

MINING FOR CHOCOLATE

METHOD

After matching everyday products to their rock or mineral sources, students “mine” chocolate chip cookies to discover the impacts of many mining operations.

MATERIALS

Part 1:

- Student Worksheet

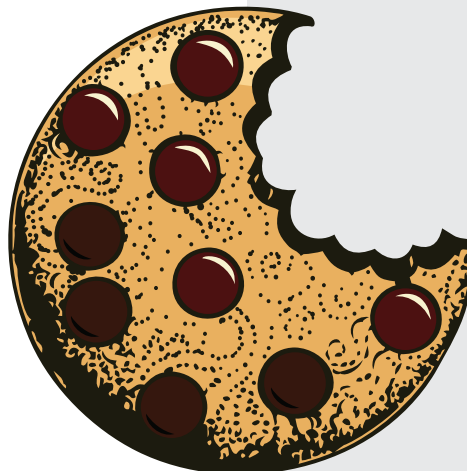
Part 2:

- Hard chocolate chip cookies (1 per student)
- Toothpicks
- Napkins
- Mining Area Grid (provided)

INTRODUCTION

Many of the products we use everyday – from plastic water bottles to wrist watches and crayons to headphone wires – are produced from rocks and minerals mined from the earth. These rocks and minerals are considered a **non-renewable resource** because there is only a set amount of each and once it is used up, it will be gone forever. Some of these resources are very common and others are scarce. As the human population has grown, the demand for these resources has grown as well.

Extracting rocks and minerals from the earth is typically done by mining. Large scale mining operations are used all over the world and can often damage the land on which they take place. Unfortunately, the end result of mining (the profits made by selling the ore) can at times overshadow the damage done by the process (destroyed animal habitat, clear cutting of trees, pollution of local streams, etc.).



CONCEPT

Nonrenewable resources are mined from the earth to meet the wants and needs of humans and there are often environmental costs to the mined land as a result.

GRADE LEVEL

Upper elementary

SUBJECTS

Science, Social Studies, Math

OBJECTIVES

Students will be able to:

- Use observation to make an estimation.
- Identify the difficulties of mining ore from the earth.
- Describe how mining operations can affect the land.
- Examine the opportunity costs associated with full-scale mining operations and name two examples.
- Match everyday items with the ore from which they are made.

SKILLS

Estimating, drawing connections, fine motor skills, brainstorming

PART 1: MINERAL MATCHING

PROCEDURE

1. To get your class thinking about how we depend on mined rocks and minerals, distribute copies of the Student Worksheet and have them fill it out. The worksheet asks students to match up some common household items with the rocks/minerals from which they were made. After students have completed the worksheet, go over it as a group.
2. Ask students to name some items which they enjoy using. This might include television, computer games, MP3 players, certain toys, and appliances. After listing their suggestions on the board, have the students brainstorm as a class what elements from the ground, perhaps some that were on the worksheet, may have been used to produce each item. For instance, electronic equipment may have a plastic shell (a petroleum product), copper wiring, etc. Some of them may be obvious, others they may have to look up. You could extend this as a library activity for finding out some of the answers.

STUDENT WORKSHEET ANSWERS

1.E; 2.L; 3.M; 4.P; 5.D; 6.N; 7.A; 8.B; 9.O; 10.K; 11.C; 12.H; 13.F; 14.Q; 15.J; 16.G; 17.I

PART 2: HANDS-ON MINING

PROCEDURE

1. Distribute the cookies to the students (but they must not eat them!). Explain that the cookies represent the land and the chocolate chips represent an ore, like coal, which they will be mining from the cookie. With the cookie flat on the desk, and without picking it up, ask students to estimate the number of chips in their cookie.
2. Distribute a copy of the Mining Area Grid to the students. Explain that the images on the grid represent various attributes of the environment where they'll be mining. Students should place their cookie on the grid and, using a pencil, trace the outline of the cookie.
3. With their toothpicks, students will attempt to extract the chips from the cookie. Cookies should stay flat on the paper (in the real world, you can't pick up the earth and dig from the bottom!). After a few minutes of mining, ask students if they wish to change their estimate of how many chips are in their cookies.
4. After students have finished mining their cookies, have everyone outline the area on their grid paper that is covered by cookie crumbs. A rough estimate is fine; this doesn't need to be exact.
5. Have the students share their experiences. What was their goal at the beginning of the activity – to extract many chips or keep the cookie intact? What was their mining strategy? Did they experience any difficulties? Do they think mining companies might have the same kinds of difficulties?

6. Ask the students to count the number of chips they extracted. (Broken chips can be combined and counted as one chip.) Have the class look at the cookies of the students that extracted the most chips and the least chips. Do the cookies look different? Do they see a connection between the amount of chips extracted and the state of the cookie?
7. Now have the students “reclaim” the land. Using just the toothpick (no hands!) instruct them to try and get the cookie crumbs and pieces back inside the original circle. Is it difficult? Do they think reclaiming actual mined land would be difficult?
8. Ask the students to count how many squares on their grid paper have any bit of cookie in them. What attributes are located in those squares?

