

EARTH COOKIES

SUMMARY: Students will classify and compare cookies and rocks according to their structure and composition.

GOAL: To enrich student understanding of how igneous rocks are formed and why their structure and composition results in different characteristics

OBJECTIVES: Students will compare and contrast different types of cookies and igneous rocks and classify them according to their structural make-up and ingredient composition.

GRADE LEVEL: Fourth through Twelve

TIME REQUIRED: 45 minutes

LOCATION: Classroom

MATERIALS: Cookies (see note under preparation), paper towels, two sets of four different types of igneous volcanic rocks (basalt, andesite, dacite, cinder, pumice, etc.), one metamorphic rock, one sedimentary rock, recipe page, worksheets, pencils

SUBJECTS: Science, Language Arts

KEY WORDS: Structure, Composition, Characteristics, Classification, Minerals, Ingredients, Igneous, Sedimentary, Metamorphic

BACKGROUND: Although the average student is relatively unfamiliar with rocks, especially their composition and formation, most students are very familiar with cookies. In actuality, cookies and rocks have many similarities, especially in the ways that they are formed. For this reason, a careful study of cookies provides a great introduction to rock formation and structure.

The building blocks of cookies are flour, butter, eggs, sugar, and baking soda. When the ingredients are mixed together, they create a substance that is not at all like the individual ingredients. The texture changes when the dough is heated. The exact same dough will produce very different results depending on the amount and type of heat to which it is exposed (the gooey cookie, the perfect cookie, the burnt cookie).

The process that produces cookies is similar to that which produces igneous rocks. The building blocks of rocks are various minerals. These ingredients can be mixed together to produce a variety of rocks. The degree of heat, water, pressure, and friction change the characteristics of the rocks, as does the way the rock cools.

Rocks can be classified using many criteria including but not limited to: weight, color, hardness, and where and how they originated. Rocks are classified into three main groups: sedimentary, metamorphic, and igneous rocks.

Sedimentary rocks are formed when different materials are laid down one on top of the other. They are characteristically layered and are formed by either deposits of previously weathered rocks, dead marine organisms, or crystallized chemical precipitates. Sandstone, shale, and limestone are examples of sedimentary rock.

Metamorphic rocks are made deep in the earth. Any kind of rock can be turned into a metamorphic rock by heat, pressure, or penetration of hot fluids. For example, shale will metamorphize into slate, sandstone becomes quartzite, and limestone will alter to marble.

Igneous rocks are made from magma that has cooled and solidified. When it cools beneath the surface, it is called intrusive igneous. Generally, intrusive magmas cool deep within the earth in an insulated environment. Crystals have time to grow large enough to be seen without magnification. When magma cools above the surface it is called extrusive igneous. This magma cools very rapidly when exposed to air resulting in smaller crystals or no crystals at all. Crystals do not have time to form. Granite is an example of intrusive igneous rock. Basalt and dacite are examples of extrusive igneous rocks.

INSTRUCTIONAL SEQUENCE:

1. Preparation of cookies. This activity will be more meaningful if the students make the cookies instead of buying them. Ask for student volunteers to make cookies the day before you do this activity. Enough cookies should be made so that there will be one of each type per student. Simple recipes for the four cookie types needed are included on the Recipe Page. You can photocopy individual recipes and send them home.
2. Discuss the differences between the three rock types and introduce the lesson. Explain that the students are going to learn more about igneous rocks, specifically the extrusive rocks that come out of volcanoes.
3. Pass out the cookies, paper towels, pencils and the Cookie Worksheet. Instruct the students to observe the cookies carefully. Many of the questions do not have right or wrong answers. Have students fill out the worksheet.
4. Put the rocks out on a table. Label and number the rocks 1 through 4.
5. Working in groups or individually have the students observe the rocks and fill out the Rock Worksheet.
6. When all the students have completed their worksheets, discuss their findings. Compare and contrast the similarities between the two mediums.
7. When finished with the activity, eat the cookies!

EXTENSION/ENRICHMENT: (1) At home students can experiment with cookie dough. Try changing the composition just slightly and see what happens. Bake them at a higher or lower temperature, bake them for shorter or longer than called for, melt some cookie dough in a pot on the stove top, bake a cookie in a microwave, or throw a hot cookie in the air. What happens to it? (2) Have the students look for igneous rocks in their neighborhood and bring them to class.

