For Those About to Rock (Cycle)

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Individual Lesson
Middle School, Grade 8
Duration: One 90-minute block, repeated twice with Lead Teacher presented to remaining classes later in the week.
Implementation: January 6, 2010, Falcon Bluffs Middle School, Littleton, CO
Lesson Prepared: December 15, 2009

Overview
In this lesson, students will review the rock cycle, a topic from sixth grade Earth science, through a hands-on activity.

Purpose
Emphasis will be on revisiting the rock cycle. Students will work through three different stations, each devoted to one type of rock; igneous, sedimentary and metamorphic. Students will describe transitions between various types of rock while practicing good lab skills.

Objectives
Students will review the rock cycle as part of their preparation for the CSAP exams. Additionally, students will review deductive reasoning and basic lab skills.

Standards Met
CO State Science:
Standard 4 Benchmark 1: Inter-relationships exist between minerals, rocks, and soils. Standard 4 Benchmark 3: Natural processes shape the Earth's surface.
National Science:
Standard A - Science as Inquiry, Standard B - Earth and space science: Structure of the Earth system

Background: Students should be able to accurately measure mass using a triple beam balance. Students should be able to follow directions when working with lab equipment such as a hot plate and follow basic lab safety procedures.

References: The rock cycle becomes increasingly more complex as one advances in studying Earth science and the related sub-disciplines. This work is based on the curriculum for Jefferson County.

Lesson Vocabulary: igneous, metamorphic, sedimentary, sediment, magma, pressure,

Materials required
Lab worksheet (see attached)
Lab Station Instructions (see attached)
Purchase (less than $15 depending on the number of students - here 5 periods approximately 90 students) 1 box of sugar cubes, 1-2 cans of Play-Doh, 1 box of colored chalk, 1 box of crayons, enough sugar and water to invert and make some version of rock candy.

Per 3 groups of students (recommended group size is 4 or 5 students):
Station 1:
Sugar cubes, Sediment (colored chalk, crayons, and pieces of rock candy), Beaker of colored water (magma) on hot plate.

Station 2: Play-Doh, Sediment (colored chalk, crayons, and pieces of rock candy), aluminum foil, and hot plate.
Station 3: Rock candy, Beaker of colored water (magma) on hot plate.

Preparation: Before lesson, assemble necessary supplies. Rock candy can be made by inverting a sugar, water mix. Slightly burning it discourages consumption and reinforces good lab safety behavior. When cooling, pour in a thin layer on a cookie sheet so that it breaks up easily. Sugar cubes, crayons, and chalk can be chopped up. Aluminum foil may be used when making the metamorphic rock at station 2 as it can be hard to clean out beakers.

Safety**:** Everything in this lab is nontoxic. Students will wear safety goggles. Basic lab safety procedures will be followed.

Method: 5 E's Model

Engage: Briefly discuss the hands-on nature of the activity and address the hot magma and required lab skills. Now is a good time for a safety demo with the hot plate. A main component of this lab was to reinforce god lab procedures in a non-toxic environment, so a discussion or example of why lab safety is important is needed.

Explore: Most of this activity allows students to explore the rock cycle by working through three stations, each one devoted to a type of rock. Directions for each station are on accompanying materials (see attached). Students are given time to complete the instructions at each station, followed by a careful rotation, in no specific order. Individual station supplies may need to be periodically restocked.

Explain: Students are guided through each station with a specific set of directions. At each station, students are required to answer a question extending what they witness at the station. Small group discussions are required to answer the extension question. Lead teacher or resident may assist with small group discussions.

Elaborate: After completing all three stations, students will have a command of the rock cycle. After completing the three required stations, a class wide discussion about the relevance of the rock cycle will ensue.

Evaluate: Students will fill out a worksheet (see attached) describing the components of the rock cycle. Additionally, each station poses a question for small group discussion. Students will record group answers to these questions on the reverse of their worksheet.

Adaptations or differentiated learning
[Include all potential adaptations that may be useful for the classroom.]

Extensions & connections

Peer review comments
[List any peer comments that aided in the preparation of this lesson]

Reflections (completed after lesson is implemented]
[How does this lesson integrate your research into the classroom?]
This lesson tested my culinary creativity and ingenuity, but did not incorporate my research directly. The main theme that was stressed was that of good lab procedures and scientific inquiry, which are underlying themes in my research.

[How could the lesson be improved?]
This lesson needed a full 90-minute block. Originally, we planned to have a short lab safety discussion and then begin the lab. To make it through all three stations and have meaningful discussions, more than 45 minutes to an hour is needed. More emphasis on reading directions before beginning the lab may have helped.

[What worked well?]
The hands-on nature of this activity challenged the students in a good way. While I mentioned that all materials were nontoxic, I did not tell the students what they were working with and they were determined to guess the components, the mysterious rock candy really kept the students.

