DIY Activities to Celebrate Mining Week

A DIY resource package to help celebrate Mining Week with activities that can be done at home or online. Online resources can be found at MiningMatters.ca/MiningWeek

DIY Activities for Mining Week - "What to Do" for the kids, Activity Explanations and Material Lists for teachers and parents

Student Investigation File - This is the corresponding notebook where kids record their observations and answers to questions

Teacher Investigation File - **Thi**s is the corresponding notebook for teachers and parents with some helpful notes to help with the learning

Building Mineral Literacy through STEM Education

mining MATTERS

Table of Contents

Creating Mineral Mates 1

What to Do

1 The back of this page has information about the three **Mineral Mates**, "Diamond," "Beryl," and "Halite." You are going to build one of the **Mineral Mates** from the geometric net your teacher will give you.

2 Read about your **Mineral Mate** on the back of this page. Choose the words that describe the properties of your **Mineral Mate** and write them on the blank faces of your geometric net.

3 Colour, cut out, fold, and tape or glue your geometric net into a three-dimensional shape. Use craft materials to make legs and arms for the three **Mineral Mates**, heads for "Diamond" and "Halite," and a face for "Beryl."

4 Display your shape.

5 Take turns presenting your **Mineral Mate**'s unique physical properties to your group.

6 In your **Investigation File**, find the section **Getting Motivated, Creating Mineral Mates, Activity 4**. Look carefully at your three-dimensional shape as well as the two others that your friends have made and answer the following questions in your **Investigation File**.

a) What two-dimensional shape (polygon) makes up an octahedron?

b) How many faces are there on an octahedron?

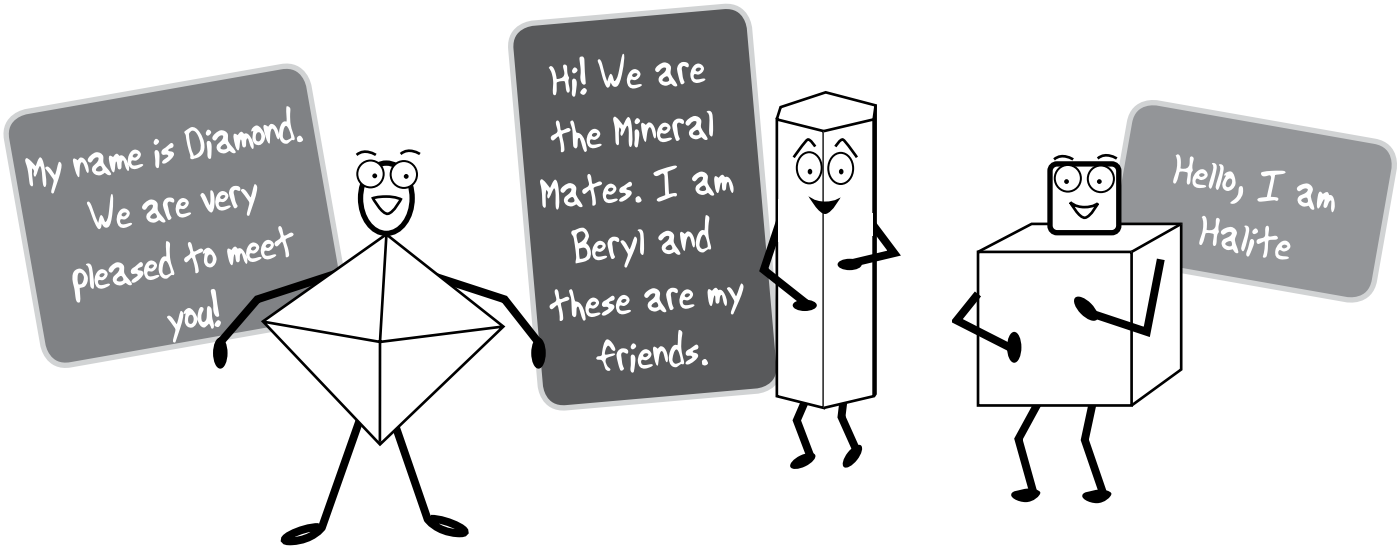
c) What two-dimensional shape (polygon) makes up a cube?

d) How many faces are there on a cube?

e) What two-dimensional shapes (polygons) make up a hexagonal prism?

f) How many faces are there in all on a hexagonal prism?

1 Introducing the Deeper and Deeper Mineral Mates



The **Mineral Mates** will be sharing interesting information with you throughout this unit. They may be additional pieces of information that help you understand some of the new concepts introduced in this unit, or they may be special words and phrases used by geologists and mineral engineers. Each of the **Mineral Mates** is a mineral that occurs in the crystal shape shown above.

Halite is a transparent (clear) to white mineral that occurs as cubes and has a salty taste. It can be scratched by a nail and is commonly called rock salt. We use salt to season our food and on our roads in the winter to dissolve ice and snow. Halite is mined in southwestern Ontario near the towns of Goderich and Windsor.

Diamond is a gemstone that is formed at very high temperatures and pressures. It is a transparent (clear) to translucent (cloudy) mineral that occurs in many colours: colourless, white, pale yellow, reddish, brown, blue, and black. It is the hardest substance found in nature. It is a rare mineral that is usually found in a special type of rock called kimberlite. Diamonds with the best colour (colourless), clarity (transparency) and carat (size) are used for jewellery, but diamonds also have many industrial uses. They are used as abrasive agents and for polishing and cutting (for example, in diamond drills and saw blades). Diamonds are mined in northern Canada, including Ontario, and have recently been found in Quebec.

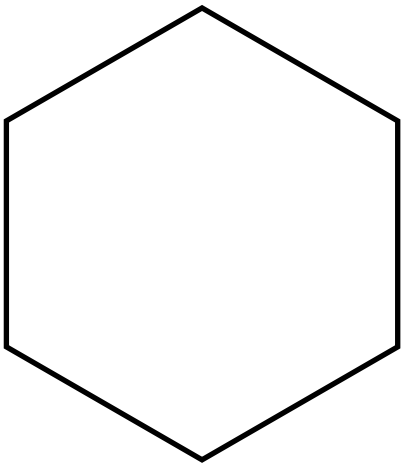
Beryl can be identified by its distinctive hexagonal (six-sided) prism shape. Golden beryl is a yellow variety of this mineral called heliodor. Bluish-green crystals of beryl are called aquamarines. Transparent (clear), bright-green beryl crystals are called emeralds. Emeralds are the birthstone for people born in the month of May. All these varieties of beryl are gemstones and are used to make jewellery. The mineral beryl is mined in many localities of Ontario and are commonly associated with pegmatites (a type of intrusive igneous rock) in Manitoba.

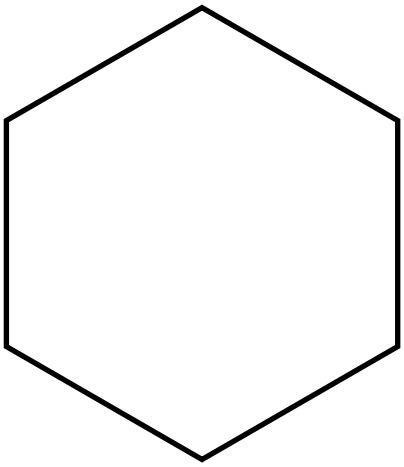
Hexagonal Prism

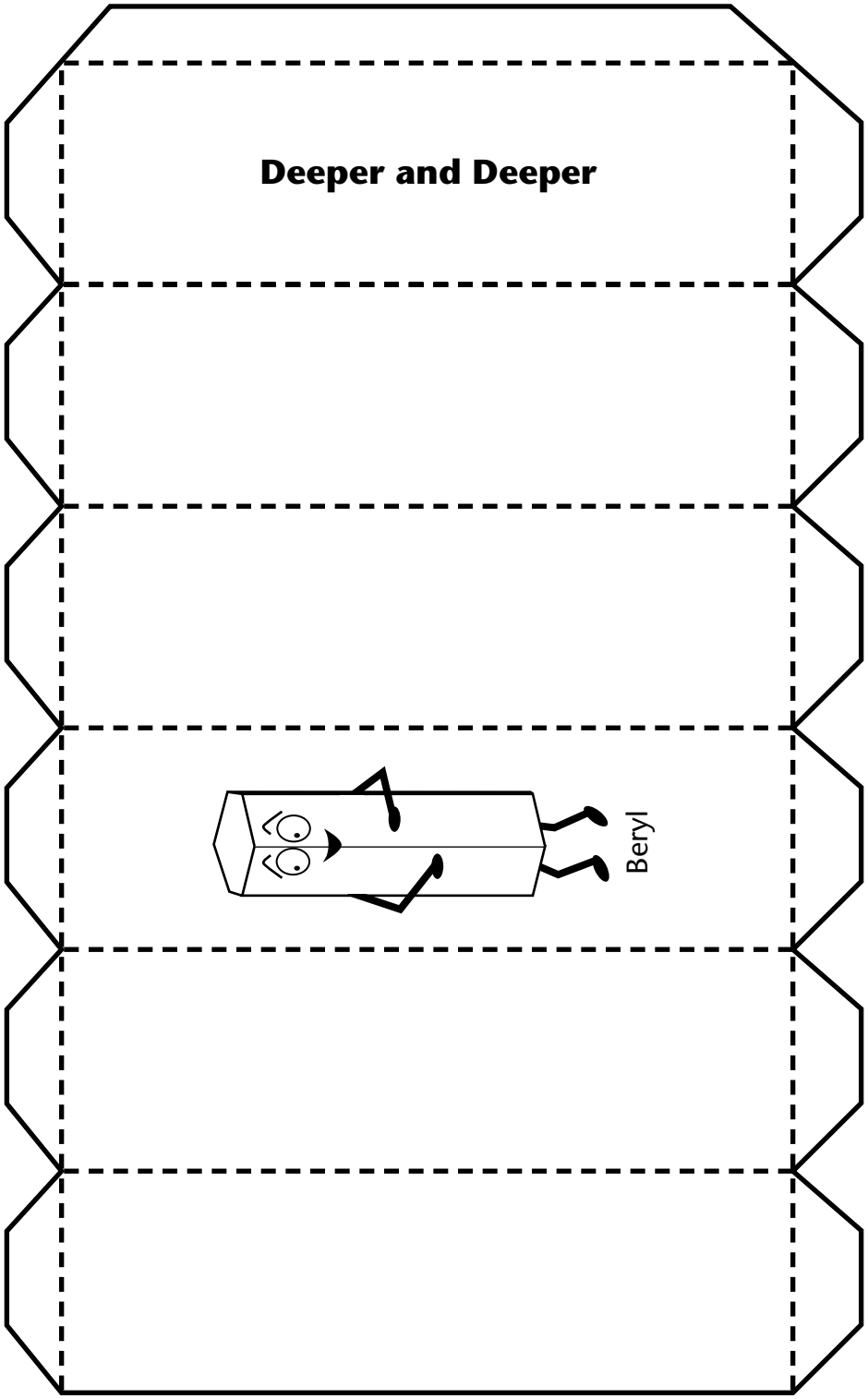
"Beryl"

Instructions

1. Cut along solid lines
2. Fold along dotted lines
3. Tape or glue together to make polyhedron
4. Create legs, arms, head and attach appropriately

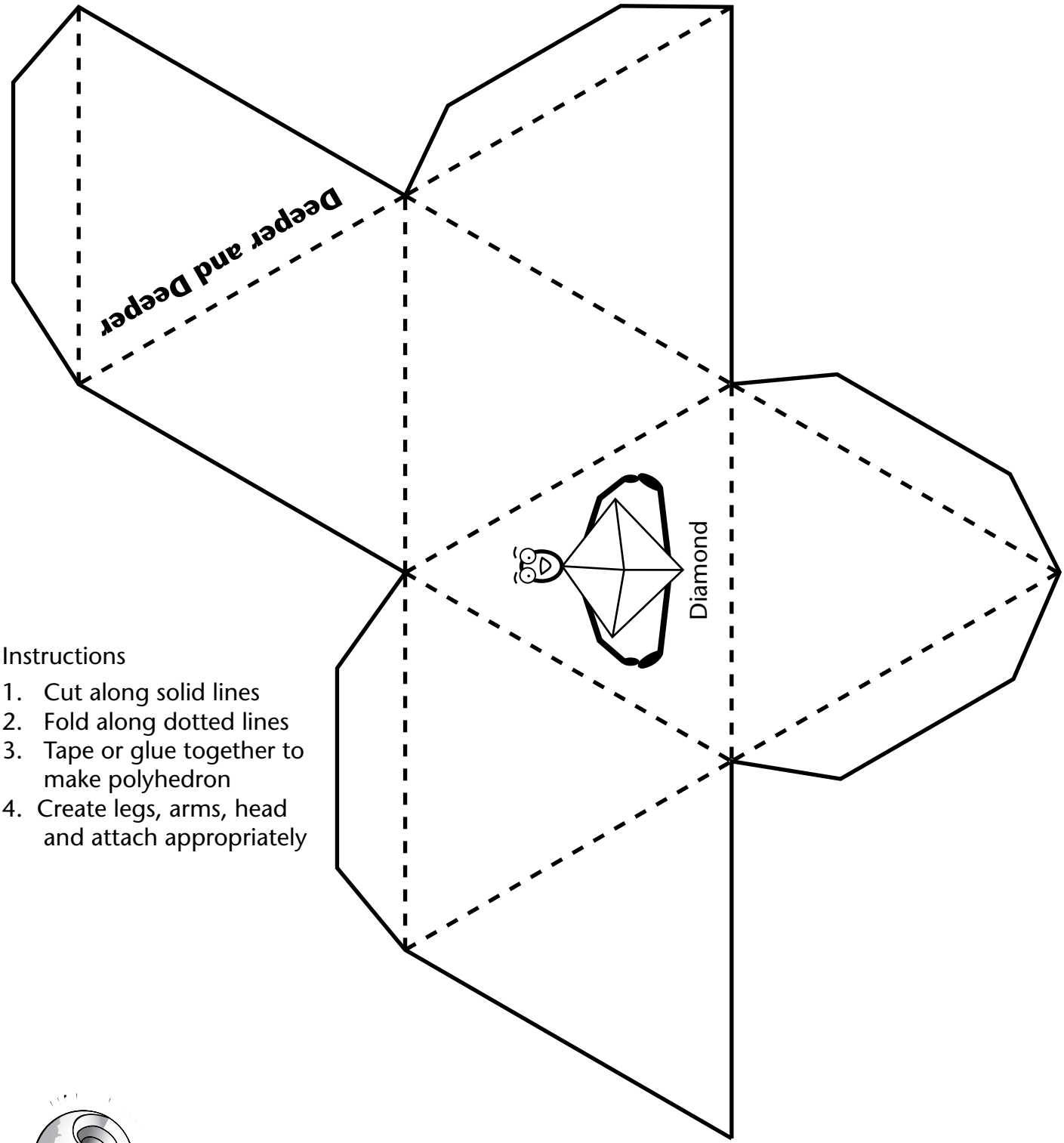






Octahedron

"Diamond"



Instructions

1. Cut along solid lines
2. Fold along dotted lines
3. Tape or glue together to make polyhedron
4. Create legs, arms, head and attach appropriately

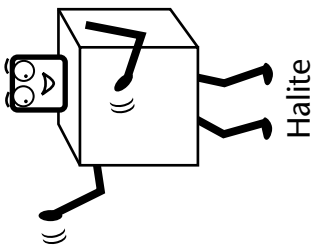
Cube

"Halite"

Instructions

1. Cut along solid lines
2. Fold along dotted lines
3. Tape or glue together to make polyhedron
4. Create legs, arms, head and attach appropriately

Deeper and Deeper



Halite

Creating Mineral Mates

Activity Explanation

Students are introduced to the **Mineral Mates**, who will be seen throughout **Deeper and Deeper**. These **Mineral Mates** will give the students additional information about rocks and minerals on the **Activity Cards**.

