

	<b>Mineral Name</b>	<b>Diagnostic Features</b>
Always Metallic	CHALCOPYRITE	metallic; H,3.5-4; S,greenish-black; softer than Pyrite!
	COPPER	metallic; tarnishes to greenish-white
	GALENA	metallic; shiny gray; high density
	MAGNETITE	metallic; black; magnetic; Also called "Lodestone"
	PYRITE	metallic; brass-yellow; S,dark gray; "Fool's Gold"
Harder Than Glass	CORUNDUM	H,9; hexagonal; dark reddish-brown
	OLIVINE	green; "sugary" texture
	ORTHOCLASE	white, tan, or salmon pink; H,6; Cl. in two directions at right angles; also Potassium Feldspar or "K-spar"
	PLAGIOCLASE	alternating light and dark color
	QUARTZ	H,7; Hexagonal crystals; or smoky, white or pink
	TOPAZ	white; H,8; Cl. in one direction
	TOURMALINE	Black; H,7-7.5, vertical striations on crystal faces
Softer Than Glass	APATITE	green or brown; hexagonal
	FLUORITE	H,4; Cl. four directions
	HEMATITE	dull or metallic; S,reddish-brown; "bloodstone"
	LIMONITE	dull or metallic; rusty spots; S,yellow-brown
	MALACHITE	green; very thin striations (layers)
Always Softer Than A Penny	BIOTITE	black; splits in thin sheets; a type of Mica
	CALCITE	reacts with acid; H,3; Cl. in 3 directions
	CINNABAR	scarlet red color; S,scarlet/orangish red
	GYP SUM	can be splintery; H,2
	HALITE	salty taste
	KAOLINITE	chalky texture; H,1
	MUSCOVITE	transparent; splits in thin sheets; a type of Mica
	SULFUR	Yellow; smell resembles rotten eggs
	TALC	soapy or greasy feel; H,1

# Mineral Identification Notes

A \_\_\_\_\_ is a substance that is naturally occurring, inorganic, and solid, with a characteristic atomic structure and with a chemical composition and physical properties that are either fixed or that vary within specific limits.

Minerals are different from \_\_\_\_\_. Rocks are an aggregate or made up of minerals.

The composition of a mineral can be expressed by a written chemical formula. However, it is not necessary or practical to make a chemical analysis of a mineral to identify it. Most common minerals can be identified by one or more of their \_\_\_\_\_ such as hardness or color. Properties that set one mineral apart from the rest are its \_\_\_\_\_. The first step in learning to identify common minerals is to become familiar with their physical properties:

## Physical Properties of Minerals

- \_\_\_\_\_ is determined by examining a fresh surface in reflected light.
- \_\_\_\_\_ is a mineral's resistance to being scratched. The hardness can be determined by attempting to scratch the mineral with a substance of known hardness, or by using it to scratch a substance of known hardness. Ten minerals have been arranged in order of their relative hardness to give a scale known as **Moh's Hardness Scale**:

Diamond	10		
Corundum	9		
Topaz	8		
Quartz	7		
Orthoclase	6	Steel File	(6.5 ±)
Apatite	5	Glass	(5.5 ±)
Fluorite	4	Nail or Blade	(5.1 ±)
Calcite	3	Copper penny	(3.0 ±)
Gypsum	2	Fingernail	(2.1 ±)
Talc	1		

There will be a quiz over this!

- \_\_\_\_\_ is the appearance of light reflected from a fresh mineral surface. Most minerals can be seen to have either a metallic or nonmetallic luster. If a mineral surface resembles a freshly cut piece of common metal such as iron, brass, or steel, it has a **metallic** luster.

### Nonmetallic Lusters:

- glassy – the luster of glass (quartz)
- pearly – (talc or muscovite)
- silky – (gypsum)
- dull – no luster (kaolinite)

- \_\_\_\_\_ is the color of the \_\_\_\_\_ of the mineral. The streak can be determined by rubbing the mineral across a porcelain streak plate. Streak cannot be obtained when the mineral is \_\_\_\_\_ than the streak plate (6). The streak may be a different color than the mineral.
- \_\_\_\_\_ is a mineral's tendency to break along planes of weakness. Some minerals have no cleavage while others have several directions of cleavage. Two cleavage surfaces running the same direction is only one direction of cleavage.

