

**Learning Objectives**

- 1) Know how the earth is structured. There are three major layers to the earth, the crust, mantle, and core.
  - a) The crust is the outermost layer and is composed of rock. It includes the ocean floor and mountains and their outcroppings.
  - b) Below the crust, exists the mantle, which extends about 1800 miles to the core. Although the temperature in the mantle is hot enough to melt rock, much of this layer remains solid because of the pressure.
  - c) The innermost layer is called the core; it is divided into two sections. The outer core is warmer than the mantle; consequently, this layer is completely melted. The inner core is even warmer, over 6,000 degrees Celsius. However, the intense pressure caused by the layers that surround it results in a solid mass. Some scientists believe that the whole core is made of nickel and iron.
- 2) Understand what rocks and minerals are and their relationship to each other. Rocks are the nonliving, solid earth materials that make up the earth. Minerals are the nonliving, solid earth materials that make up rocks. There are more than 4000 different types of minerals, of which twelve are common among the 600 types of rock.
- 3) Observe that minerals can be distinguished by their properties. These properties also determine a mineral's use.
  - a) **Color:** geologists determine the true color of a mineral by examining the powdery trail it leaves on a streak plate.
  - b) **Luster:** this property refers to their shininess, the way they reflect light.
  - c) **Cleavage:** minerals have a tendency to break into pieces with flat surfaces. The number of directions of these surfaces determines the cleavage.
  - d) **Hardness:** geologists measure how hard or soft a mineral is on the Mohs' hardness scale, the higher the number on the scale, the harder the mineral.

- 4) Realize rocks are formed in three different ways and are classified by the way they were formed.
  - a) **Igneous:** Minerals inside the earth melt and become molten rock, or magma. When this magma cools, it becomes igneous rock. There are two types of igneous rock. Extrusive rock is formed when magma exits the earth from volcanoes, cooling rapidly and forming only small crystals. Magma that becomes trapped in the earth and cools slowly while inside the earth is called intrusive igneous rock. The slow cooling results in larger crystals.
  - b) **Sedimentary:** As layers of sediment settle upon each other, pressure builds on the lower layers, forming solid sedimentary rock. The type of rock depends on the type of sediment of which it is composed. Sedimentary rock also can be formed by the evaporation of water containing soluble minerals.
  - c) **Metamorphic:** Metamorphic rocks are formed when one kind rock is changed into a new kind of rock. The rock changes as a result of the extreme heat from magma and the intense pressure from colliding plates.
- 5) Explain how weathering and erosion work to change the size and location of rocks. Weathering is the process of big rocks being broken down into smaller rocks. Acid rain and natural forces such as wind, rain, ice, snow, and plant root growth decompose the rocks. Once the rocks are broken down, they are moved to different locations through a process called erosion. Winds, waves, glaciers, and flowing water erode rocks.
- 6) Understand that rocks keep changing. These changes are observed in a cyclic pattern, known as the rock cycle, in which igneous, sedimentary, and metamorphic rocks can all become each other.

**Suggested Activities**

- 1) Start a rock and mineral collection: Have students bring in rocks and minerals that they have found as a class, test their properties and rank them on the

Mohs' scale. Discuss whether they are igneous, metamorphic, or sedimentary and how this is determined.

Mohs' Hardness Scale:

Diamond	10
Corundum	9
Topaz	8
Quartz	7
Orthoclase	6
Apatite	5
Fluorite	4
Calcite	3
Gypsum	2
Talc	1

- 2) Play the Rock Cycle Quiz Game: Divide class into small groups. Give each group a bell or some other noise-making device, which they will use to ring in when they come up with the correct answer. Make up questions like "If you take an igneous rock and break it down by weathering or erosion and little pieces build up in the bottom of a lake, it will form a..." Groups should ring in with their answer as soon as they know it.

**Vocabulary**

**Geologist** – someone who studies the earth and the materials that make up the earth

**Glacier** – a mass of moving ice, which erodes the land in its path

**Lava** – magma, or melted rock, that reaches the earth's surface

**Outcropping** – the part of a rock formation that projects from the surface

**Sediment** – a material such as sand, silt, and organic matter that settles in water or is deposited through erosion