

Activity 2

Mining and Recycling

Objectives

Students will be able to: (a) describe how resources are extracted from the earth; (b) identify the effects of resource extraction on the environment in terms of land use and pollution; and (c) infer the ability of recycling to conserve resources and reduce the harmful effects resource extraction has on the environment.

Procedure

PART A

1 Prior to conducting the chocolate chip mining activity, have students complete the handout, *Things I "Gotta Have."* Discuss with students why we mine (needs and wants) and what we mine. After students discuss their answers, ask them to research and then list on the back of the handout how their first choice was manufactured and what minerals, energy or metals were mined to make it.

2 Display the handout, *Know Your Minerals*, on an overhead projector. Ask students to count how many unfamiliar minerals and metals make a car. Which minerals and metals are found in common consumer products that can be recycled?

PART B

1 Divide the class into groups of four and pair up students in each group. Distribute materials. Before passing out the cookies, tell students:

DO NOT EAT THE CHOCOLATE CHIP COOKIE. Using an overhead projector, look at the handout, *Mining Activity Sheet*. Together, read through the sheet and define any terms that are unfamiliar, such as conglomerate, processing time, extracted, extruder, bankrupt, cost, earnings.

2 Write the following rules on the chalkboard:

- Your cookie will earn \$1,000 for every 2-cm. straw you fill with chocolate pieces.
- You will be charged \$100 for every minute it takes to process your chocolate (remove all the crumbs).
- The value of your cookie goes down \$100 just for digging into it. The more damage, the more you lose. The fine: \$100 for each cookie piece that breaks off.

3 Have students consider the following:

- What is the best way to extract the chocolate from the cookie?
- Is it better to work in a group of four or form a conglomerate and combine

RESOURCE EXPEDITIONS

Inquiries

- How are resources extracted from the earth?
- What are the potential environmental consequences, both positive and negative, of mining?
- How does recycling lessen the demand for natural resources and protect the environment?

Content Domain

Math

Science—General science, earth science

Learning Outcomes

Math, Grade 4, #3, #8 and Grade 6, #3

Science, Grade 4, #14 and Grade 6, #4, #17

Duration

Part A: 60 minutes

Part B: 50 minutes

Materials

Chocolate chip cookies (one per student); **toothpicks** for use as extruders (one per student); **straws** cut into 2-cm. segments (several per student); **paper towels** (one per student); **overhead projector**

Handouts

- *Things I "Gotta Have"*
- *Know Your Minerals*
- *Mining Activity Sheet*

mining results? (This must be decided before students begin the actual mining process.)

Distribute an activity sheet to each group.

4 Share the following with students: Examine your cookie. How many chips can you see? Peek “underground” by looking at the bottom of the cookie. Predict how many straws your cookie will fill with chocolate. Also, predict how much money your cookie will earn. Write these figures on the activity sheet. Have your partner time your work. Using your extruder, carefully dig out the chocolate as your partner times your work. You must dig only from the top. Why? (Applications to real-life considerations: practicality, available technology, safety, expense.)

5 Share the following computation process for the handout, *Mining Activity Sheet*, with students.

- Figure land damage by counting the cookie pieces (if your cookie is still whole, count it as one piece) and record the total under “Land Damage.” Round off the time to the nearest minute and record it under “Processing Time.”
- Measure your chocolate by picking up the pieces with a 2-cm. straw. Fill as many straws as you need and record the number of straws under “Chocolate Extracted.”
- Figure your earnings on the activity sheet to find out how successful your digging was.

Questions for Discussion

- Whose cookie made money?
- Did anyone go bankrupt?
- Did your “conglomerate” bail you out?
- Why do you think you either made or lost money? (lots of chocolate, careful digging, good planning or lack thereof)
- If you were real miners, what would your cookie represent? (a mine)
- If the cookie is a mine, what is the chocolate? (gold, silver, iron ore, etc.)
- What do the pieces of cookie represent? (waste product, land damage)
- How do you think the process of mining affects the environment, both positively and negatively?
- What role do you believe mining companies can or should take in environmental stewardship?
- What does recycling have to do with all of this?
- How is recycling connected to resource management?
- How can recycling help reduce the harmful impacts of resource extraction?

Assessment

Completion of the handout, *Mining Activity Sheet*.

Student Handout

THINGS I "GOTTA HAVE"

Directions: Rank-order each of the consumer items listed below, #1 being the item you would be least willing to give up. There is a blank for your favorite item if it is not on the list.

