

## Grade 9 Resource (SNC1W) – Biology & Physics (Climate Change & Resource Extraction)

### Overview

This lesson can be completed over ***several days***.

**Minds-on:** (See slides 2 - 5 on [slide deck](#)). Students will reflect on everyday items they use or depend on and consider what resources they are made of (e.g., metals in cellphone). Students will review renewable and nonrenewable resources.

**Action:** There are 3 components:

1. **Lesson:** Teacher-directed lesson with [slide deck](#) and accompanying [Student Handout](#) (fill-in-the blanks). General content that is discussed includes:

- What are fossil fuels?
- Burning and extraction of fossil fuels
- Colonialism connection to climate change and resource extraction.
- What is mining? Minerals and Processing Ores
- Impacts of mining and resource extraction (environmental, economical, social, on Indigenous communities)

2. **Small Group Inquiry and Discussions:** As students fill out their handout, there will be embedded opportunities for students to pause from the teacher lesson and deepen their learning through watching videos, reflecting and exploring further the impacts on Indigenous communities.

3. **Cookie Mining Activity:** In the *middle* of the lesson/PowerPoint is a prompt for a [hands-on activity](#) that encourages students to explore the impacts of resource extraction by ‘mining’ for resources (chocolate chips) in a cookie. Teachers can use the accompanying [Cookie Mining PowerPoint](#) for support.

Sample solutions to the student handout are also provided [here](#).

**Consolidate:** Students will reflect in small groups with guiding questions on the last slide of the [slide deck](#).

### Learning Goals

*We are learning to ....*

- Explain the effects of various human activities on the dynamic equilibrium of ecosystems
- Assess the impacts of climate change on the sustainability of Canadian ecosystems.
- Assess the impacts of climate change on Canadian communities, including First Nations, Métis and Inuit communities.
- Assess social, environmental and economic impacts of fossil fuels.
- Assess possible solutions to address some of these impacts.

### Success Criteria

*I can ...*

- *Distinguish between a renewable and nonrenewable resource and give examples of each.*
- *Explain what a fossil fuel is and list 2 - 3 examples.*
- *Describe how we use fossil fuels and can name two ways they can be removed from the Earth.*
- *Explain how fossil fuels contribute to global warming and climate change.*
- *Define what mining is and describe the process.*
- *Explain the resources used in mining (e.g., tools, workers, fossil fuels, water).*
- *Explain how the extraction and mining of resources (e.g., fossil fuels, minerals, ores) can impact the environment, economy and society.*
- *Consider the costs, risks and environmental impacts of mining (e.g., cookie mining activity)*
- *Describe impacts on Canadian communities, including First Nations, Métis, and Inuit communities.*
- *Describe strategies that can minimize the damage and destruction caused by resource extraction (e.g., remediation from mining nickel in Sudbury).*

