



GRADE FOUR

UNIT PLAN

ROCKS AND MINERALS



This unit covers the **Understanding Earth and Space Systems** strand of the Grade 4 Ontario Science and Technology Curriculum, **Rocks and Minerals**, through the use of culturally representative Indigenous (Aboriginal) learning materials and stories.

This unit allows students the opportunity to explore rocks and minerals through different hands on labs and lessons.

LESSON SEQUENCE

1. Scavenger Hunt
2. Crayon Investigation
3. Testing Minerals Lab
4. Cultural Connections
5. Use of Rocks and Cookie Mining

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GRADE FOUR ROCKS AND MINERALS

LESSON ONE SCAVENGER HUNT (INSIDE AND OUTSIDE)

Time Frame: 2 hours

OVERALL AIM OF THE LESSON

Students will begin to explore what rocks and minerals are. They will start to understand the properties of each and be introduced to the different types of rocks and the rock cycle.

SPECIFIC CURRICULUM LINKS

Ontario Curriculum Grade 4 Science and Technology

Students will

- 3.1 describe the difference between rocks and minerals;
- 3.3 describe how igneous, sedimentary and metamorphic rocks are formed;
- 3.4 describe the characteristics of the three classes of rocks;
- 2.1 establish safety procedures for outdoor activities

LAUNCH

30 minutes

Students will be given the handout with different questions on it. Students will use the internet to look for answers- this is the internet scavenger hunt. Students will use their research skills to introduce themselves to rocks and minerals.

TALK TIME

15 minutes

What are some of the findings that we came up with?
Did anyone find something different?
Answers should be similar

Introduce vocabulary words igneous, sedimentary, metamorphic, and physical properties. These vocabulary words are words that students will need to know and have practice with. Create anchor charts for students to refer too if they need clarification on these terms.

Students can ask questions based on their finding, if there is something that they didn't understand or need more clarification with. If students have prior knowledge, they can share during this time.

MATERIALS

- Computers- iPads
- Internet Scavenger Hunt Handout
- Pencil, Pens
- Chart paper
- Markers
- Sifter – strainer or something to sift through sand and dirt
- Shovel
- Rocks and Minerals (gem stones if needed)
- Paper
- Coloured Pencils

PREPARATION AHEAD OF TIME

If you wanted to, you could create boundaries for your students when they go outside and look for different rocks and minerals.

If you know that your school yard is limited on rocks and minerals, you can buy some from a store and hide them. When students go outside they will have more things to find when they are outside.

CHALLENGE

30 minutes

Students are to go outside and see if they can find some different types of rocks and minerals. Students can sift through the sand and record their findings on their paper. If you wish, students can colour the rock or mineral that they found in order to remember what they found.

It is important for students not to keep the rocks or minerals that they find because we need to leave Mother Earth in the same way in which we found her. By putting the rocks and minerals back it also gives other students the opportunity to find them.

When students are done looking or have found a variety of rocks and minerals, students will list the properties of what they have found. By referring to the handout, students can identify the different rocks (this can be done inside or outside).

COMING TOGETHER

15 minutes

When everyone has finished listing the properties and naming the rocks, students will share their findings with each other. This will give students the chance to work with the terms and the different properties.

TO THINK ON

10 minutes

Read page 18 in I'm a Geological Engineer. This page references the importance of putting Mother Earth back the way we found her. Why do you think that it is important to put things back where we found them? What impacts might this have on the environment?

Back here on the surface too, we find the work of geological engineers. After a mine has run its course, the mine site has to be reclaimed. That means it has to be put back as close to how it was before the mine project began.

Mining can leave big scars Mother Earth. In the past, people just moved on and left those scars. Now though, we have a duty to return the site to its natural state. It is the law.

Geological engineers will work to design the restoration of the habitat around a mine. That's so important, for all of the species of plants and animals that live in the area.

As a Métis who grew up hunting and fishing, I enjoy my time out on the land. I for one am glad these restoration projects are the law.



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GRADE FOUR ROCKS AND MINERALS

LESSON TWO THE THREE TYPES OF ROCKS AND UNDERSTANDING HOW THEY ARE FORMED

Time frame: 2 class periods (80 minutes)

OVERALL AIM OF THE LESSON

Students will gain a better understanding of what a rock is and the 3 different types of rocks. Through an investigation using crayons, students will get a better visual at what happens to minerals in order to form the 3 types of rocks.

