

# **Lesson Plan #3—Science**

## **Title: CHOCOLATE CHIP COOKIE MINING**

### **Introduction:**

The purpose of this lesson is to expose the students to an environmental issue. Students will realize that extracting energy resources can damage the Earth and have a significant effect on environmental concerns. The Chocolate Chip Cookie Mining Activity can show students how much care must be taken during the mining stage to avoid destroying the land and the surrounding ecosystem.

### **Objectives:**

During this activity, students will learn to:

- Analyze information.
- Think critically about an environmental issue.
- Understand an issue from various viewpoints.
- Infer and describe the environmental damage that mining causes.
- Make an informed decision based on what they have read and experienced.
- Describe some economic and social costs of increased care for the environment.

**Session Time:** 45- 60 minutes (not including extensions)

### **Materials:**

- Chocolate chip cookies
- Paper towels
- Toothpicks
- Clock (with second hand)

**Methods:** guided discussion, cooperative learning, interactive participation, written response

### **Instructor Information:**

Coal is the compressed remains of ancient plants. For millions of years, buried plants were heated and compressed. They were converted to a material that is mostly carbon. Since coal is made from ancient forests, we call it a fossil fuel. Oil and natural gas are the other fossil fuels. Coal is more abundant than oil or natural gas.

All coal is not the same. The more heat and pressure it received while being formed, the more it changed. Some coal is not greatly changed from the original plants. That coal is soft and brown. It is called lignite. Two types that changed more are called sub-bituminous and bituminous. Anthracite is the name of the hard, black coal that changed

the most. The harder coals make better fuels and are more valuable, but they are not as common.

Coal is widespread around the world. Coal is found in flat layers or seams, between the layers of rock, or sediments, that formed it. The coal seams may be narrow, from a few centimeters, to many meters. The rock sediments may be hundreds of meters thick. If mountain-building activity has folded and broken the land, the coal seams are folded and broken, too.

In this activity, the chocolate chips represent coal in the ground in mountainous areas where geologic forces have folded and broken the ground so that the layers of coal are no longer flat and continuous. This would be representative of the type of coal found in British Columbia rather than the type found in the central United States.

### **Procedure:**

Distribute a chocolate chip cookie to each student on the paper towel and the [worksheet](#). The cookies represent environments that contain a source of energy. The chocolate chips represent coal. Ask them to predict how many chips they can dig out from their environments and record their predictions.

Have students extract as many chips as possible in two minutes, using the toothpicks as mining tools. Their chip mines will earn \$1,000.00 for every chip they remove. Have them pile the chips to one side. Count the chips they recovered and compare to the number of chips they predicted.

Ask them to study the impact of mining on their “cookie” environment.

Ask students to plan ways to mine a second cookie with less damage to the environment. Hand out another cookie to each student, and ask him or her to mine it for two minutes and pile the new chips to one side. This time tell them they will be penalized \$200.00 for each piece broken off the cookie.

Compare the two piles of chips and any other difference between the two cookie mines.

Answer the following questions:

- How would you change your mining techniques to make more money next time?
- How could your mining techniques change if you were not fined for breaking the cookie?
- How does all of this relate to real mines?

### **MATH EXTENSIONS:**

Mathematically figure out your profit from mining the two cookies.

Calculate your land damage cost. (\$200.00 per piece broken off)

Calculate your total earnings. (number of chips X \$1,000.00)

Calculate your profit (total earnings – costs)

Which cookie had the greater profit?

Graph the amount of profit made by each group using a bar graph. Whose mine made the most profit? Why?

Calculate the class average for the amount of profit made during the second “environmentally friendly” mining situation.

### **LANGUAGE ARTS EXTENSIONS:**

Have students discuss whether it is worth getting a reduced yield or paying more for energy in order to protect the environment.

Discuss the advantages and disadvantages of using fossil fuels and other energy sources to supply energy.

Have students write an essay on a current issue such as “Solar Energy”, “The Depletion of the Rain Forests”, or “The Greenhouse Effect”.

### **GEOGRAPHY EXTENSIONS:**

Using an U.S. state map, have each student choose a state and find out what item that state is famous for producing. You could also have each student find the state capital, flower, bird, tree, motto, etc. and give a report to the class.

### **SOCIAL STUDIES EXTENSION:**

Discuss the impact that coal mining has on the people of the Midwest (jobs, mine subsidence, damage to the ecosystem, etc.)

### **HISTORY EXTENSIONS:**

Research the time period when coal was formed.

Make a timeline of pollution causing inventions. You could start with naturally occurring phenomenon (i.e. volcanoes).

Research and discuss the different mining equipment over the years.

### **SCIENCE EXTENSIONS:**

Research and discuss the different fossil fuels.

Compare/contrast sources of energy.

Discuss energy conservation techniques/recycling.

What might happen to any animals and plants that live above the coal deposits after surface mining?

Research other materials that are mined (i.e. gold, lead, gemstones, etc.)

Discuss how fossil fuel burning effects the environment (acid rain, ozone depletion, greenhouse effect).

**ART EXTENSION:**

Make a diorama of an alternative energy source – i.e. windmills, solar panels, etc.

Construct a figure using all recyclable materials.

***Note: This lesson is included in a science workshop available through the Southern Illinois Professional Development Center***