

Metamorphic Rock: Melting Rock

<http://www.canteach.ca/elementary/earthspace14.html>

Focus on Inquiry

The student will collect and analyze data while simulating searching for coal deposits on the Earth's surface and under the ground.

Lesson Overview

In this activity students will create sedimentary and metamorphic rock models. They will simulate how sedimentary and metamorphic rocks are formed, then compare their rock models to conglomerate and marble.

Duration 45 minutes	Setting Classroom	Grouping Cooperative groups of four	PTI Inquiry Subskills 5.8, 5.4, 7.3
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Lesson Components	Estimated Time	Inquiry Subskills Used	Technology Used	Level of Student Engagement	Brief Description
<i>Engage</i>	5 min	None	Internet (video)	1	Students view a video segment and discuss the meaning of "metamorphosis".
<i>Explore</i>	15 min	5.8	None	3	Students use marshmallows, chocolate chips and peanut butter to simulate how a conglomerate rock metamorphoses.
<i>Explain</i>	15 min	5.4, 7.3	Internet (video)	1	Students identify how the parts of the model represent elements of the metamorphic process and view a video of metamorphic rocks.
<i>Expand</i>	10 min	5.4	None	2	Students observe another model of metamorphic process.
<i>Evaluate</i>	Varies	N/A	None	N/A	Teacher-made rubric for lab worksheet.

Level of Student Engagement

1	Low	Listen to lecture, observe the teacher, individual reading, teacher demonstration, teacher-centered instruction
2	Moderate	Raise questions, lecture with discussion, record data, make predictions, technology interaction with assistance
3	High	Hands-on activity or inquiry; critique others, draw conclusions, make connections, problem-solve, student-centered

National Science Education Standards – Inquiry

Develop descriptions, explanations, predictions, and models using evidence.
Think critically and logically to make the relationships between evidence and explanations.
Communicate scientific procedures and explanations.



National Science Education Standards – Earth Science

Some changes in the solid earth can be described as the "rock cycle." Old rocks at the earth's surface weather, forming sediments that are buried, then compacted, heated, and often recrystallized into new rock. Eventually, those new rocks may be brought to the surface by the forces that drive plate motions, and the rock cycle continues.

Louisiana Grade Level Expectations – Inquiry

Gr. 8, Inquiry GLE#14 - Develop models to illustrate or explain conclusions reached through investigation (SI-M-A5)
Gr. 8, Inquiry GLE#19 - Communicate ideas in a variety of ways (e.g., symbols, illustrations, graphs, charts, spreadsheets, concept maps, oral and written reports, equations) (SI-M-A7)



Louisiana Grade Level Expectations Earth Science

Gr. 8, GLE#16 – identifying the characteristics and uses of minerals and rocks and recognizing that rocks are mixtures of minerals (ESS-M-A5)
Gr. 8, GLE#18 –explaining the processes involved in the rock cycle (ESS-M-A6)

Materials List (per group)

- 2 cups mini-marshmallows
- 1 cup choc chips
- Smooth peanut butter
- Waxed paper
- Hot plate
- Mixing bowl
- Mixing spoon
- Conglomerate rock sample or picture
- Marble rock sample or picture
- iron
- Several colors of wax pieces (from a craft store) (*optional*)
- Clear, heat-safe container (or beaker) (*optional*)
- Computer
- Internet access

Advance Preparation

1. Download the original lesson from the CanTeach website at <http://www.canteach.ca/elementary/earthspace14.html>
2. Obtain materials from materials list for each group of students.
3. Copy **Blackline Master #1**.
4. Sign up for a trial membership to United Streaming (<http://www.unitedstreaming.com>).
5. Download and preview the video segments “What is metamorphosis?” and “Metamorphic Rock” for grades 6-8 on the UnitedStreaming website (<http://www.unitedstreaming.com>). You can locate these video segments by typing the name of the video segment in the search box on the UnitedStreaming website.
6. An optional, free video about metamorphic rocks can be obtained from www.learner.org/resources/series78.html. Please note that this is a 30-minute video compared to the 1:20 video clip from UnitedStreaming.

Other Information

Prior Knowledge Needed by the Students

Although it is not necessary, it may be beneficial for students to know how sedimentary and igneous rocks are formed before beginning this activity.

Procedure

Engage

1. Show students a short video clip entitled “What is metamorphosis?”
2. Discuss with students that metamorphosis means change. Ask them to identify organisms that undergo metamorphisms.
3. Inform students that nonliving things, such as rocks, can also undergo metamorphism. Then tell them that in this activity they will simulate how rocks change from one type to another.

Explore

1. Students complete the activity found on the website <http://www.canteach.ca/elementary/earthspace14.html>
2. Students answer the questions on **Blackline Master #1** while completing the activity.

Explain

1. Students should write their answers to questions on the Analysis and Conclusion sections of the **Blackline Master #1**.
2. Explain to students that the original rock model they created represented a sedimentary rock, because it was composed of different ingredients clumped together. The rock model ingredients represented the sediments (tiny pieces of sand, dust, & pebbles) that stick together to form a sedimentary rock. When they exposed the sedimentary rock model to heat, it changed form. The new rock model had different properties from the original rock model. When real rocks undergo changes due to heat and or pressure, they become a new type of rock called a metamorphic rock. Explain that rocks are classified according to the way they are formed. Any rock

(sedimentary, igneous, or metamorphic) that changes due to heat, pressure, and or chemical reactions becomes a new rock known as a metamorphic rock.

