

# Mineral Properties

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:** Minerals can be identified by their properties.

## Conceptual Flow:

- » A mineral is a solid found in nature that has a definite chemical make-up.
  - Minerals make-up rocks. A mineral is an ingredient in a rock.
  - A property of a mineral is a trait or characteristic.
    - The properties of minerals reflect the processes that form them.
    - Minerals have observable properties such as color, streak, hardness, and luster.
    - Minerals can be identified by their properties. Properties that are used to identify minerals are hardness, luster, color, streak, and streak color.

## Teacher Background:

Geologists describe and identify minerals according to a set of properties, such as hardness, cleavage, color, and streak. Hardness is determined by the Mohs hardness scale, which refers to materials' relative ability to scratch other materials or be scratched by them. A mineral's hardness is indicated by H. The hardness of window glass (about 5.5 on Mohs scale) is indicated by G. If  $H > G$ , then the mineral is considered hard and scratches glass. If  $H < G$ , the mineral is considered soft and does NOT scratch glass.

Luster describes how brilliant or dull the mineral is. Metallic is one term used to describe luster. Streak is found by rubbing the mineral across a streak plate which is made of a hard, unglazed porcelain material. The mineral's streak is the color of the powder left behind on the streak plate. Sometimes the streak and color of minerals are the same. Or the streak may be quite different from the color; for example, the silver-grey mineral hematite leaves a red-brown streak.

Cleavage describes the way a mineral breaks that is a result of the mineral's molecular structure. Many minerals break along flat planes, or cleavages—some in only one direction, others in two directions, and some in three or more directions.

The identification process requires matching the observed properties of a sample with those noted on a diagnostic table of properties. This standard focuses on only a few of the most common rock-forming minerals (e.g., quartz, calcite, feldspar, mica, hornblende) as well as some important ores, such as galena (lead) and hematite (iron). The colorful ores of copper may also be added to this list. (Adapted from and excerpted from the *Science Framework for California Public Schools: Kindergarten Through Grade Twelve*.)

See “Expanded Mohs Hardness Scale” at the end of this lesson.

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

### Teacher Materials

- Transparency: “Mineral Properties”
- “Mineral Properties Reference Sheet”
- One metallic mineral, such as magnetite (or limonite, or galena)
- One non-metallic mineral, such as mica or feldspar
- “Expanded Mohs Hardness Scale” (for teacher reference) (Note that original Mohs Hardness Scale has only 10 minerals and those are on the chart in bold)

### Student Hands-on Materials

(Obtain the minerals, glass plates, and streak plates from a science materials supply store.)

For each group of students:

- Rocks and minerals (six minerals: (1) hornblende, (2) calcite, (3) fluorite, (4) quartz, (5) pyrite, and (6) graphite)
- Glass plates
- Streak plates
- Chart paper

### Student Handouts

- “Exploring Mineral Properties” (one per student)
- “Mineral Properties Reference Sheet” (one per student)

## 5E Lesson: Mineral Properties

Teacher Does	Student Does	Concept
<p><b><u>ENGAGE:</u></b></p> <p>Distribute a group of specimens (rocks and minerals) (mixed) to each group of students. (Be sure to have a special numbering system to differentiate the rocks and minerals for teacher ease in collection of the rocks).</p> <ul style="list-style-type: none"> <li>▶ <i>Sort the specimens into two groups: one rocks and one minerals onto the chart paper. (5 min). Discuss with your group your rule for sorting the specimens. Write the rule at the bottom of the chart paper. (2 min.)</i></li> <li>▶ <i>Everyone stand up and we are going to walk around the room clockwise to see how all the other groups sorted their specimens. (3 min. to walk around the room and review; be on task, keep focused)</i></li> <li>▶ <i>Return to your seats.</i></li> </ul> <p>Ask each table to share one difference they noticed.</p> <p>Collect the rocks and leave the minerals on the tables.</p>	<p>Sort the specimens.</p> <p>Write the rule.</p> <p><b>Expected Student Response (ESR):</b> rocks are bigger and harder; minerals are shiny and prettier. Rocks are more than one color; minerals are one color. Rocks are bumpy and minerals are smooth.</p> <p>Walk around and review the group sorts.</p> <p>Return to seats.</p>	<p>A mineral is an ingredient of a rock.</p> <p>A property of a mineral is a trait or characteristic.</p> <p>A mineral is a solid found in nature that has a definite chemical make-up.</p>
<p><b><u>EXPLORE:</u></b></p> <ul style="list-style-type: none"> <li>▶ <i>We have looked at rocks and minerals. So today our focus is going to be minerals. Minerals make up rocks.</i></li> <li>▶ <i>Each group will have six minerals at their table. Each of you will have: an “Exploring Mineral Properties” sheet that you will individually complete. Later you will be given a reference sheet to help you identify the minerals.</i></li> </ul> <p>Place the transparency of “Mineral Properties” on the overhead. Fill out the sheet on the overhead while demonstrating how to complete various tests. Show two samples: one metallic (such as magnetite) and one non-metallic mineral (such as mica) and explain that the luster of the mineral allows us to identify whether it is metallic or nonmetallic. Show two samples and discuss the color. Conduct the streak test with the metallic</p>		<p>Minerals have observable properties such as color, streak, hardness, and luster.</p>