| Curriculum Expectation(s)  |  |
|--|--|
| <p><b>Overall Expectations</b><br/><b>Biology</b><br/><b>B1. Relating Science to Our Changing World</b> Assess impacts of climate change on ecosystem sustainability and on various communities and describe ways to mitigate these impacts.</p> <p><b>Physics</b><br/><b>D1. Relating Sciences to Our Changing World</b> Assess social, environmental, and economic impacts of electrical energy production and consumption, and describe ways to achieve sustainable practices</p>   | <p><b>Specific Expectations</b><br/><b>Biology</b><br/>B1.1 assess impacts of climate change on the sustainability of local and global ecosystems, describe local or global initiatives for combating climate change, and identify solutions to address some of the impacts.</p> <p>B1.2 assess impacts of climate change on communities in Canada, including First Nations, Métis, and Inuit communities</p> <p>B2.5 explain the effects of various human activities on the dynamic equilibrium of ecosystems</p> <p><b>Physics</b><br/>D1.1 assess social, environmental, and economic benefits and challenges resulting from the production of electrical energy from various sources (<i>in this lesson</i> → <i>non-renewable fossil fuels</i>)</p> <p>D1.4 analyse social, environmental, and economic impacts of emerging technologies related to electrical energy production, consumption, storage, and conservation (<i>in this lesson</i> → <i>mining for rare metals (e.g., lithium is mined</i> → <i>energy stored in batteries for electric vehicles</i>).</p> |
| Student Prior Learning   |  |
| <p>Students may have already learned about or be familiar with:</p> <ul style="list-style-type: none"> <li>• Greenhouse gases and their connection to global warming.</li> <li>• What is climate change?</li> <li>• Renewable and non-renewable resources (e.g., from Physics Unit)</li> </ul>   |  |
| Lesson Descriptor  |  |
| <p>This lesson can be completed over <b><u>several days</u></b>.</p> <p><b>Minds-on:</b> (See slides 2 - 5 on <a href="#">slide deck</a>).</p> <ul style="list-style-type: none"> <li>• Students will reflect on everyday items they use or depend on and consider what resources they are made of (e.g., metals in cellphone). Students prompted to connect their items to human activities (e.g., deforestation and logging, fossil fuel extractions, mining)</li> <li>• Students will review <b>renewable</b> and <b>nonrenewable resources</b>.</li> <li>• Jamboard interactives are provided as options.</li> </ul> <p><b>Action:</b> There are 3 components:</p> <p>1. <b>Lesson:</b> Teacher-directed lesson with <a href="#">slide deck</a> and accompanying <a href="#">Student Handout</a> (fill-in-the blanks). Content that is discussed includes:</p> <ul style="list-style-type: none"> <li>• What are fossil fuels?</li> <li>• Burning and extraction of fossil fuels</li> <li>• Colonialism and how it connects to climate change and resource extraction.</li> <li>• What is mining? Minerals and Processing Ores</li> <li>• Impacts of Mining and resource extraction (environmental, economical, social, on Indigenous communities)</li> </ul> <p>2. <b>Small Group Inquiry and Discussions:</b> As students fill out their handout, there will be embedded</p> |  |

opportunities for students to pause from the teacher lesson and deepen their learning through watching videos, reflecting and exploring further the impacts on Indigenous communities.

\*These inquiry prompts could serve as lesson extensions or research opportunities for students.

### 3. Cookie Mining Activity *(likely 1 full period, depending on student needs):*

In the *middle* of the lesson/PowerPoint is a prompt for a [hands-on activity](#) that encourages students to explore the **impacts of resource extraction** by 'mining' for resources (chocolate chips) in a cookie.

Teachers can use the accompanying [Cookie Mining PowerPoint](#) to support the teacher with facilitating the activity and explaining the procedure with the class.

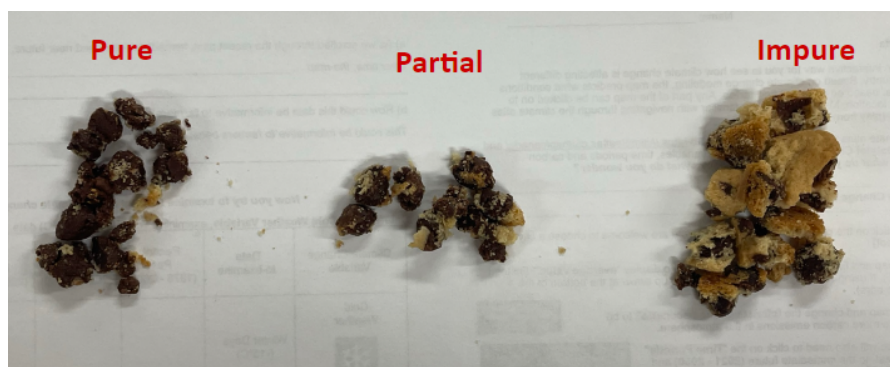
Sample solutions to the student handout are also provided [here](#).