The students learn about the geometric properties of three polyhedra: the octahedron, the hexagonal prism, and the cube. They associate a mineral with each polyhedron, based on the crystal shape. This property is sometimes useful to help identify minerals.

Students work within a small group setting and demonstrate comprehension of a reading passage about the properties of the **Mineral Mates**, as well as artistic ability on the faces of the polyhedra.

Instructions

Before the Activity

Copy one geometric net for each student and collect extra craft materials for the legs, arms, and heads.

During the Activity

Give one geometric net to each student. To ensure that all students experience success in folding and forming the three dimensional shapes please note that the octahedron is the most difficult shape to make followed by the cube and then the hexagonal prism.

Place the students in small groups to read the **Mineral Mates** information bulletin, and choose descriptive words to write on the faces of their geometric nets. Allow time for the construction, decoration, and display of their models. The models can be displayed on students' desks or they can be suspended from the ceiling. Some may want to create a three-dimensional mineral city with the shapes.

Share the distinct physical properties of each **Mineral Mate** with the entire class before directing students to complete the analysis questions in their Investigation Files.

Remind students to complete their **Tracking Sheets** for **Activity 4**. Ask students for vocabulary suggestions for the **Word Wall**.

Materials Required

From Kit	From School
	Photocopy of a geometric net for each student
	Photocopies of the Information Bulletin
	Glue
	Scissors
	Coloured pencils
	Craft Material

If you don't have a printer you can always trace the patterns!

The Importance of Rocks and Minerals in Our Everyday Life 2

What to Do

1. Build a model or draw a picture of a house to show how rocks, minerals, and metals are used in our homes. Use craft materials, magazines pictures, or art supplies to build your model.
2. Label the rocks, minerals, and metals found in your house using the list on the back of this card as reference. Write your labels clearly and point to the correct item in the house.
3. In your **Investigation File**, find the page headed **Rocks and Minerals, The Importance of Rocks and Minerals in Our Everyday Life, Activity 5**. On it, describe how a house would look if it were built without using mined rocks and minerals.

2 Rocks and Minerals in our Houses

Item	Rock, Mineral, Or Metal in Each Item
Carpet	Barite
Sink	Nickel, Iron
Iron fence	Iron
Utensils	Nickel, Iron, Silver
Cement	Limestone, Gypsum, Iron Oxide, Clay
Insulation	Vermiculite
TV/Computer screens	Indium
Bricks	Clay, Shale
Doorknobs/Hinges	Copper, Iron, Zinc
Ceramic tiles	Iron (steel), Feldspar, Chromium
Telephone	Zinc, Copper, Aluminum
Window glass	Quartz, Limestone
Porcelain figurine	Silica, Limestone, Gypsum
Wallboard	Gypsum
Paint	Titanium Dioxide
Toilets	Porcelain (Clay)
Electric wiring	Copper, Aluminum
Interior walls	Gypsum

The Importance of Rocks and Minerals in Our Everyday Life

Activity Explanation

Students construct a two or three-dimensional model of a home, indicating the various rocks, minerals, and metals used to build it.

Instructions

This task can serve as a formative assessment; an **Evaluation Rubric** is provided in the **Curriculum** section. Discuss the evaluation criteria with students at the beginning of the activity. On their model home, they should do the following:

- include all the items on the list
- label items with the rocks, minerals, or metals used
- organize the model house, putting appropriate items in each room

In addition, they should describe many things about a house made without rocks or minerals when they answer question 3 in their **Investigation Files**.

Talk to the students about the many rocks and minerals that are found in their homes and help them find ways to label them on their drawings or constructions.

Students may cut out pictures from home furnishing magazines to help them decorate their home and even add pieces of carpet or tile for added authenticity.

Remind students to complete the **Tracking Sheet** for **Activity 5**. Ask students for vocabulary suggestions for the **Word Wall**.

Students may be amazed to find out that the construction of our houses is dependent on mined materials. A house built without mined materials would look like a mud hut, with leather hinges and no glass in window openings. For more information on this subject you may visit the following Web sites: www.womeninmining.org and www.nrcan-rncan.gc.ca/kids/index_e.html

Materials

From Kit	From School
	Bristol Board or cardboard box
	Scissors, rulers, pencils, markers, paint, tape, brushes, etc.
	Craft materials
	Home decorating magazines (optional)

Rock Story Drama 3

What to Do

1 With your partners, create a short scene that shows the formation and characteristics of one of the three rock groups.

2 Incorporate movement and dialogue into your scene.

3 In your scene, demonstrate many of the qualities that your rock has. Use the chart below to help you review these qualities.

Sedimentary	Igneous	Metamorphic
Formed from eroded particles (these particles are sometimes blown away by the wind)	Formed by the cooling of magma coming from far beneath the Earth's crust	Formed when rocks are changed by extreme heat and pressure deep in the Earth
Particles eventually settle on land and in bodies of water	Magma is under very high pressure and heat	Often, these changes are so extreme that the rock's original identity is obscured
Particles compact layer upon layer and eventually harden to form rocks	Magma may cool under the surface—this is called plutonic igneous rock	If heat and pressure are extremely high, some minerals may react chemically with each other and form new minerals
Large amounts of particles settle as sediment from rivers that empty into larger bodies of water	Magma that flows on the surface cools quickly to form a lava flow—the resulting rock is called volcanic igneous rocks	Foliation (colour banding) is a physical characteristic of some metamorphic rocks
Fossils form in sedimentary rocks		

4 In your **Investigation File**, find the page headed **Rocks and Minerals, Rock Story Drama, Activity 13**. On it, make a drawing to show what your group will do to demonstrate your knowledge of your chosen rock group.

Rock Story Drama

Activity Explanation

Students prepare and perform a short scene using movement and dialogue to show how one rock type is formed.

Instructions

You may wish to do this activity with students before they write the **Rock and Mineral Test**, as it helps them to consolidate their knowledge. To help students feel confident about the exercise, review information on the chart and pick out the key elements of each group. Ask students to brainstorm techniques they can use to express such notions as heat, pressure, slow and fast movements, floating particles, etc. You may also want to review the content from *The Magic School Bus, Inside the Earth*.

An **evaluation rubric** for the performance is provided in the **Curriculum** section; share the evaluation criteria with students as they prepare their scene.

Place students in groups and ask each group to create a short scene that shows the formation and characteristics of **one** of the three rock groups. Encourage them to include expressive movement and descriptive dialogue.

Allow adequate time for research, preparation, rehearsal, and performance of each group's presentation.

After the performance, have each student complete a **Self and Group Assessment** of their cooperative learning skills.

Remind students to complete the **Tracking Sheet** for **Activity 13**.

Materials

From Kit	From School
Book: *The Magic School Bus, Inside the Earth*	Photocopies of Student Self and Group Assessment

Student Self and Group Assessment

Date: _____

Answer the following questions.

1. Who worked with me?

   _____

2. What was our task?

   _____

3. What did we do well?

   _____

4. What did the group need to improve on?

   _____

Colour one square on each line that describes your performance in your group.

Completing the Work	I did not complete any of the work expected	I did very little of the work expected	I did nearly all the work expected	I did all the work expected
Participating	I did not share my ideas with the group	I either gave too little information or information that was unimportant or off-topic	I offered some information – most was on-topic	I offered a lot of important information – all was on-topic
Sharing the Work	I relied on others to do the work	I often needed reminding to work together with others	I usually worked together with others, rarely needed reminding	I always worked together with others
Listening and Speaking	I was always talking – never allowed anyone else to speak	I usually did most of the talking – rarely allowed others to speak	I listened but sometimes talked too much	I listened and spoke a fair amount for the group
Cooperating with Teammates	I usually argued with teammates	I sometimes argued	I rarely argued	I never argued with teammates
Making Fair Decisions	I usually wanted to have things my way	I often sided with friends instead of considering all views	I usually considered all views	I always helped the group reach a fair decision

Rock and Mineral Concentration 4

What to Do

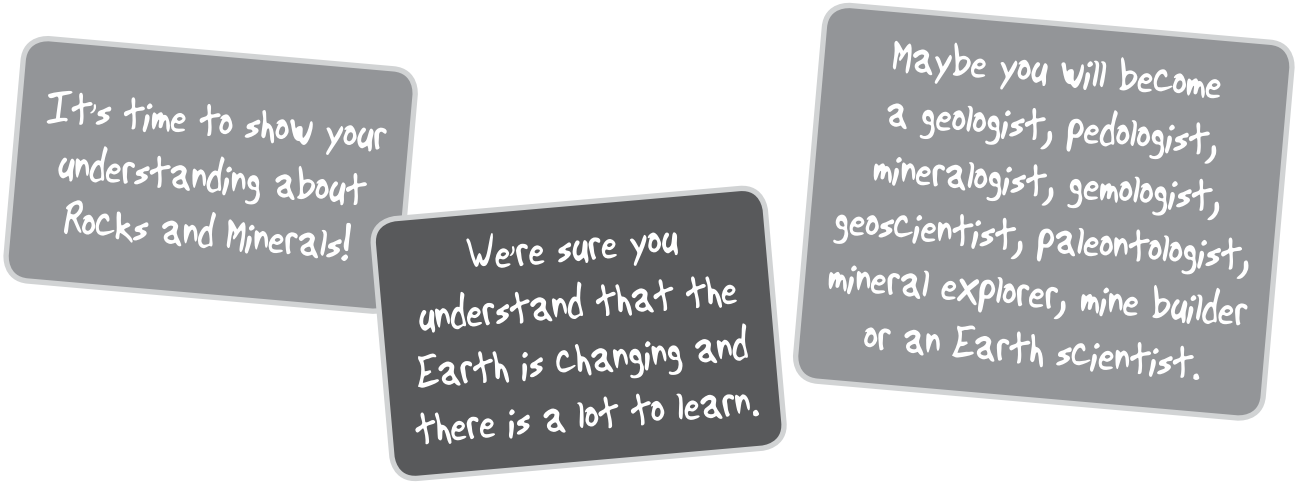
1 With up to three other players, you will play the card game **Rock and Mineral Concentration**. This set of cards has 25 word cards and 25 definition cards, for a total of 50 cards. Before playing the game, match the words to their corresponding definitions.

2 Spread the cards upside down on a table so that no cards are on top of each other.

3 Player 1 turns over two cards. If the player matches a word card with a definition card, the player keeps the cards and takes another turn. If Player 1 does not have a match, the cards are returned face down in the same position on the table and it is the second player's turn.

4 Player 2 follows the same procedure until all the cards have been paired up. The player with the most cards wins the game. The overall game winner is the player who wins two out of three games.

5 After playing the game three times, write out three words and their definitions in your **Investigation File** under **Rocks and Minerals, Rock and Mineral Concentration, Activity 14**.



Rock and Mineral Concentration

Activity Explanation

Students play the **Rock and Mineral Concentration Game** to review the key concepts and definitions covered in **Topic 2: Rocks and Minerals**. Students match word cards with definition cards, following the rules of the card game Concentration.

Instructions

Before students play the game, allow them to read the word cards and match them to their corresponding definitions.

This is a challenging activity due to the number of pairs to be matched and the complexity of the information. To help students feel encouraged about playing the game and to promote retention of the information, try using the following scaffolding strategies:

1. Students read the word cards and find the definitions on the master sheet.
2. Students sort the set of cards into two categories: words and definitions.
3. Students match the corresponding word and definition cards.
4. Students play the game with only part of the deck.
5. Students play the game with the answer sheet.

Emphasize that accuracy is more important than speed in winning the game.

Remind students to complete the **Tracking Sheet** for **Activity 14**.

Extensions

Use the cards as a game or quiz for the whole class or as a "find the matching pairs" search game.

Materials

From Kit	From School
5 sets Rock and Mineral Concentration Cards	

Cards can be cut out or copied from the pages below, or check out our online version, the link and other resources can be found at: MiningMatters.ca/MiningWeek

Concentration Game Card Master Sheet

Amethyst	I am a purple mineral sometimes used in jewellery.
Calcite	I am a white mineral that can be scratched by a penny.
Chalcopyrite	I am a copper mineral that conducts electricity.
Granite	I am an igneous rock that forms deep in the Earth from magma.

Gypsum	I am a soft white mineral.
Halite	I am a salty mineral that has a cubic shape.
Hematite	I have a distinctive red streak, but I am not always a red mineral.
Igneous Rocks	I am formed when molten material becomes solid.

Lava	I am molten rock that pours from a volcano.
Limestone	I am a sedimentary rock that often contains fossils.
Magma	I am molten rock deep below the Earth's surface.
Magnetite	I am a black magnetic mineral.

Marble	I am a metamorphic rock formed from limestone.
Metamorphic Rocks	I have been changed by heat and pressure.
Mineral	I am a solid composed of the same substance throughout. I have special characteristics that can be used to identify me.
Quartz	I am a hard white mineral with a “glassy” lustre.

Quartzite	I am a metamorphic rock formed from sandstone.
Rhyolite	I am an igneous rock that forms on the surface of the Earth from lava.
Rock	I am a solid composed of different minerals.
Sandstone	I am a sedimentary rock formed from sand.

Sedimentary Rocks	I am layered rocks formed from pieces of eroded rock.
Shale	I am a sedimentary rock formed from mud.
Slate	I am a metamorphic rock formed from shale.
Stalactite	I am shaped like an icicle and am formed in caves by dripping water that contains limestone.

Stalagmite	I am shaped like a cone and am formed in caves by dripping water that contains limestone.

Introduction to Mining 5

What to Do

In your **Investigation File**, find the page headed **Mining Responsibly, Introduction to Mining, Activity 1**.

1

a) Read the **Information Bulletin: Let's Explore Mining** to learn about mining, the process that extracts valuable minerals and rocks from the Earth. In your **Investigation File**, make point-form notes about one part of the mining process.

