

Mighty Minerals

Grade Level: 7 – 8

Purpose: To investigate the physical and chemical characteristics of the minerals in Illinois and their uses.

Suggested Goals: Students will be able to perform basic identification tests to describe the physical and chemical characteristics of minerals. In addition, students will be able to identify important uses for common minerals in Illinois.

Objectives: As a result of this lesson, students will be able to:

1. List the five characteristics of a mineral.
2. Demonstrate the proper procedure for a variety of mineral identification tests (hardness, streak, magnetism, etc.)
3. Identify common minerals based on their appearance and data collected from identification tests.
4. List important uses for common minerals.

Time Required: 2 - 3 class periods for each of the two projects.

Group Size: Individually or teams of 2-3 students. The report should be completed individually.

Background: What is a mineral? Minerals are defined as solid, inorganic substances that occur naturally and have a definite atomic structure and chemical composition. They exhibit several properties that are useful for identification. Color, crystal shape, hardness, and luster are a few of the properties that can be used to determine a mineral's identify. During this lab, students will learn about the five characteristics of a mineral and conduct tests to identify minerals that are found in Illinois.

Materials:

Classroom display of minerals

Access to the ISM Geology Online GeoGallery of mineral photos and information

Safety goggles

Identification guides (such as Golden Guide: Rocks & Minerals)

Copies of the lesson worksheets

 “What is a mineral?” Worksheet

 Mineral ID Guide

 Mineral ID Chart

Optional: Ultraviolet lamp

For each group:

Testing set of 10-12 minerals*

Streak plate

Glass plate

Steel nail
Penny
Vinegar (or weak HCl acid)
Magnet

Preparation: Try to include as many of the minerals featured in the ISM Geology Online GeoGallery collection as possible. Suggested Illinois minerals include gypsum, fluorite, galena, pyrite, calcite, mica, dolomite, crystalline quartz, sphalerite, and hematite. Magnetite, barite, graphite, or talc might also be considered for this lab. [Kits can be ordered from the Illinois State Geological Survey.]

Use a small plastic container, such as an old plastic butter tub, to hold all the testing supplies for each group. You might also consider purchasing several small plastic *tackle* boxes with individual compartments to keep the mineral samples organized. You can also use egg cartons for this purpose.

To organize the testing sets of minerals, place a small dot of white correction fluid (or white paint) on each mineral specimen. Use a permanent marker to label each specimen using the letters A through L. If you are using plastic containers or egg cartons, write the letter in each compartment to help students organize the samples.

You may want to demonstrate the proper procedure for conducting the hardness test. For example, ask the students to divide the samples into two groups, such as minerals harder than 5.6 or 6 and those that are softer. Demonstrate how to use the objects (fingernail, coin, glass plate, and nail) and Mohs Scale of Hardness to determine the hardness of a mineral sample. If the students will be using the acid test, discuss proper safety procedures and distribute safety goggles.

Skills: Students will need to be able to follow directions to perform the mineral identification tests and have an understanding of basic safety rules. Students will also need to be able to use identification guides or online resources for the Mighty Mineral report.

Procedure:

Part I: Exploring Mineral Identification

1. Distribute copies of the “What is a mineral?” worksheet. Discuss the five characteristics of a mineral to help the students complete the top section. Allow time for the students to complete the bottom portion. They should use the five characteristics of a mineral to determine which items are minerals and circle those items. After they have finished, discuss the answers and have the students provide reasons for excluding the items that are not minerals.
2. Distribute the testing sets of minerals and ask the students to classify the specimens into 2 to 4 groups. After the groups have sorted the samples, ask the students, “How did you classify the minerals?” Discuss the criteria that were used to sort the samples and make a list on the chalkboard. Responses may include

color, shape, size, and texture as well as other physical characteristics of the specimens.

3. Explain that scientists use a variety of tests to identify minerals. Distribute the Mighty Minerals ID Guide. Compare the criteria used by the students in #2 to the tests listed on the Mineral ID Guide.
4. Distribute the testing equipment and Mineral ID Charts. Allow time for students to practice testing the minerals in the testing sets.
5. Once the students are familiar with the testing process, allow time for them to test all the specimens and record the data on the Mighty Mineral ID Chart worksheet. You will need to monitor the groups and provide assistance when needed.
6. After students have completed all the mineral identification tests, have them use the collected data and identification guides to identify the minerals. You might consider providing a list of minerals in the testing sets if the students experience a lot of difficulty with the identification process.
7. Have students wash their hands and clean up the lab area. Provide time for the students to discuss their results with their classmates before revealing the names of the minerals.

Part II: Applying the Knowledge

1. Once students are familiar with the properties used for mineral identification, allow each student to *adopt* a mineral found in the state and complete the Mighty Mineral project, which consists of an advertisement and a data page.
2. Allow students to use printed or online reference materials to complete the data page. If mineral samples are available, students may also perform tests to obtain the data.
3. Students also need to create an advertisement with a cartoon character or superhero and slogan that highlights one or more important uses for their mineral. For example, fluorite might be represented by a superhero tooth (complete with a cape) and the slogan, “Mighty Fluority saves the day by protecting the world from tooth decay!”
4. Students should staple the advertisement to the front of the data page. Create a display on “Mighty Minerals” in the classroom or hallway.

