activate some of the knowledge from last class.

Indicate that rocks are classified into one of three groups and ask groups if they would cross out any of their items or make any changes. Have students choose the three items they believe are most likely to influence classification.

Groups will then present to the class and the teacher will write down the findings, determining if there are any links to the formation of three rock classes in the answers. Have the students attempt to determine that the classification of the rocks is based on how they are formed.

The teacher may wish to show this short video, which outlines the rock cycle in a down-to-earth, kid-friendly manner: <http://magma.nationalgeographic.com/ngexplorer/0605/quickflicks/>

To determine students' understanding, do this short quiz. Metamorphic=1 finger; Igneous=2 fingers; Sedimentary=3 fingers. Students will indicate what type of rock is formed by the following process using their fingers, which will be held close to their chests so only the teacher sees.

- Heat and pressure = Metamorphic rocks (1 finger)
- Cooling of magma = Igneous rocks (2 fingers)
- Weathering, erosion, deposition, and cementation = Sedimentary rocks (3 fingers)

The teacher can determine if class is ready to move forward and if not, he/she can use the rock cycle picture link above to further outline the process.

Connections

Assessment

Categories addressed: knowledge and understanding; thinking and investigation; communication application

Assessment for learning

How well students recalled the different characteristics that identified their rocks (i.e., colour, texture, etc.).

Assessment as learning

Note students who recognize that there may be modifications of their classification choices based on the fact that there are only three classes.

Action

1. Each student will then take the information they have gathered so far and either draw their own depiction of the rock cycle or write down a description of the process.
2. Pose question to class: Do you think that rocks in a specific class will have certain identifying characteristics? Why? What ideas do you have of what they might be? Write down students' answers and link to Ministry of Education provided class descriptions (these descriptions are also on the students' inquiry sheets):
 - a. Igneous rocks generally have no layers, have variable textures, and do not contain fossils.
 - b. Metamorphic rocks may have alternating bands of light and dark minerals, or may be composed predominantly of only one mineral, such as marble or quartzite, and rarely contain fossils.
 - c. Sedimentary rocks often have flat layers, are composed of pieces that are roughly the same size with pores between these pieces that are commonly filled with smaller grains, and sometimes contain fossils.

Teacher may provide pictures to show students what some of the rocks look like and how they align to the characteristics for each class. This link shows a number of pictures for each class of rock:

<http://geology.com/rocks>.

3. Teacher will hand back the rocks to each group and the students will determine each member's rock. They will fill in their answers on their inquiry sheets.
4. Once every member in the group has decided what their rock is, they will note their class of rock on a bar chart set up by the teacher. The class can then easily see what types of rocks are most prevalent in the class.

Connections

Assessment

Categories addressed: knowledge and understanding; thinking and investigation; communication

Assessment of learning

The inquiry sheets. For students who are not strong writers, the teacher can ask targeted questions to determine their analysis process orally.

Extensions

- a chart or key to help observe and classify different types of rocks

Consolidation

Using a Knowledge Building Circle

This lesson can be best wrapped up using a Knowledge Building Circle, which elaborates on the principles of Knowledge Building Discourse.

Knowledge Building Discourse is a communal activity in which learners come together to pose questions, posit theories, and to revisit, negotiate, and refine their ideas. The collective goal is 'idea improvement'. Knowledge Building Discourse serves to identify shared problems and gaps in understanding and to advance the understanding beyond the level of the most knowledgeable individual.

The term Knowledge Building Circle refers to the seating configuration of students as they engage in Knowledge Building Discourse. The circle is ideal to successful Knowledge Building for several reasons : it promotes attentive listening and communication; it eliminates hierarchy; and it fosters respect for all life.

Initially, especially in a class of 25-30 students who are new to KB Circles, the teacher may need to work with students to establish agreed-upon expectations for ensuring behavioural and mutual respect during KB Circles. For more information about Knowledge Building Discourse and Knowledge Building Circles, see: www.naturalcuriosity.ca

Questions to pose during Knowledge Building Circle

Have students take a minute to think and look over their inquiry sheets after asking the questions, then open the floor to discussion.

1. How has your thinking about rocks changed since the beginning of the last lesson? An ideal answer would include what the student thought at the start of the lesson, the processes that changed his/her thoughts, and what they think now.
2. What is the best thing that you have learned in this lesson?