Choose from:

Looking for Minerals

Evaluating a Mineral Discovery

Constructing a Mine

Mining and Processing Minerals

Closing a Mine and Reclaiming the Land

Protecting the Environment and Connecting with Communities

9000 years ago, there was a mine on Manitoulin Island, in Ontario

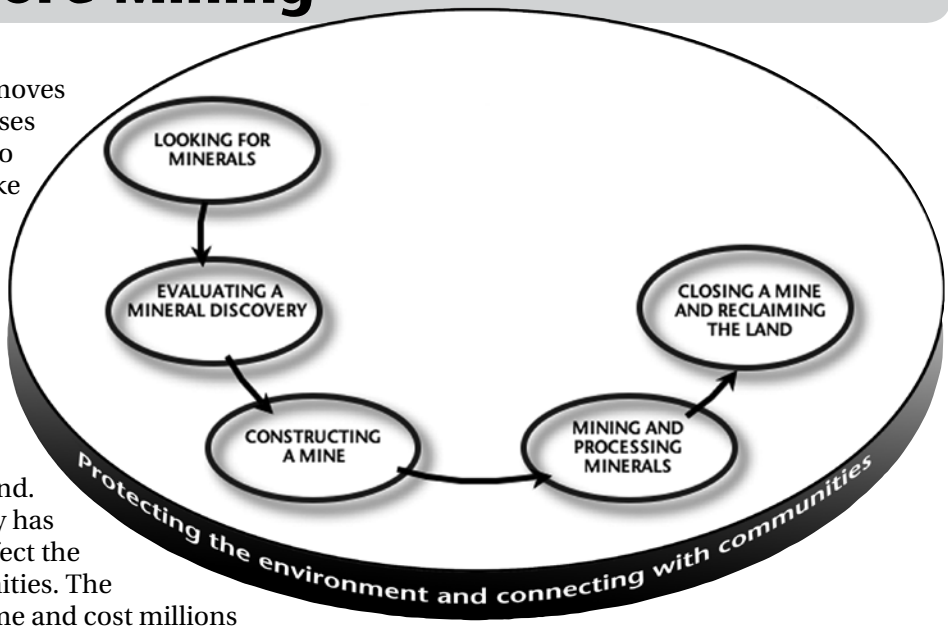
b) Use your point-form notes to make a poster that illustrates one stage in the mining process. Use words, pictures, and diagrams to make it attractive and informative.

2

Look at the two posters that show you what an underground mine and a surface mine (open pit mine) look like. In your **Investigation File**, list three ways in which the mines are different.

In the future, we might mine on other planets.

5 Information Bulletin: Let's Explore Mining



Mining is an industrial activity that removes **rock** from the Earth's crust and processes it to remove **valuable minerals** for us to use. We need mineral resources to make many of the things we use in our daily lives, from toothpaste to buildings, computers to cars.

The **mining process** is very complicated and involves five stages: looking for minerals; evaluating a mineral discovery; building a mine; mining and processing minerals; and closing the mine and reclaiming the land. From start to finish, a mining company has to think about how its activities will affect the environment and any nearby communities. The mining process can take a very long time and cost millions of dollars.

Looking for Minerals

Looking for minerals is called **mineral exploration**. Geologists use many different methods to look for valuable minerals. They study satellite images of the Earth and use airplanes or helicopters to measure things, such as the magnetism in the land. Maps also help them choose an area to explore.

Before a mining company can explore more closely, it must get the exclusive rights to a piece of land. This is called **staking a claim**. The company can then use special equipment to look more closely for mineral deposits. Geologists do field work to identify different rocks and collect rock and soil samples to study in a laboratory. If the results are good, the company drills holes in the ground to take out long, thin cylinders of rock called **cores**, which can be studied to find out how much valuable mineral they contain.

Evaluating a Mineral Discovery

Once a mining company finds a mineral deposit, the next step is to decide if it will be worth spending the millions of dollars needed to construct a mine.

A **mineral evaluation** looks at how much it will cost to construct and operate the mine, to sell the minerals, to take care of the environment, and whether or not the company will make any money.

Finding a good mineral deposit is rare. Very few mineral exploration properties actually make it to the mineral evaluation stage of the mining process.

5

Constructing a Mine

Mineral deposits close to the surface of the Earth can be mined by digging a **surface** or **open pit mine**. This means using huge diggers to scrape away the surface material and blasting the solid rock with explosives to reach the valuable minerals.

Mineral deposits buried deep in the Earth have to be mined using an **underground mine**. This means digging tunnels into the Earth to reach the valuable minerals.

Mining and Processing Minerals

Actual mining can begin once construction of a mine is complete. Miners use drills and explosives to break up the rock and large scoops and machines to move the rock to the processing plant.

Mined rock contains valuable minerals as well as worthless ones, all mixed together. **Processing** separates out the valuable minerals from the waste. Usually, the rock is first crushed into a fine powder. Then, a **separation process** captures the small amount of valuable minerals from the large amount of powdered waste rock. Some minerals are then **refined** to produce pure metal in a process called **smelting**.

A mining company has to deal with the leftover waste materials, called **tailings**, which are rock fragments, dust, and chemicals. They must be stored in safe areas to avoid polluting the air or water.

Closing a Mine and Reclaiming the Land

No mine will last forever. When a mine closes, the mining company has to reclaim the land, making it safe, usable, and a natural part of the surrounding environment. It must remove the buildings, make sure mine waste doesn't harm the environment, make any pits or tunnels safe, and replant the land with grass and trees.

Protecting the Environment and Connecting with Communities

At every stage of the mining process, environmental specialists study the soil, water, wildlife, and vegetation, as well as the air quality and climate, to make sure an area remains safe and can be returned to usable land when mining is complete. The company also goes to local communities to learn about the area, explain the mining plans, answer questions, and talk about work opportunities.

Information Bulletin for Teachers: The Mining Process

We mine the Earth to get the mineral resources we need to make all the things we use in our daily lives, from toothpaste to buildings, computers to cars. There are five different types of mineral resources – **metallic minerals, industrial minerals, construction materials, gemstones** and **fossil fuels**.

Metallic minerals – like copper, gold, iron, silver, and nickel – are valuable metals.
Industrial minerals – like asbestos, talc, silica, salt, graphite, potash, and mica – are used by industries.
Construction materials – like limestone, sand and gravel, clay, and granite are used to build things.
Gemstones – like diamonds, emeralds, rubies, and sapphires –for jewellery and industrial uses.
Fossil fuels – like coal, petroleum, and natural gas – power our homes and vehicles.

The Mining Process

What does it take to start a mine? Does a mining company just dig holes in the ground looking for valuable minerals? Actually, it's a lot more complicated than that. The mining process involves five stages: looking for minerals; evaluating a mineral discovery, building a mine; mining and processing minerals; and closing the mine and restoring the land.

Protecting the Environment and Connecting with Communities

A mining company has to think about more than finding and taking minerals from the Earth. Right from the beginning, it has to think about the environment. The company sends environmental specialists to study the soil, water, wildlife, and vegetation, as well as the air quality and climate before mining, so that an area can be returned to safe and usable land when mining is complete. The company must also think about how local communities will be affected by mining activities. Company employees learn about the area, explain the mining plans, answer questions, and invite the local people to supply goods and services or to work for the mine.

From start to finish, the mining process can take a very long time and costs millions of dollars.

Looking for Minerals

Looking for minerals is called **mineral exploration**. Geologists look for valuable mineral deposits, called ore bodies, using a many different methods. They study satellite images of the Earth, looking for clues in the land that suggest where possible mineral deposits might be. Using airplanes or helicopters carrying special equipment, they search for anomalies in the land— areas that have some very different characteristics from the land around them. Geologists also look at government maps and work done by other mining companies to help them choose an area to explore.

Once it has chosen a piece of land to explore more closely, a mining company must get the exclusive rights to that land. This is called **staking a claim**, or **land acquisition**. After acquiring the land, the company can then carry out a ground survey. This involves identifying the different rocks in the area, collecting and analyzing rock and soil samples, and using special equipment to look more closely for unusual characteristics in the land, like magnetism and radioactivity. If the results are promising, drilling is the next step.

Drills bore holes into the ground, only a few centimetres across, but sometimes one or two kilometres deep. The drill produces a long, narrow cylinder of rock called a **core**, which can be analyzed, or assayed, to find out how much valuable mineral it contains. Drilling more holes could determine the size and shape of the ore body.

Evaluating a Mineral Discovery

Once a mining company determines how big and how rich a deposit is, the next step is to decide if it will be worth spending the millions of dollars needed to construct a mine. A **mineral evaluation** looks at how much it will cost to construct and operate the mine, to sell the minerals, to take care of the environment, and whether or not the company will make any money. Less than 10 out of every 100 mineral exploration properties actually make it to the mineral evaluation stage of the mining process.

Constructing a Mine

If a mineral deposit is close to the surface of the Earth, it can be mined by digging it out from a **surface** or **open pit mine**. Surface material and waste rock are removed from the surface. Solid rock is broken up by explosives and then taken away for crushing, grinding, and processing.

When a deposit is buried deep in the Earth, the only way to get at it is to construct an **underground mine**. This may mean digging a vertical tunnel, called a **shaft**, down to the level of the ore body, and horizontal tunnels, called **drifts**, to the ore body itself. An **elevator**, or **cage**, carries the miners and equipment down and up the shaft, and a **bucket**, or **skip**, lifts the broken rock and ore to the surface. Miners get fresh air through vertical tunnels called **ventilation shafts**.

Mining and Processing Minerals

Actual mining, called **mineral production**, can begin once construction of a mine is complete. Miners start by **drilling** and using **explosives** to break up the ore. The area they work on is called the **face**. They load broken ore into a **scoop**, a large machine which combines a front-end loader and a truck. Then they drive the ore to the skip that will lift it to the surface. The next step is **processing**.

Mined ore contains valuable minerals as well as worthless ones, all mixed together. The goal is to separate out the valuable minerals. The first step, called **milling**, is to crush the broken ore into a fine powder, using large crushers and rotating drums. The small particles are then put through a **separation process**, to capture the small amount of valuable minerals from the masses of powdered rock. Next, those minerals are refined to produce pure metal in a process called **smelting**.

After separating the valuable minerals from the crushed rock, a mining company has to deal with the leftover materials, called **tailings** (rock fragments, dust, and chemicals). Tailings might contain dangerous chemicals that could leak into streams and lakes, so they need to be stored in cells—specially designed ponds lined with heavy plastic or dense clay. Any water leaving the pond is specially treated to remove dangerous chemicals. The tailings are eventually covered with soil and planted with grass and trees.

Closing a Mine and Reclaiming the Land

Mining is a temporary use of the land— no mine will last forever. When a mine closes, the mining company then has to reclaim the land so that it is safe and usable and it blends with the surrounding environment.

Reclamation involves a few steps: removing all the buildings or physical property; treating the mine tailings or waste water; stabilizing the underground workings or open pits; and closing the mine shafts and tunnels. Open pits must be filled, and the areas that were used for the buildings must be replanted with grass and trees.

Introduction to Mining

Activity Explanation

Students read and summarize an **Information Bulletin** about the mining process. They produce posters to illustrate the stages of the mining process. They examine and compare illustrations of how an underground mine and a surface mine operate.

Instructions

Before the Activity

As an introduction, assess the students' background knowledge of the mining process by asking the question: What does the word "mining" mean to you? At this stage, students should understand that mining is the process that extracts valuable minerals or rocks from the Earth.

During the Activity

1. Allow students to read the **Information Bulletin, Let's Explore Mining**. Ask them to make point-form notes in their **Investigation Files** on one stage of the mining process. Ensure that all the necessary parts of the mining process are covered in the class: looking for minerals, evaluating a mineral discovery, constructing a mine, mining and processing minerals, closing a mine and reclaiming the land, protecting the environment and connecting with communities.

   A teachers' version of the **Information Bulletin, The Mining Process** is included, providing additional background information and detail.

2. Following the reading, have students work in groups to create a poster of one stage of the mining process, using their point-form notes. Encourage them to make their posters visually attractive, because they will be placed on display around the class as a framework for the subsequent **Topic 3: Mining Responsibly** activities.

3. Show students the two posters of underground and surface mines provided in the kits and ask them to list in their **Investigation Files** three differences between the two mine types.

   Explain to students that, when looking at the diagram of the underground mine, they should realize that the drifts, crosscuts, and shafts are surrounded by solid rock and are not suspended in open underground spaces. Suggest that students imagine an ant trying to get raisins from a raisin loaf. The ant would need to tunnel its way through the bread to get to an individual raisin. The ant would then have to follow the same tunnel back in order to remove the raisin bit by bit. The ant would need many tunnels to get to all the raisins.

After the Activity

As a whole group, begin two lists on chart paper: **Benefits of Mining for Rocks and Minerals** and **Costs of Mining for Rocks and Minerals**. These lists will be added and referred to throughout **Topic 3: Mining Responsibly**. In this instance, "benefits" are positive results or advantages and "costs" are negative results or disadvantages.

Items on the list may include the following:

Benefits
- provides materials for the many different items that we use every day
- provides materials for the many items in our homes
- creates jobs and brings money into the economy

Costs
- digs up the land
- uses big machines
- creates waste
- uses lots of energy

Remind students to complete the **Tracking Sheet** for **Activity 1**. Ask students for vocabulary suggestions for the **Word Wall**.

Extensions

1. Build a model of an underground mine.
2. Visit the Natural Resources Canada Web page "Canadian Mineral Exploration" at https://www.nrcan.gc.ca/mining-materials/exploration/8290, to learn more about mining practices in Canada.

Materials Required

From Kit	From School
Surface (open pit) Mine Poster	Poster-making materials
Underground Mine Poster	Chart paper

Posters can be found on our website:
MiningMatters.ca/MiningWeek

Underground Mining Methods 6

What to Do

In your **Investigation File**, find the page headed **Mining Responsibly, Underground Mining Methods, Activity 2**.

In this activity, you will watch a series of animations outlining the various methods used to get ore from deep within the Earth to the surface where it can be processed and used for products.

The deepest mine in the world is in South Africa; it goes down to almost four kilometres.

Sudbury is a town in Ontario, Canada.

1 As you watch the animations take note of the following:
a) heavy equipment and machinery,
b) location of where the operation begins,
c) presence of tunnels,
d) the direction of the tunnels, as well as
e) drilling and blasting.

2 a) Stop the animation and turn off the computer display monitor and/or the projector. Read the appropriate section of the **Underground Mining Methods Backgrounder** describing the mining method your group was assigned. Watch for key ideas that relate to the criteria set out in step 1 above.

b) Watch the animation a second time and reflect back on the mining method description you just read. In the video, look out for examples of the following:

Backfill material	*Bolting*	*Cave*	*Crusher*
Drift	*Drilling and blasting*	*Jumbo*	*Load Haul Dump*
Mineral	*Muck*	*Open pit*	*Ore body*
Ore pass	*Pillar*	*Raise*	*Ramp*
Room	*Skip*	*Stope*	*Tailings*

In the **Student Investigation File**, circle the words that apply to the mining method your group was assigned.

3 There are many new terms and concepts related to underground mining methods. To demonstrate your understanding of the basic concepts, create a **Sequence Chain** outlining the steps that occur in the method assigned to your group.

Underground Mining Methods Key Terms

Key Terms	Explanations
Bolting	Drilling a hole, and inserting a bolt to strengthen the ceiling and walls of an underground mine.
Crusher	A machine used to crush ore before it is transported.
Drift	A horizontal underground tunnel that follows a vein or ore body.
Drilling and blasting	The process of using a drill to create long, narrow cylindrical holes in the rock, and filling these holes with explosives which are then detonated to fragment the rock.
Jumbo	A drill which is capable of drilling more than one hole at a time and is especially useful in preparation for blasting.
Load Haul Dump	A vehicle with a large bucket on the front used for transporting ore to crushing stations and mucking.
Mineral	Naturally occurring chemical compound with a unique three dimensional crystalline structures and chemical composition; component of rocks.
Muck	Waste rock that has been broken by blasting.
Ore body	A naturally occurring concentration of minerals that can be mined at a profit.
Ore pass	A vertical or inclined passage that is used for transporting ore down to a lower level or hoist.
Pillar	The columns of rock that are left to support the ceiling in room and pillar mining.
Raise	A vertical or inclined opening from one level of a mine that is driven toward the level above.
Ramp	Inclined tunnels used to transport ore or machinery.
Room	The open areas left open by blasting in room and pillar mining.
Skip	A self-dumping bucket used in a shaft for hoisting ore or rock.
Stope	An underground mine from which ore has been removed extracted.
Tailings	Materials rejected from a mill after the recoverable valuable minerals have been.