Extensions:

1. Fluorite is the state mineral of Illinois. Have your students contact geological surveys in other states to request information and samples of their state mineral. Use the donated specimens to create a “Minerals of the USA” classroom display. Visit <http://www.isgs.uiuc.edu/us-map/usa-surveys.html> for a listing of state geological survey websites.
2. Have the students research the chemical composition of their *adopted* minerals or the minerals in the testing sets. Make a master list of the elements and chart the number of times each one appears in a chemical formula. Investigate mineral groups, such as silicates, oxides, carbonates, etc., and relate to the chemical composition of the *adopted* minerals.
3. Use the Mighty Mineral reports to create a scavenger hunt exploring the uses of

the state minerals. Develop one to two questions or riddles about each mineral and display the projects in the classroom or hallway. Allow time for the students to find the answers using the information in the report pages.

4. Challenge the students to create a dichotomous key or other method of classification for the testing set of minerals. Students should use the data on the Mineral ID Chart to develop the key and incorporate at least 5 of the specimens in the testing kit. Allow groups to trade keys when they are finished and try to identify the minerals.

Assessment: Assessment for this activity should be based on the student's ability to perform the mineral identification tests, make accurate measurements, and record collected data. Providing samples of common minerals for the students to group according to a specific property, such as hardness, or identify in a lab practical situation may be used as a performance assessment. Evaluation of the Mighty Mineral report (advertisement and data sheet) should also be considered to determine if the objectives have been met.

Print Resources:

Educational Series 5: Guide to Rocks and Minerals of Illinois

Published by Illinois State Geological Survey, 1971

Ordering information can be found at:

<http://www.isgs.uiuc.edu/servs/pubs/edshome.htm>

Golden Guide: Rocks and Minerals

ISBN #0-307-24499-7

Eyewitness Handbooks: Rocks and Minerals

By Chris Pellant, ISBN# 1-56458-033-4

Web Resources:

ISM Geology Online GeoGallery

<http://geologyonline.museum.state.il.us/geogallery>

The Science Spot: Earth Science Links for Kids

<http://sciencespot.net/Pages/kdzethsci3.html>

Illinois State Geological Survey web site -

links to state geological surveys

<http://www.isgs.uiuc.edu/us-map/usa-surveys.html>

Illinois State Board of Education Goals and Standards:

11.A.3c : Collect and record data accurately using consistent measuring and recording techniques and media.

11.A.3f : Interpret and represent results of analysis to produce findings.

12.E.3a : Analyze and explain large-scale dynamic forces, events and processes that affect the Earth's land, water and atmospheric systems.

12.E.3b : Describe interactions between solid earth, oceans, atmosphere and organisms that have resulted in ongoing changes of Earth.



Name _____

What is a mineral?

- 1) A mineral must occur _____ in the Earth's crust. It cannot be a manufactured or manmade item.
- 2) Most minerals are _____ rather than organic. Organic materials are formed from _____ things. Most minerals are made from materials that were never living things.
- 3) A mineral is usually always a _____. Minerals are rarely liquids or gases.
- 4) A mineral has a _____ _____. Minerals may be made of a single element. Some minerals are formed by compounds, or combinations of two or more elements.
- 5) A mineral's atoms are arranged in a definite _____. This repeating pattern is called a _____.

Circle the items below that meet all five characteristics of a mineral.

Halite(salt)

Diamond

Ice

Steel

Coal

Sugar

Gold

Graphite

Silver

Cement

Wood

Copper

Oxygen

Sulfur

Glass



What is a mineral?

- 1) A mineral must occur **naturally** in the Earth's crust. It cannot be a manufactured or manmade item.
- 2) A mineral usually must be **inorganic** rather than organic. Organic materials are formed from **living** things. Most minerals are made from materials that were never living things.
- 3) A mineral is usually always a **solid**. Minerals rarely are liquids or gases.
- 4) A mineral has a **definite chemical composition**. Minerals may be made of a single element. Some minerals are formed by compounds, or combinations of two or more elements.
- 5) A mineral's atoms are arranged in a definite **pattern**. This repeating pattern is called a **crystal**.

Circle the items below that meet all five characteristics of a mineral.

Halite(salt)	Diamond	Ice
Steel	Coal	Sugar
Gold	Graphite	Silver
Cement	Wood	Copper
Oxygen	Sulfur	Glass

Possible reasons for non-minerals:

Steel - manmade, no crystals

Cement - manmade

Oxygen - gas

Coal - organic

Wood - organic

Sugar - organic

Glass - no crystals

Ice may not be normally thought of as a mineral; however, it meets all the characteristics.



Mineral ID Guide

What tests can you use to identify a mineral?

Color - Describe the color of your mineral. Color is one of the least reliable tests for identifying a mineral sample, but may provide some clues depending on the specimen.