6. \_\_\_\_\_ is when a mineral breaks in a direction other than along a cleavage plane.  
There are several types of fracture:
- Uneven:** The surface of the fracture is irregular and rough. Most minerals have this kind of fracture.  
**Conchoidal:** The surfaces of the fracture are smooth and sometimes rounded.  
**Earthy:** Soft minerals may exhibit smooth but dull fracture surfaces. Similar to a broken dirt clod.  
**Splintery:** A fibrous fracture.
7. \_\_\_\_\_. Sometimes the crystal shape is visible and can help set it apart from other minerals with similar characteristics.
8. \_\_\_\_\_. Minerals, like Calcite, will effervesce (bubble) when treated with dilute hydrochloric acid.
9. \_\_\_\_\_. A few minerals are soluble enough to have diagnostic tastes. Halite for example has a strong salty taste.
10. \_\_\_\_\_. Some minerals have a distinct smell such as Sulfur.
11. \_\_\_\_\_. A few minerals will attract a magnet. Example: Magnetite
12. \_\_\_\_\_. Minerals like Calcite can split light rays into two parts. One ray travels straight through the mineral. The other ray is bent. This causes two images to be seen when viewed through a transparent specimen.
13. \_\_\_\_\_. The mineral's ability to glow while under ultraviolet light.

**Define other key terms:**

**Crystal** \_\_\_\_\_  
\_\_\_\_\_

**Specific Gravity** \_\_\_\_\_  
\_\_\_\_\_

**Ore** \_\_\_\_\_  
\_\_\_\_\_

**Gem** \_\_\_\_\_  
\_\_\_\_\_

**Tetrahedron** \_\_\_\_\_  
\_\_\_\_\_

## Structure of Minerals Notes

A) Minerals are often found as \_\_\_\_\_.

1. Crystal: A regular \_\_\_\_\_ solid.
2. Orderly arrangement of \_\_\_\_\_ determines shape of crystal.







B) \_\_\_\_\_ basic crystal shapes.

1. Described by crystallographic \_\_\_\_\_. (over)

C) \_\_\_\_\_ Tetrahedron

1. Silicates: compounds of silicon and oxygen plus one or more \_\_\_\_\_ element.
2. Four \_\_\_\_\_ atoms packed closely around a silicon atom held together by a \_\_\_\_\_ bond.

## Crystal Systems

System name	Axes of intersection	Ideal shape	Length of axes
cube or isometric	90°		all three axes equal
tetragonal	90°		two horizontal axes equal third axis different
hexagonal	60° 90°		three horizontal axes equal fourth axis different
orthorhombic	90°		all three axes unequal
monoclinic	90° third axis different than 90°		all three axes unequal
triclinic	all 3 axes different than 90°		all three axes unequal

### 3-5 Mineral Word Search

Locate and circle the names of minerals commonly found in earth science textbooks. The names appear in the list below. Names may be found backward, forward, vertically, horizontally, and diagonally. Be careful!

E A C A L C I T E C F P N O A  
 S B H E T I T A M E H E I L T  
 U G A U O L E C I R T H Q E M  
 L T L A A S B E L I M A I U G  
 F V C P S E T I R A B W F T Q  
 U C O I J I K O E A N E L A G  
 R I P B M A U E U W A S C L E  
 M E Y O G L A X Z C G I E C T  
 E A R L F R I E Q N M B P M I  
 A H I Q M T A M C E T I N O L  
 C L T P E G D L O G C O E L A  
 O F E L D S P A R N Q T C B H  
 R X C U M U S P Y G I I P O T  
 Y Q U A R T Z I O R G T L S I  
 O S I L M E R E U P B E E T C  
 D T A M O N D Z A E R U B Y A  
 S L A O C W A E T I H P A R G

AZURITE -  $Cu_3(CO_3)_2(OH)_2$

MICA -  $KAl_2(AlSi_3O_{10})(OH)_2$

GYPSUM -  $CaSO_4 \cdot 2H_2O$

FELDSPAR -  $K(AlSi_3O_8)$

BIOTITE -  $K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$

SULFUR - S

LIMONITE -  $FeO \cdot OH \cdot H_2O$

CHALCOPYRITE -  $CuFeS_2$

BARITE -  $BaSO_4$

OPAL -  $SiO_2 \cdot H_2O$

HALITE - NaCl

FLUORITE -  $CaF_2$

CALCITE -  $CaCO_3$

TALC -  $Mg_3Si_4O_{10}(OH)_2$

GRAPHITE - C

CHROMITE -  $FeCr_2O_4$

BAUXITE -  $Al(OH)_3$

QUARTZ -  $SiO_2$

HEMATITE -  $Fe_2O_3$

GALENA - PbS

Use one color for each silicate mineral and another color for each nonsilicate mineral.

# Mystery Minerals

A worker at a geology laboratory discovered 5 unlabeled mineral samples in his collection. Two samples were white, one was brown, and two were translucent.