SPECIFIC CURRICULUM LINKS

Ontario Curriculum Grade 4 Science and Technology

Students will

- 3.1 describe the difference between rocks and minerals;
- 3.3 describe how igneous, sedimentary and metamorphic rocks are formed;
- 3.4 describe the characteristics of the three classes of rocks

LAUNCH

Recall the first lesson, what do you remember?
What is the difference between a rock and a mineral? What are the three types of rocks that we researched?

TALK TIME

Spend time defining each rock type. When defining and explaining a rock type, include some example pictures for students to look at.

Key words: Igneous, Sedimentary and Metamorphic

CHALLENGE

Have each student use a pencil sharpener to create 3 different piles of wax crayon shavings. The 3 different piles are going to be formed into rocks, the way that igneous, sedimentary and metamorphic rocks are formed, by using heat and pressure (the textbook). Read instructions to students, step by step.

*See handout for instructions

MATERIALS

- Chart Paper
- Markers
- Pictures of the 3 types of rocks for a visual
- Crayons
- Hand Pencil Sharpener(s)
- Iron
- Extension Cord
- Scissors
- Wax Paper/ Tin Foil
- Heavy Textbooks

PREPARATION AHEAD OF TIME

Depending on students and class time, you could have the crayons already shaved and ready to hand-out. Have heavy textbooks ready that students can use during their experiment. Teacher decides if they want to post the instructions for each rock type (hide the name of each rock) or read them out loud for students to follow step by step.

Students can make notes about what they see happening to the wax crayon pieces. You can ask students to name the rock type to match their crayon rock.

COMING TOGETHER

Have students talk about their notes and what they saw. What did they name their crayon rocks, did anyone have a different idea? Check if they matched the crayon rock to the proper name of the rock, check this for understanding. Talk about the differences again for clarification if needed.

TO THINK ON

Why do you think it is important to know the names of the rocks and how they are formed? Refer to page 6 in *I'm a Geological Engineer*, why do you think that it is important for geological engineers to understand Mother Earth before building?

[It is important for geological engineers to know what the ground is made out of and if Mother Earth will be able to support and provide a strong foundation for a project (Ex. Bridge or building being built) Geological engineers need to know if it will be safe to build or what effects it might have on the environment.]



WAX CRAYON INVESTIGATION INSTRUCTIONS

Igneous rocks are formed deep within the Earth and are formed by heat. Move the iron just a little close to the crayon shavings. They slowly start to melt. Discuss how they form crystals that are either long coarse grains or short fine grains based on the length of time it takes to melt.

Then discuss sedimentary rocks. Cut a small piece of the wax paper and place it over the top of the second pile of crayon shavings. Add the science book to the top and apply lots of pressure. . Discuss how it would look after years, and years of more pressure. Finally, metamorphic rock. Take the third pile and place a piece of wax paper over it. Then apply the iron down on the wax paper – applying both pressure and heat. Just a quick 10 seconds or so does the trick.

****When it is time to use the iron, please help your students do this by going to their desk and allowing them to watch and take notes about what is happening to the wax.** We encourage going to their desk so students do not have to carry their "rock" back to their desk when it is hot.**

Remind students that the wax shavings are a representation of different minerals that form rocks.

GRADE FOUR ROCKS AND MINERALS

LESSON THREE PHYSICAL PROPERTY TEST LAB

Time Frame: 2 Periods

OVERALL AIM OF THE LESSON

Students will learn about the physical properties of a rock. By conducting experiments, students will gain hands on experience and a better understanding of the different physical properties of rocks and be introduced to different types of minerals.

SPECIFIC CURRICULUM LINKS

Ontario Curriculum Grade 4 Science and Technology

Students will

2.2 use a variety of tests to identify the physical properties of minerals

2.3 use a variety of criteria to classify common rocks and minerals according to their characteristics

2.5 use appropriate science and technology vocabulary, including hardness, colour, lustre and texture, in oral and written communication

3.2 describe the properties that are used to identify minerals

LAUNCH

Review the types of rocks from the previous lesson and how they are formed.

Igneous, Sedimentary, Metamorphic

For the next two periods, we are going to take a closer look at rocks and the different minerals that form them.

TALK TIME

**review safety considerations associated with scientific experimentation, as specified by your school or board policies.