Glossary References: MineralsEd, *Social Studies 10/11: Mining in BC A Resource Unit*; The Northern Miner, Mining Explained: A Layman's Guide (1996)

Underground Mining Methods Backgrounder

Animations courtesy of Sandvik Tamrock Canada
Accompanying text by Terry Gong, UBC Mining Engineering student

Room and Pillar

Ramps (inclined tunnels) are excavated to connect the surface to the underground **ore body**. **Drifts** (horizontal tunnels) are excavated at different elevations to surround the ore body. Next, **stopes** (tunnels that have direct access to mining the ore) are mined to gain access to the ore. All tunnels are excavated by **drilling and blasting**. **Jumbos** are in charge of drilling the holes in the rocks and filling them with explosives. The loose rock, also called **muck**, is transported by either dump trucks or **Load Haul Dump (LHD)** vehicles back up to the surface for either waste disposal or processing. As mucking progresses, rooms (tunnels) are cut into the ore body. In order to provide safe roof support for mining, pillars of material around the rooms are left standing to hold up the rock ceiling above. Some parts of the mine roof can be particularly weak and fragile. In addition to pillar support, a jumbo is then brought back in for rock **bolting** of the roof to ensure safety. When all the ore in the stopes has been transported up to surface, some pillars can be removed, since they still have valuable **mineral** content, while some must be left standing to provide active support for the ceiling. In some **room** and **pillar** mines, pillars are all excavated as mining nears completion, to allow the natural collapse of the roof.

Sublevel Stoping

Sublevel stoping is a mining method in which ore is blasted from different levels of elevation but is removed from one level at the bottom of the mine. Before mining begins, an ore pass is usually drilled from a lower to a higher elevation. **Jumbos** selectively drill holes into the roof of the **drift** and fill them with explosives. When the roof is blasted, loose rocks, or **muck**, fall through the drilled **ore pass**. A **Load Haul Dump (LHD)** vehicle transports the muck to another ore pass where it falls to a hopper that feeds a **crusher**. The crushed ore is then elevated (raised) to the surface in a **skip**. As the muck is taken out, more drilling of the now higher roof continues. The roof is blasted till it is so high that it cannot be reached by a jumbo. Then a jumbo working in a higher elevation drift is used to intersect the **stope**. After blasting, the ore falls down to the lower drift where LHDs can drive in to load the muck and dump it at an ore pass. **Drilling and blasting** continues until the **stope** is completely excavated. Once the stope is completely hollowed out, it is backfilled from the bottom, up. The **backfill material** used can be a mixture of sand and rocks, waste rock with cement, or dewatered mill **tailings** (rejected low grade ore from processing, usually fine and sandy). The backfill material must have a lot of strength to support the roof of the empty stope.

Cut and Fill Stoping

In cut and fill stoping, the **ore body** is retrieved in horizontal slices beginning at the very bottom and advancing upwards towards the surface. **Ramps** (inclined tunnels) are excavated to connect the surface to the underground ore body. **Drifts** are excavated to come in contact with the ore slices. The slices are **drilled** using a **jumbo**, **blasted** by charging the drill holes with explosives, and ore is removed by using dump trucks or **Load Haul Dump (LHD)** vehicles. The ore is dumped into an **ore pass**, an inclined tunnel where ore is transported to a lower elevation in the mine. The ore is picked up at the other end of the ore pass by a LHD to be transported out of the mine through a **ramp** (inclined tunnel). Once a slice is completely mined out, the empty space is partially backfilled hydraulically. The **backfill material** used can be a mixture of sand and rocks, waste rock with cement, or dewatered mill **tailings** (rejected low grade ore from processing, usually fine and sandy). The backfill underground serves to keep the mine walls stable and also as the floor for mining the next slice. Mining continues upwards towards the surface until the **ore body** is depleted.

Sublevel Caving

Sublevel caving is usually carried out when mining of the **ore body** through an **open pit** method is no longer economically feasible. Mining now proceeds underground, underneath the open pit. At first, both a **raise** and a network of tunnels are made. At different sublevels, **jumbos** are used for long hole drilling, drilling directly upwards into the roof. These holes are then charged with explosives and blasted. As the roofs **cave** in, the rock from the ground surface will cave in to the underground as well. **Load Haul Dump (LHD)** vehicles transport the **muck**, loosened rocks, to an **ore pass** where the rocks are lifted to the surface. **Drilling and blasting** takes place at different underground levels of the mine at the same time. As the blasted rock, muck, is continuously transported to the **ore pas**s, more blasting will encourage the roof to cave in to the void and further into the **drift**. This is repeated until blasting, caving and transporting depletes the entire ore body.

Underground Mining Methods

Activity Explanation

Students watch a set of animations to visualise a series of underground mining methods: Room and Pillar, Sublevel Stoping, Cut and Fill Stoping and Sublevel Caving.

Instructions

Before the Activity

Review with students the two major types of mines by showing them the **Underground and Surface Mine posters**. Explain to students that this activity will focus on the underground mine and some methods employed to extract the ore. Start an "Underground Mining Methods" **Word Wall**. Blank vocabulary signs have been provided. Students can colour and decorate the sign with appropriate explanations, pictures and symbols.

Introduce the following machinery to the students:

Crusher - A machine used to crush ore before it is transported.

Jumbo - A drill which is capable of drilling more than one hole at a time and is especially useful in preparation for blasting.

Load Haul Dump - A vehicle with a large bucket on the front used for transporting ore to crushing stations and mucking.

Skip - A self-dumping bucket used in a shaft for hoisting ore or rock.

Show the students pictures of the equipment and describe their use in order to facilitate the viewing process. Visit https://mining.cat.com/products/underground-mining to find photographs of the machinery.

During Activity

Divide the students into 4 groups and assign each group the task of watching one of the following animations:

i. Room and Pillar,

ii. Sublevel Stoping,

iii. Cut and Fill Stoping, and

iv. Sublevel Caving

After Activity

Instruct the students to demonstrate their understanding of the mining method their group was assigned by showing the correct stages on the **Sequence Chart** in their **Investigations Files**.

As a class, brainstorm the challenges associated with undergrounding mining. Once a list is generated, discuss the modern day technologies that could be used to resolve these challenges.

Extensions and Modifications

1. Complete the task as a whole group activity. Have the teacher read the description of each of the mining methods.
2. Have each student create a **T-Chart** to compare and contrast two of the four underground mining methods described in this lesson.
3. Copy, cut and scramble the **Sequence Charts** for each mining method in the **Teacher Investigation file**. Use a different colour card stock for each mining method. Have the students place them in the correct sequence.

Materials Required

From Kit	From School
Mining Matters USB flash drive with animations Underground Mine Poster Surface Mine Poster	Internet connection Computer, projector and projection screen

Animations and posters can be found on our website: MiningMatters.ca/MiningWeek

Operating a Surface Mine 7

What to Do

During this activity, you will "operate" a surface mine model provided by your teacher. You will investigate how mining companies extract valuable minerals that are close to the surface of the Earth and then reclaim the land after the process.

In your Investigation File, find the page headed **Mining Responsibly, Operating a Surface Mine, Activity 3**.

1 In your **Investigation File**, draw a picture of your model before any mining starts.

2 Working in your group, make a list of the steps that you will follow to mine and reclaim your surface mine. Write the list in your **Investigation File**.

3 a) Mine the rock containing the minerals and place it on the table in front of you.

b) Separate the mineral from the rock. Keep the mineral in a paper cup.

c) In your **Investigation File**, draw a picture of what your surface mine looks like during mining. Remember to include the pile of rock that you took out of the mine.

Even though it's against the law, in many countries children work in mines.

4 Answer the questions in your **Investigation File**:
How has mining changed the land?
How could we use the pile of mined-out rock that you took from your surface mine?

5 a) Reclaim your mine. As much as possible, make the model look the way it did before mining, but without the minerals.

b) In your **Investigation File**, draw a picture of the land after mining.

Diamonds are often mined from surface mines.

6 Look at the **Mine Site Reclamation** photographs of mine sites before and after the land has been reclaimed. In your **Investigation File**, write three things that have been done to reclaim the land used for mining.

Operating a Surface Mine

Activity Explanation

Students use a model to simulate a surface mine operation, extracting the target mineral and reclaiming the land after mining is complete. They compare and analyze photographs of mine sites during mining and after reclamation.

Background

The **Surface Mine Poster** included in the kit shows the characteristics of a surface mine and the stages used in a typical surface mine operation.

Two common procedures used to separate minerals from rocks take advantage of the physical properties of the sought materials. When mixed with liquid, heavier or denser minerals sink, and therefore can be separated from lighter minerals. This procedure is called **Heavy Media Separation**. This process could be used to separate heavier chalcopyrite from lighter quartz when mining for copper and nickel. If the valuable minerals are magnetic, they can be separated from other rock and minerals by passing the crushed ore under a powerful magnet. This procedure is called **Magnetic Separation**.

When reclaiming a surface mine, even if all the remaining rock (called "waste" rock, meaning rock devoid of valuable mineralization) were replaced into the surface mine, the depression formed by mining would not be refilled completely. However, the wall of the depression can be contoured to gentle slopes, the surface can be covered with topsoil, and grass and trees can be planted to create a naturalized landscape or environment. In some cases, mined-out surface mines and rock quarries have been made into recreational lakes, public parks, rock gardens, farmland, and housing sub-divisions.

Mining companies use grass to stabilize slopes and reduce soil erosion, and they plant seeds and seedlings to encourage the establishment of plant and tree communities. As the plants and trees mature, animal species diversity increases in the area. The habitat reclamation process is highly monitored by scientists from many disciplines.

Instructions

Before the Activity

1. Create one model of a surface mine for each group of students. There is considerable flexibility in the materials that may be used: the general principle being to have a valuable mineral or rock that must be separated from a waste or county rock component. Look at the suggestions in the table below; you can substitute the different valuable target minerals/rocks into alternate country rock.

2. Build the target rock body or mineral ore.

   a) In a small container (~250 ml), mix a 4:1 ratio (200 ml: 50 ml) of country rock/waste material and valuable target rock/mineral.

Valuable Target Rock/Mineral	Separation Process	Country Rock/Waste
Magnetic beads	Using a magnet	Sand or gravel
Paper clips	Using a magnet	Potting soil
Dried beans	Physical picking with fingers or tweezers	Pasta
Large sunflower seeds	Sieving, physical picking with fingers or tweezers	Small-grain bird seed
Coloured beads	Sieving, physical picking with fingers or tweezers	Rice
Peanuts in shells	Crushing and sieving	Peanut shells

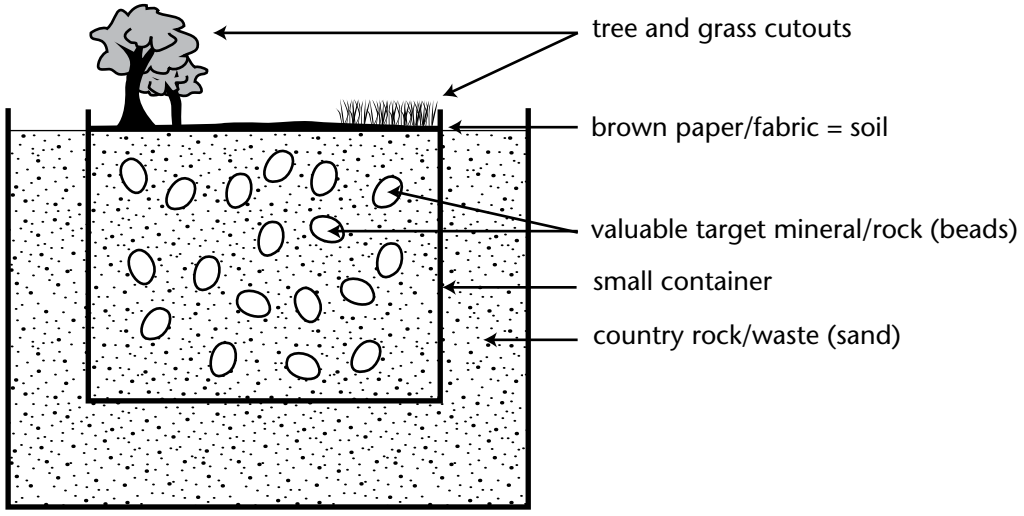
b) Lay brown construction paper or fabric on top of the rock to represent soil.

c) Place tree and grass cut-outs or magazine pictures of natural habitats on top of the soil.

3. (Optional) Put the target rock body or ore in a wider environment.

Either a) Rest the smaller container inside a larger container (750 ml or 1 litre). Fill the area around the inner container with the same country rock material as it contains, making sure that the rim of the inner container can be seen after filling.

Or b) Submerge the small containers in a sand table, making sure the rims can be seen.



During the Activity

1. Review the **Surface Mine Poster** with the students. Show students how the overburden (surface soil and loose rock) is removed and how drilling and blasting breaks the rock. Large trucks and diggers move the rock to the crushers and processing plant where the valuable materials are separated from the waste.
2. Explain to students that they will mine their model of a surface mine for either a valuable rock or mineral.

   Ask students to draw a picture of their model and make a group list showing the steps they will follow to mine, and later reclaim, their model in their **Investigation Files**.
3. Have students extract the rock/mineral mixture from the smaller container, and then separate the target valuable materials from the country rock/waste. You will need to instruct students on the method to use, depending on the materials you chose for the models.
4. Instruct students to complete a drawing of their model during mining in their **Investigation File** and answer the questions about the impact of mining.
5. Have students reclaim the surface mine by returning all of the country rock material to the pit, minus the valuable minerals.
6. Ask them to complete the drawing of their reclaimed model in their **Investigation File**.

After the Activity

1. Ask each group to share their extracted valuable rocks/minerals with the class. Discuss with students the steps of their mining and reclamation operations and any differences between the original model and the model after reclamation. It is important to note that the reclaimed pit may not look exactly the same as the original model. For example, students may note that there is a depression due to the missing minerals that were extracted. Discuss whether the animals, trees, and plants can be returned to the area immediately, as well as the time factor involved in restoring a landscape.
2. Provide students with the **Mine Site Reclamation** photo resource card from the **Topic 3 Envelope**. Ask students to write in their **Investigation Files** three observed differences between the photographs of a mine site during mining and those of the same site after reclamation.
3. Ask students if there are any new ideas that should be added to either of the **Activity 1** chart-paper lists of the benefits and costs of mining.

Remind students to complete their **Tracking Sheet** for **Activity 3**. Ask students for vocabulary suggestions for the **Word Wall**.

Modifications

This activity may require extra time to finish. If it is necessary to split it into two sections, the logical place to stop is after students have completed the diagram of the “mined-out” surface mine, step 4 above.