3. Why would it be important to know about the characteristics of rocks and how they were formed? Would their characteristics make them more suitable for certain purposes (e.g., granite is nice for counter tops because of its shine, mineral patterns, and strength).
4. What else would you like to know about rocks and minerals?
5. Give students the opportunity to pose their own questions.

Connections

Teacher: make notes of student discussion for assessment purposes as outlined below.

Assessment

Assessment of learning

Teachers can determine students' depth of learning in their answers. As some students are not strong writers, this oral discourse can provide a valuable source of student understanding and may supplement their written work.

Assessment as learning

Teacher to note students' ability to self-assess their growth over this lesson.

Differentiated Instruction

Provide students alternative opportunities to demonstrate their learning via written and visual communication.

- Chunking of tasks;
- Extra time to complete tasks;
- If writing is an issue, partner the student with one who is proficient at writing. They can work together to write down the most essential points for the exceptional student.
- Vary the number of rocks to be compared or make it a step-wise process starting with the comparison between two rocks, and then adding a third rock.

Let's Rock!

Part 1 of Lesson

Is this my rock?

Make a detailed drawing of your rock and include any notes to describe it using your senses of touch, sight, smell, and sound.

Did you correctly identify your rock? Why or why not? What would you do differently next time to help in properly identifying your rock?

Rock Testing Table (Be sure to have samples with very specific characteristics to make identification possible.)

	Rock #1	Rock #2	Rock #3	Rock #4
Rock Owner				
Streak test colour				
Scratch test result	Fingernail:yes/no Penny:yes/no Nail:yes/no Sandpaper: yes/no	Fingernail:yes/no Penny:yes/no Nail:yes/no Sandpaper: yes/no	Fingernail:yes/no Penny:yes/no Nail:yes/no Sandpaper: yes/no	Fingernail:yes/no Penny:yes/no Nail:yes/no Sandpaper: yes/no
Attracted to magnet? yes or no				
Colour(s)				
Lustre				
Texture: how does it feel?				
Other appearance notes (layers, smaller rocks inside bigger rock, fossils, transparent, etc.)				

How does your rock compare to your group members' rocks?

Using the information in the table above, note the number of similarities between your group's rocks (Example: Rock #3 and Rock #4 have 3 similarities)

	Number of similarities		Number of similarities
Rock #1 and Rock #2		Rock #2 and Rock #3	
Rock #1 and Rock #3		Rock #2 and Rock #4	
Rock #1 and Rock #4		Rock #3 and Rock #4	

Which rocks are most similar and why?

Which rocks are most different and why?

Part 2 of Lesson

Draw a picture or write a description of the rock cycle.

What class am I?

1. Heat and pressure =
2. Weathering, erosion, deposition and cementation =
3. Cooling of magma =

Characteristics of each class of rocks

Igneous rocks generally have no layers, have variable textures, and do not contain fossils.

Metamorphic rocks may have alternating bands of light and dark minerals, or may be composed predominantly of only one mineral, such as marble or quartzite, and rarely contain fossils.

Sedimentary rocks often have flat layers, are composed of pieces that are roughly the same size with pores between these pieces that are commonly filled with smaller grains, and sometimes contain fossils.

What class of rock do you have?

Take the information you collected in your table on your rock last class and use the descriptions above and pictures available from the teacher to determine what class your rock is (sedimentary, igneous, or metamorphic):

My rock is

I think this because

Grade 4 Rocks and Minerals

Lesson 3 - Discovering Human Made Items Which Contain Rocks and Minerals

Lesson Overview

Students will go into the schoolyard or local neighbourhood and try to identify human-created items that contain rocks or minerals. They will then further consider the advantages and disadvantages of the item to the local environment and to the environment in which it was mined. Their work will be peer reviewed.

Connections to Environmental Education

- *The Earth's physical and biological systems*
- *The dependency of our social and economic systems on these natural systems*
- *The positive and negative consequences, both intended and unintended, or the interactions between human-created and natural systems*

Curriculum Expectations

Science - Grade 4 Understanding Earth and Space Systems: Rocks and Minerals:

- OE1. assess the social and environmental impacts of human uses of rocks and minerals
- SE1.1 assess the social and environmental costs and benefits of using objects in the built environment that are made from rocks and minerals

Social Studies - Grade 4 People and Environments: Political and Physical Regions in Canada