Rocks are made up of many different minerals. Minerals, as we will learn, are found in the Earth's crust. Geologists complete the following tests to identify the physical properties of rocks: colour, lustre, streak, transparency and hardness. The reason why geological

MATERIALS

- rocks (different types and colours)
- lab sheet
- pencils
- hardness scale
- coloured pencils
- unglazed/porcelain tile
- rocks and minerals book
- lamps (23)
- fingernail
- magnify glass (34)
- penny
- magnet
- butter knife
- vinegar
- steel nail
- bowl
- glass
- spoon(s)
- safety glasses

PREPARATION AHEAD OF TIME

Have 7 different rock testing lab stations ready for students to explore and experiment.

Station 1 materials: Colour - (rocks, pencils, rock and mineral book, coloured pencils)

Station 2 materials: Streak - (unglazed/porcelain tile)

Station 3 materials: Hardness - (fingernail, penny, butter knife, steel nail, glass, safety glasses, lab sheet, hardness scale)

Station 4 materials: Lustre - (magnify glass, lamp)

Station 5 materials: Transparency - (lamp)

Station 6 materials: Acid Test - (vinegar, bowl, spoon, different stones, magnifying glass)

Station 7 materials: Magnetism - (magnet)

engineers do this is because not every rock is made up of the same minerals, just like people are not the exact same, and they need to know what type of rock they are working with.

We use different characteristics to identify people, such as eye color, hair color, language, etc. Geologists do the same thing, using specific properties to identify rocks and minerals. Geologists use the following tests to distinguish minerals and the rocks they make: hardness, color, streak, luster, cleavage and chemical reaction. Today we are going to test some rocks and make note of their characteristics.

While you are working, it will be important to record your work at each station using pictures, drawings and words.

CHALLENGE

Students will have time to work at each station. Students can work with partners at each station but students must record their own work on their lab sheet. Students will choose 2 rocks that they would like to test at each station. Students will have ten minutes at each station and then they will rotate stations.

Physical Property Testing Stations

Station 1: Colour test- rocks, coloured pencils, pencil, rocks and mineral book

Station 2: Streak Test- unglazed tile, rocks

Station 3: Hardness Test- fingernail, penny, butter knife, steel nail, glass, safety glasses, lab sheet, hardness scale

Station 4: Lustre Test- lamp, magnifying glass, matching sheet (examples)

Station 5: Transparency Test- lamp

Station 6: Acid Test- vinegar, bowl, spoon, magnifying glass

Station 7: Magnetism- magnet

COMING TOGETHER

Have students share their results. Is there anything that shocked or surprised the students? Was there anything similar between their 2 rocks? Was there a test that they liked the best or one that needs more explanation?

Take the time to help students better understand a station if they need it.

TO THINK ON

Why do you think that these tests are important to Geological engineers? Why is it important for engineers to know what kind of rocks they are dealing with?

Geological engineers work to understand rocks and minerals to better understand the Earth and its history. Geological engineers need to know where it is safe to build important structures, where these buildings won't be damaged by the environment.



LESSON FOUR CULTURAL CONNECTIONS AND EVERYDAY USE

Time Frame: 80 minutes

OVERALL AIM OF THE LESSON

Students will start to think of all the ways that we as humans use and rely on rocks and minerals. Students will compare the uses of rocks and minerals by traditional North American Indigenous Peoples and the way in which we use them today.

SPECIFIC CURRICULUM LINKS

Ontario Curriculum Grade 4 Science and Technology

Students will

2.4 use scientific inquiry/research skills to investigate how rocks and minerals are used, recycled, and disposed of in everyday life

2.6 use a variety of forms to communicate with different audiences and for a variety of purposes

3.1 describe the difference between rocks and minerals and explain how these differences determine how they are used

LAUNCH

Read, *The Hunting of the Great Bear, a Haudenosaunee Legend*. Have students listen carefully to the kind of tools that were used to help catch the Great Bear. When the story is done, listen to the student's ideas from what they have heard. You might have to guide them into thinking about rocks and minerals in relation to the weapons that were used.

How do you think they made the spear?

What kind of rock would be strong enough not to break at the end of a spear?

How do you think the fourth brother started to cut up the bear with?

How do you think that the blade stays sharp?

MATERIALS

- Legend: The Hunting of the Great Bear
- Computers for research
- Handouts with websites and questions to help guide students
- Please see aboriginalaccess.ca/cc4 for website resources on cultural connections.

