

# Identifying Minerals

Grade 4

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**Science Content Standards:** Grade 4, 4b— *Students know* how to identify common rock forming minerals (including quartz, calcite, feldspar, mica, and hornblende) and ore minerals by using a table of diagnostic properties.

**Lesson Concept:** Mohs hardness scale is used to help identify minerals.

## Conceptual Flow:

- ▶ Rocks can be grouped by observable properties.
  - Rocks are made up of different minerals.
  - Types of rocks are determined by how they are formed.
- ▶ Minerals are formed through process of the Earth.
  - Minerals have different properties.
  - Minerals can be identified by their properties, such as hardness, color, and luster.
  - Different minerals have different hardness, which can be tested. Minerals can be identified by their hardness using Mohs scale.
- ▶ There are many cycles on Earth.
  - Rocks change through the Earth's processes.
- ▶ Rocks have many uses for humans.

## Teacher Background:

Geologists describe and identify minerals according to a set of properties, such as hardness, cleavage, color, and streak. One way to determine hardness is by using the Mohs hardness scale, which refers to materials' relative ability to scratch other materials or be scratched by them. In 1812, Fredrich Mohs (1773-1839), a German mineralogist, devised the mineral hardness scale by selecting ten minerals that were common or readily available. This hardness scale demonstrates the ability of a harder material to scratch a softer material. (Adapted and excerpted from the *Science Framework for California Public Schools: Kindergarten Through Grade Twelve*.)

**Friedrich Mohs (1773 to 1839)** was a German geologist well known for creating the Mohs Hardness Scale. Mohs studied chemistry, mathematics, and physics at the University of Halle/Saale and at the Mining Academy in Freiberg under Abraham Werner. He moved to Austria in 1802 where he worked to identify minerals in a private collection belonging to a banker. During this task, he started sorting and annotating the minerals by the physical characteristics. His preference for sorting by physical attributes (e.g., shape, cleavage, hardness, and specific weight), put him in conflict with most other mineralogists of his time who used chemical composition for identification.

Mohs hardness scale, created in 1812, refers to materials' relative ability to scratch other materials or be scratched by them. This hardness scale demonstrates the ability of a harder material to scratch a softer material. In general, a higher number will scratch all lower numbers. For example, a mineral with a Mohs hardness of 6 will scratch any mineral of the same hardness or less. It can be scratched itself by a mineral with the same or higher number.

The ten minerals on Mohs Hardness Scale are: Talc, Gypsum, Calcite, Fluorite, Apatite, Feldspar, Quartz, Topaz, Corundum, and Diamond

## **Materials Needed for the Lesson:**

### Teacher Materials

- Transparency of Student Handout, "Testing the Hardness of Minerals"
- Gypsum (to model hardness test)

### Student Hands-on Materials

- (Obtain the minerals and glass plates from a science materials supply store.)
- Hand lenses
- Tools for testing ("copper" pennies, iron nails)
- 5 sets of mineral samples for each group of three to four, such as pyrite, hornblende, quartz, calcite, fluorite, hematite, and graphite

**Note:** Samples of minerals need to be at least 1 inch in size. Samples need to be lettered, not numbered as it gets confusing when students start talking about the numbering on Mohs hardness scale.

### Student Handouts

- "Testing the Hardness of Minerals"
- "Expanded Mohs Hardness Scale" (Note that the original Mohs Hardness Scale has only 10 minerals and those appear on the expanded chart in bold; additional minerals were added to the chart to assist with this lesson.)