Teacher Does	Student Does	Concept
<p>mineral and show students. Using one of the samples, show how to scratch glass. The scratch test is done by taking the mineral and firmly scratching it on the glass plate. Make certain that there is an actual scratch mark on the glass and not just dust from the mineral before deciding that it is harder than glass. Explain H&gt;G or H&lt;G. Note: H&gt;G means that the mineral’s hardness is harder than glass; i.e., it scratches glass. H&lt;G means the mineral’s hardness is softer than glass; i.e., it does not scratch glass. Glass has the hardness of 5.5. Mica’s hardness is 2-2.5; magnetite is a 6.</p> <p>Approx: 30 minutes</p> <p>Distribute materials and “Exploring Mineral Properties” sheet.</p> <p>▶ <i>The “special” column is for any extra notes you might want to include. Leave mineral name blank. When you are finished, hold up the worksheet.</i></p> <p>After students complete the mineral property sheets, give them the “Mineral Properties Reference Sheet.”</p>	<p>Students will identify numbered minerals by luster, color, streak, and hardness.</p> <p>Students can work in groups but should complete their own worksheets.</p> <p>Students hold up completed worksheets.</p> <p>Using the Mineral Properties Reference Sheet, students identify the minerals.</p>	
<p><b><u>EXPLAIN:</u></b></p> <p>▶ <i>In your science journal or on a sheet of paper or on back of the “Exploring Mineral Properties” paper answer this question: What are four properties that can be used to identify minerals?</i></p>	<p>Students identify the names of minerals by using data gathered during the “Explore”.</p> <p><b>ESR:</b> Minerals can be identified by color, streak, hardness, and luster.</p>	<p>Minerals can be identified by their properties.</p>
<p><b><u>EXTEND:</u></b></p> <p>▶ <i>Since minerals can be identified by their properties, how can you apply this rule to other forms of matter?</i></p>		

**Input Question:** What are four properties that can be used to identify minerals? (in Explain section)

**Process Question:** What is your rule for sorting the mineral specimens? (in Engage section)

**Output Question:** Since minerals can be identified by their properties, how can you apply this rule to other forms of matter? (in Extend section)

## Transparency

# Mineral Properties

<b>Number</b>	<b>Luster</b> metallic or non-metallic	<b>Color</b> What color is the mineral?	<b>Streak</b> What color is on the streak plate?	<b>Hardness</b> Harder than glass or softer than glass?	<b>Special</b>	<b>Mineral Name</b>

**STUDENT HANDOUT**

**Exploring Mineral Properties**

<b>Number</b>	<b>Luster</b> metallic or non-metallic	<b>Color</b> What color is the mineral?	<b>Streak</b> What color is on the streak plate?	<b>Hardness</b> Harder than glass or softer than glass?	<b>Special</b>	<b>Mineral Name</b>
<b>1</b>						
<b>2</b>						
<b>3</b>						
<b>4</b>						
<b>5</b>						
<b>6</b>						

**STUDENT HANDOUT**

**Mineral Properties Reference Sheet**

<b>Number</b>	<b>Luster</b> metallic or non-metallic	<b>Color</b> What color is the mineral?	<b>Streak</b> What color is on the streak plate?	<b>Hardness</b> Harder than glass or softer than glass?	<b>Special</b>	<b>Mineral Name</b>
<b>1</b>	Non metallic	Black or green or white	none	H > G (harder than glass)		hornblende
<b>2</b>	Non metallic	Colorless or white or yellow	none	H < G (softer than glass; glass is harder)		calcite
<b>3</b>	Non metallic	Purple or green or yellow	none	H < G (softer than glass)		fluorite
<b>4</b>	Non metallic	Colorless or white or pink or smoky or purple	none	H > G (harder than glass)		quartz
<b>5</b>	Metallic	Brassy yellow	black	H > G (harder than glass)	Called "Fool's gold"	pyrite
<b>6</b>	Metallic	Steel gray	Black or gray	H < G (softer than glass)	Smudges paper, feels greasy	graphite

## Expanded Mohs Hardness Scale

Mineral	Hardness	
<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	