PREPARATION AHEAD OF TIME

Have some websites to help guide students in their research. Having a handout of questions ready for students to help narrow their search.

TALK TIME

First Nations had and still have a strong relationship with the land and Mother Earth. Rocks are sacred as they have seen and experienced many things during their time on Mother Earth. It is said that rocks will guide us through life. Everything in First Nations communities and life are considered living, as everything has a spirit.

This will get students thinking of the previous lesson and the characteristics of rocks. This had to be thought of when making tools in order for them to be strong enough to be used for protection, hunting, cooking food and to help the community.

Have students think about the use of rocks and minerals for hunting. What else did traditional North American Indigenous People use rocks and minerals for? Where else do we see or have we heard of rocks and minerals having an important role in FN culture? How do they still use it today?

Brainstorm some ideas as a group

Some ideas might be:

Jewelry, Artwork, Ceremonies (Sweat Lodge), Tools-tomahawk, arrowheads, knives, Burials, Rock Carvings and Paintings (documenting hunting cycles etc.) Hunting, Building, Harpoons

CHALLENGE

Students are to research different items that were used every day by traditional North American cultures. We are going to look at different items that were created with or that used rocks and minerals. Through research we are going to investigate if items that were used by traditional North American cultures are still used today and in what form?

Students can work with partners while researching an item of interest. Students will focus on the use of rocks and minerals in the making or use of the item.

Example:

Researching weapons

What type of weapons used rocks?

-Spear

What type of rock would be strong enough to be used at the end of a spear?

-students can think back to their previous lessons

Are spears still used today?

-yes, when it is spear fishing time in the spring, spear are still used to catch fish.

Are the spears still made the same way or do they still use rocks or minerals to create the head of the spear?

COMING TOGETHER

Have the students share their findings. Did anyone find anything interesting? Was there anything that shocked you? Is there anything that we still use today?

TO THINK ON

Do you think that any of these items were created by engineers? Did engineers help improve these items that were used and that we still use today?

EXTENSION

Take students outside to find some rocks and create their own pictographs- something about their daily lives or something that is important to them.



<http://www.indiantime.net/story/2009/09/10/cultural-corner/the-story-of-the-great-bear-the-big-dipper/4292.html>

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GRADE FOUR ROCK AND MINERALS

LESSON FIVE USE OF ROCKS AND MINING EFFECTS ON ENVIRONMENT

Time Frame: 80-90 minutes

OVERALL AIM OF THE LESSON

We are going to look at all of the things that we use that are created by using rocks and minerals. We are going to gain a better understanding of mining and the costs of mining.

SPECIFIC CURRICULUM LINKS

Ontario Curriculum Grade 4 Science and Technology

Students will

- 1.1 assess the social and environmental costs and benefits of using objects in the built environment that are made from rocks and minerals
- 1.2 analyze the impact on society and the environment of extracting and refining rocks and minerals for human use, taking different perspectives into account
- 2.1 follow established safety procedures for outdoor activities and for working with tools, materials and equipment
- 2.4 use scientific inquiry/research skills to investigate how rocks and minerals are used, recycled, and disposed of in everyday life

LAUNCH

20 minutes

Hand out worksheets for students to look over. Ask students to make a chart in their notebooks and sort the items on their handout into “Rocks and Minerals” and “Not Rocks and Minerals.” Students can work with partners to complete this task.

Talk about what students think. Name items one by one and have students agree or disagree that it is a rock or mineral. If students are unsure, ask them why. Students might need some help understanding where the rock or mineral is within the item.

The Learning Zone website will be helpful when explain what mineral or rock are used to create this item. <http://www.oum.ox.ac.uk/the-zone/minerals/usage/home.htm>

MATERIALS

- Sorting Sheet
- Pens, Pencils
- Computer/ iPad
- Smart Board (for videos)
- Chart Paper and Markers
- Chocolate Chip Cookies/Rainbow Bit Cookies (hard and soft)
- Grid Paper
- Plastic Fork
- Plastic Knife
- Toothpicks
- Napkins or Small Paper Plates

PREPARATION AHEAD OF TIME

Have copies of “sorting sheets” and “pros and cons sheets” copied for students, new terms and definitions ready on chart paper, chart paper for pros and cons.

Have chart paper ready to create a visual for students of new terms.

Have experiment utensils or sets ready to handout for students, (one fork, one knife, a few toothpicks and a napkin or paper plate, two cookies-one soft and hard).