### 5E Lesson: Title of Lesson

Teacher Does	Student Does	Concept
<p><b>ENGAGE:</b></p> <ul style="list-style-type: none"> <li>▶ <i>Today we are going to begin our investigation of minerals. You will be given a set of mineral samples and a hand lens. What are you able to observe about these minerals?</i></li> </ul> <p>Distribute mineral samples and hand lenses.</p> <ul style="list-style-type: none"> <li>▶ <i>Record observations. (5 min.)</i></li> </ul> <p>Have students share some of their observations and record on the board.</p> <ul style="list-style-type: none"> <li>▶ <i>Minerals have many properties that geologists use to distinguish types of minerals. One of those properties is hardness. You will now have an opportunity to explore the hardness of several minerals.</i></li> </ul> <p>Be sure to give the “scientific definition” of a scratch</p> <ul style="list-style-type: none"> <li>▶ <i>A scratch leaves a visible mark on the item being scratched; but if color of the tool doing the scratching is left behind, that is NOT a scratch.</i></li> </ul> <p>Display transparency of “Testing for Hardness of Minerals”. Explain that:</p> <ul style="list-style-type: none"> <li>▶ <i>You will scratch the given mineral with your fingernail and if your fingernail scratches the mineral then put an “X” in the box marked fingernail. The numbers under fingernail gives the hardness number of the mineral. Once you put an “X” in a box, go to the next mineral. Scratch that mineral with your fingernail, if your fingernail does not scratch the mineral, go to the next tool (copper penny) and see if the penny scratches the mineral. If yes, put an “X” in the box, and you are done, if not, go to the next tool (iron nail).</i></li> </ul> <p>Using gypsum, model how to do the hardness tests and how to fill in observation sheet. (Do as a “think aloud.”)</p>	<p><b>Expected Student Response (ESR):</b> Color, size</p> <p><b>ESR:</b> They are different colors; some have sparkly, some have streaks, they have bumps, some have more than one color.</p> <p>Observe teacher.</p>	<p>Minerals have different properties.</p>

<p><b><u>EXPLORE:</u></b>                  Distribute tools for testing and “Testing the Hardness of Minerals”.                  ▶ <i>Together as a class, everyone does mineral A and fills in observations sheet; do the same with B. Now do C &amp; D on your own with your partner.</i>                  (Do each mineral together as a class)                  (10 min.)                  Group share for mineral C and D.</p>	<p>Do hardness tests on the four minerals, filling in the “Testing the Hardness of Minerals” chart.</p>	<p>Different minerals have different hardness, which can be tested.</p>
<p><b><u>EXPLAIN:</u></b>                  Provide copies of the “Expanded Mohs Hardness Scale” to students and share information about Mohs (see “Teacher Background”).                  Distribute an “unknown mystery” mineral.                  ▶ <i>Do your tests with the “unknown” mineral and then see if you can determine the name of the mineral using the Mohs Hardness Scale.</i></p>	<p>Test “unknown mystery” mineral; then identify the mineral.</p>	<p>Minerals can be identified by their hardness using Mohs Hardness Scale.</p>
<p><b><u>EXTEND:</u></b>                  Further explore properties of minerals by observing and recording the luster and color of each sample mineral. Conduct a streak test on each mineral.</p>		

**Input Question:** What are you able to observe about these minerals? (in Engage section)

**Process Question:** What can you infer about the identity of the unknown mineral?

**Output Question:** If you have different Mohs hardness scale readings from several minerals, what does that tell you about the minerals?

**STUDENT HANDOUT**

**Testing the Hardness of Minerals**

If the tool scratches the mineral, put an "X" in the box.

Mineral Letter	Tool: Fingernail	Tool: "Copper" Penny	Tool: Iron Nail	Not scratched	Name of Mineral
	Hardness 1, 2	Hardness 3	Hardness 4, 5, 6	Hardness 7	
A					
B					
C					
D					
Unknown Mystery Mineral					

**STUDENT HANDOUT**

**Expanded Mohs Hardness Scale**

<b>Mineral</b>	<b>Hardness</b>	
<b>Talc</b>	1	
Graphite	1 - 2	
<b>Gypsum</b>	2	
Mica	2 – 2.5	
		Fingernail (2.5)
<b>Calcite</b>	3	
		Penny (3.2)
<b>Fluorite</b>	4	
<b>Apatite</b>	5	
Hornblende	5 - 6	
		Glass (5.5)
Magnetite	6	
<b>Feldspar</b>	6	
Pyrite	6 – 6.5	
		Iron nail (6.5)
<b>Quartz</b>	7	
<b>Topaz</b>	8	
<b>Corundum</b>	9	
<b>Diamond</b>	10	