3. Show students video clip entitled “Metamorphic Rock” from the United Streaming website.

Expand/Elaborate

1. You can also simulate how heat and pressure change existing rocks by placing the sedimentary rock model (start with new marshmallows, chocolate chips and peanut butter) in between two pieces of wax paper and pressing gently on the wax paper with a heated iron.
2. Teacher can also simulate how metamorphic rocks are formed by taking a handful of various colors of candle wax (available at a crafts store) and putting them in a clear, heat safe bowl on a hot plate. Allow children to see how the candle wax first becomes soft (due to the increased heat)... which is a change (or metamorphosis) in the shape of the wax beads. If the wax completely melts, ask students what type of rock would be formed. (igneous)
3. *Optional.* Have students research different types of metamorphic rock and explain how people use these rocks. Discuss how several metamorphic rocks are known for their beauty, because they contain swirls of different colors due to the process in which they are formed.

Evaluate

1. **Blackline Master #1** can be used for assessing student knowledge.
2. Students can create a Venn-diagram comparing and contrasting sedimentary and metamorphic rocks.
3. Students can write a paragraph explaining how metamorphic rocks are formed.

Blackline Master

1. **Metamorphic Rock: Melting Rocks**

Supplementary Resources

Metamorphic Rocks Formations

http://www.geocities.com/rainforest/canopy/1080/metamorphic_formation.htm

This site contains general information about the formation of metamorphic rocks.

Exploring Earth

http://www.classzone.com/books/earth_science/terc/content/visualizations/es0607/es0607page01.cfm?chapter_no=visualization

On this site, students can view an animation of a metamorphic rock forming.



Name: _____ Date: _____ Class Hour: _____

Metamorphic Rock: Melting Rocks

Focus Question: How are sedimentary and metamorphic rocks formed? How are they related in the rock cycle?

Materials: (per group of students)

- 2 cups mini-marshmallows
- 1 cup chocolate chips
- Peanut Butter (smooth/creamy)
- Wax paper (at least two sheets per group)
- Hot plate
- Mixing bowl
- Mixing spoon
- Baking pan
- Pot holders
- Conglomerate rock sample or picture
- Marble rock sample or picture
- Computer with Internet access

Procedure:

Part 1:

1. Mix mini-marshmallows and chocolate chips in a bowl.
2. Using the mixing spoon, add just enough Peanut Butter so the mixture clumps together.
3. Grab handfuls of the mixture and make clumps to resemble rocks.
4. Place the “rocks” on the wax paper.
5. Observe your rocks. Record your observations in the data table below before proceeding to the Analysis section to answer those questions in complete sentences.

Data table:

Identify Your Rocks' Properties:	COLOR	SIZE	SHAPE	TEXTURE	OTHERS

WHAT TYPE OF ROCK DOES THIS REPRESENT? _____

Analysis:

1. You created a model of sedimentary rock. Sedimentary rocks are made of sediments (tiny pieces of sand, dust, and pebbles) that clump together and harden. What ingredients represent the sediments in your “rocks?”

2. What material was used to cement the sediments together?

3. Conglomerate is an example of a sedimentary rock. Observe the conglomerate rock sample or picture. How does your “rock” compare to the conglomerate?

Procedure:

Part 2:

1. Now take your “rocks” and place them on the pan (still on the wax paper).
2. Make sure the hot plate is on low heat.
3. Put on the pot holders and then place the pan over low heat until the marshmallows melt.
4. Using the mixing spoon, take a spoonful of the new “rocks.” And place on a new sheet of wax paper.
5. Observe your new rocks. Record your observations in the data table below before proceeding to the Analysis section to answer those questions in complete sentences.

Data table:

Identify Your Rocks' Properties:	COLOR	SIZE	SHAPE	TEXTURE	OTHERS

WHAT TYPE OF ROCK DOES THIS REPRESENT?: _____

Analysis:

1. How did exposing your “rock” to heat change your rock?

2. Heat and pressure can change existing rocks into new rocks. When this occurs, the new rock becomes a different type of rock called a metamorphic rock. Rocks are classified by the way they are formed. Any rock (sedimentary, igneous, or metamorphic) that changes due to heat, pressure, and/or chemical reactions becomes a new rock known as metamorphic rock. Marble is an example of a metamorphic rock. Observe the marble sample or picture. How does your rock model compare to the marble?

3. Is this activity (Part 1 and 2) an example of a model or an experiment? Explain by using the appropriate definition of each word with an example from this activity.

Conclusion:

1. Show your understanding of the rock cycle by assuming the role of Marvin the Metamorphic Rock. Describe Marvin’s adventures through each stage of the rock cycle as he morphs from one rock type to the next. Be sure to give specific details on how these changes occur (ex. due to pressure, heat...). Illustrate Marvin’s adventures on the back of this page and be sure to label the pictures.