

Name: _____ Class: _____ Date: _____

A Geologist's Mystery

Learner Outcomes:

- Distinguish between rocks and minerals
- Explain the need for common terminology and conventions in describing rocks and minerals, and apply suitable terms and conventions in describing sample materials



Key Terms:

Luster

Fracture

Mohs' hardness scale

Transparency

Streak

Cleavage

Crystals

Background Information:

You are a geologist and have just received a parcel from your company's field team in northern Alberta. The attached note reads, "New mines discovered. Enclosed are samples of minerals found there. Please identify."

Research Question:

What mineral properties are useful for identifying different minerals?

In order to identify a mineral, you will consider the following properties:

Luster (metallic - shiny like tin foil or gold, or sparkles like glitter)

Hardness (clear glass plate hardness 5.5)

Cleavage (the way the mineral breaks - even: flat surfaces, or uneven fractures: rough surfaces)

Streak (the color of the mineral's powder streaked on a white ceramic plate)

Common colors (some minerals may have many different colors so other tests must also be performed)

This investigation / activity has been adapted from:

Bullard J, Krupa G, Krupa M, et al. *Science Focus 7*. Toronto, ON: McGraw-Hill Ryerson.

Materials:

Mineral samples	Utility knife	Sand paper
Hand lens	Steel file	Emery paper
Iron nail	Streak plate	10% HCl in dropper
Copper penny	Glass plate	

Procedure:

1. Observe the overall characteristics of the mineral and record the mineral's color.
2. Using hand lens, look for and record any distinguishing crystal shapes (Refer to Table 5.2 on p. 355)
3. Examine the mineral and record its luster.
4. Scrape the mineral across the streak plate and record whether it streaks and what color the streak is.
5. Scratch the mineral with; your fingernail, a penny, an iron nail, glass, a steel file, sandpaper and emery paper to assess its hardness. (Refer to table 5.1 on p. 255)
6. Observe and record other features such as cleavage, fracture and transparency.
7. Carefully add 2-3 drops of 10% hydrochloric acid (HCl) and record any evidence of reaction. Rinse the sample with water afterwards.
8. Repeat steps 1-7 with each of the minerals provided.

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Observations:

Mineral Number	Colour	Crystal Shape	Lustre	Streak	Hardness	Other (cleavage, fracture, transparency)	Mineral name

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Properties of Common Minerals

LUSTER	HARD- NESS	CLEAVAGE FRACTURE	COMMON COLORS	DISTINGUISHING CHARACTERISTICS	USE(S)	MINERAL NAME	COMPOSITION*
Metallic Luster	1-2	✓	silver to gray	black streak, greasy feel	pencil lead, lubricants	Graphite	C
	2.5	✓	metallic silver	very dense (7.6 g/cm ³), gray-black streak 	ore of lead	Galena	PbS
	5.5-6.5	✓	black to silver	attracted by magnet, black streak	ore of iron	Magnetite	Fe ₃ O ₄
	6.5	✓	brassy yellow	green-black streak, cubic crystals 	ore of sulfur	Pyrite	FeS ₂
Either	1-6.5	✓	metallic silver or earthy red	red-brown streak	ore of iron	Hematite	Fe ₂ O ₃
Nonmetallic Luster	1	✓	white to green	greasy feel	talcum powder, soapstone	Talc	Mg ₃ Si ₄ O ₁₀ (OH) ₂
	2	✓	yellow to amber	easily melted, may smell	vulcanize rubber, sulfuric acid	Sulfur	S
	2	✓	white to pink or gray	easily scratched by fingernail	plaster of paris and drywall	Gypsum (Selenite)	CaSO ₄ •2H ₂ O
	2-2.5	✓	colorless to yellow	flexible in thin sheets 	electrical insulator	Muscovite Mica	KAl ₃ Si ₃ O ₁₀ (OH) ₂
	2.5	✓	colorless to white	cubic cleavage, salty taste 	food additive, melts ice	Halite	NaCl
	2.5-3	✓	black to dark brown	flexible in thin sheets 	electrical insulator	Biotite Mica	K(Mg,Fe) ₃ AlSi ₃ O ₁₀ (OH) ₂
	3	✓	colorless or variable	bubbles with acid 	cement, polarizing prisms	Calcite	CaCO ₃
	3.5	✓	colorless or variable	bubbles with acid when powdered	source of magnesium	Dolomite	CaMg(CO ₃) ₂
	4	✓	colorless or variable	cleaves in 4 directions	hydrofluoric acid	Fluorite	CaF ₂
	5-6	✓	black to dark green	cleaves in 2 directions at 90° 	mineral collections	Pyroxene (commonly Augite)	(Ca,Na)(Mg,Fe,Al)Si ₂ O ₆
	5.5	✓	black to dark green	cleaves at 56° and 124° 	mineral collections	Amphiboles (commonly Hornblende)	CaNa(Mg,Fe) ₄ (Al,Fe,Ti) ₃ Si ₆ O ₂₂ (OH) ₂
	6	✓	white to pink	cleaves in 2 directions at 90°	ceramics and glass	Potassium Feldspar (Orthoclase)	KAlSi ₃ O ₈
	6	✓	white to gray	cleaves in 2 directions, striations visible	ceramics and glass	Plagioclase Feldspar (Na-Ca Feldspar)	(Na,Ca)AlSi ₃ O ₈
	6.5	✓	green to gray or brown	commonly light green and granular	furnace bricks and jewelry	Olivine	(Fe,Mg) ₂ SiO ₄
	7	✓	colorless or variable	glassy luster, may form hexagonal crystals 	glass, jewelry, and electronics	Quartz	SiO ₂
7	✓	dark red to green	glassy luster, often seen as red grains in NYS metamorphic rocks	jewelry and abrasives	Garnet (commonly Almandine)	Fe ₃ Al ₂ Si ₃ O ₁₂	

*Chemical Symbols: Al = aluminum Cl = chlorine H = hydrogen Na = sodium S = sulfur
 C = carbon F = fluorine K = potassium O = oxygen Si = silicon
 Ca = calcium Fe = iron Mg = magnesium Pb = lead Ti = titanium

✓ = dominant form of breakage

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Analysis:

1. Using your evidence, refer to the table "Properties of Common Minerals" to identify what mineral is found in each sample.
2. Before testing, which minerals looked the same?
3. Were you able to identify all of the samples? If not, what are some other tests for further investigation?
4. Which features or properties were most helpful in helping you identify the samples? Why?
5. Which features or properties were least helpful in helping you identify the samples? Why?
6. What is the relationship between a mineral's hardness and the color of its streak?
7. Why did we use different materials to assess a mineral's hardness?

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Conclusion:

Extension:

Select three minerals you identified in this investigation and give 2 examples of how each is used and how the minerals properties make them useful.

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