Teacher Guide: Rock Classification

Learning Objectives

Students will …

- Learn how igneous, metamorphic, and sedimentary rocks form.
- Compare the characteristics of different rocks.
- Classify rocks based on their texture and other characteristics.
- Categorize igneous rocks as intrusive or extrusive.
- Identify where each type of rock formed.

Vocabulary

classify, extrusive igneous rock, foliation, fossil, igneous rock, intrusive igneous rock, metamorphic rock, mineral, sedimentary rock, strata, texture

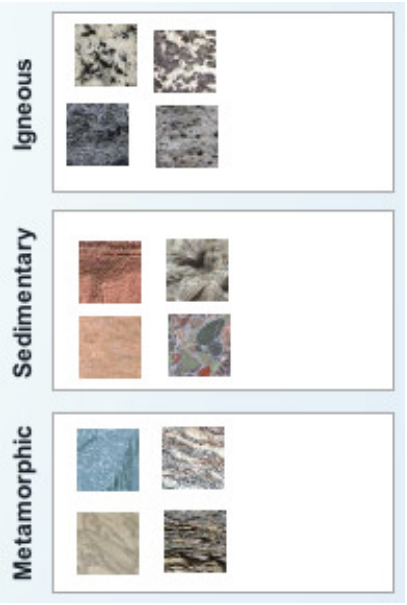
Lesson Overview

Based on how they formed, rocks are classified as igneous, sedimentary, or metamorphic. The texture and appearance of a rock give clues about how the rock was formed.

In the *Rock Classification* Gizmo™, students will classify 12 rocks based on their textures and other characteristics. Students also will determine the locations where each type of rock could have formed.

The Student Exploration sheet contains two activities:

- Activity A – Students classify rocks as igneous, sedimentary, or metamorphic.
- Activity B – Students determine where different types of rocks form and categorize igneous rocks as intrusive or extrusive.



Suggested Lesson Sequence

1. **Pre-Gizmo activity: Modeling rock formation** (15 – 30 minutes)
   Have students work in groups. Give each group several pieces of modeling clay in different colors. Instruct students to form tiny cubes of clay from each piece. The tiny cubes represent minerals. Tell students to gather all of the tiny cubes into one pile and firmly press them together, leaving no gaps. This represents an igneous rock. You can use a plastic knife to cut the "rock" open and view a cross-section.

   Next, have students begin pinching off small pieces of their "igneous rock." They should roll each piece into a small ball before setting it in a separate pile. This process represents the weathering, erosion, and deposition of sediments. Have students continue doing this until the model of the igneous rock has been completely "weathered." Students should then gently press the pile of "sediments" together. This models how sedimentary rock forms.

Finally, have students press the clay flat, fold the clay in half, and press it flat again. Tell students to repeat this a second time and then examine and describe how the appearance of the clay has changed. Explain that folding and pressing the clay models how metamorphic rock forms.

In addition to having students do this activity, you may want to have them explore the *Rock Cycle* Gizmo before completing the *Rock Classification* Gizmo.

2. **Prior to using the Gizmo** (10 – 15 minutes)
Before students are at the computers, pass out the Student Exploration sheets and ask students to complete the Prior Knowledge Questions. Discuss student answers as a class, but do not provide correct answers at this point. Afterwards, if possible, use a projector to introduce the Gizmo and demonstrate its basic operations. Demonstrate how to take a screenshot and paste the image into a blank document.

3. **Gizmo activities** (15 – 20 minutes per activity)
Assign students to computers. Students can work individually or in small groups. Ask students to work through the activities in the Student Exploration using the Gizmo. Alternatively, you can use a projector and do the Exploration as a teacher-led activity.

4. **Discussion questions** (15 – 30 minutes)
As students are working or just after they are done, discuss the following questions:
    - What are the differences between igneous, sedimentary, and metamorphic rocks?
    - How do you think fossils form in a sedimentary rock?
    - Why would the mineral crystals in an intrusive rock be larger than the minerals in an extrusive rock? [When magma cools slowly underground, large crystals have time to form. Lava erupting from a volcano cools quickly, so there is no time for large crystals for form.]
    - Do you think most of the rocks on Earth's surface would be igneous, sedimentary, or metamorphic? What about the rocks deep in Earth's crust? [Due to weathering, erosion, and deposition, approximately 75% of the rock on Earth's surface is sedimentary rock. However, deep in Earth's crust, approximately 95% of the rock is igneous or metamorphic.]
    - Most of the metamorphic rock on Earth's surface is found in mountain ranges. Why do you think this is the case?

