Name _____ Section _____ Date _____

CONCEPTUAL INTEGRATED SCIENCE | Experiment

Chapter 23: Rocks and Mineral | Mineral Properties

Identifying Minerals

Purpose

To identify some common minerals by observing and testing their properties

Apparatus

mineral samples
tools for testing hardness: your fingernail, a penny, and a carpenter's nail
vinegar in a small cup
streak plate (white unglazed porcelain)
bar magnet

Discussion

Rocks are made of minerals. But that's not all. Most of the products that we use in everyday life—from computers to paint to toothpaste—are made from minerals. We don't often see minerals in rocks and commercial products, but the minerals are there just the same.

Examine each of the mineral samples your teacher has provided. Observe its properties. Then use these properties to identify each mineral.

The properties you will use for identification are described here in the Mineral Properties Box and the Moh's Hardness Scale.

Mineral Properties

Color. Color is the least reliable physical property for mineral identification. Yet, when used in combination with other tests, it is often a helpful clue.

Streak. Streak is the color of the powdered mineral. A mineral's color can be different from its streak color.

Luster. Luster is the way a mineral reflects light. There are two main classifications for luster: metallic and nonmetallic. Metallic luster is a metal-like shine. A nonmetallic luster may be shiny or dull, but it does not look like the typical shine you see on a metal such as iron, gold, or silver. Some words used for nonmetallic luster are: *glassy, waxy, pearly*, and *oily*.

Cleavage or Fracture. These properties describe how a mineral breaks. Cleavage is the ability of a mineral to break along a particular direction or plane. Any break that is not a cleavage is a fracture.

Hardness. Hardness is the ease with which one mineral scratches another. A harder mineral leaves a visible scratch on a softer one. Hardness is measured with Moh's Scale. For example, Quartz rates a 7 on Moh's scale, while calcite rates a 3. Quartz can easily scratch calcite, while calcite cannot scratch quartz. Therefore, quartz is harder than calcite.

Special Properties. Special properties are properties that are only exhibited by some minerals. For example, only a few minerals exhibit magnetism. Also, only minerals such as calcite ($CaCO_3$) show the property of "fizz". When a mineral shows fizz, it reacts with acid to produce bubbles of carbon dioxide (CO_2) gas.

Moh's Hardness Scale

Diamond	10
Corundum	9
Topaz	8
Quartz	7
Feldspar	6
Apatite	5 (carpenter's nail is between 5 and 6)
Fluorite	4
Calcite	3 (copper penny is 3.5)
Gypsum	2 (fingernail is between 2 and 3)
Talc	1

Procedure

Step 1: Read the information in the Mineral Properties box.

Step 2: Observe each of the mineral samples your teacher has provided. Note that each mineral has a number attached to it.

Step 3: Describe the color, luster, and cleavage or fracture of each mineral. You can determine these properties simply by looking at the mineral. Write each description in the Mineral Data Table for each mineral.

Step 4: Test each mineral for streak: Scrape the specimen along the streak plate. Does it leave a streak—a trail of powder? If so, what color is the streak? Record your observations.

Step 5: Test each mineral for hardness. To do this, lay each mineral on the table and try to scratch it with an object of known hardness (a penny, a fingernail, and a nail). Assign a value of hardness or a range of hardness to each mineral. (For example, if a fingernail scratches the mineral but a penny does not, your mineral has a hardness range between 2.5 and 3.5.) **To avoid injury, handle the nail with caution.** Record your data.

Step 6: Determine each mineral's specific gravity. To do this, first measure the mass and volume of each mineral. Then calculate the mineral's density with the formula Density = Mass/Volume.

a. To measure mass, use a balance. Measure the mineral's volume with the displacement method. (Ask your teacher how to do this if you do not know.)

b. Finally, to convert a density calculation to specific gravity, simply divide the density measurement by the density of water: 1.0 g/cm^3. The value of specific gravity has the same magnitude as density, but it has no units.

Step 7: Use the magnet to test for magnetism.

Step 8: Dip a corner of the mineral in a cup of vinegar to test for fizz.