- OE B1. **Application:** assess some key ways in which industrial development and the natural environment affect each other in two or more political and/or physical regions of Canada (FOCUS ON: *Cause and Consequence; Interrelationships*)
- OE B2. **Inquiry:** use the social studies inquiry process to investigate some issues and challenges associated with balancing human needs/wants and activities with environmental stewardship in one or more of the political and/or physical regions of Canada (FOCUS ON: *Perspective*)
- OE B3. **Understanding Context:** identify Canada's political and physical regions, and describe their main characteristics and some significant activities that take place in them (FOCUS ON: *Significance; Patterns and Trends*)
- SE B1.1 analyze some of the general ways in which the natural environment of regions of Canada has affected the development of industry
- SE B1.2 assess aspects of the environmental impact of different industries in two or more physical and/or political regions of Canada
- SE B1.3 describe some key actions taken by both industries and citizens to address the need for more sustainable use of land and resources

Learning Goals

- At the end of this lesson, students will be able to recognize the type of items that contain rocks and minerals.
- At the end of this lesson, students will be able to organize items which contain rocks and minerals into categories of human use.
- At the end of this lesson, students will take an item observed in their local environment and consider the costs and benefits of the item to their local community and also to the mining community.

Instructional Components and Context

Readiness

- What is a rock and what is a mineral?
- Understand that there are many items that contain rocks and minerals, and be able to make reasonable guesses as to which types of items contain rocks and minerals
- Rocks are minerals that are mined from the earth
- Humans impact the environment through extraction, processing, and use of natural resources

Materials

- Worksheets
- Pictures depicting mineral extraction and processing (website provided below)
- Digital devices for taking pictures (optional)

Terminology

- rocks
- minerals
- mines
- materials which contain rocks and minerals (drywall, concrete, asphalt, shingles, glass, brick, tiles, post, gutters, etc.)
- extraction
- processing

Minds On

Done inside

Arrange students in small groups

Give them all pictures of various stages in the extraction and production process and have them place them in order from the raw material to the finished product. Encyclopedia Britannica has some good pictures that show the copper process: <http://www.britannica.com/EBchecked/topic/136794/copper-processing/81931/Extraction-and-refining> . This will get the students thinking about the steps of taking a product from raw to processed state. Later in the lesson, they will consider the costs and benefits of this process

Each small group will now list as many things around the classroom that are comprised of rocks and minerals (examples-chalk board, concrete walls, drywall, flooring, desk legs, fixtures, etc.) The teacher will ask for an example from each group and make a class list of materials in the classroom environment that contain rocks and minerals. This should spark their thinking for the next part of the lesson.

Connections

Assessment

Categories of knowledge and skills-thinking and investigation

Assessment for learning

Mineral/rock extraction and processing, and the number of things in our environment that contain processed minerals and rocks can be noted.

Action

This can be done in the school yard or through a walk in the neighbourhood-Have students work in pairs and do a rocks and minerals hunt, whereby they need to list human-created products observed in their outside environment that use rocks or minerals (examples- metal fences, basketball nets, pavement, concrete, buildings, windows, metal building components, asphalt, shingles, etc.)

Have the pairs organize their items into categories of human use, such as recreation, shelter, transportation-related (i.e., roads, sidewalks, parking lots), etc.

Each pair will pick one item from their hunt that they found most interesting and would like to further consider, and will answer the questions on the work sheet. The teacher may provide the students time to do some research on a mining town in order to provide further depth to the answers on their project sheets.

This site from the Natural Resources Canada provides a map of the towns in Canada which are reliant on natural resources: <http://atlas.nrcan.gc.ca/site/english/maps/economic/rdc2001/rdcmin>

Technology Add-ons

If you have access to digital cameras, phones, iPads, iPods, etc., the students can take pictures of the items that they discover and then, as they separate their items into categories, they can put the pictures they took into the categories for a more graphic depiction. One way to do this would be to have the students load their pictures onto the school computer and then the teacher can decide if they will print a hard copy or if it will be used digitally.

Connections

Assessment

Categories of knowledge and skills - thinking and investigation; communication; application

Assessment for learning

How well are students able to take the items listed in the class and apply it to an outdoor setting; can they organize the items into broader categories of use; can they answer questions related to the costs and benefits of a particular item?

Assessment of learning

The worksheet, particularly examining the depth of responses and the learning goals will be used.

Consolidation

Once completed, students are to share their completed inquiry regarding a specific item containing rocks and minerals with another pair to gain peer feedback. The feedback should include two positive points and one area for improvement, plus the names of the assessors.

Connections

Assessment

Categories of knowledge and skills - communication; application

Assessment as learning

Students must reflect on what constitutes a good response to a question in order to provide effective feedback to another pair.