____ MICROWAVE OVEN

____ SOAP

____ BICYCLE

____ TELEPHONE

____ TELEVISION

____ ALUMINUM CONTAINERS

____ PERSONAL COMPUTER

____ MILK

____ CLEAN CLOTHES

____ FISHING POLE

____ DEODORANT

____ CANDY

____ WATCH

____ LIGHT BULB

____ TOOTHBRUSH

____ HAIR DRYER

____ CURRENT FASHION

____ STEREO

____ NEWSPAPER

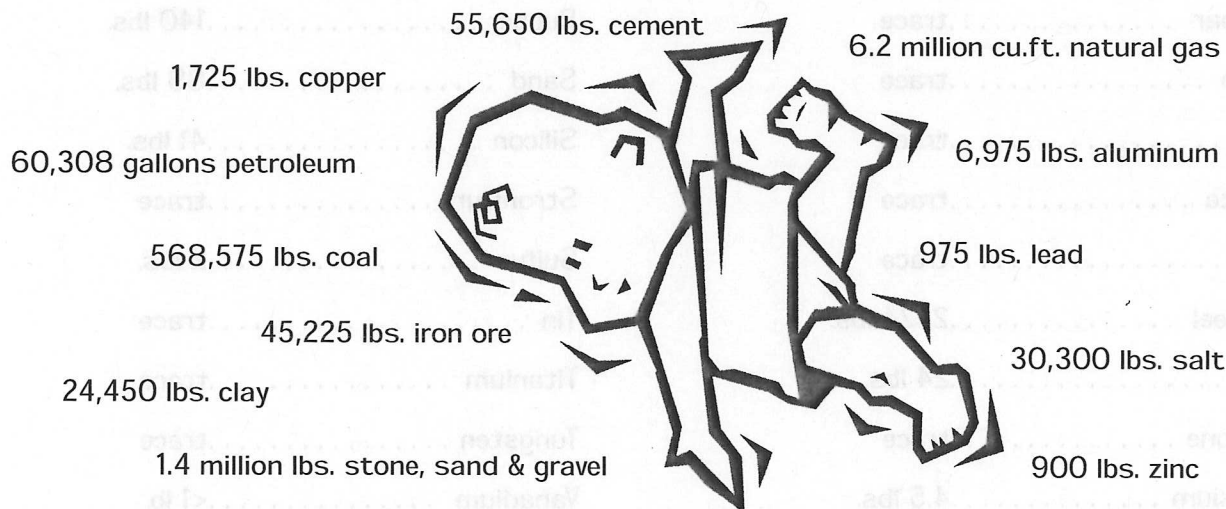
WHY DO WE MINE?

Because people need, want and sometimes demand the products made from minerals, metals and energy that come from the earth.

EVERYTHING IS MADE OF SOMETHING

When a person wants something, rarely does he or she think about the source of the materials needed to make that product. Everything tangible that you want or buy must be made of materials taken from our natural resources. Most of this material is from minerals, metals and petrochemicals.

Every American born will need...



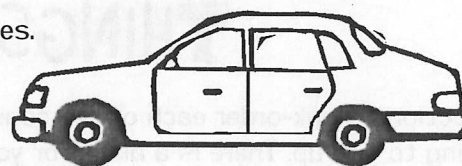
...3.5 million pounds of minerals, metals and fuels in a lifetime*

*Adapted from materials provided free to teachers from the Mineral Information Institute, web site: www.mii.org

Student Handout

KNOW YOUR MINERALS

More than 8 million new cars are made every year in the United States. In 1995, there were 133,929,661 cars in the United States.



The average weight of an automobile is 2,600-3,000 pounds. It is made by combining at least 39 different minerals and metals, each performing a special function when used in combination with the other.

Aluminum and steel figures overlap in some applications, such as the frame or engine, so the total weight of all components may exceed 3,000 pounds.

What's in a Car?

Material Weight

Aluminum240 lbs.

Antimonytrace

Asbestos66 to 1.2 lbs.

Bariumtrace

Cadmiumtrace

Carbon50 lbs.

Cobalttrace

Copper42 lbs.

Chromium15 lbs.

Fluorspartrace

Galliumtrace

Goldtrace

Graphitetrace

Halitetrace

Iron/Steel2,124 lbs.

Lead24 lbs.

Limestonetrace

Magnesium4.5 lbs.

Manganese17 lbs.

Molybdenum1 lb.

Material Weight

Micatrace

Nickel9 lbs.

Niobium<.5 lbs.

Nitrogentrace

Palladiumtrace

Plastics250 lbs.

Platinum05 to.1 troy oz.

Phosphorus<1 lb.

Potashtrace

Rubber140 lbs.

Sand89 lbs.

Silicon41 lbs.

Strontiumtrace

Sulfur2 lbs.

Tintrace

Titaniumtrace

Tungstentrace

Vanadium<1 lb.

Zinc22 lbs.

Zirconiumtrace

* Adapted from materials provided free to teachers from the Mineral Information Institute, web site: www.mii.org.

Student Handout

MINING ACTIVITY SHEET

PREDICTING

How many straws do you think you will fill? _____

How much money do you think you will make? _____

Will your group need to work as a conglomerate? YES NO

HOW TO FIGURE YOUR EARNINGS

- Your cookie will earn \$1,000 for every 2-cm straw you fill with chocolate pieces.
- You will be charged \$100 for every minute it takes to process your chocolate (remove all the crumbs).
- The value of your cookie goes down \$100 just for digging into it. The more damage, the more you lose. The fine: \$100 for each cookie piece that breaks off.

Fill in your scores and multiply to get the total amount.

STEP 1

LAND DAMAGE (see above) _____ pieces x \$100 = \$ _____

PROCESSING TIME _____ minutes x \$100 = \$ _____

Add dollar values for the PROCESSING TIME and LAND DAMAGE

TOTAL COSTS: \$ _____

STEP 2

CHOCOLATE EXTRACTED _____ straws x \$1,000 = \$ _____

Are the TOTAL COSTS (Step 1) more than the dollar value of your CHOCOLATE EXTRACTED (Step 2)?

YES Your mine has lost money. Write **BANKRUPT** below.

NO Subtract the TOTAL COSTS from the CHOCOLATE EXTRACTED

Write answer below.

TOTAL EARNINGS: \$ _____

TOTAL CONGLOMERATE EARNINGS: \$ _____

(if you chose in the beginning to work as a conglomerate)