

Cookie Mining

Students will learn how and where minerals are mined in Nevada, and examine the costs and benefits associated with mining renewable and nonrenewable resources.

Grade Level: 6th-8th

Objectives:

- Students will be able to list common minerals used in their every day lives.
- Students will be able to identify Nevada as the lead gold producer in the United States as well as be able to identify where minerals are mined in Nevada.
- Students will be able to define and give examples of non-renewable resources.

Materials:

- 3 different types of cookies
- Graph paper
- Toothpicks
- Paper clips
- Popsicle sticks with tasks written on them (See p. 3)
- Map of United States Mining

Appendixes:

- Teacher's guide for Activity 1: Page 5
- Mining worksheet: Page 6
- Map of Nevada: Page 7
- Mineral cards: Pages 8-15

Time Considerations:

Preparations: 5 minutes

Lesson Time: 50 - 60 minutes

Introduction: 10 minutes

Activity 1: 10-15 minutes

Activity 2: 20-25 minutes

Conclusion: 10 minutes

Related Activities:

Geothermal Energy



Nevada Department of Education Standards

Earth's Composition and Structure

E.8.C.6 Students know minerals have different properties and different distributions according to how they form.

E.8.C.7. Students know the characteristics, abundances, and location of renewable and nonrenewable resources found in Nevada.

Excellence in Environmental Education Guidelines

Strand 1—Questioning, Analysis, and Interpretation Skills

F) Learners understand that relationships, patterns, and processes can be represented by models.

Strand 2.1—The Earth as a Physical System

A) Learners are able to identify basic characteristics of and changes in matter.

This lesson has been adapted from Sierra Nevada Journey's "Cookie Mining" lesson:

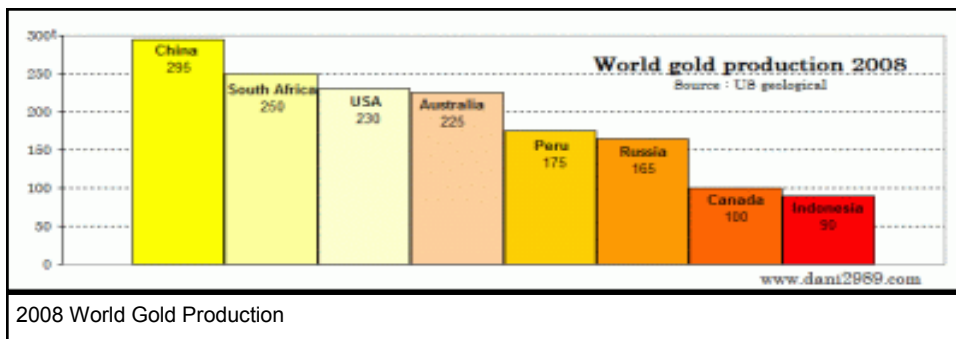
Sierra Nevada Journeys. Retrieved Nov. 19, 2010, from <http://www.sierranevadajourneys.org/wp-content/uploads/Gold-Cookie-Mining.pdf>

Background

As consumers, we use large amounts of minerals to carry out essential parts of our daily lives. For example, we use chromium in appliances, galena in computers, feldspar in phones, and tungsten in light bulbs. These minerals are made available for production by mining, a process that extracts minerals and ore from the Earth. We also use minerals to keep our bodies functioning properly. The milk we drink contains strong teeth and bones. The orange juice and bananas we eat contain Potassium which

maintains fluid and mineral balance as well as helps our heart function normally.

Because mining allows for the production of most of the products we use every day, it is important to consider whether or not these resources will be around for generations to come. Some of the resources that are mined are renewable, which means they are available (and in most circumstances the Earth continuously produces the resource). However, some of the resources we mine are nonrenewable, which means there is a finite amount



country besides gold? (YES)
Can they name any other minerals?

Show students a map of the United States that illustrates which minerals are mined where. Give each student a map of Nevada so that they can identify which minerals are mined in Nevada and where. Do they notice any trends?

Ask students if they think gold grows? Explain to students that there are two different types of resources: renewable and nonrenewable. Gold is nonrenewable since it takes longer for the Earth to create it than we consume it. However, timber is renewable when harvested sustainably because the Earth can produce it nearly as quickly as we consume it.

Activity 1: Minerals, Minerals, Everywhere

Explain to students that we will be playing a matching game to see just how important minerals are to our every day lives.

Instruct students that they will be using index cards to match a mineral to a specific object or description (ex: one card could be “calcium,” it’s match would be “helps maintain strong bones and teeth” or one card could be “clay” and it’s match would be “bricks”)

available. One example of a non-renewable resource heavily mined in Nevada is gold. Nevada is the third largest gold producer in the world (China first, south Africa second) and accounts for three quarters of U.S. production.