Streak - The streak is representative of the color of the mineral when it is ground into a fine powder and may not be the same as the color of the mineral. To obtain a streak, rub the mineral across the white plate provided in your testing kit. Streak may be described as colorless, white, black, gray, red, etc.
CAUTION: The streak plate has a hardness of seven. Using minerals harder than seven will damage the streak plate.

Hardness - Mohs Scale of Hardness is commonly used to determine the hardness of a mineral ranging from 1 for the softest mineral to 10 for the hardest mineral. To determine a mineral's hardness, try scratching the mineral with an object (fingernail, coin, nail, or piece of glass) or scratching an object with a mineral sample. Which one is harder - the object or the mineral?
 Examples: If a mineral is scratched by a fingernail, it would be softer than 2.5. If the mineral scratches a penny, it would be harder than a 3.

#	Mineral	Common Objects
1	Talc	Easily scratched by fingernail
2	Gypsum	Scratched by fingernail (2.5)
3	Calcite	Very easily scratched by nail (5.5-6); will not scratch penny (3)
4	Fluorite	Easily scratched by nail
5	Apatite	Difficult to scratch with nail; will not scratch glass (5.5-6)
6	Feldspars	Scratched by steel file (6.5-7); may barely scratch glass
7	Quartz	May barely scratch steel file; easily scratches glass
8	Topaz	Scratches a steel file or nail (6.5-7) as well as the streak plate (7)
9	Corundum	
10	Diamond	

Texture - How does the mineral feel?

Gritty or sandy?

Powdery or chalky?

Smooth like glass?

Sharp like metal?

Soapy or greasy?

Smooth like wax?

Transparency - Can you see through it? Some minerals are highly transparent and you can see through them. Minerals that are considered translucent only allow light to pass through it. Other minerals are opaque, which means that you cannot see through them.

Luster - How would you describe the way the mineral shines?

Metallic - Looks like metal or appears to have metal flakes

Glassy or vitreous - Shines like glass

Earthy or chalky - Dull; does not reflect much light

Waxy, silky, or pearly - Has a muted shine; may resemble shells or pearls

Other? Describe in your own words.

Crystal Shape - Does the mineral have a well-defined crystal shape? Some minerals show well-defined crystals, while others may have crystals that are too small or hard to distinguish. Describe the crystals in the sample in your own words or sketch a diagram on your data page. How many sides does it have? Does it look like a cube or a pyramid? Provide as much detail as possible.

Cleavage or Fracture - This test describes the way a mineral breaks, which depends on the way the atoms of a mineral are arranged. Some crystals are formed from atoms that have strong bonds between them, while others have areas of weakness. The crystals will tend to break (or cleave) where the bonds between the atoms are the weakest.

CAUTION: Don't break the testing samples unless you have permission from your teacher! Examine the outer surfaces of a mineral specimen for clues!

Cleavage occurs as a mineral breaks smoothly along even planes or surfaces. A few examples include mica forming sheets and halite or galena forming cubes.

Fracture occurs when a mineral breaks into odd shapes or an irregular pattern. It may be described as uneven, splintery, conchoidal (shell-like), jagged, or granular.

Other Tests You Can Try ...

Double Refraction - Some minerals, such as some calcites, cause a double image when placed over words in a book or an object.

Magnetic Attraction - Was the mineral attracted to a magnet, or does it act like a magnet? If so, it might be magnetite.

Fluorescence - Does it glow under ultraviolet light? If so, it might be fluorite.

Specific Gravity — This property is the weight of the mineral relative to the weight of an equal volume of water. Minerals with a high specific gravity or density feel heavy for their size, such as galena. Those with a low specific gravity, such as graphite, feel light for their size.

Reaction with Acids - Does it fizz when exposed to hydrochloric acid? If yes, it is a carbonate, such as calcite or dolomite.

WARNING: You must have your teacher's permission to perform the acid test!



Project Requirements

Name: _____

My mineral is _____.

For this project you will need to:

1) Complete the Mighty Mineral data sheet.

You may use a variety of reference materials, such as encyclopedias, science catalogs, magazines, and Internet sites*. Data sheets must be neat and provide all the information requested. For the occurrence section, list the locations in the state (or nation) where your mineral can be found. You will also need to provide three important uses for your mineral.

2) Create an advertisement for your mineral.

What are the important uses for your mineral? Create a slogan that "advertises" one of the important uses and design a cartoon character or superhero! The advertisement must include the mineral's name, the slogan, and a diagram of your cartoon character or superhero. Advertisements must be neat and colorful. You may draw the advertisement by hand or use computer graphics tools and a word processor to create it on a computer.

Reports are due on _____.



A list of mineral sites is available on
The Science Spot at <http://sciencespot.net/>
Go to **Kid Zone**, then choose **Earth Science Links**
to find websites for rocks and minerals.

Mighty Mineral Advertisement



Mighty Mineral Data Page



Name _____

My mineral is _____.

Chemical Formula:

Color(s):

Mineral Group:

Streak:

Hardness:

Luster:

Specific Gravity:

Cleavage:

Transparency:

Fracture:

Occurrences:

Important Uses:

(1)

(2)

(3)