

Teacher Resource: That's the way the cookie crumbles!

Loriana Caruso

Grade and Unit:

The following case study is designed for grade seven students who are learning *The Earth's Crust* unit of their science curriculum. This activity will allow students to explore the concept of mining as they delve into collecting as much chocolate as possible from two chocolate chip cookies! The process allows students to question what it is like to locate mineral deposits, extract these deposits from the ground, and the difficulties associated with both the extraction of the resources and the later reclamation of the land.

Student Learning Expectations:

- Compile qualitative and quantitative data gathered through investigation in order to record and present results
- Communicate the procedures and results of investigations for specific purposes
- Identify past and present-day applications of technologies that have contributed to the study of geology
- Describe how raw materials are collected and process produce different materials (Matter and Materials Strand)
- Estimate and compare fractions using manipulatives (Math)
- Systematically collect, organize, and analyze data (Math)
- Evaluate data and make conclusions from the analysis of data (Math)
- Add and subtract fractions with simple denominators (Math)

Position of the Topic within the Unit:

Students have spent the first few lessons of the unit learning about the formation of the Earth, its layers, its dynamics (re: volcanoes, earthquakes, mountains) and the various rocks and minerals found on the Earth's surface. By this point, students should have developed a better understanding about the Earth's crust and the dynamic processes that occur both above and below its surface. A brief lesson prior to beginning this lab is necessary for students to understand key mining terms such as: "deposit," "ore," "tailings pond," "extraction," "strip mining," and "underground mining." This lesson will form the basis of the chocolate chip cookie mining lab, as students will be exploring mining issues, such as reclamation and land use.

Brief Teaching Notes:

This is the first lab that the students will be performing for this unit. Depending on the position of this strand within the annual science curriculum, it could potentially be the first lab students experience that

year. Reviewing (or even teaching for the first time) the scientific method is useful, even though students are not required to produce a formal lab report upon completion. Using this as one of the first labs of the year helps students practice their skills at following simple procedures, collecting data, analyzing data, and making inferences based on their observations and the data obtained. Students really enjoy this activity as it is one of the few science labs where they are allowed to eat the results! Prior to beginning, however, check for food allergies. If food allergies are present, different cookies can be substituted. Teachers should use their discretion whenever they are dealing with food in the classroom.

In this lab, students must mine as much chocolate from the chocolate chip cookies as possible. In the first attempt, students can break apart and crumble the cookie to extract the "ore," but in the second case, students must attempt to keep as much of the cookie intact and damage-free. Students will learn the consequences of mining on the environment and how mines must disturb the environment as little as possible.

Materials Required and Instructions:

Each student will receive two chocolate chip cookies, 2 paper towels, and 2 toothpicks. Two digital scales will be used to weigh the chocolate.

Explain to students how the chocolate will be mined (draw a diagram of a cookie on the board to demonstrate):

1. Look at the first cookie and fill in the first three parts of the chart.
2. Extract as much chocolate from the cookie as possible using toothpicks. You may break the cookie up if you want. Crumbling the cookie is allowed!
3. Weigh the amount of chocolate and the amount of leftover cookie separately. Fill in the next three parts of the chart.
4. Fill in the remainder of the chart. Eat the cookie.
5. Repeat steps 1 to 4 with the second cookie, but make sure there is as little damage to the cookie part as little as possible. The goal is to leave as much of the cookie intact as possible, while extracting the chocolate.

References:

- Nelson Science and Technology* 7, p. 200-202
<http://www.gemsociety.org/nw/active1.htm>
http://www-ed.fnal.gov/trc/sciencelines_online/Spring01/student_sheet.html
<http://www.uen.org/Lessonplan/preview.cgi?LPid=832>

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Mining Chocolate Chips

Name: _____

Date: _____

Lab: Mining Chocolate Chips

You must use only mining tools (toothpicks) to extract the ore (chocolate) from the land (cookie) – not your hands!
 For cookie #1, break up the cookie as much as you want in order to extract as much chocolate as possible.
 For cookie #2, remove as much chocolate as possible but damage the cookie as little as possible.

	Cookie #1	Cookie #2
Estimated amount of Cookie (%)		
Estimated amount of Chocolate (%)		
Estimated fraction of Cookie that is chocolate		
Measured amount of Cookie (g)		
Measured amount of Chocolate (g)		
Actual Fraction of Chocolate		
Level of difficulty of chocolate removal (1 easy, 5 hard)		
Amount of chocolate left in the Cookie (1, a little; 5, a lot)		
Value of Chocolate @ \$0.10/gram		

Name: _____

Date: _____

There are six questions to answer about this lab. Answer each question in complete sentences in the space provided.

1. Which cookie produced the most chocolate chips? Which cookie produced the least chocolate chips?
2. Which method produced the most damage to the cookie? Which method produced the least damage to the cookie?
3. Describe the difference between the two ways you mined for chocolate.
4. How much more chocolate did you extract from the first cookie than the second cookie?
5. After a mine is completed, the land must be as close to its original state as possible (reclamation). Which method demonstrates this concept? How?
6. Can you think of any potential problems that may occur when a portion of land is mined?