In past decades, mining has left unappealing scars on the Earth’s surface. Flora and fauna that once thrived in mined areas could no longer survive. However, today there are reclamation efforts that can make it hard to tell where mining has taken place in years past. These reclamation projects include replacing native plants and, if needed, reintroducing wildlife to the once mined habitat. In Nevada, awards are given to the mines that produce the best reclamation (the mine that protects, restores, and improves the land the best).

Preparation

Gather all appropriate materials. Make sure there are enough cookies for each group of students, enough pieces of graph paper as well as toothpicks and paper clips. Make sure there are enough pairs of mineral cards for each student to have one.

Doing the Activity

Introduction :
Ask students how many of them have family members or friends that work at a mine? Do they know what they do there? Have students give examples of jobs their families do while working in the mine.

Ask students how many of them know what mining is?

- Mining is the process of extracting minerals or ore from the ground

What is the most popular mineral mined in Nevada? (GOLD!) Tell students that Nevada is the leading producer of gold in the United States!

Ask students if they think other minerals are mined in the



Gold Mining site

Note to Instructors: The mineral cards will have "mineral" printed below it for students to easily identify which is the mineral and which is the description.

Hand cards out to students and allow them to move around freely until everyone has found their match.

Have students share their matches with the class.

Ask students if they think these minerals we use every day are important to us? YES! Where do minerals come from? *The Earth*. How do we get them from the Earth? *Mining*.



Activity 2: Cookie Mining

Tell students that today we will be using chocolate chip cookies to demonstrate the processes of mining such as costs and benefits associated with mining, mining jobs, and the importance of reclamation efforts.

Explain to students they will be

working in groups to determine the most profitable way to mine the chocolate chips out of their cookie.

Put students in groups of four and explain that each person in the group will perform a certain task: one person will be the accountant (to decide how much money to spend and how much is kept at the end), one person will be the geologist (to decide where the most chocolate chips can be found), one person will be the engineer (to determine the most effective way of extraction and how to remove chocolate chips), and the environmental scientist (to reclaim the mine sight, or put the cookie back together).

Explain the steps of cookie mining to students before choosing tasks and handing out materials. Remind students that cookies are part of a scientific experiment and must not be eaten.

Have each group come up to the front of the class one at a time. One person will choose a popsicle stick out of a can that has a task written on it (Accountant, Geologist, Engineer, Reclamation). This will be their task for the entire activity. Each person in the group will choose their own popsicle stick.

Once all groups have received

their tasks, pass out graph paper, and the cookie mining worksheet.

Tell students the pricing of different materials: cookies represent land— a crunchy cookie is \$3 and is Nevada, slightly chewier is \$5 and is Alaska, chewiest is \$7 and is California. Paperclips are \$4 and Toothpicks are \$6.

Ask students why they think land is priced differently?

For this model, cookies are priced differently to reflect the varying cost of land. For example: land in Nevada costs less than land in California because the quality of the land for mining is deemed to be less— it has less moisture and takes more effort to drill into because of the large amount of hard rock. Alaska is priced somewhere in the middle because the quality of land is somewhere between that of California and Nevada.

Explain to students that they will be using the tools they purchase to remove chocolate chips from the cookie while causing the least amount of damage to the remainder of the cookie.

Remind students that they are not allowed to use their hands or fingers, but only the tools they purchased.

In addition to the cost of materials, explain to students that each minute of mining costs \$1. They will have a maximum of 5 minutes.

Give students time to discuss which cookie and tools they wish to use.

Once groups have decided on their means of production, have students purchase their materials from the instructor.

Before students start mining, have accountants record their costs on their worksheet and geologists trace the cookie on the graph paper. (Mining is to take place on the graph paper.)

Inform students that tracing the cookie helps determine reclamation costs. If part of the cookie is missing, then reclamation costs will be more.

Now it's time for mining to begin! Start the timer and watch for when 5 minutes is up. When the 5 minutes is up, call "Time!" and have students push their cookie back into the traced circle on the graph paper that they made before they began.

Instruct accountants to record the amount of time they used on their worksheet.

Walk around the classroom to determine reclamation costs (how much of the cookie is

cracked/broken/missing) and the profit (how many chocolate chips were mined) and instruct students to record this on their worksheet as you give them the final numbers.

Conclusion

Have students calculate their costs and profits on their worksheet to determine an overall outcome.

Discuss as a class who made a profit and who lost money. Why do you think some mining group's efforts were more profitable than others?

Was it hard to get the chocolate chips out without ruining the cookie completely? Do you think this is a realistic comparison to the landscape? Why or why not?

Have students answer the final question on their work sheet; discuss student's thoughts and insights as a class.

Ask students what about this activity made them think about the mining process differently? Do they think the cookie mining model was a realistic comparison to mining in Nevada? Why or why not?