Differentiated instruction

For students that have a difficult time conceptualizing what it would be like to be in a mining town, the teacher could provide pictures or engage in discussion to give a general overview.

Rather than being marked solely on written answers, students could take one of the questions and do a drama, create pictures or make a video of their answer.

For students who wish to be further challenged, invite them to provide research on a town that actually mines the rock or mineral they are further considering.

Extensions

This lesson could be developed into a project which further studies the impact of mining natural resources on the mining community, as well as the local and global environment. Using the Natural Resources Canada map of towns reliant on natural resources is a good place to find such a town in Ontario. Students could be placed in groups and each be provided a different question relating to one product that was observed in their local environment. For example, the steel used in the post for a basketball net could be further assessed for its impact on the local community, as well as the mining community. The City of Hamilton has historically been a major centre for steel production and it could be further studied to determine the historic and current impacts of that natural resource processing on the environment and the community.

Resources

Encyclopedia Britannica pictures of copper extraction and processing:

<http://www.britannica.com/EBchecked/topic/136794/copper-processing/81931/Extraction-and-refining>

Natural Resources Canada map of the towns in Canada which are reliant on natural resources:

<http://atlas.nrcan.gc.ca/site/english/maps/economic/rdc2001/rdcmin>

Discovering Human Made Items Which Contain Rocks and Minerals

1. Items discovered outside that contain rocks or minerals

2. Into which category does each of your items listed above fit ?

<u>Recreation</u>	<u>Shelter</u>	<u>Transportation Related</u>	<u>Other</u>

3. Which item are you interested in further considering and why does it interest you?

4. Thinking more about the item and the rock or mineral contained in it,

- a) What rock or mineral might be in here?
- b) Is it a rock or mineral that is very common or hard to find? Why?
- c) How does the mineral or rock get out of the ground?

5. Thinking more about the item and how it affects our community,

- a) What is this item used for and what are the advantages to the local environment or my community?
- b) What are the disadvantages to the local environment or community?

6. Thinking more about the item and how it affects the community from which it was taken,

- a) If you lived in the community that mined this rock or mineral, what do you think would be the advantages to you or your town of mining this rock or mineral?
- b) If you lived in the community that mined this rock or mineral, what do you think would be the disadvantages to you or your town of mining this rock or mineral?

c) If you lived in the mining community, do you think there would more advantages or disadvantages to mining the rock or mineral? Why?

Grade 4 Rocks and Minerals

Lesson 4 - Repurposing Items

Lesson Overview

Students will bring an item from home containing rocks and minerals that was destined for disposal and will repurpose it for a new use. The first part of the lesson will take place outside and the students will identify ways that nature reduces-reuses-recycles (herein referred to as “the 3-Rs”), then the class will discuss the 3-Rs from a human perspective. The students will brainstorm new purposes for their item and propose an idea, which will receive peer and teacher feedback. During the following class, students will create their new item and the lesson will culminate with a Knowledge Building Circle, where the students’ creations are shared and the concept of reusing/repurposing is further discussed as a class. A trip to the local dump would allow students to see disposal first-hand and understand where the items left at the end of their driveways actually end up.

*To be completed over two lessons.

Connections to Environmental Education

- *Sustainability and stewardship*

Curriculum Expectations

Science - Grade 4 Understanding Earth and Space Systems: Rocks and Minerals

- SE1.1 assess the social and environmental costs and benefits of using objects in the built environment that are made from rocks and minerals

Social Studies – Grade 4 People and Environments: Political and Physical Regions of Canada

- OE B2. **Inquiry:** use the social studies inquiry process to investigate some issues and challenges associated with balancing human needs/wants and activities with environmental stewardship in one or more of the political and/or physical regions of Canada (FOCUS ON: *Perspective*)

Learning Goals

- At the end of this lesson, students will discuss and deliberate humans and the 3-Rs.
- At the end of this lesson, students will create a repurposed item, which has been planned out, received constructive feedback, and implemented to completion. Students will reflect on their completed item.

- At the end of this lesson, students will determine ways that items can be repurposed in their home, school, and environment

Instructional Components and Context

Readiness

- Understand the 3-R's (reduce, reuse, recycle)
- What is a rock, what is a mineral, how and where are they used in our daily lives?