5. **Follow-up activity: More classification practice** (20 – 30 minutes)
Bring a collection of igneous, sedimentary, and metamorphic rocks to class. Have students apply what they learned in the Gizmo to classify the rocks.

    Discuss each rock sample with students and have students describe the characteristics that led them to classify the rock as igneous, sedimentary, or metamorphic. Encourage students to use the correct vocabulary when talking about rock characteristics.

    If time allows, take students on a field trip to visit a local rock outcropping. Have students examine the local rock and identify what type of rock it is.

Scientific Background

Earth's crust is primarily made up of three types of rocks: igneous, sedimentary, and metamorphic. Igneous rock forms from cooling magma or lava. Sedimentary rock forms when small rocks, sediments, and other materials are compacted and cemented together. Metamorphic rock forms when a preexisting rock is changed by heat and/or pressure.

Rocks are classified and identified by their composition and texture. For example, igneous rocks are classified based on the size and composition of their crystals. *Intrusive igneous rocks* form from magma cooling deep underground. This slow cooling allows large crystals to form, resulting in a coarse texture. *Extrusive igneous rocks* form from lava cooling quickly on (or above) Earth's surface. This results in a fine-grained texture.

Igneous rocks are also classified by composition. Light-colored igneous rocks, called *felsic rocks,* are rich in elements such as silicon, aluminum, sodium, and potassium. Dark-colored igneous rocks, called *mafic rocks,* are rich in iron, magnesium, and calcium.

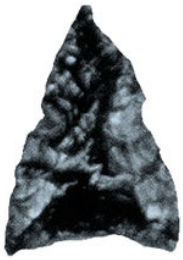
Sedimentary rocks are classified by their composition. *Clastic sedimentary rocks,* such as conglomerate and sandstone, are made up of fragments of other rocks and minerals. *Chemical sedimentary rocks,* such as halite and gypsum, form as minerals precipitate out of a solution. *Organic sedimentary rocks,* such as coal and limestone, form from the remains of organisms.

Metamorphic rocks are divided into two main groups, foliated and nonfoliated. *Foliated* rocks show patterns of layers or bands caused by the growth of crystals perpendicular to the direction of pressure. Examples of foliated rocks include slate, schist, and gneiss. *Nonfoliated* rocks such as marble and quartzite do not show a regular crystal pattern. The composition and crystal size of metamorphic rocks can indicate the levels of heat and pressure present when the rock formed. For example, garnets can indicate very high-pressure conditions during formation.

Technology Connection: Stone tools

The oldest evidence of human culture takes the form of stone tools. Archaeologists have found stone hammers, axes, and blades that are more than 1 million years old. Artifacts such as flint arrowheads and spears remain the classic example of human technology throughout the Stone Age.

Perhaps because of this, many people think of stone tools as "low-tech" and a thing of the past, but that is far from true. Stone tools are still in use today. For example, some of the finest blades in the world are made out of obsidian—a type of extrusive igneous rock. Obsidian blades are considered to be better than steel for many applications and are even used for surgical scalpels.



Obsidian arrowhead

Selected Web Resources

Igneous rock: http://vulcan.wr.usgs.gov/LivingWith/VolcanicPast/Notes/igneous_rocks.html
Sedimentary rock activities: http://www.coaleducation.org/lessons/sme/elem/6.htm
Metamorphic rock: http://www.windows.ucar.edu/tour/link=/earth/geology/meta_intro.html
Stone tools: http://geology.about.com/od/stone_age_tech/a/stonetools.htm

Related Gizmos:
Rock Cycle: http://www.explorelearning.com/gizmo/id?436
Mineral Identification: http://www.explorelearning.com/gizmo/id?640