Materials

From Kit	From School
Surface Mine Poster Mine Site Reclamation photo card	1 plastic container (250ml) for each group Approximately 4 litres of country rock material (see above for suggestions) Approximately 300 ml of target mineral/rock material (see above for suggestions) 6 squares of brown construction paper or fabric Tree and grass cut-outs or 6 natural habitat magazine pictures 6 plastic spoons 6 paper cups

The poster and photo card can be found on our website: MiningMatters.ca/MiningWeek

Mining Crushed Stone, Sand, and Gravel

8

What to Do

In your **Investigation File**, find the page headed **Mining Responsibly, Mining Crushed Stone, Sand, and Gravel, Activity 4**.

Crushed stone, sand, and gravel are also called "aggregates." They are called aggregates because they are often mixed with other things, like cement to make concrete and tar to make asphalt. There are hundreds of different uses for crushed stone, sand, and gravel in our daily lives.

1. Discover a few of the many uses for crushed stone, sand, and gravel in the **Uses of Crushed Stone, Sand, and Gravel Bingo** game.

2. Find the two students whose cards match yours in the **Crushed Stone, Sand, and Gravel Matching Game**. Each group of three cards includes a **Crushed Stone, Sand, and Gravel Activity** card, **A Concern** card, and **A Possible Solution** card.

3. In your **Investigation File**, paste your **Crushed Stone, Sand, and Gravel Matching Game** card in the correct box. Use words and pictures to illustrate your group members' cards.

Mining Crushed Stone, Sand, and Gravel

Activity Explanation

Students play two games—Bingo and a card matching game—to discover both the benefits and costs of the crushed stone, sand, and gravel industry.

Background

The sources of aggregate were formed by geological processes long ago. The rocks—the source of the crushed stone—were formed by seas, glaciers, lakes, and rivers over millions of years. The sand and gravel extracted today were deposited thousands of years ago by glacial meltwaters and rivers. Aggregates are extracted by surface mining, also known as open pit mining, and the material is processed on-site. The materials are put into a crusher. This machine crushes the aggregates into pieces of the desired size, which are sometimes washed with water. A series of vibrating screens sort the rock, sand, or gravel by size. Typically, operations are located close to where aggregates are needed, because it often costs more to ship them to where they are used than it does to produce them at the pit or quarry. Approximately 60 per cent of the cost of aggregates is due to transportation costs.

There are hundreds of different uses for aggregates in modern society, ranging from asphalt to toothpaste. Crushed stone, sand, and gravel are used as a base for roads and buildings and are also components of concrete and asphalt. Calcium from limestone, silicon from sand, aluminum, and iron are used to make cement. Clay and the sedimentary rock, shale, are used to make bricks, and sand is excavated to make glass and fibreglass insulation.

Instructions

During the Activity

You may wish to define the word **aggregate** for the students as the term used by the mining industry for crushed stone, sand, and gravel.

1. The **Bingo** game provides a short list of some common products in which crushed stone, sand, and gravel components are used.

   Distribute copies of the **Uses of Crushed Stone, Sand, and Gravel Bingo** cards to students. As a class, decide on the winning combination (full line in any direction, full line across, etc.). Have students cut out the vocabulary and glue the words randomly onto their blank cards. Prepare one set of cards for yourself, so that you can randomly draw one at a time and read out the product name. Students should find and mark off the word on their cards, using either a pen or a Bingo marker. When a student has all the boxes covered to fit the winning combination, they can yell “Aggregates!”

2. The **matching game** focuses on the mining aspect of the crushed stone, sand, and gravel industry. Review the **Surface Mine Poster** with students as an example of an aggregate operation.

   There are eight matched groups of cards listing some of the major activities, concerns, and possible solutions within the crushed stone, sand, and gravel industry. The game demonstrates the risk that the industry entails to humans and the environment, as well as the steps that the industry is taking to reduce this risk.

   Photocopy and cut out the cards from the **Crushed Stone, Sand, and Gravel Matching Game**. Provide each student with one card. Have the students silently find the other two students that have the matching activity, concern, or solution card.

   In their **Investigation File**, each student pastes their own card and copies the information on the other two matching cards from their group. Each group of students can present their cards to the class.

After the Activity

Ask students if there are any new ideas that should be added to either of the **Activity 1** chart-paper lists of the benefits and costs of mining.

Remind students to complete their **Tracking Sheet** for **Activity 4**. Ask students for vocabulary suggestions for the **Word Wall**.

Modifications

Simplify the matching game by making each set of cards a different colour or adding the same number or letter to each group of cards before distributing

Materials Required

From Kit	From School
Surface Mine Poster	Photocopies of Crushed Stone, Sand, and Gravel Bingo cards Photocopies of Crushed Stone, Sand, and Gravel Matching Game (Bingo markers – optional) Glue sticks Scissors

This would be a fun activity to do as a group online, you can use video conferencing software like Zoom!

Uses of Crushed Stone, Sand, and Gravel Bingo

Asphalt						Vinyl
Concrete blocks						Plastic
Fish habitat			Free Space			Toothpaste
Concrete paths						Sewage treatment
Window glass						Water filtering
Golf sand traps	Field drainage channels	Fibreglass	Porcelain toilet and sinks	Mortar	Sports field base	Medicines
Fertilizer	Shingles	Paint	Bricks	Play ground safety sand	Goal post stands	Food

Crushed Stone, Sand, and Gravel Matching Game

Crushed Stone, Sand, and Gravel Activity Trucks transporting crushed stone, sand, and gravel can cause a lot of dust.	**A Concern** Large amounts of dust in the air can cause breathing problems for some people.	**A Possible Solution** Truck wheels are often sprayed with water when they leave the mine site, and dust enclosures are used on processing equipment to reduce dust.
Crushed Stone, Sand, and Gravel Activity Companies have many needs for water, like washing the crushed stone, sand, and gravel, and wetting roads to reduce dust.	**A Concern** Companies might take water from lakes and rivers or from the supply for local communities.	**A Possible Solution** Companies reuse and recycle all their water.
Crushed Stone, Sand, and Gravel Activity Working trucks and mining machinery can be noisy.	**A Concern** People living close to a mining operation might get annoyed by the noise. The noise might scare away wildlife.	**A Possible Solution** Equipment that contains noise-reducing materials, like rubber, helps cut down noise.
Crushed Stone, Sand, and Gravel Activity Crushed stone, sand, and gravel are transported by truck to where they are needed.	**A Concern** The transportation is expensive and may damage roads.	**A Possible Solution** Crushed stone, sand, and gravel mines are usually located close to where their product is needed.

Crushed Stone, Sand, and Gravel Activity Explosives are used to blast (break up) the rock.	**A Concern** Blasting can cause vibrations which could damage nearby homes and scare away wildlife.	**A Possible Solution** Trained blasters ensure that the noise and vibration of the blast is within acceptable levels.
Crushed Stone, Sand, and Gravel Activity Extracting the valuable resources from the Earth will alter the land.	**A Concern** Surface mining changes the appearance of the land and can cause a loss of habitat to wildlife.	**A Possible Solution** Companies rehabilitate mine areas creating naturalized landscapes, housing developments, parks, conservation and recreation areas, agricultural areas, and fish habitats.
Crushed Stone, Sand, and Gravel Activity During surface mining, the top soil is removed.	**A Concern** The topsoil is needed for plant growth and can cause a loss of habitat to wildlife.	**A Possible Solution** Companies store the top soil until rehabilitation, and then replace it on the land.
Crushed Stone, Sand, and Gravel Activity Some surface mines are dug below the water table.	**A Concern** Local residents fear that the mining operation may lower the groundwater level and affect their water supply.	**A Possible Solution** Most surface mines are located above the water table. Deeper mines are designed to prevent changes to the water table.

Recycling Rocks and Minerals

9

What to Do

1. Read the **Information Bulletin, Recycling Rocks and Minerals** on the other side of this card to learn how humans can dispose of our manufactured products when they are no longer useful.

2. Compete in the **Product Relay** with your classmates.

3. In your **Investigation File**, find the page headed **Mining Responsibly, Recycling Rocks and Minerals, Activity 7**. Draw a line to connect each product to the correct destination when it is no longer useful. Use different coloured pencils or pens for Reuse, Recycle, and Landfill.

Information Bulletin: 9 Recycling Rocks and Minerals

Imagine…"If it's not grown, it's mined." This means that you'll use thousands of things in your life that are made from rocks, metals, and minerals. If you're smart and you care about our Earth, you won't throw them all in the garbage when you're done with them. Instead, you'll recycle many of those products. When we recycle, we take Earth's resources in a circle, making things from them, breaking those things down when they get old, and then making new things from them. You'd be surprised how much material we can recycle. Let's look at some familiar things and what can happen to them when they're no longer useful.

Cell Phones and Electronics

Cell phones and other electronic products are made from many materials, including plastic, glass, and metals like steel, aluminum, copper, and gold. One hundred per cent of the materials in electronic products can be recycled. This is very important because some of the materials—like lead, mercury, and cadmium—are dangerous to the environment and shouldn't go into landfill sites. Special recycling plants take apart the equipment, save any reusable parts, and recycle the rest.

Asphalt and Construction Materials

Black tarry asphalt, used for highways, city streets, and country roads, is mostly made from sand and gravel. When a road gets resurfaced, large machines rip up the old asphalt and save the material to recycle for new roads. Using recycled asphalt to make new road surface costs only 25 per cent of the cost of using all new materials. Many other construction materials—like concrete, cement, and drywall—can also be saved when buildings are torn down. Special recycling plants make them usable for new buildings.

Bicycles

Bicycles are made of metals like steel and aluminum and can be taken to a metal waste collecting centre to be recycled. Metals can be recycled again and again because they keep their original properties no matter how often they are melted down and reused. That makes them 100 per cent recyclable. New steel products are usually made with at least 25 per cent recycled metal. The shiny new car in your driveway might be made from old soup cans, bikes, and refrigerator parts!

CDs and DVDs

CDs and DVDs are made to last for hundreds of years, but we don't keep them that long. If thrown away, the aluminum, plastics, gold, chemicals, glass, and nickel they contain would be lost. Specialized electronics recycling companies can grind the discs and make them into a high-quality plastic for new products like car parts, office equipment, street lights, and electrical cable insulation.

Right now, you can't put any of these things into your recycling Blue Box, but all of them can be recycled at special recycling centres. We're finding ways to recycle more things all the time. By recycling, you can help save our Earth's resources and energy, as well as help stop our bad habit of littering the Earth.

Information Bulletin for Teachers: Recycling Rocks and Minerals

Imagine…you'll use thousands of things in your life that are made from rocks, metals, and minerals, and you might throw them all in the garbage when you're done with them. These days; however, you have another choice.

Today, community recycling programs help us use the Earth's resources wisely and dump less garbage on the land. Many families separate paper, food cans, and plastic and glass bottles from the garbage into a recycling blue box. Other everyday things can be recycled too, like computers, cars, cell phones, telephones, TVs, skateboards, fridges, stoves, plumbing pipes, batteries, pop cans and even the kitchen sink. Or how about asphalt roads and concrete? These things are all made from rocks, minerals, and metals that would be lost if they were to go out with the garbage.

Let's look at the word ***recycle***. ***Re*** means "to do again," and ***cycle*** comes from the Greek word *kyklos*, meaning "circle, or wheel." When we recycle, we take Earth's resources in a circle, making things from them, breaking those things down when they get old, and then making new things with them. You'd be surprised how much material we can recycle. Steel, aluminum, silica, lead, cadmium, zinc, copper, gold, nickel, glass, and plastics are just a few of the materials that can be used again and again. Today, 76 per cent of the contents of an average car can be recycled.

Metals like steel and aluminum are 100 per cent recyclable. That means that they keep their original properties no matter how many times they get melted down and made into new things. This is why they are such valuable recycling items. Metal does not get consumed when we use it in the way that oil or gas does; all the metal mined through history still exists in the world in some form.

Steel is the most commonly recycled material. Bridges, cars, refrigerators, and food cans are made of steel. These days, new steel products are usually made with at least 25 per cent recycled metal. The shiny new car in your driveway might be made from old soup cans, building materials, and refrigerator parts! Making steel from recycled material uses 60 per cent less energy than making it from iron ore. So, by using recycled steel when making a car, we use less energy and fewer raw materials. The car costs less to make—an added bonus!

Aluminum, the second most commonly recycled material, is the most valuable recycling item in your Blue Box. Producing new aluminum from bauxite ore takes a lot of energy. Producing aluminum from old pop cans takes 95 per cent less energy than producing from raw materials. And here's something to think about: It takes 300 years for a pop can to break down by natural processes. Recycling that pop can saves enough energy to power your television for three hours.

Glass is another product of mined Earth resources. Made from silica sand (60 per cent), limestone (15 per cent), soda ash (20 per cent), and alumina silicate (4 per cent), glass is 100 per cent recyclable and can be used over and over again. Just think of all the glass food jars that can be made into clean new bottles and jars, instead of being left for years to slowly break apart in a landfill site. Making one glass bottle from recycled glass saves enough energy to keep a 100 watt light bulb going for four hours. Recycling one tonne of glass saves mining 1.2 tonnes of raw material.

Did you know that **money** gets recycled? When you see shiny new coins, chances are they contain material from old pennies, nickels, dimes, quarters, loonies, and toonies collected by the Royal Canadian Mint. That means that new metals do not have to be mined to create the coins.

Where would we be without **batteries**? They make our cars run, our cell phones work, and our flashlights shine, using lead, cadmium, zinc, mercury, and nickel that can be used again when the power runs out. Putting batteries in the garbage means putting dangerous materials in our landfill sites, so it's very important to recycle them. Special recycling plants break them down and use the recyclable material in new batteries. Some batteries can be recharged and reused over 1000 times before they have to be recycled.

Many buildings, highways, driveways, and paths are made of **concrete**, which is made of limestone, sand, and gravel. These materials can't go in our Blue Boxes, but we can recycle them. When a road gets replaced or a building gets torn down, the material gets crushed and used in new construction projects, like roads.

Black tarry **asphalt**, used for highways, city streets, and country roads, is mostly made from sand and gravel. When a road gets resurfaced, large machines rip up the old asphalt and save the material to recycle for new roads. Using recycled asphalt costs only 25 per cent of the total cost of a brand new road.

And don't forget old computers, printers, fax machines, televisions, telephones, monitors and keyboards that could end up in garbage dumps when people get new models. Recycling **e-waste** is very important because it keeps dangerous materials like lead, mercury, and cadmium out of landfill sites and saves valuable metals, glass, and plastics. Canadian recycling programs can now recycle 100 per cent of electronic equipment, so that nothing has to end up in a landfill site.

Today, many things can be recycled. And we're finding ways to recycle more things all the time. By recycling, you can help save our Earth's resources and energy, as well as help stop our bad habit of littering the Earth.

Recycling Rocks and Minerals

Activity Explanation

Students discover what happens to products manufactured from rocks and minerals when they are no longer useful. Three short parts to this activity involve reading an **Information Bulletin**, playing a product relay race, and completing a matching exercise in the **Student Investigation File**.

Instructions

Preparation

Collect items to use in the product relay race. The **Product Destination Master List** below has suggestions. You'll find that items listed on the table in bold have picture cards in the card game **What's Yours is Mined**, included in the kit. The remaining products are most likely available in the school and home. It is not necessary to have everything listed, and substitutions and duplicates are acceptable. Ensure there is a sufficient number of cards and items so that every student has at least one.