TALK TIME

30 minutes

Once the list has been discussed, ask students where we get all these rocks and minerals from. If needed, give students a hint.

We are going to talk about mining.

Let's talk about mining. Does anyone know what mining is?

Removal (extraction) of minerals, rocks and metals from Mother Earth

What kind of things do we mine for?

Coal, gold, silver, diamonds and other minerals

Does society gain anything from mining?

Mining allows for job creation, the materials that we mine for can provide us with energy (coal-energy) and economic benefits

Do you think that mining is good for the environment?

Allow students to talk about this, and keep point form notes on their ideas. There are no wrong answers, encourage students to think about this question and share their ideas.

We are going to introduce some new terms that are used when we talk about mining, more specifically coal mining for this lesson.

Extraction: removal of something

Mining Property: approved/purchased site for mining

Deforestation: The removal of forests and tree for large mining sites

Reclamation: The restoration of land and environmental values to a surface mine site after the coal is extracted

Miner: one who engaged in the business or occupation of extracting

www.digintomining.com – Dig into Mining has some great virtual field trips of copper mines and the steps that have to be taken into order to start mining. (4 videos, each video is between 17-22 minutes long) This could be a good way to introduce students to mining and what mines are. Students can watch a video that helps explain and show students what a mine looks like.

CHALLENGE 1

RESEARCH THE PROS AND CONS

25-30 minutes

Students will be divided into groups and they will use the website Energy Kids https://www.eia.gov/KIDS/energy.cfm?page=coal_home-basics, to look up different types of resources that we mine for and use every day.

From this website students will learn:

1. how far down into the ground we have to mine for these resources,
2. if the mineral/rock is a renewable or nonrenewable source,
3. how the resource is made,
4. how it is transported,
5. what we use it for,
6. the effects on the environment

Bring students back together and talk about what students found. Make a chart and talk about the pros and cons of mining for each resource, with a focus on the environment.



CHALLENGE 2 COOKIE MINING

20 minutes

We are going to become miners for the rest of this class period. We are going to do a cookie mining activity. The cookie is Mother Earth and the chocolate chips are the coal that we are mining for.

Each student is going to have a grid paper and a cookie. The student will put their cookie on their grid paper, students will then trace the cookie to create a circle, and this circle will then become their mining site. Students must mine the “coal” (chocolate chips) out of Mother Earth without breaking big pieces off of her and they must keep everything inside their “mining site.”

Students are to only use the tools provided to mine the coal and they must keep their coal in a pile. Students will do this for both cookies. When students are done mining the coal, they are to examine their mining site. If there are cookie pieces or crumbs outside of the mining site, they must leave the pieces or crumbs where they are.

The pieces and crumbs that are inside the mining site are to be reclaimed by putting all the pieces of the cookie, Mother Earth, back together without the coal.

RULES

Students must not use their hands to touch the cookies. Students can only use the mining tools provided. Students are not to share their mining tools, if something breaks they must come to the teacher and ask for a new one and throw the broken tool out. **STUDENTS MUST NOT EAT ANY PART OF THEIR MINING PROJECT.** They can eat the cookies after.





COMING TOGETHER

20 minutes

When everyone is done, have the students come together and share their experiences with being a miner.

Which cookie was harder? Was there a certain utensil that worked better than the others? Were you able to mine all the coal? Was the reclamation of the mine site hard? Did the site look the same as when you started? Is there anything else that you noticed while being a miner? (Did some pieces of coal come out easier than others, did some tools make the coal split in half etc.) We talked about reclamation in earlier lessons, was this something that was taken into consideration before the mining started? Reclamation is very important when it comes to mining and this is something that geological engineers think about before the mining has even started.

Why do we have to reclaim the mine site?

Read pages 17-18 of “I’m a Geological Engineer” to help answer this question.
if there are students who have pieces or crumbs outside their mining site

Why do you think that you had to leave the pieces and crumbs there?

It was outside your mining site, you as a miner disturbed other land that was not supposed to be touched. If you were a real miner for a company then you would have to pay a fee for working outside your mining site.

STUDENTS CAN NOW EAT THEIR COOKIE

TO THINK ON

What effects would mining have on ecosystems around us?

What would happen if we stopped mining all together?

Will Mother Earth return back to its original state?

Since we looked at the pros and cons-how do you feel about mining?

EXTENSION

Talk about the different effects that mining has on miners, (health).

