

# Metamorphic Rocks

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**Strand** Rocks

**Topic** Investigating Metamorphic Rocks

**Primary SOL** ES.5 The student will investigate and understand the rock cycle as it relates to the origin and transformation of rock types and how to identify common rock types, based on mineral composition and textures. Key concepts include  
c) metamorphic rocks.

**Related SOL** ES.1 The student will plan and conduct investigations in which  
f) current applications are used to reinforce Earth science concepts.

## Background Information

The term metamorphic refers to a change in form. This means that a metamorphic rock is a rock that has changed in some manner by certain processes. These dominant processes responsible for metamorphism is a change in temperature in pressure. These rocks are further classified by their texture and their composition (chemical and mineral). Like other rock types, metamorphic rocks form under certain constraints and in certain locations. Depending on the location, metamorphism can occur on a local or regional scale. Examples of metamorphic rocks include gneiss, slate, marble, schist, and quartzite.

Throughout this lesson, students will explain the formation of metamorphic rocks as a result of extreme heat and pressure. Emphasis will be placed on classification of metamorphic rocks according to their textures and on the identification of metamorphic rocks and the rocks from which they formed.

## Materials

- Set of metamorphic rock samples for each group:
  - Granite
  - Gneiss
  - Sandstone
  - Quartzite
  - Limestone
  - Marble
  - Shale
  - Slate
  - Schist
- Students' completed Rock Charts (from the "Three Types of Rocks" lesson)
- Flour-salt modeling clay
- Rice
- Metamorphic Rocks Activities (attached)
- Modeling clay (three different colors)

## Vocabulary

*composition, contact metamorphism, foliated, nonfoliated, regional metamorphism, texture*

## **Student/Teacher Actions (what students and teachers should be doing to facilitate learning)**

### *Introduction*

1. Divide the students into small groups of 3 or 4. Give each student three pieces of modeling clay. Each piece of clay should be a different color. The students should construct their own metamorphic rock.
2. Explain to the students that each of the three pieces of modeling clay represent a different rock. Explain to the students that through the process of increased temperature and pressure, a metamorphic rock can form. The students should use their hands to create their metamorphic rock.
3. Have them write down the steps that they used in creating their own metamorphic rock.

### *Procedure*

4. Give each student group a set of metamorphic rock samples, and ask groups to categorize their rocks according to observable characteristics. Instruct groups to be prepared to discuss and defend their classification systems. Have the students make a comparison to the rocks that they created in the prelesson activity.
5. Allow groups to share their classification systems and defend their choices. Go over the origins of metamorphic rocks, and have students give some examples. Review the metamorphic rock information contained in their Rock Charts.
6. After students have defended their classification systems, instruct student groups to classify the metamorphic rock samples according to classification categories used by geologists—i.e., texture/grain size and composition/color.
7. Distribute copies of the attached Metamorphic Rocks Activities handout. Instruct students to complete Part 1. Discuss Part 1 before having students complete Part 2.
8. After all are finished, go over the rock identifications, and answer any questions to reinforce the story-telling aspect of metamorphic rocks.

### **Assessment**

- **Questions**
  - Complete questions on the Metamorphic Rocks Activities sheet.
- **Journal/Writing Prompts**
  - Have students tell each metamorphic rock's story.
- **Other**
  - Have the students classify they candy rocks that they created.

### **Extensions and Connections (for all students)**

- The Blue Ridge province of Virginia contains some of the oldest rocks found on the North American continent. Have the students complete research to determine how these rocks formed and prepare a presentation detailing the sequence of events leading to their formation.

### Strategies for Differentiation

- Have pairs of students sit back to back. Hand partner A one metamorphic rock sample from the lesson, but don't allow Partner B to see it. Instruct Partner B to ask yes/no questions about the rock, using classification category vocabulary. Partner A should respond to each question until Partner B has identified the rock. If desired, create a chart (e.g., a simple yes/no flowchart) to record responses. Have partners switch roles and follow the same procedure with a different rock. (You may wish to extend this activity by adding igneous and sedimentary rocks for review.)
- Create a template and/or sentence framework for each student to use as he/she writes "the story" of a selected metamorphic rock. Have students read their stories aloud to the class. Display stories around the classroom.
- Provide a three-column chart to each student with the columns labeled "Igneous," "Sedimentary," and "Metamorphic." Have students work in teams of three on a culminating jigsaw activity to review the characteristics of each type of rock, examples of each type, and the vocabulary related to each. Instruct each team to divvy up the three rock types, one per student. Each student will then become an "expert" on his/her type of rock by recording in the appropriate column of the chart the information from all lessons/activities related to his/her rock type. Have teams then review all the recorded information. Direct each team to select one student to report to the class on the team's findings. Other teams should add additional information while you record and modify the information as needed on a large three-column poster. Keep the poster on display in the classroom.

# Metamorphic Rocks Activities

Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Pre-Lesson Activity-

Complete the candy metamorphic rock activity and draw a picture of your final rock on the space below! Be sure to explain why it is now a metamorphic rock. What are the two things that are needed to create one in the rock cycle? If you only had one starburst candy and deformed it, what type of metamorphic rock would you have?



**Part 1: Modeling Metamorphism**

1. Obtain a ball of homemade clay (a mixture of 50% flour-salt modeling clay and 50% uncooked rice) that is approximately 8 centimeters in diameter.
2. What does the flour-salt modeling clay represent?
3. What do the rice grains represent?
4. Using a book or other hard, flat object, apply pressure to the top of the clay-rice mixture so that it flattens out to about 4 cm high. Observe the flattened block from both the top and the sides. What happened to the rice when pressure was placed on the ball?
5. What type of metamorphism occurs in this demonstration? Explain your answer.

**Part 2: Identification**

1. Divide the metamorphic rock samples into two categories—foliated and nonfoliated.
2. Describe the samples in each group.
3. Complete the following chart for each rock sample.

Sample Number	Foliated/ Nonfoliated	Color/Composition Description	Texture Description	Name
1				
2				
3				
4				
5				
6				
7				
8				
9				