Before the Activity

Many students will likely be familiar with the three terms: **Reduce, Reuse**, and **Recycle**. Activate students' prior knowledge by asking them to describe what these terms mean to them.

During the Activity

1. Students read and discuss the **Information Bulletin, Recycling Rocks and Minerals**. Class discussion should include what products can be put into your municipal recycling program. Depending on the time available and the reading levels of the students, you may choose to use the **Information Bulletin** as a shared class reading. A teachers' version of the **Information Bulletin** has been included that provides additional background information and detail.
2. Take the class to a large area (e.g., gym, outside). At one end of the area, set up three containers labelled **Recycle, Reuse**, and **Landfill**. At the opposite end, place the collected products and picture cards. Divide the students into equal teams. To play the relay game, the first person in each team chooses an item from the pile and runs to place it in the container that describes where that item should go when it is no longer useful. They return to their team and the second person repeats the task. Continue until all the team members have had a turn.

   When the relay is complete, gather the students and review and discuss where each item was placed. Ask students if any of the items could be placed in more than one container. Use the **Product Destination Master List** as guidance.
3. For the final part of the activity, students complete the **Product Destination** activity in their **Investigation File**. Have students use different coloured pencils or pens for **Recycle, Reuse**, and **Landfill**.

After the Activity

Ask students if there are any new ideas that should be added to either of the **Activity 1** chart-paper lists of the benefits and costs of mining.

Remind students to complete their **Tracking Sheet** for **Activity 7**. Ask students for vocabulary suggestions for the **Word Wall**.

Materials

From Kit	From School
What's Yours is Mined Card Game	3 containers with labels Reuse, Recycle, Landfill Products for Relay Race (suggested list provided)

Check out out our online version of "What's Yours is Mined" card game or create your own!

Product and Destination Master List

This is used in the relay race and as a written exercise in which students match the products to their destinations in their **Investigation Files**.

Items in **bold** have picture cards in the **What's Yours is Mined Card Game**.

Product	Destination
AAA battery	Special Recycling Centre
Aluminum pie plate	Blue Box
Baby powder	Landfill
Backpack	Reuse, Landfill
Books	Reuse, Recycle
Bronze Olympic medal	Special Recycling Centre
Candescent (old style) light bulb	Landfill
Candy bar wrapper	Landfill
Car airbag sensor	Special Recycling Centre, Landfill
Car battery	Special Recycling Centre
Cardboard box	Blue Box
Carpet	Landfill
CD/DVD	Special Recycling Centre
Cement	Special Recycling Centre
Coins	Special Recycling Centre
Compact fluorescent (new style) light bulb	Special Recycling Centre
Computer	Reuse, Special Recycling Centre
Computer and TV screen	Special Recycling Centre
Electric power cable	Special Recycling Centre
Empty aerosol can	Blue Box
Empty paint can and lid	Blue Box
Glass	Blue Box
Glass juice jar	Blue Box
Glasses (spectacles)	Reuse, Special Recycling Centre Landfill
Insulation	Special Recycling Centre
Jeans	Reuse, Recycle, Landfill
Jewellery	Reuse
Kitchen sink	Special Recycling Centre
Lamp	Landfill
Laser printer cartridge	Reuse, Special Recycling Centre
Magazine	Reuse, Blue Box
Match	Landfill
Medicine	Special Hazardous Waste
Nail/Screws	Special Recycling Centre
Pencil	Landfill
Phone	Special Recycling Centre
Plastic CD packing	Landfill
Plastic grocery bag	Reuse, Landfill
Plastic toy	Reuse, Landfill

Product	Destination
Plastic water bottle	Blue Box
Pop can	Blue Box
Road –asphalt	Special Recycling Centre
Running shoes	Reuse, Landfill
Silver polish	Special Hazardous Waste
Skate board	Special Recycling Centre
Soup can	Blue Box
Styrofoam containers	Blue Box
Sunscreen	Landfill
Table salt	Landfill
Thermometer	Special Recycling Centre
Toothpaste	Landfill
Utensils (knife, fork, spoon)	Special Recycling Centre

Mining Comes to Ogimokwe

10

What to Do

In your **Investigation File**, find the page headed, **Mining Responsibly, Mining comes to Ogimokwe, Activity 8**.

1 Read and perform a Readers' Theatre piece on a family dinner conversation about a possible mining project coming to a First Nation community.

2 Using the Thought Bubble Organizer in your **Investigation File**, identify the unique perspectives each character has towards mining on their traditional territories, and the evidence presented in the script.

3 Andrew was undecided about the mining project at the end of the script. Using the letter-writing template in your **Investigation File**, organize your thoughts and write a letter from Andrew's perspective, expressing your opinion on the mining project.

Indigenous Peoples of Canada are the First Nations, the Inuit, and the Métis.

There are 617 First Nations communities in Canada. Almost half of these communities are in British Columbia (198) and Ontario (126).

Nokomis means "Grandmother" in Ojibwe.

Mining Comes to Ogimokwe

Activity Explanation

In this activity, students will

- read and perform a Readers' Theatre piece featuring a family dinner conversation about a possible mining project coming to a fictional First Nation community.
- identify the unique perspectives that First Nation communities have towards mining on their traditional territories.
- examine the ways in which Impact Benefit Agreements with mining companies help to ensure that Indigenous Peoples concerns are addressed and Indigenous Constitutional rights considered.
- sort and classify ideas by weighing perspectives and formulate a personal viewpoint by writing a letter in the role of one of the characters.

Instructions

Before, during, and after reading the Readers' Theatre piece, engage students in word study activities based on the provided glossary terms to reinforce vocabulary and understanding.

Before the Activity

Prior to beginning this activity, students should already know what mining is and the processes by which rocks and minerals are extracted from the Earth.

Engage students in a pre-reading discussion or brain storming session covering what they know about the First Peoples of Canada.

During the Activity

Have students first perform the piece in small groups of seven or eight, with each person assuming a role. Alternatively, students may join together on roles and read chorally. Arrange chairs in a circle for the readings to ensure that all members focus on the reading and everyone can be heard. The reading of the Readers' Theatre piece can be done over several days, so that students can gain confidence with the play and the specific vocabulary as it relates to both mining and to First Nations culture.

After at least one reading, ask students to locate key information from the play about each character's perspective and complete a thought-bubble organizer in their **Investigation File**.

The opinion of one character, Andrew, is left undecided at the end of the play. Instruct students to organize their thoughts about this mining project from the perspective of Andrew on the letter writing template in their **Investigation Files**. The template can serve as a first draft organizer. Students can produce final drafts on the computer. An **Evaluation Rubric** for students' letters is provided in the **Curriculum Section**.

After the Activity

Ask students if there are any new ideas that should be added to either of the **Activity 1** chart-paper lists of the benefits and costs of mining.

Remind students to complete their **Tracking Sheet** for **Activity 8**. Ask students for vocabulary suggestions for the **Word Wall**.

Modifications

You may wish to offer additional support in the form of extra time, assistance with scribing, permission to work with a partner, or access to bilingual dictionaries.

Extensions

1. To reinforce the lesson, you may wish to contact local First Nation communities to invite an Elder to the classroom. Such a visitor could talk about the unique relationship that First Nations people have with the natural environment and the ways in which traditional hunting, harvesting and spiritual practices rely on the preservation of natural ecosystems. A local Friendship Centre can help you arrange such a visit and provide guidance on how to prepare for the visit.
2. An actual performance could be staged for other classes, parents, or the community.
3. A number of issues arise from the Readers' Theatre in addition to the primary focus on the various perspectives toward mining voiced by the characters. You may wish to use this as a spring board into discussions concerning health and nutrition with the attitudes expressed towards drinking soda. You could also discuss how the various characters demonstrate responsible or sustainable use of wealth, or their attitudes toward change versus the status quo.

Additional Resources

An excellent resource to learn learn about Canada's three distinct Indigenous Peoples (First Nations, Inuit and Métis) and gain access to "Kids' Stop"; a fun zone for children loaded with information about Indigenous Peoples history, culture and languages, games and stories, and classroom resources for teachers.

https://www.aadnc-aandc.gc.ca/eng/1100100013785/1304467449155

Materials

From Kit	From School
	Photocopies of Mining Comes to Ogimokwe – Readers' Theatre script Highlighters

Glossary of Terms

Anishinaabe – Indigenous People who come from Odawa, Ojibwe, or Algonkin ancestry.

Band Council – the governing body of a band or First Nation community

(Chi) Miigwetch – "thank you" in Ojibwe

Chief – political leader of a First Nation community

Elder – a member of a First Nation community who has trained throughout their whole life to pass on the languages, traditions and spirituality of the culture, considered the most revered members of a First Nation community for their wisdom, guidance and strength.

First Nation – a community shared by members of the same band

Impact Benefit Agreement – an agreement between a First Nation community and a mining company intended to ensure that Indigenous Peoples benefit from mining projects and are compensated for the negative impacts of mines on their communities, their land, and their traditional way of life.

Indigenous People(s)** – a group name for the original peoples of North America and their descendants. There are three groups of Indigenous peoples: First Nation, Métis, and Inuit, each with unique heritages, languages, cultural practices, and spiritual beliefs.

Indigenous Rights** – the rights that some Indigenous Peoples of Canada hold as a result of their ancestors' long-standing land use and occupancy. The rights of certain Indigenous Peoples to hunt, trap, and fish on ancestral lands are examples of Indigenous rights.

Nokomis – "Grandmother" in Ojibwe

Ojibwe – an Indigenous language; a person who speaks or descends from a speaker of Ojibwe; a cultural group of those who come from Ojibwe heritage.

Reserve**– an area of land that is set apart for the use and benefit of a band. Some bands have more than one reserve. Many First Nation communities now prefer the term "First Nation community," and no longer use the term "reserve."

Seventh Generation Stewardship – a traditional First Nation belief that the present generation has the responsibility to both learn from the actions of the past seven generations and make decisions with the next seven generations in mind. It is believed that the effects of our actions today will be felt seven generations after us.

Traditional Territory – land that has been occupied and used by a particular First Nation since before contact with Europeans.

** Resource: https://www.aadnc-aandc.gc.ca/eng/1100100013785/1304467449155

Mining Comes to Ogimokwe – A Readers' Theatre

This story takes place on a fictional reserve called "Ogimokwe First Nation." The people of Ogimokwe are Anishinaabe (Ojibwe).

Characters (7)

Rita Toulouse or "Nokomis"
The Grandmother, who is also a community Elder

Sarah Solomon
Rita's daughter, who is also a Band Council employee

Joe Solomon
Rita's son, who lives and works in Toronto as a salesman for a large industrial company

Catherine Morriseau
Sarah's friend, who is a single mother of three and currently out of work

Andrew Solomon
Sarah's teenage son

Jake Beaucage
Andrew's best friend

Narrator

Narrator: It was a late, summer afternoon at Ogimokwe First Nation, and the Solomon family was about to sit down to dinner with family and friends. Sarah was awaiting the arrival of her brother Joe, who had been living off the reserve for the past four years. After high school, Joe had studied business at the University of Toronto and got a high-paying job for a large company in the city. Although Sarah was a bit jealous some days of the money he made, she would never want to leave the reserve to live in the city—it just wasn't for her. She was very proud to call Ogimokwe her home.

Andrew: Hey, Ma! When's Uncle Joe supposed to get here?

Sarah: (sarcastically)
I have no idea Andrew. Maybe his BMW got a flat coming through the bush.

Jake: (excitedly)
Are you serious? He drives a Beemer?

Sarah: (laughing)
Not sure Jake, but it must be something nicer than my rusty old pick-up!

Catherine: Speaking of that, I wanna thank that rusty pick-up for bringing me out here today!

Sarah: No problem, you know we love having you over for dinner. Andrew, can you check to see if your Nokomis needs help with the rice?

Andrew: Yeah, sure. Hey Jake, it's your turn to set the table, eh. You have to earn your supper around this place.

Sarah: I taught my boy well!

Catherine: You certainly did.

Narrator: About ten minutes later, Sarah heard the crunching of gravel as a vehicle pulled up in the driveway.

Andrew: (shouting from the other room)
Ma! Uncle Joe is here!

Narrator: Sarah peeked through the drapes on the front window to see a shiny, new SUV.

Sarah: (sarcastically)
Oh look, a Hummer. Now at least that is sensible!

Narrator: Andrew excitedly ran over to get the door for his uncle. Joe came in smiling, with his arms full of bags.

Joe: Hey everyone! So great to see you all again.

Narrator: Joe hugged each one of them, one by one. The last person was Nokomis; he gave her a very special long hug.

Joe: Hello, Ma….

Narrator: Nokomis was her usual stoic self.

Nokomis: Joseph….

Narrator: She gave Joe a nod and went back to the kitchen to finish preparing supper.

Andrew: So what did you bring me?

Sarah: Andrew!

Joe: (laughing)
Don't worry; I didn't forget your cream soda!

Andrew: Aw, sweet!!

Jake: Hey, pass me one buddy…

Sarah: Joe, you know I don't like the kids drinking pop.

Andrew: Yeah, more like we can't afford pop….

Sarah: No, it's bad for you and, yes, it's a waste of money.

Joe: Aw, c'mon Sarah, it's just a little treat from the big city.

Sarah: (rolling her eyes)
So how is "the big city" these days anyway?

Joe: Funny you should ask, Ogimokwe made the newspaper yesterday. I hear they are planning a mine…

Sarah: (irritated)
They are not bringing in a mine if I have something to say about it. The Chief has been talking to the newspapers before we have even had a chance to agree to this as a community.

Andrew: Ma, Nokomis is ready with dinner and I'm starving.

Sarah: Okay, okay. Everybody, sit down.

Narrator: The Solomons and their guests all found chairs around the big oak table that had been passed down through the family for many generations. As Nokomis was an Elder, it was customary in their house that she offers thanksgiving. Everyone bowed their heads.

Nokomis: (bowing head)
Creator, we thank you for the food that you have provided for us today.
We thank you for our strength and knowledge to prepare these foods, and for our health.
We also thank you for bringing us all together here today… (pauses, raising her eyebrow)
and for allowing my son Joseph to find his way home from "the big city."

Andrew and **Sarah**: (smirk)

Nokomis: Chi miigwetch.

Everyone: Miigwetch

Narrator: As everyone dug into the wonderful meal that Nokomis had made, Joe attempted to restart his earlier conversation.

Joe: So about this mine…I think it is fabulous. Think about what this could do for Ogimokwe's economic development.

Nokomis: What are you talking about?

Joe: I was just telling Sarah that Ogimokwe was in the newspaper yesterday. Apparently they are in talks with Trillium Mining Company to establish a nickel mine just off Lake Ogimokwe.

Joe (reading from the newspaper):
Listen, it sounds fantastic. They've quoted Chief Bernard as saying, "This will be a positive step for the future of our reserve. There will be training for our people and a guarantee of employment, benefits, and revenue sharing. They won't come in without compensating our people and they will respect our inherent right to protect our land. If we can generate our own economy, then we will be self-governing."

Sarah (increasingly annoyed):
You know, I've been working in the band office for 20 years now. We don't need the mine here. Everything is okay here, so why change anything?

Jake: I know my parents have been out of work for a long time now. They have been talking about moving, and I don't wanna leave all my cousins here. My dad would love the chance to work at the mine. Who knows, maybe that's what I can be doing in a couple of years.

