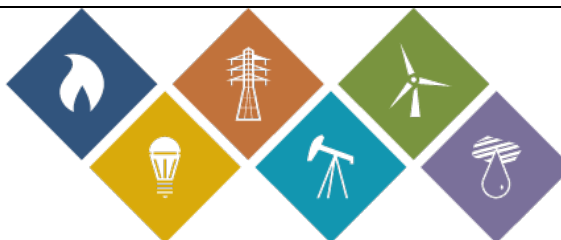


GOVERNOR'S OFFICE OF
ENERGY DEVELOPMENT

Advancing Utah's Energy Future



Patterns in Minerals

Grade/Subject: 5th Science

Strand/Standard SEEd 5.2.2 Ask questions to plan and carry out investigations to identify substances based on patterns of their properties. Emphasize using properties to identify substances. Examples of properties could include color, hardness, conductivity, solubility, or a response to magnetic forces. Examples of substances could include powders, metals, minerals, or liquids. (PS1.A)

Lesson Performance Expectations:

- Students will plan and carry out an investigation on minerals to look for patterns associated with their color, hardness, streak color and response to magnetism.
- Students will be able to identify the minerals based on the investigation.

Materials:

- [Mineral Kits](#) - Each group of 4-6 students needs to have one kit.
- Suggested minerals:
 - Fluorite
 - Feldspar
 - Hematite
 - Pyrite
 - Quartz
 - Calcite
 - Mica: Muscovite
 - Magnetite
 - Gypsum
 - Talc
 - Pyrolusite
 - Mica: Biotite
 - Graphite
 - Gypsum: Satin Spar
 - Gypsum: Selenite
- One for each group
 - Magnets
 - Magnifying Glass
 - Nail
 - Ceramic scratch plate
 - Copper penny (optional)
 - Steel file (optional)

Time: 1-60 minute period

Teacher Background Information:

Minerals are naturally occurring inorganic, pure substances. Minerals have a very orderly structure that can often be seen in the form of crystals. There are more than 3000 known minerals on Earth. Rocks are made up of combinations of different minerals. Geologists categorize minerals based on certain properties: chemical composition, color, luster, density, crystal form, cleavage/fracture, tenacity, hardness and transparency. Minerals have many different uses that are usually dependent on their properties.

Utah is rich in many minerals that make life as we know it possible. Copper, gold, silver, uranium, iron, lead, zinc, molybdenum, phosphate, salt, potash, beryllium and gilsonite top the list. The world's largest known beryllium resource is in Juab County, and the world's largest open-pit copper mine is at Bingham Canyon just southwest of Salt Lake City.

[This](#) link has a list of more than these basic 4 ways to identify minerals.

Ways to Test Minerals

Type of Test	Procedure
Color	<ul style="list-style-type: none"> ● Examine the mineral with all the lights on in the room. ● Many minerals have multiple colors. ● Record the color.
Streak	<ul style="list-style-type: none"> ● Rub the mineral across a ceramic plate. ● The mineral may leave a colored streak of powder. ● Record the color of the powder. <p>*If the mineral does not leave a streak, it has hardness greater than 6.5.</p>
Hardness	<ul style="list-style-type: none"> ● Hold the mineral firmly and drag the nail across it. ● Use your magnifying glass to look for a scratch. ● The nail has a hardness of 5. ● If the mineral shows a scratch from the nail, it has a hardness less than 5. ● Other materials you can use to test hardness: <ul style="list-style-type: none"> ○ Copper penny - hardness level 3 ○ Fingernail - hardness level 2.5 ○ Steel file - hardness level 6
Magnetism	<ul style="list-style-type: none"> ● Hold a magnet to the mineral. ● If the mineral is attracted to the magnet, it has magnetic properties.

Student Background Knowledge:

- Students understand that everything is made of matter and that matter has specific properties by which it can be identified. Students should know that substances can be identified by looking at patterns of their properties.

Teacher Step by Step: A 3-d lesson should insist students do the thinking. Provide time and space for the students to experience the phenomenon and ask questions. The student sheet provided below provides guidance but is only an example of how students might respond.