Step 9: Note any other special properties you observe for each mineral. Record your data.

Step 10: Compare the data you collected to the Identifying Minerals chart. Try to identify each of your sample minerals. Fill in the column with the heading "Mineral Name" in your data table.

Luster	Hardness	Specific Gravity	Streak	Color	Other Properties	Mineral
Metallic	6-6.5	5.0	Yellow	Greenish black, brownish black	Cubic crystals, fracture	PYRITE
Metallic	5.5-6.5	5.2	Black, grey	Black	Magnetic, no cleavage	MAGNETITE
Nonmetallic	7	2.7	Clear, white, pink, purple, gray, black	Varies	No cleavage, fracture, can form 6-sided crystals	QUARTZ
Nonmetallic	3	2.7	Clear, white, yellow, blue	None	Fizzes, cleavage (3 directions), transparent to translucent	CALCITE
Nonmetallic	2	2.3	Clear, white, pink	White	May show cleavage, may occur in granular masses	GYPSUM
Nonmetallic	1.5-2.5	2.1	Yellow	Yellow, brownish yellow, greenish yellow	Flammable, odorous	SULFUR
Nonmetallic	4	3.2	White	Purple, green, yellow	Cleavage, transparent to translucent	FLUORITE

Mineral Data Table								
Mineral #	Color	Streak	Luster	Cleavage or Fracture	Hardness	Special Properties	Specific Gravity	Mineral Name

Summing Up

1. Why is it better to use several mineral properties rather than just one to identify a mineral?

2. What property is the most reliable one to use for mineral identification?

3. Name two or more different careers that require knowledge of minerals.

ROCK INVESTIGATION

Asking Questions/Defining Problems

Your challenge in this investigation is to determine the characteristics of different types of rocks and minerals.

Preparing to Investigate

You will be provided with a set of rock samples containing: obsidian, granite, schist, coal, sandstone, marble, andesite, slate, conglomerate, and, limestone. Using the magnifying glass and the website: www.geology.com/rocks identify the rocks and minerals you have been given.

Gathering Evidence

To begin, make observations about the rocks and minerals you have on your table.

Sample Number /Color /Letter	Observations (Large crystals? Texture? Foliation? Color?, etc. etc.)	Igneous, Metamorphic, or Sedimentary?	Name of Rock/Mineral

*Have your instructor check your classification before moving on!

Igneous rocks

1. Sort your samples from most dense to least dense (don't worry about getting the order exactly perfect). Record the numbers/ colors/letters below.

2. Describe/ draw the appearance of the least dense rocks.

3. Do you think the least dense rocks cooled slowly or quickly? EXPLAIN.

4. Now sort your samples from smallest to largest grain size. There are a few samples that have such small grains you can't actually see them. Record the numbers/ colors/letters below.

5. Which samples do you think cooled the fastest?

6. Which samples do you think cooled the slowest?

7. Based on your answers to the previous questions, sort your rocks into intrusive and extrusive. How did you decide which rock to put in each pile?

Sedimentary Rocks

8. Do any of the samples have distinct strata? Record the numbers/ colors below.

9. How do strata form?

10. Draw one of the samples that contain a fossil.

11. Explain how the fossil became trapped in the rock.

Metamorphic Rocks

12. Do any of your rocks display foliation? If so, record the numbers/ colors below.

13. How does foliation come to appear in a metamorphic rock? Draw a picture to describe this process.

Drawing Conclusions

14. A geologist finds an igneous rock that has large crystals embedded in a matrix of smaller crystals. What is the texture of this rock? How did it form?

15. Why do rocks made from slowly cooling magma have large crystals? Give an example of this type of rock.

16. Why do some high quality drills have diamond tips?

17. Cycles in nature, such as the rock cycle, consist of both materials and processes. What are the processes of change that take place in the rock cycle? What are the materials that are affected by these processes?

18. One of your friends thinks that all mining should be stopped because it can damage the environment. Another friend thinks that mining shouldn't be subject to any laws that would protect the environment because it is critical to get the resources we need. Which friend do you agree with – or don't' you agree with either of them? Explain your thinking.