Sarah: If this mine comes, it is going to be worse here; you'll have so many people coming in that everyone will be fighting for jobs.

Catherine: I don't know Sarah. I kind of like the idea of having something big like that come to Ogimokwe. They should make the mining company give jobs to the people who are here now first. I don't know if I could work in the mines, but maybe I could go to school to work in the offices…or maybe I could cook. I would just love to have a job so my kids could look up to me. I just wanna work, eh.

Joe: Just think of how much money this would bring to the reserve! We would have more people coming here….

Sarah: …which would mean not enough housing. We don't need all this aggravation…we don't need change!

Joe: Hear me out Sarah. If the mine comes, it brings with it other companies to supply materials to the mine. True, this will bring in more people, but they don't necessarily have to live on the reserve. They can commute. These people will, however, be using businesses on the reserve during the work day, which means a tonne of external revenue.

Jake: I have no idea what that means, but I know I'd really like a youth centre or something for kids to do around here because, for teens, this place is boring!! Give us something to do, eh??

Andrew: Well said, buddy!

Catherine: Oh…I know my kids would love that too. It should be free though. What would be the point of making a big, fancy recreation centre where nobody could afford to send their kids?

Joe: Well, according to the article in the paper, that is what they are offering to do here. They want to build a recreation facility and provide new computers and other technology to the local schools. Trust me; this is so great for the community.

Nokomis: (clearing throat)
A-hem!!

Narrator: Suddenly there was silence. Joe cautiously turned towards his mother.

Joe: Sorry, Ma. Would you like to say something?

Nokomis: (sternly)
Well Mr. "Big City," it seems like you have forgotten where you came from.

Narrator: Forks dropped and mouths gaped as everyone waited for what Nokomis was about to say.

Joe: (stunned)
Pardon?

Nokomis: Do you not remember when you were little, when your Nokomis took you out to the lake to gather medicines?

Joe: Yes.

Nokomis: Do you not remember when you and she would fish at that same lake?

Joe: Yes, what are you getting at Ma?

Nokomis: What I am "getting at" is that the lake here is a site of traditional hunting and gathering for our people. Your grandparents worked their trapline in this territory for many years. They spent winters out there in our cabin and lived off the land.

Joe: Yes Ma, but we have to accept the fact that times have changed. If we want economic prosperity, we have to be willing to be open to new ways of making money for ourselves.

Nokomis: It isn't about making money, my son. You see, when I was young, my mother, grandmother, and aunties taught me very much about the land, the water, the animals and plants, the medicines and birds, and even the insects. Today, we aren't teaching our children these lessons. We have to take care of the Earth so there will be medicines and animals and fish. In whatever decision we make, we must consider the effects for the next seven generations. You know that Joseph.

Joe: But we are thinking about the future generations of Ogimokwe. Bringing in the mine is securing our young people jobs for many years to come. When people are employed they have good housing and can enjoy everything that other Canadians enjoy. Speaking of that, did you know that many of those very things we want— like phones, computers, better housing—are made of mined materials?

Nokomis: I understand that. I don't expect everyone to go live in the wigwam again. We want to live like others and use computers and all that. We want to work like everyone else does, but we have to balance our needs with our Earth's needs. If this here company thinks this mine is so important, they should be willing to work with us and follow our traditions. We must have our ceremonies and ask for permission from the spirits that live in the bush.

Jake: I still go out gathering medicines with my grandma and aunties at the lake. I can see how it would be important to do things our traditional way. My auntie says that the mining coming in is gonna pollute the lake from all that drilling, and then there won't be any fish to catch.

Andrew: Aw, that's not right! I would hate it if we couldn't go fishing in the lake.

Joe: Well, according to the article, these are the kinds of things that they are trying to put into an Impact Benefit Agreement between the Band and Trillium Mines. This will make sure that measures are put into place so that the mine doesn't disturb the fish and wildlife and doesn't interfere with traditional gathering.

Catherine: That sounds like a good plan. This way both sides are happy.

Nokomis: I sure hope that we do our homework on this. Once the mine is here—if it comes at all—it will be too late to turn back. Remember the seven generations….

Sarah: Well, I'm still against the whole idea. It seems like a whole lot of bother more than anything. I think that what Ma said is right. We have to protect the environment and this mine will destroy it.

Narrator: Nokomis stopped, paused, and turned to Sarah.

Nokomis: I never said this mine would destroy anything.

Joe: Exactly, a mine brought in the right way would not harm the environment.

Nokomis: (turning to **Joe**)
I never said that either.

Narrator: Nokomis offered her guests a wink as she headed back to the kitchen.

Jake (to **Andrew**): Wow, your Nokomis is a smart lady.

Andrew: (sarcastically)
Yeah, dude. That's kinda why she's an Elder….

Catherine: Well, she's been around for much longer than any of us, and she's been able to learn from her grandmothers and grandfathers who have been around even longer.

Andrew: I don't know what to think. Having the mine sounds so exciting and it would be great for there to be more for us to do here. I don't know about messing up the land or the lake though.

Joe: Well, I guess it is about figuring out what is important to us as a community here, and making sure that we let the Band Council know what we can negotiate with Trillium Mines, and what is not up for negotiation.

Andrew: (triumphantly)
Maybe we should bring this up in class tomorrow, eh Jake? Maybe if we get other kids in the community involved we could get in there and stand up for what we want!

Jake: First we have to figure out what we want.

Andrew: (smiling)
True…and right now, my friend, there is nothing I want more than a great big slice of my Nokomis' blueberry pie.

Sarah: (relieved)
Well, at least we can all agree on something!!

The End

Creating a Mining CD 11

What to Do

Part A: Writing a Mining Song

In your **Investigation File**, find the page headed **Mining Responsibly, Creating a Mining CD, Activity 9**.

1 Brainstorm with your group to come up with words and ideas that you could include in a mining song about rocks, minerals, metals, mining, and the environment.

Write your ideas in the organizer in your **Investigation File**.

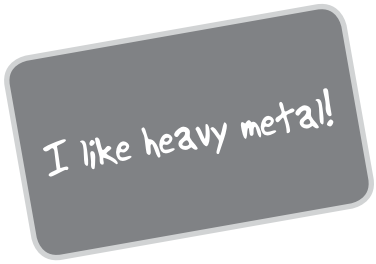
Review each list as a group and circle the ideas and words your group would like to include in your song.

2 Choose a favourite children's song to use as music for your song lyric.

3 Write your song, including as many appropriate mining-related words as possible and at least one big idea about mining. Remember to pay attention to the rhythm and rhyme pattern of the original song.

4 Once your group has finished the song, each of you should write the finished lyric in your **Investigation File**.

5 Your group will *quietly* practise singing your song.



Part B: Designing a Mining Song CD Jacket

You have been hired by a large recording company to design a CD Jacket for the class songs.

Devise a group name, a title for your CD, and a list of the songs that will appear on your recording. Illustrate your CD cover in your **Investigation File**. Everything on your CD cover must relate to rocks, minerals, metals, mining, and the environment.

Creating a Mining CD

Activity Explanation

This is a two-part activity; depending on the time available, the teacher may choose to complete only one task.

Part A: Students

- write simple song lyrics using science vocabulary demonstrating the social and/or environmental impact of mineral and rock extraction, set to a familiar song melody
- complete a musical performance for the class and possibly for an authentic audience (see extension ideas)

Part B: Students design a CD cover using words and images about rocks, minerals, metals, mining, and the environment.

Instructions

Part A: Writing a Mining Song

Before the Activity

Explain to the students that they will be working in small groups to compose a mining song about rocks, minerals, metals, mining, and the environment.

Review the class-generated chart-paper lists showing the benefits and costs of extracting minerals and rocks from the Earth.

With the students, brainstorm and record on a new sheet of chart paper a list of possible song ideas and favourite children's songs. Some examples are listed below:

Mining Ideas	Children's Songs
Uses of minerals or rocks	Old MacDonald Had a Farm
Reuse and recycling of rocks and minerals	Bingo
Open pit mining	Row, Row, Row Your Boat
Underground mining	Mary Had a Little Lamb
A favourite mineral and its uses	Have You Ever Seen a Lassie?
Mining and the environment	Twinkle, Twinkle, Little Star
Mining and people	The Muffin Man
A product life cycle	

Lyrics have been provided to the melody of Row, Row, Row, Your Boat. The lyrics were written by teacher Lenna Rhodes, whose Grade 2 class performed this and other Earth science songs at Dynamic Earth in Sudbury, Ontario. You can use this song to demonstrate the activity to the students. Alternately, you may choose to model the activity or write a class song.

During the Activity

Have students brainstorm in their groups, using the organizer in their **Investigation Files**. Group members should draw and write as many ideas as they can in the organizers in the allotted time. Remind students to review vocabulary in their **Investigation File**, science textbook, or the **Word Wall** for ideas.

Ask the students to share the words and ideas they have written with their group. The group then circles the ideas and words in each list they would like to include in their song.

Allow time for each group to write and practise their song.

Have the groups perform their songs for the class.

After the Activity

After completing the class performance, provide the students with the self and group assessment used in **Topic 2: Rocks and Minerals, Rock Story Drama, Activity 13**. Alternatively, you may choose to have the students write a reflection about the experience.

Part B: Designing a Mining Song CD Jacket

Instruct students they will design a CD jacket using words and images relate to rocks, minerals, metals, mining, and the environment.

If the students completed **Part A: Writing a Mining Song**, incorporate the class song titles onto the CD jacket. Alternatively, brainstorm ideas with the class on song titles or group names in the theme of rocks, minerals, metals, mining and the environment. For ideas, review the class-generated chart-paper lists showing the benefits and costs of extracting minerals and rocks from the Earth, their **Investigation Files**, and the **Word Wall**.

Discuss art techniques such as line, colour, and perspective drawing and encourage students to use these in their design. You may also find it helpful to bring examples of school-appropriate CD cover art to demonstrate some of the characteristics of the art media.

There is a template in the Investigation File for students to complete. Alternatively you may provide paper or card cut to size.

Remind students to complete their **Tracking Sheet** for **Activity 9**. Ask students for vocabulary suggestions for the **Word Wall**.

Modifications

1. Write a class song or practise the "Read, Read, Read Your Words" song.
2. Provide magazines for students to cut out images to use on their CD cover.

Extensions

1. Have students choreograph suitable actions into their song performances.
2. Provide an authentic audience for your songs: another class, parents, a school assembly, a community event.

Materials

From Kit	From School
	Part A: Photocopies of "Read, Read, Read Your Words" lyrics Photocopies of Self and Group Assessment Chart paper and markers Part B: Pencils, rulers, coloured pencils, scissors Paper measured to the size of a CD cover (optional)

Songs can be recorded and posted on YouTube and instead of a CD cover students can create thumbnail art!

Read, Read, Read Your Words

Lyrics by Lenna Rhodes

Sing to the melody: Row, Row, Row Your Boat

Read, read, read your words.
They all begin with M.
Miners, minerals, and metals too.
They all begin with M.

Read, read, read your words.
They all begin with M.
Machines, mechanics, and mining too.
They all begin with M.

Product Life Cycle Research 12

What to Do

A product life cycle tells us about the materials and energy used to make, use, and dispose of the product. When we buy and use products, looking at the life cycle helps us to make good choices that help to protect and preserve our environment.

In your **Investigation File**, find the page headed **Mining Responsibly, Product Life Cycle Research, Activity 10**.

1 Complete the **Product Life Cycle Research Plan** in your **Investigation File**.

For ideas about products made from rocks or minerals, look back through the activities in your **Investigation Files** for all three **Deeper and Deeper Topics: Getting Motivated, Rocks and Minerals**, and **Mining Responsibly**.

2 Research your product's life cycle and find out the answers to the following questions:

a) What rocks, minerals, or metals are used to make the product?
b) How is the product made?
c) What environmental impacts may have occurred during the manufacturing of the product?
d) Who benefits from the use of the product, and how do they use it?
e) What choices are there for what happens to the product at the end of its life?

3 Choose one rock or mineral that is used to make your product. Research your choice and find out the answers to the following questions:
a) What are its composition and characteristics?
b) Where is it mined?
c) How is it extracted or processed?
d) Are there any environmental impacts during the mining and extraction process?
e) How is it used in the product?

Record your research in your **Investigation File**.

4 Publish your research. Include in your presentation what choices consumers like you could make to reduce the environmental impact of your product. Use the **Publication Checklist** in your **Investigation File**.

5 Prepare a short talk on your product's life cycle, using your published research.

Product Life Cycle Research

Activity Explanation

This activity is a culminating task that brings together the many ideas students have experienced throughout **Topic 3: Mining Responsibly**.

Students complete a research project on the life cycle of a product, the minerals or rocks used to make it, who uses it, and how the product is disposed of at the end of its useful life. They focus on one specific mineral and/or rock used in their product and discover its composition and characteristics, where it is mined, how it is extracted or processed, and how the mineral or rock is used in that product. An emphasis should be placed on any environmental impacts during the extraction and manufacturing processes.

Instructions

1. Discuss with students the concept of a product life cycle. Introduce the purpose of their research and the intended audience for their published project. Share the **Evaluation Rubric** provided in the **Curriculum Section** with students.
2. Have students choose a product and associated rock or mineral that they will research to answer the questions on the **Activity Card**. Students can review their Investigation Files for lists of items made from rocks and minerals. See the responses for **Topic 1: Getting Motivated, Activity 2**; **Topic 2: Rocks and Minerals, Activities 2**, and **5**; and **Topic 3: Mining Responsibly, Activities 2, 4, 5**, and **7**.
3. Have students complete the **Product Research Plan** in their **Investigation Files**. Review their plans to ensure students have an appropriate focus for their research.
4. Allow time for independent research, either during class or as homework. Encourage students to consider more than one source of information. They may use encyclopaedias, library books, the Internet, and/or government agencies or contact knowledgeable professionals, such as geologists.
5. Students choose a method to publish their research using words and images. Ask students to complete the **Publication Checklist** in the **Investigation File** prior to finishing their task.
6. Students give a short oral presentation sharing the results of their research.
7. Remind students to complete their **Tracking Sheet** for **Activity 10**.

Modifications

Have students complete only one part of the research: either the product life cycle, or one rock or mineral.

Materials

From Kit	From School
	Resource materials on uses of rocks and minerals, extraction and processing of rocks and minerals

Personal Reflections on Mining

13

What to Do

During **Topic 3** you have completed activities that looked at

- how underground and open pit mines work
- the impact on the environment from mining and refining, and solutions to those problems
- how mine sites can be reclaimed when mining is finished
- how we use products made from rocks and minerals
- how products made of natural materials can be recycled
- the benefits and costs of mining

Find the page in your **Investigation File** headed **Mining Responsibly, Personal Reflection on Mining, Activity 11**.

Reflect on what you have studied in these activities, and complete the sentences below in your **Investigation File**.

- The most interesting part was…because….
- In this topic, I have learned….
- This topic is important to me and my life because....
- When I compare the costs of mining to the benefits of mining, I see that.…
- From what I know about mining and rocks and minerals, I will change.…

Personal Reflections on Mining

Activity Explanation

As closure to **Topic 3**, this activity provides an opportunity for students to reflect on their personal opinions and reactions to the information about mining and resources. Particularly important is how they might change their behaviours or attitudes following the unit, for example, in their choice and use of products.