ASSESSMENT: Students describe and list three similarities between cookie and igneous rock formation. Have students describe how they identify the differences between different igneous rocks. Have the students write a story about the formation of a volcanic rock.

COOKIE WORKSHEET

Name of Cookie Connoisseur _____

Rocks are similar to cookies in many ways. They differ in ingredients and the temperature that they are heated. They are made and react to heat much like kitchen-made cookie dough. Use the most descriptive words you can think of to describe the following:

	Sugar	Peanut Butter	Chocolate Chip	Oatmeal
Smell				
Shape				
Color				
Texture				
Main Difference				

Look at the recipe sheet and list the ingredients that are common to all the cookies:

Which cookies are the most alike? _____ Why?

Which cookies are the least alike? _____ Why?

Does cookie dough look like the finished cookie? ____ Why or why not?

How would the cookies be different if you baked them (a) for half the time the recipe called for? _____ (b) for twice as long as the recipe called for? _____ (c) at a lower temperature? _____ (d) at a higher temperature?

What would happen to the chocolate chip cookie dough if you heated it in a pan on the stove top?

What would happen to the chocolate chips in the dough if they were heated together on the stove top and stirred?

Break one cookie in half. Is the texture on the inside the same as on the outside?

If you took a cookie hot out of the oven and threw it in the air, do you think it would change shape? ____ What would happen when it landed?

ROCK WORKSHEET

Name of Rock Hound

You should have four rocks. Number them 1 through 4.

Use the most descriptive words you can think of to describe the four rocks.

	1	2	3	4
Smell				
color				
Shape				
Texture				
Main Difference				

Can you see any minerals common to all the rocks?

List anything you see that they have in common.

Which rocks are the most alike?

Why?

Which rocks are the least alike? _____ Why?

Do you think the magma looked like the solid rock does now?

Pick a rock with crystals. Do you think it cooled quickly or slowly?

Why?

Do you think the magma that made this rock would look the same if it was thrown up in the air while still hot?

Pick another rock. If you were able to stick it into a magma chamber, would it look the same when it came out and cooled as it does now? _____ Why or why not?

List similarities between cookies and igneous rocks.

RECIPE PAGE

Sugar Cookies

1 cup butter	1 cup sugar
2 eggs	1 Tbsp water
1 tsp vanilla	1 tsp baking powder
about 3 cups flour	

Cream butter and sugar together. Beat in vanilla, water, and eggs. Sift in dry ingredients gradually. Roll out to 1/4 inch thickness. Cut in desired shapes or with cookie cutters. Put on ungreased baking sheet. Bake for 10 minutes at 375 degrees.

Peanut Butter Cookies

1 cup chunky peanut butter	1/2 cup butter
1/2 cup sugar	1/2 cup brown sugar
1 egg	1/2 tsp salt
1/2 tsp baking soda	1/2 tsp vanilla
1 to 1 1/2 cups flour	

Cream butter and sugars together. Beat in egg, peanut butter, salt, baking soda, and vanilla. Sift in flour. Roll into small balls and place on ungreased cookie sheet. Press flat with a fork. Bake 10 to 12 minutes at 375 degrees.

Chocolate Chip Cookies

1 cup softened butter	3/4 cup white sugar
3/4 cup brown sugar	1 tsp vanilla
1/2 tsp water	2 eggs
2 1/4 cups flour	1 tsp soda
1 tsp salt	12 oz semi-sweet chocolate chips

Cream butter and sugars together until well blended. Add vanilla, water, and eggs. Beat until creamy. Add flour, salt, and soda. Stir. Add in chocolate chips. Drop by teaspoons onto ungreased cookie sheet. Bake for 10 to 12 minutes at 350 degrees.

Oatmeal Cookies

1/2 cup butter	1/2 cup packed brown sugar
1/2 cup white sugar	1 egg
1 tsp vanilla	1 Tbsp milk
1 cup flour	1/2 tsp baking soda
1/2 tsp baking powder	1/2 tsp salt
1 cup quick rolled oats	

Cream butter and sugars together until well blended. Add vanilla, egg, and milk. Sift dry ingredients together. Stir until smooth. Add oats. Drop by teaspoons onto ungreased cookie

sheet. Bake for 10 to 12 minutes at 350 degrees.

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