Materials

- Worksheets
- Items students brought from home that were destined for disposal
- Craft supplies required are to be determined using the information provided by the students at the end of the first lesson

Terminology

- rocks
- minerals
- the concept of reduce-reuse-recycle

Minds On

To be done outside

Have students work in pairs or small groups, and pose the following question: How does nature reduce, reuse and recycle? Students can then move around outside and list ways that the natural environment reduces, reuses, and recycles. Examples include: leaves decomposing; animal decomposers; birds taking fallen grass and materials, and reusing them to make a nest; etc.

Come together and have students share findings. Ask if they think that nature does a good job of reducing, reusing, and recycling. Get some feedback from the students and then have each student write an answer on their project sheets.

Establish that nature does a great job of the 3-R's and then segue into what the class thinks of human's success utilizing the 3-R's principle by asking if they think that human's do a good job of reducing, reusing, and recycling. Get some feedback and then have each student write an answer on their project sheets.

Indicate that the lesson will involve repurposing the item they brought from home by creating a new use for it.

Teachers and students should consider that repurposing should not involve any materials that could be hazardous in any way.

Connections

Assessment

Categories of knowledge and skills-knowledge and understanding; thinking and investigation; communication

Assessment for learning

How does nature reduce, reuse, and recycle? Compare nature's capacity for the 3-R's with human's success employing the 3-Rs?

Action

The students will bring in items from home that contain rocks or minerals that are either not being used or are destined for disposal (i.e., the parents are aware that the students will be re-making this item). Examples of items could be glass jars, metal cans, utensils, cookware, pennies, tetra paks, wire or metal supplies, garden pots, ceramic dishes/mugs, etc.

In small groups, the students will decide what would eventually happen to their item if it was not brought into class. Would it be reused, recycled or thrown in the garbage? To help students in their decision making, access a copy of your local recycling guidelines. Each group will show their findings on a master bar graph which will be visible for the class to see.

The teacher will ask the following inquiry-based questions which can be answered by the class as a whole, in small groups or individually:

- are you surprised by the findings of our graph and why?
- do you think that any of our items destined for the trash should be part of the local recycling program and why? Do you think that there are parts of the item that would be difficult to recycle?
- what other purposes could your item be used for?
- do you think that the item would have to be changed in order for it to be used and what changes would you make?

The last two questions allow the students to start brainstorming what their item could be repurposed for.

The students can be advised that they will be taking their item and creating another use for it. For the students who may have a difficult time imagining what do with their item, the following websites outline numerous ways to re-purpose items:

<http://familyfun.go.com/crafts/can-do-robots-674831/>
http://www.makingfriends.com/landfill_rescue.htm
<http://crafts.kaboose.com/recycling-or-reusing-materials-to-make-new-crafts.html>
<http://myzerowaste.com/2010/10/5-ways-to-reuse-your-tetra-pak-cartons/>
<http://www.youtube.com/watch?v=JIFeRMvNXKA>

Once students have decided on a repurposing idea, sketched a picture, listed their required materials, and the purpose for their item, they are to confer with their group members for feedback, which they will record on their project sheet. The student will decide what changes to make, note down the changes on the project sheet, and present their proposal to the teacher. The teacher will propose changes.

The students will work on their repurposed items next class which will give the teacher the opportunity to organize the required supplies.

Connections

Assessment

Categories of knowledge and skills-thinking and investigation; communication; application

Assessment for learning

How well are students able to decide on realistic ideas for repurposing their item. For example, a student comes in with an empty soup can and says that he/she wants to use the metal to make a circuit board. Although this is a great idea, it is not practical in most classroom settings. If the student is highly self-motivated, a solution may be that the student creates an artistic version of a circuit board using the soup can or that the student creates part of the circuit board using the material he/she has.

Assessment of learning

The worksheet, particularly examining the depth of responses will be used. Question: do you think that any of our items destined for the trash should be part of the local recycling program and why? Example answer: I think that the garden pots should be put in the recycling because it could be broken down and created into new pots, instead of sitting in a dump.

Assessment as learning

The students will reflect on their initial repurposing ideas based on the feedback of group members and will subsequently decide on whether to make changes to their design based on this feedback. For example, if a group member says that it would be really cool to put a piece of string around a clay pot so that it could be hung up on the wall, the student could decide that it would be an interesting idea but would need to be attached securely and safely as the pot is fairly heavy and would be dangerous if it dropped.

Consolidation

Using a Knowledge Building Circle (KBC)

This lesson can be best wrapped up using a Knowledge Building Circle, which elaborates on the principles of Knowledge Building Discourse.