Instructions

This task can be delivered in various ways:

1. Provide the reflection questions on **Activity Card 11** to students to prepare in advance and have the whole class share orally in a teacher-led discussion. Give more time to the last three statements in order to focus on higher order critical thinking.
2. Have the students discuss the statements in small groups and afterward formulate their personal responses.
3. Have students write their responses in their **Investigation Files**.

Materials

From Kit	From School
	Benefits and costs of mining charts created during Topic 3

Underground Mine Tour 14

What to Do

In your **Investigation File**, find the page headed **Mining Responsibly, Underground Mine Tour, Activity 2**.

In this activity, you will watch *NickelQuest*, an animated DVD that lets you see how an underground mine works. Do the following tasks in your **Investigation File**.

The deepest mine in the world is in South Africa; it goes down to almost four kilometres.

Sudbury is a town in Ontario, Canada.

1 As you watch the video, each time something is identified that is made from nickel, write down its name

2 At the end of the video, count how many things you found and write down the total.

3 Nick finds out from Nicole how an underground mine works. When he gets back to the Tunlin Commune, he finds that he has mixed up his notes. Help him put them in the right order. Write the stages in the correct sequence on the flow chart.

Drill makes holes in the rock to fill with explosives	**Blasting** uses explosives to break up the rock wall around the ore
Exploration for minerals finds nickel ore	**Products that are made from nickel**
Flotation tanks mix the crushed rock and ore with chemicals and water so the unrefined nickel floats to the top	**Pyrometallurgy** heats the unrefined nickel in a furnace to make the metal better quality
Grinding mill breaks the crushed rock and ore into very small pieces	**Crusher** breaks the rock and ore into pieces small enough to go in the skip and up to the surface
Mucking moves the broken rock and ore from the blast area	**Stabilize** makes the rock wall safe with bolts, bars, and wire nets

Underground Mine Tour

Activity Explanation

Students watch a video to see how an underground mine works and to find out what we use nickel for. They sequence the stages in extracting and processing nickel.

Instructions

During the Activity

Review with the students the **Underground Mine Poster**. Show students the *NickelQuest* video included in your kit (running time 19:13 minutes). Explain that they shall discover how nickel is extracted from the Earth and processed into metal. Tell them to write in their **Investigation Files** the names of all the products identified in the video that are made from nickel. Most products are named in the pop-up windows of the video. Warn students that some come very quickly and they need to pay close attention to catch them all. Play the video right through to the end of the credits, since more products are displayed afterward as visual icons.

The video can also be downloaded from the Ontario Mining Association Web site at http://www.oma.on.ca.

After viewing the video, ask students to tally how many nickel products they found and write down the total. Start a master list on the board. Choose the person who has the highest number to tell you three things. The person who has the next highest number shares three more things. Continue until there are no more new items.

Instruct students to arrange the stages in an underground mining process into the correct sequence on a flow chart in their **Investigation Files**.

After the Activity

Ask students if there are any new ideas that should be added to either of the **Activity 1** chart-paper lists of the benefits and costs of mining.

Remind students to complete the **Tracking Sheet** for **Activity 2**. Ask students for vocabulary suggestions for the **Word Wall**.

Extensions and Modifications

1. Copy the stages of the underground mining process onto cards for students to sort and sequence.
2. Provide two lists— the mining terms and their definitions. Have the students match each term to its corresponding definition.
3. The *NickelQuest* video also includes information about the safety issues in underground mines. Have some students record this information during the video. Look back at **Topic 2, Activity 1, Geology and Safety** and add any new information.

Materials Required

From Kit	From School
NickelQuest DVD Underground Mine Poster	TV and DVD player

The poster and a link to the video can be found on our Mining Week Resource page: MiningMatters.ca/MiningWeek

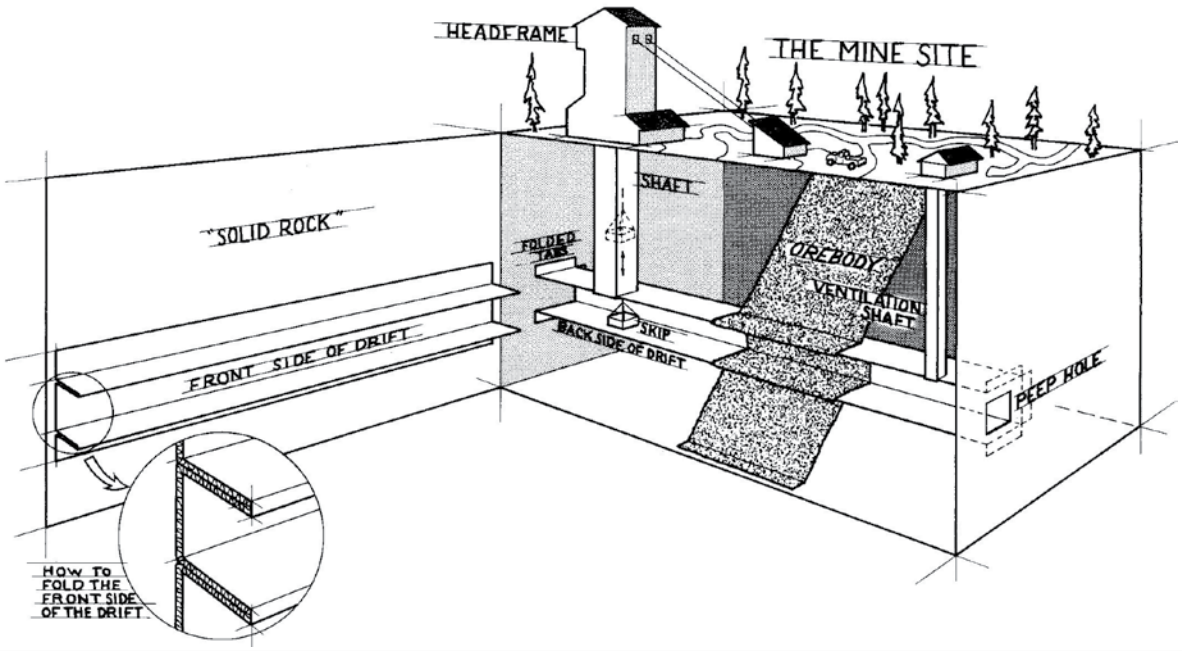
Engineer and Build an Underground Mine

15

What to Do

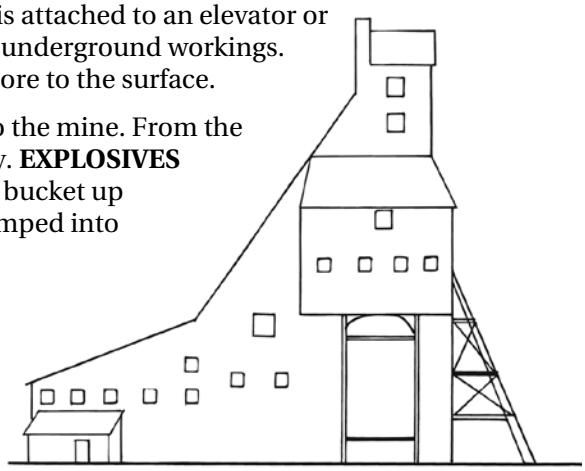
Read the Information Bulletin and finish the word search to learn some of the words associated with underground mining. Then get ready to build your underground mine model! The materials that you will need as well as the structures that you must construct are as follows:

Construction	Material Needed
Mine Site	Cardboard box
Head Frame	Cardboard/construction paper/popsicle sticks
Buildings on Site	Cardboard/construction paper/miniature toy buildings
Trucks	Construction paper/miniature toy trucks
Trees	Construction paper/miniature toy trees/twigs
Shaft	Cardboard/construction paper/cardboard tubes
Cage/Skip	Cardboard/construction paper/string
Ventilation Shaft	Cardboard/construction paper/cardboard tubes
Drift	Cardboard/cardboard tubes
Ore host rock	Aluminum foil
Rock	Construction paper/newspaper/painted fibre fill
Other supplies	Masking tape or duct tape, paint, flashlight



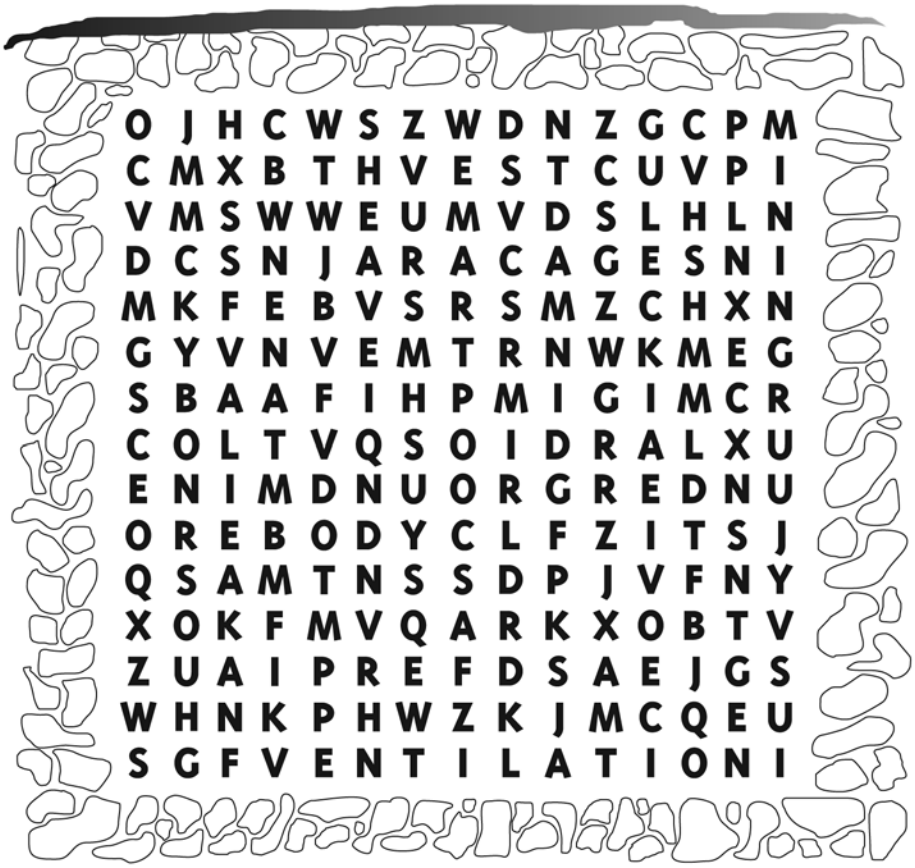
Information Bulletin: Engineer and Build an Undergound Mine

MINING is a temporary use of the land during which valuable rock containing metal or minerals, called an **OREBODY**, is removed from the Earth. An **UNDERGROUND MINE** is created when deep tunnels are dug to reach an orebody. The main vertical tunnel is called a **SHAFT**. At its top is a wood, steel or concrete **HEADFRAME** containing a **SHEAVE** (pulley system) that is attached to an elevator or **CAGE** to transport the miners and equipment from the surface to the underground workings. The sheave also supports a bucket or **SKIP** to lift the broken rock and ore to the surface.



Other vertical tunnels called **VENTILATION SHAFTS** bring fresh air to the mine. From the shaft, horizontal tunnels called **DRIFTS** provide access to the orebody. **EXPLOSIVES** break up the rock so it can be picked up by a low, narrow truck with a bucket up front, called a **SCOOPTRAM**. It is driven to the shaft and the ore is dumped into the skip, which brings it to the surface.

Can you find the words associated with underground mining? Words can be found in any direction.



WORD BANK

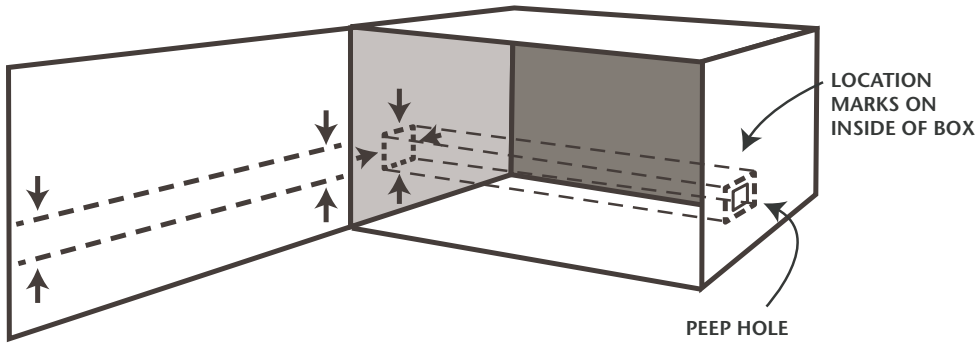
MINING
OREBODY
UNDERGROUND MINE
SHAFT
HEADFRAME
SHEAVE
CAGE
SKIP
VENTILATION
DRIFTS
EXPLOSIVES
SCOOPTRAM

Follow the steps below to build your mine!

1 Prepare your box, the mine site, by taping all sides closed.

2 Cut open one side of the box to make a “door”.

3 Locate the position of a drift by measuring and drawing horizontal lines on the inside of the “door” Draw corresponding marks on the insides of the sides of the box as shown below. Cut a “peep hole” out of the right side of the box at your marks.



4 Your drift has two sides (back side and front side). Create both sides of your drift by either folding cardboard as shown in the completed model illustration or by cutting a stiff cardboard tube in half lengthwise. When folding the cardboard it helps to use a strong straight edge, like the edge of a tabletop, to ensure you get a straight edge.

5 Using your drift location marks as guides, glue the front side of the drift to the “door”. Attach the back side of the drift by gluing the folded tabs at both ends to the sides of the box. Ensure that the back side of the drift lines up with the “peep hole”.

6 Make a shaft out of cardboard by folding four sides into a tube or by using a round cardboard tube. Make a hole in the top of the box slightly larger than the shaft, directly above the left end of the drift. Cut a corresponding hole in the top of the drift. Lower the shaft through the surface to the top of the drift at the hole. In a real mine, the shaft is dug down through solid rock to the drift level and then the drifts are dug horizontally.

7 Make a smaller ventilation shaft in your mine by repeating Step 6 on the right end of the drift.

8 Make a headframe (building at the top of the shaft) and place it over the shaft hole. A small building for fans should be made for the top of the ventilation shaft. Make a cage/slip out of string and construction paper. Be sure that it is small enough to fit through the shaft.

9 It's time to make the orebody! Take a sheet of aluminum foil (ore host rock) long enough to extend from the top of the box to the bottom of the box with at least 15 cm extra. Fold the foil to a width approximately 10 to 15 cm. Tape the foil to the inside of the box top and to the top of the drift. Press the foil into the drift along the top, back and bottom allowing the remaining foil to extend to the bottom of the box. Secure with tape at the bottom of the drift and box.

11 Carefully fill the remaining open spaces in the box with shredded newspaper or painted fibre fill. This will give the impression that the drift is actually passing through solid rock. Complete your model by painting the surface and placing trees and trucks to represent a real mine.

12 When the "door" of the model is closed, peek into the mine by shinning a flashlight into the "peep hole". This really gives you the feeling of being underground.

13 Use your model to deliver a short video presentation to your classmates about the processes of mining and milling. Describe how ore is taken from the ground (mined) and processed (milled).