- ❖ *Please ensure nut-free cookies are used for this activity and check for other sensitivities within your class (e.g., gluten).*
- ❖ *Cookies are for the activity. Please remind students not to eat them.*
- ❖ *Remind students to use caution while working with mining tools. Paper clips and toothpicks may be sharp.*
- ❖ *Crumbs may fly up towards the eyes when mining (goggles)*

Materials: chocolate chip cookies, mining tools (toothpick, paperclip), timer, land grid, goggles, calculator

In summary:

- Students explore the process and impacts of mining through a hands-on simulation. As a mining engineer, they will be extracting and mining for ores (chocolate chips) from the land (cookie).
- Students place their cookie on a [land grid](#) and trace the outline with a pen or marker. This represents their target mining area. Students choose a tool of their choice to mine with.
- Teacher will put a 10 minute timer as students mine for chocolate chip cookies. Students should not be lifting up the cookie or crumbs with their hands. As students mine, they set their extracted ores to the side.
- After a 10 minute timeframe, students have the choice to have two more chances to mine (at 1 minute timeframe). However, it will be an additional cost over time.
- After all students are done mining, students can begin to record their observations (e.g., qualitative, quantitative). Students will also organize their ores into three piles, based on quality (pure, partial or impure). Pure chocolate chips hold the most value, since the ore (chocolate chip) is most isolated from the Earth (cookie).



- Students will then begin to work through calculations to determine if they made an economic profit or experienced an economic loss.
- Students will then attempt to return all the cookie crumbs back into the traced outline on their land grid (this will represent land reclamation). For any crumbs (even tiny ones!) that fall outside of that traced outline has a penalty and fee. Students note the land that was unreclaimed and consider impacts.
- Students reflect on the mining process, economic profit/loss and its relationship to land degradation through analysis questions.

**Tip:** Teacher can put students in pairs or small groups if not enough cookies for the class (e.g., one student can mine for 5 minutes)

**Tip:** Teacher can adjust mining timeframe, depending on student needs.

**Tip:** Teacher could laminate land grid sheets or put in sheet protectors.

**Cookie Tip:** Cookies that have larger chocolate chips or pieces are easier for students to handle.

**Cookie Tip:** Cookies that are harder in texture will mimic the mining process more closely.

### Consolidate

Students will reflect in small groups with guiding questions on the last slide of the [slide deck](#).

## Lesson Extensions

### Cookie Mining Activity:

#### Activity modification:

- Cookies that contain **different types** of chips (e.g., dark chocolate, white chocolate) can also create a further layer of *complexity* to the activity.

For example, using cookies with coloured chocolate chip: yellow could represent gold (most valuable), red - iron, blue - cobalt and green - copper). Each 'colour' could also hold a different economic value/price.

- Students may retry various trials of mining by trying different types of cookies/ores or mining with different tools, strategies or length of time.



To deepen the inquiry process and explore further resource extraction, students may:

- research further Canadian communities directly impacted by mining (see slide 22 of [slide deck](#)).
- reflect on hazards of mining and safety of mining workers; examining workers rights and conditions.

## Cross-strand Connections

**Biology:** Cooking Mining Activity can be connected to the topics of soil and soil erosion. Students might make the connection that not all the cookie crumbs can fit back into the original traced space because the Earth has been disturbed and is full of air pockets. This is similar to soil that has been tilled too much in agriculture. When soil loses its compaction, it can be more vulnerable to eroding.

### Chemistry:

- Elements from the periodic table are extracted from the Earth (e.g., tin, aluminum, iron, copper, gold, silver, nickel).

- Properties of metals (e.g., lustrous, conductors, ductile) and nonmetals (e.g., carbon, silicon)

**Earth & Space:** Space exploration may also include ambitions for resource and mineral extraction (e.g., mining on the Moon, Mars or asteroids).

## Resources

### References and videos in PowerPoint

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