Knowledge Building Discourse is a communal activity in which learners come together to pose questions, posit theories, and to revisit, negotiate, and refine their ideas. The collective goal is 'idea improvement'. Knowledge Building Discourse serves to identify shared problems and gaps in understanding, and to advance the understanding beyond the level of the most knowledgeable individual.

The term Knowledge Building Circle refers to the seating configuration of students as they engage in Knowledge Building Discourse. The circle is ideal to successful Knowledge Building for several reasons: it promotes attentive listening and communication; it eliminates hierarchy; and it fosters respect for all life.

Initially, especially in a class of 25-30 students who are new to KB Circles, the teacher may need to work with students to establish agreed upon expectations for ensuring behavioural and mutual respect during KB Circles. For more information about Knowledge Building Discourse and Knowledge Building Circles, see: www.naturalcuriosity.ca

After all the repurposed items are completed, the group will come together in a KBC to display their items and discuss what they have learned and what they are interested in learning more about.

Allow students the opportunity to show their item, indicate what it was previously used for, and what its repurposed use is.

Potential questions to pose during Knowledge Building Circle:

- What do you think is better for the environment, recycling items or repurposing them? What factors did you use to make your decision of which is better?
- Can you give any examples of items which are repurposed and do you think that it is a common practice? Examples include: plastic yogurt and margarine containers, as well as metal cans and cardboard boxes which can be used for storage; hand-me downs; using old clothing for rags; re-using plastic bags; sending items to thrift stores, etc.
- If we were to look around our human-built environment, what items do you think should be reused and how might it be done? Examples could be: desks in the classroom; furniture; old electronics, like TVs, gaming systems, iPods; newspapers and magazines; building materials, such as bricks, concrete, windows, etc.
- What are the benefits of reusing or repurposing materials?
- Would you be interested in learning more ways to repurpose items around your home?
- Can we create repurposed items for use around the classroom? What might they be?

Connections

Teacher: make notes of student discussion for assessment purposes as outlined below.

Assessment

Categories of knowledge and skills-communication; application

Assessment of learning

Determine students` depth of learning in their answers. As some students are not strong writers, this oral discourse can provide a valuable source of student understanding and may supplement their written work.

Assessment as learning

Teacher should note students` ability to self-asses their growth over this lesson.

Differentiated instruction

For students that have a difficult time coming up with an idea of what to create with their item, the websites provided above can be used as examples

For students having a difficult time writing their answers on paper, they may be able to type them or present orally for the teacher

For students that may have challenges interacting with peers in a group setting, they may work with just a partner or work individually with input from the teacher

For students that may have a difficult time staying on task, note regularly, verbally and in writing, what part of the task the students should be completing at certain times

Resources

<http://familyfun.go.com/crafts/can-do-robots-674831/>

http://www.makingfriends.com/landfill_rescue.htm

<http://crafts.kaboose.com/recycling-or-reusing-materials-to-make-new-crafts.html>

<http://myzerowaste.com/2010/10/5-ways-to-reuse-your-tetra-pak-cartons/>

<http://www.youtube.com/watch?v=JIFeRMvNXKA>

Repurposing items containing rocks and minerals – Project Sheet

Part 1: Minds On

Give some examples of ways in which nature reduces, reuses, and recycles. (reduce-reuse-recycle will now be called “the 3-Rs”)

Do you think that nature does a good job of the 3-Rs? Why or why not?

Do you think that humans do a good job of the 3-Rs? Why or why not?

Part 2: Action

What is the item you brought from home?

Does your group think it would be recycled, reused or thrown in the garbage? Explain.

Why does your group think that?

Brainstorming a new purpose for your item

If you wanted to keep your item from going in the trash or being recycled, what are some ideas for giving your item a new use?

Would your item need to be changed in order for it to be used for another purpose? What changes would you make?

If you have outlined a number of ideas, which idea do you think would be the best repurposing of your item and what features make it your preferred choice?

Picture of what you think your repurposed item will look like

Materials required to create your repurposed item

Feedback from group members and teacher

Feedback from my group members

Name	Feedback
------	----------

Name	Feedback
------	----------

Name	Feedback
------	----------

Based on my group members, feedback, I did / did not (circle one) make any changes to my design.
If I made changes, this is what my changes were.

My teacher recommended the following changes to my design:

Part 3: Consolidation

Your repurposed item is / is not (circle one) like your original design.
What changes were made?

Why were these changes made?

What is your favourite part about your new creation?

What else would you be interested in repurposing?