DISCUSSION QUESTIONS

1. Which students did the most damage to the earth? (*The students who covered the most squares on the grid paper.*) Which students make the most money from their mining operations? (*The students who extracted the most chips.*)
2. **Opportunity cost** is the value of the next best choice that one gives up when making a decision. For example: If you choose to go see a movie, you cannot spend that time reading a book and you cannot spend the ticket money on something else. The opportunity cost of attending the movie is the pleasure you’d have reading and the price of the ticket. The opportunity cost of using a resource, is the value of an alternative use of that resource.

In regards to the cookie, what is the opportunity cost of “mining” your cookie and turning it into crumbs?

Getting to enjoy the cookie as a snack.

3. We put a monetary value on the rocks and minerals mined from the earth. Do we put a price on the natural attributes included on the grid and the services they provide – trees that provide oxygen, vistas that provide beautiful natural views, etc? Why not? Would it be possible?

Answers will vary.

4. What do you think it means when an attribute square on your grid has cookie on it?

That the specific natural attribute has been damaged or lost.

Thinking specifically about the water, does covering just one or two “water squares” with cookie impact just those two squares or does it impact additional squares?

It impacts all of the water squares downstream. The water is moving down the stream so pollution at any point will have an impact on the entire resource.

5. What about the squares that have been “reclaimed” – those located between the original circle and the

new outline. Just because they're no longer covered by cookie, do you think that area is completely back to normal?

No. Even the reclaimed land will be different than it was originally.

When you first put your cookie down on the grid, did you consider what natural attributes you'd be covering? What was your reasoning for the cookie's placement?

Answers will vary. Some students may have tried to cover the least total natural attributes; others may have tried to cover a small amount of many types of natural attributes or mostly only one type. Alternatively, some students may not have thought about what was being covered.

6. Have students brainstorm ways to reclaim their cookies (put them back together). They might think to use frosting to stick the pieces together, or get the crumbs wet and mush them back together. But will the cookie ever be the same as it was?

MEASURING LEARNING

Review the Student Worksheet and have students write a journal entry about their experiences mining the cookies. Have them answer the following questions:

- What was my original goal when I started mining the cookie? What difficulties did I have while mining my cookie?
- If I were to mine another cookie, would I have the same goal? If not, what would my new goal be and why?
- How is your experience similar or different than the goals and difficulties of real mining operations?
- Give an example of a time when you had to make a choice. What did you choose to do and what was the opportunity cost of that choice?

FOLLOW-UP ACTIVITY

Because minerals are nonrenewable resources, they need to be conserved and recycled so that we don't run out of minerals that are in short supply. Select several of the minerals listed on the Student Worksheet and ask students to offer suggestions on how these elements might be conserved. For instance, tin and aluminum cans are often recycled as part of curbside recycling programs. Tin cans can be washed and reused as containers for pennies or paper clips. Gold can be melted down and redesigned for other uses. Aluminum cans can be remade, saving 95 percent of the energy used to make new cans from newly mined aluminum.

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MINING FOR CHOCOLATE

STUDENT WORKSHEET

Name: _____







































































































Date: _____

Everything listed below is produced using minerals mined from the ground. In the blank to the left of the items listed, write the letter of the element from which these items were made. The elements are listed at the bottom of the page.

1. _____ Soup cans
2. _____ Matches, gunpowder, rubber
3. _____ Watches, radios, televisions, radar instruments
4. _____ Pencil
5. _____ Bricks, pottery, tennis courts
6. _____ Pennies, stereo wire, brass instruments
7. _____ Wedding band, first-place medal, nuggets
8. _____ Soda pop cans, foil wrap, baseball bats, house siding
9. _____ Horseshoe, hammer, steel products (cars, nails, swords)
10. _____ Food seasoning and preserver
11. _____ Plastics, heating fuel, gasoline, vinyl, synthetic fabrics
12. _____ Old five-cent coins, paper clips
13. _____ Baby powder, crayons, soap
14. _____ Jewelry, drill bits
15. _____ Most common source of electricity in the U.S.
16. _____ Pipes, old paint, X-ray shields
17. _____ Flatware (forks, knives, spoons), jewelry, second-place medal

- | | | | |
|---------------------------|------------------|------------------|--------------------|
| A. Gold | E. Tin | I. Silver | M. Quartz |
| B. Aluminum | F. Talc | J. Coal | N. Copper |
| C. Oil (Petroleum) | G. Lead | K. Salt | O. Iron |
| D. Clay | H. Nickel | L. Sulfur | P. Graphite |
| | | | Q. Diamond |

MINING AREA GRID

Natural Attributes:



Tree



Deer habitat



Rich top soil



Water



Beautiful vista