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# Ores to Minerals

## Lesson 5
Cookie Mining

LESSON PLAN

Standards Alignment, Learning Objectives, Materials List,
Step-by-Step Instructions, Teacher Key, Vocabulary Bank, Differentiation Suggestions

## Standards

AP® Environmental Science Standard: 5.9 Impacts of Mining - LEARNING OBJECTIVE-EIN-2.K: Describe natural resource extraction through mining.

Next Generation Science Standard: HS-ESS3-1 - Construct an explanation based on evidence for how the availability of natural resources [and/or the] occurrence of natural hazards...have influenced human activity.

Next Generation Science Standard: HS-ESS3-2 - Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.

Next Generation Science Standard: HS-ESS3-3 - Create a computational simulation to illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity.

**CAUTION!** *Some students may have allergies to the cookie ingredients. Check for allergens before proceeding.*

## Learning Objective

**Explore the mining process using a chocolate chip cookie as a model.**

## Materials

1. Student Worksheet
2. Student Slides
3. Student Lab Guide
4. Exit Ticket
5. Ruler with centimeters
6. Chocolate chip cookie, soft and large
7. Extraction tools (scoopula, scientific spatula, toothpick, straw, plastic knife, chopstick, safety pin, nail, paper clip, etc.)
8. Timer

## Step-by-Step Instructions

1. Display the Student Slides and review them with students.
2. Supply students with materials for cookie mining.
3. Instruct students to follow the Lab Guide and complete the Student Worksheet.

# Teacher Key to Student Worksheet

### Analysis

1. When mining, what are some costs to consider? Possible answers include: Costs of tools, equipment, labor, transport, electricity; cost of reclamation; fines, if any.
2. What kind of resource are minerals obtained from ore? Mineral ore is a nonrenewable resource.
3. What could you do to make the costs less in order to generate a higher net profit? Possible answers: Work quickly to reduce labor costs. Take care to cause little environmental damage.
4. Were chocolate chips evenly distributed throughout the cookie? How does that model real-life minerals? Possible answer: No. Minerals are unevenly distributed because of geographical factors like volcanic activity, plate tectonics, weathering, and erosion.
5. Did knowing that the land must be restored affect the time? Possible answer: Yes. Knowing increased the mining time because extra caution was required to minimize destruction.
6. Were your costs more or less than the sale profit? Possible answer: Less. I was able to make a small net profit.
7. What is your advice to other cookie miners to increase profitability? Possible answers: Choose the right tool, be quick, try a different type of cookie, be sure the chocolate chips are whole, and sprinkle water on the cookie.
8. What additional costs may miners encounter in real-world mining? Possible answers: The cost of clean-up for water/air pollution, the cost of extra time required based on the hardness of the rock being dug, possible fines, the cost of transportation of ore and minerals, fees to sale intermediaries, and utility bills.

# Teacher Key to Exit Ticket

1. How are minerals obtained from the Earth's crust? The location of the mineral is pinpointed, the raw ore is extracted in mining operations, and then the raw ore is processed and refined to obtain the minerals contained within. The minerals are sold or traded in worldwide markets.
2. What is ore, and what processes refine minerals from raw ore? Ore is the rock that contains desired minerals or resources. To refine the desired mineral or resource, the ore is typically crushed and ground. Other processes may include washing with water, applying electricity, or heating.
3. What factors influence mining and refining operations? Many factors, including costs of land, tools, labor, and restoration, the need to preserve the environment as much as possible, and obeying laws.
4. How are minerals distributed in the Earth's crust? Minerals in the Earth's crust are unevenly distributed due to geological forces like volcanic activity, weathering, erosions, and plate tectonics.
5. What is restoration? Is it effective, and why is it important? Restoration is the renewal of land that has been mined so that it can once again be a useful part of the ecosystem. Restoration is important because mining operations can damage the quality of air and water, and it can also eliminate habitats for species important to the ecosystem.
6. Are minerals a renewable resource? Minerals are not a renewable resource. They are nonrenewable because they cannot be re-grown or replaced once extracted.

## Vocabulary Bank

- **Dredging** - A method of underwater excavation used in mining
- **Electrolysis** - The process of using electricity to purify minerals by separating the desired metal from impurities
- **Erosion** - When natural forces, such as wind or water, move material on the surface of the land
- **Extract** - To obtain minerals from the Earth's crust
- **Mountain-top removal** - A surface mining technique involving deforesting, exploding, and clearing away the top layer of a mountain to obtain minerals
- **Nonrenewable** - A resource that cannot be easily replenished
- **Open-pit mining** - A surface mining technique of digging a pit to extract rock or minerals close to the surface
- **Refinement** - The process of separating and purifying raw minerals to produce pure metals and minerals
- **Renewable** - A resource that can be easily replenished
- **Smelting** - A heating and melting process to help refine metals
- **Strip mining** - The removal of strips of soil and rock to expose the mineral deposits which are extracted
- **Surface mining** - Any mining process in which minerals are obtained from above ground
- **Tectonic plates** - The large rock slabs that make up the Earth's crust and move independently on the magma of Earth's mantle
- **Underground mining** - A mining technique that involves digging shafts into the ground
- **Weathering** - When rock is worn down by long exposure to the elements

## Differentiation Suggestions

- Scaffold Support: Provide or allow aids, like additional text or images, as reference resources.
- Reduce Cognitive Load: Limit the text you include in each slide.
- Role Assignments: Assign roles to each member of a group. For example, measuring, timing, recording data, and performing calculations are all responsibilities that a student may take.
- Group Composition: Form heterogeneous groups to ensure a mix of abilities and skills, fostering peer support and collaboration.
- Ongoing Check-Ins: Regularly check in with groups to provide feedback and support, ensuring all students participate and understand the task.
- Use extra visual materials showing additional examples.
- Use translation technology or a bilingual dictionary.
- Read the text aloud.
- Model the cookie mining activity, showing how to use the extraction tools on a cookie and how to measure the areas and keep track of time.