Assessment

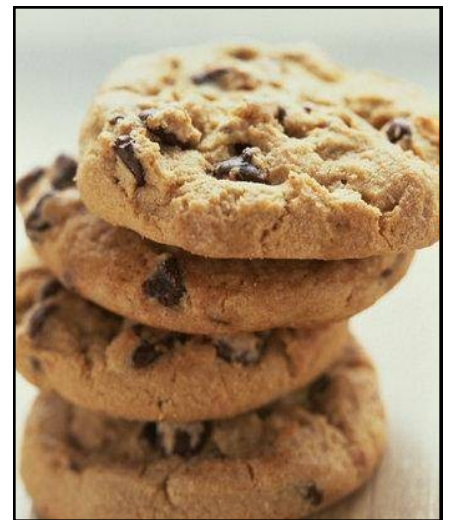
Assess students ability to wager costs before making decisions.

Assess students on responses

to concluding questions and completion of the cookie mining worksheet.

Extensions

Have students do the cookie mining activity a second time, making any changes they had written down on their worksheet. Where they more profitable during the second round of mining than the first?



Cookies

Teacher's Guide to Activity 1 : Minerals, Minerals, Everywhere

- *Calcium*: Builds strong bones and teeth.
- *Chromium*: Helps keep blood sugar level steady.
- *Coal*: Heating.
- *Copper*: Electrical wiring, plumbing fixtures; helps red blood cells utilize iron.
- *Gold*: Jewelry, dental work.
- *Iron*: Essential for manufacture of red blood cells; steel, screws, rain gutters.
- *Lead*: Batteries, X-Ray shields, ammunition.
- *Magnesium*: Maintains nervous system; release stored energy.
- *Phosphate*: Fertilizer.
- *Potassium*: Maintain fluid and mineral balance, helps nerves and muscles.
- *Salt*: Table salt, de-icer.
- *Sand, Gravel, Clay*: Bricks, roads, building materials
- *Selenium*: Helps proteins in hair and nails.
- *Silver*: Jewelry, photography.
- *Sodium*: Helps regulate flow of water in and out of blood and tissue cells.
- *Zinc*: Helps body repair wounds; Brass fixtures, nails, rain gutters.

Vocabulary

Engineer: someone who is trained to design and build machines, vehicles, bridges, roads, or other structures.

Mining Environmental Scientist: a scientist in charge of reclamation when a mine is done with production

Extract: to get, pull, or draw out, usually with special effort, skill, or force

Geologist: a person who studies the earth's layers of soil and rock.

Mineral: a substance found in nature that is not an animal or a plant.

Mining: the process of extracting minerals or ore from the ground

Nonrenewable Resource: a natural resource which cannot be produced, grown, generated, or used on a scale which can sustain its consumption rate.

Reclamation: to return the land as close to its natural state as possible once mined from.

Renewable Resource: any natural resource that can replenish itself naturally over time.

Sources

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Name: _____

Land: Nevada (crunchy)- \$3, Alaska (semi chewy)- \$5, California (chewy)- \$7
Equipment: Paper Clip- \$4, Toothpick- \$6

Income	Costs
Start-up Money:	Land Cost:
Gold Profits:	Equipment Cost:
	Excavation Cost:
	Reclamation Cost:
<i>TOTAL Income:</i>	<i>TOTAL Costs:</i>

TOTAL Income \$ _____

TOTAL Costs -\$ _____

Did you earn a PROFIT or LOSS? =\$ _____

(More than \$19 is a profit; Less than \$19 is a loss)

After one round of being a miner, what would you do differently and why would you make that change?

Gold

(Mineral)

Jewelry, Dental Work

Copper

(Mineral)

Electrical Wiring,
Plumbing Fixtures

Helps red blood cells
utilize iron

Coal
(Mineral)

Salt
(Mineral)

Heating

Table Salt, De-Icer

**Sand, Gravel,
Clay**
(Minerals)

Phosphate
(Mineral)

**Bricks, Roads,
Building Materials**

Fertilizer

Silver
(Mineral)

Jewelry, Photography

Lead
(Mineral)

**Batteries, X-Ray
Shields, Ammunition**

Iron

(Mineral)

Essential for the
manufacturing of red
blood cells

Steel, Screws, Rain
Gutters

Calcium

(Mineral)

Builds strong bones
and teeth

Sodium

(Mineral)

Helps regulate flow of
water in and out of
blood and tissue cells

Potassium

(Mineral)

Maintain fluid and
mineral balance, helps
nerves and muscles

Magnesium

(Mineral)

Maintains nervous system, Release stored energy

Chromium

(Mineral)

Helps keep blood sugar level steady

Zinc

(Mineral)

Helps body repair
wounds

Brass Fixtures, Nails,
Rain Gutters

Selenium

(Mineral)

Helps proteins in hair
and nails