[What did you learn?]

[How does this impact your future profession?]
[Further thoughts...]

student work examples (completed after lesson is implemented]
[Include examples of student work from this lesson - includes worksheets, tests, pictures, etc.

Metamorphic

IGNEOUS

S.E.DI.M.E.NT.

SEDIMENTARY

Magma

For those about to Rock

Description: The goal of this lab is to review the rock cycle. The rock cycle shows the relationship between the three main types of rocks: igneous, metamorphic, and sedimentary. We will see how any type of rock can become another kind.

Lab safety:
1. The materials used in this lab are nontoxic, but none of the materials should be consumed.
2. Hot plates will be used, follow directions and safety guidelines as described by your teachers.
3. Use care when handling the rock samples, some have sharp edges.

Key question: What is the rock cycle?

Directions: There are three stations, each dedicated to one type of rock. You will get to work through most of the parts of the rock cycle while completing a worksheet. Each station has **specific** instructions to follow and questions for you to answer. Record your answers in the appropriate boxes on the worksheet or on the back of the worksheet if asked. Be sure to follow the procedures in order. Before moving on to a different station, be sure to return the station to its original condition (turn off hot plates you may have turned on).

Station #1

Step 1. Begin by looking at two sugar cubes, these are sedimentary rocks. In the appropriate box on the worksheet, give a description of sedimentary rocks.

Step 2. Take one of the sugar cubes and break it up. You now have sediment. Fill out the arrow from sedimentary to sediment describing what you did to the sugar cube.

Step 3. Next look at the other examples of sediment and give a description of sediment in the appropriate box on the worksheet. Add the sediment you made to this sample.

Step 4. Discuss with your lab group how you think sugar cubes are made from sugar. Use your group's answer to fill out the arrow going from sediment to sedimentary.

Step 5. Take another sugar cube and place it in the beaker labeled magma. Be careful when using the hot plate. Do not throw the sugar cube in. You may have to stir the mixture using a stir rod. Discuss what happens and use your group's answer to fill out the arrow from sedimentary to magma.

Step 6. If we apply heat and pressure to a sedimentary rock, it can turn into a metamorphic rock. Fill in the arrow going from sedimentary to metamorphic. On the back of your worksheet, as a group, answer the following question (label it Q1).
Q1: What will happen if we apply heat and pressure to a sugar cube?

Station #2

Step 1. Our first step for this station is to build a metamorphic rock. Take a little clay and some of the ingredients from the container labeled **Container #2** and press them together. Give a description of your metamorphic rock in the appropriate box on the worksheet.

Step 2. Metamorphic rocks break down and can turn into sediment. Fill in the arrow connecting metamorphic rocks and sediment. An example of sediment is in the container labeled sediment. Give a description of sediment in the appropriate box on the worksheet (you may have already done this). On the back of your worksheet, as a group, answer the following question (label it Q2).
Q2: What may cause a metamorphic rock to break down to sediment?

Step 3. Take your metamorphic rock and place it in a beaker. On the back of your worksheet, write **Observations 2**. Put the beaker on a hot plate and turn the hot plate on low. Slowly turn up the temperature and record your observations each time you increase the temperature. When the rock melts, you have created magma and you should turn off the hot plate.

Step 4. Fill in the arrow connecting metamorphic and magma. In the box labeled Magma, describe the substance in your beaker. When the magma has cooled, remove it from the beaker and take it to the main supply area on the counter.

Station #3

Step 1. Examine the two samples labeled igneous rocks and give a description in the box labeled igneous on the worksheet.

Step 2. Looking at the brown glass-like sample, discuss how this roc may turn into sediment. Use your answer to fill in the arrow from igneous to sediment.

Step 3. Take a piece of the brown glass-like sample and add it to the beaker labeled magma on the hot plate. Be careful not to splash the magma. On the back of your worksheet, write **Observations 3.** Use a stir rod and record your observations.

Step 4. Fill in the arrow going from igneous to magma with a description of the process you just witnessed. Igneous rocks can form from magma by reversing this process. On the back of your worksheet, as a group, answer the following question (label it Q3).
Q3: How can magma turn into an igneous rock?

Step 5. Igneous rocks can also turn into metamorphic rocks through heat and pressure. Take another sample of the brown glass-like rock and a few of the colored ones. Place both samples in a beaker and slowly turn up the temperature until the colored rocks begin to melt. When the colored rocks begin to melt, remove the beaker from the hot plate and allow it to cool. You have just created a metamorphic rock. In the bow labeled metamorphic, describe the new rock you created (you may have already done this).

Step 6. Once the sample has cooled, remove it from the beaker and take it to the main supply counter.