1. **Introduce *Phenomenon*:**

- a. Show students the minerals in the mineral kit and the following image:



- b. Ask students for questions that they have about the phenomenon. Students record them on their student sheet.
 - c. Guiding questions for the lesson: How do we identify minerals?
2. Students will conduct an investigation to identify the minerals in the mineral kit:
- a. **Plan an Investigation**
 - i. Handout the Student Sheet and tell students they will be conducting tests to look for patterns in the minerals.
 - ii. Allow students to look at the minerals (these should be numbered, but not labeled with the name of the mineral) and supplies given to them and plan a way to look for patterns in the minerals that will help them identify each mineral.
 - iii. Once students have decided the patterns they will look for and test, they will label it at the top of their charts. Students may test many different properties of their minerals, some should include, "hardness, color, streak or magnetism".
 - b. **Carry out an Investigation**
 - i. Allow 15-20 minutes for students to test the properties of the minerals.
 - c. **Communicate Information**
 - i. Have students share the information they have discovered about the minerals.
 - ii. Give students the Mineral Identification Key. Students should use the Identification key to identify the minerals. If needed, allow time for students to conduct further tests for identification.
 - iii. After students have identified as many minerals as possible, conduct a class survey by asking each group to hold up the mineral as you call them by name. (For example, the teacher would say, "Hold up the mineral you identified as calcite.", and one person in each group would hold up the mineral they had identified as calcite.)

Assessment of Student Learning: Each Group will be given an unknown mineral. They will use their charts to identify the mineral. Students will successfully identify the minerals in the kit by conducting the tests accurately.

Standardized Test Preparation:

Patterns in Minerals

1. Two white minerals are observed to have the same streak color. Can you conclude that the two samples are the same?
 - a. Yes, two characteristics are enough to identify a mineral.
 - b. Yes, streak is a very important mineral test.

- c. No, more tests need to be done.*
- d. No, streak and color are not ways to identify minerals.

2. Which of the following tests would help you find out if a diamond in a ring was a real diamond or a fake?

- a. scratch it across a glass*
- b. look closely at the cut
- c. feel it with your fingers
- d. Wear it and see if it sparkles

3. What patterns help to identify minerals? Choose all that apply.

- a. Streak*
- b. Hardness*
- c. Luster*
- d. Weight



Mineral A



Mineral B

4. What pattern do the two minerals have in common?

- a. Color
- b. Shape
- c. Crystals
- d. Magnetism

Extension of lesson and Career Connections:

- Have students research and write an essay on how minerals are used in their daily routines. Everyday objects are made with mined materials. Utah is an abundant source of many of these required minerals. Find a manufacturer who uses one or more minerals mined in Utah to create a product we use daily. Research which mineral(s) is/are used how much of that mineral is used, how much it costs, and any jobs that are related to the extraction, manufacture and sale of that item.

Patterns in Minerals

Name _____

Observe the phenomenon. Write down the questions that come to mind while observing the phenomenon.

- 1.
- 2.
- 3.

Explain the patterns you will test and how it will help you identify the mineral

Record your observations from your investigation on the following table.
You will need to conduct multiple tests to identify each mineral.

Mineral #	test	test	test	test
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				

14				
15				

These pages will be given to students after their initial tests are completed to check their identification.

Mineral Identification Key

Number of Mineral	Name of Mineral	Color	Streak	Hardness	Magnetic
	Gypsum: Selenite	Colorless	White	2	No
	Gypsum: Satin Spar	White, gray	White	2	No
	Gypsum: Alabaster	White, gray, yellow	White	2	No
	Talc	White, green, gray	White	1	No
	Quartz: Milky	Colorless, white	None	7	No
	Pyrite	Pale brass yellow	Brown	6-6.5	No
	Fluorite	Green, yellow, purple	White	4	No
	Feldspar: Microcline	White, red, green	White	6	No
	Mica: Muscovite	Colorless, yellow, brown	Colorless	2-2.5	No
	Pyrolusite	Black, steel gray	Black	2-6.5	No
	Mica: Biotite	Green, brown, black	Colorless	2.5-3	No
	Graphite	Black	Black	1-2	No

	Magnetite	Iron-black	Black	6	Yes
	Hematite	Red, Brown, black	Dark Red	5.5-6.5	Yes, when heated
	Calcite	White, yellow, brown, blue	White	4	No

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Magnetism	<ul style="list-style-type: none"> ● Hold a magnet to the mineral. ● If the mineral is attracted to the magnet, it has magnetic properties.

Other properties and identifiable patterns of minerals: Geologists categorize minerals based on certain properties: chemical composition, luster, density, crystal form, cleavage/fracture, tenacity, and transparency. [This](#) link has more information.