He labeled the samples A, B, C, D, & E. The two white samples, A and B, looked very similar. However, sample A bubbled when dilute hydrochloric acid was poured on it. Sample B did not react to dilute HCl. Sample C, the brown mineral, attracted iron filings and caused the laboratory compass to deflect.

After making these observations, he found 5 labels that had no sample to go with them: Diamond, Quartz, Calcite, Halite, and Magnetite.

Answer the following questions based on the information above:

1. Based on the lab worker's observations, which is the calcite sample? \_\_\_\_\_

Explain your choice: \_\_\_\_\_

2. Which is the magnetite sample? \_\_\_\_\_

Explain your choice: \_\_\_\_\_

3. What test could the worker perform to clearly identify the diamond sample? \_\_\_\_\_

\_\_\_\_\_

4. List TWO tests the worker could perform to clearly identify the quartz and halite samples:

\_\_\_\_\_

\_\_\_\_\_

# ● Mineral Identification

Match the terms in Column I with the phrases in Column II. Write the letter of the correct phrase in the blank on the left.

## Column I

- \_\_\_\_\_ 1. cleavage
- \_\_\_\_\_ 2. diamond
- \_\_\_\_\_ 3. fracture
- \_\_\_\_\_ 4. hardness
- \_\_\_\_\_ 5. mica
- \_\_\_\_\_ 6. luster
- \_\_\_\_\_ 7. Mohs
- \_\_\_\_\_ 8. quartz
- \_\_\_\_\_ 9. streak
- \_\_\_\_\_ 10. talc

## Column II

- a. The measure of how easily a mineral can be scratched
- b. Name given to the scale of hardness
- c. One of the softest known minerals
- d. The hardest known mineral
- e. Reflection of light from a mineral's surface
- f. Color left by powdered mineral on unglazed porcelain
- g. Tendency to break along smooth, flat surfaces
- h. A common mineral that breaks along smooth, flat surfaces
- i. Tendency to break with rough or jagged edges
- j. A common mineral that breaks with rough or jagged edges

In the blank at the left, write the term in the box that correctly completes each statement.

crystal carbonates	halide elements	silicates oxides	4000 98 percent	8 6
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- \_\_\_\_\_ 7. Scientists know of more than \_\_\_\_\_ minerals.
- \_\_\_\_\_ 8. Most of these are composed of only \_\_\_\_\_ elements.
- \_\_\_\_\_ 9. These few elements make up \_\_\_\_\_ of Earth's crust.
- \_\_\_\_\_ 10. Minerals that combine to form the most common rock-forming group are \_\_\_\_\_.
- \_\_\_\_\_ 11. A group that includes rock salt is the \_\_\_\_\_ group.
- \_\_\_\_\_ 12. Each mineral has a different \_\_\_\_\_ formation.
- \_\_\_\_\_ 13. Scientists have identified \_\_\_\_\_ major formation systems.
- \_\_\_\_\_ 14. Two other major groups of minerals are \_\_\_\_\_ and \_\_\_\_\_.



# Mineral Identification

Complete the descriptions of the 15 minerals listed below. Using page 912-913 as reference, match the property in the list with the mineral name.

**\*\*All characteristics in the list may be used more than once.**

## Mineral Characteristics

a. specific gravity of 7 or greater	f. hardness of 6.0
b. can be a white color	g. source of copper
c. conchoidal fracture	h. source of iron
d. hardness of 6.5 or greater	i. contains calcium
e. hexagonal crystal form	j. contains sulfur

1. Copper:            used for wire, pipes, & coins, \_\_\_\_\_, \_\_\_\_\_.
2. Galena:            cubic cleavage, \_\_\_\_\_, \_\_\_\_\_.
3. Quartz:            \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_.
4. Chalcopyrite:    metallic luster, \_\_\_\_\_, \_\_\_\_\_.
5. Limonite:          yellowish brown streak, \_\_\_\_\_, \_\_\_\_\_.
6. Corundum:        \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_.
7. Olivine:            green color, \_\_\_\_\_, \_\_\_\_\_.
8. Plagioclase:      \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_.
9. Pyrite:            metallic luster, \_\_\_\_\_, \_\_\_\_\_.
10. Hornblende:     ferromagnesian silicate, \_\_\_\_\_, \_\_\_\_\_.
11. Fluorite:          glows under UV light, \_\_\_\_\_, \_\_\_\_\_.
12. Magnetite:        black streak, \_\_\_\_\_, \_\_\_\_\_.
13. Potassium Feldspar:    2 cleavage planes @ 90°, \_\_\_\_\_, \_\_\_\_\_.
14. Topaz:            orthorhombic shape, \_\_\_\_\_, \_\_\_\_\_.
15. Hematite:        \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_.



# Minerals Review Questions

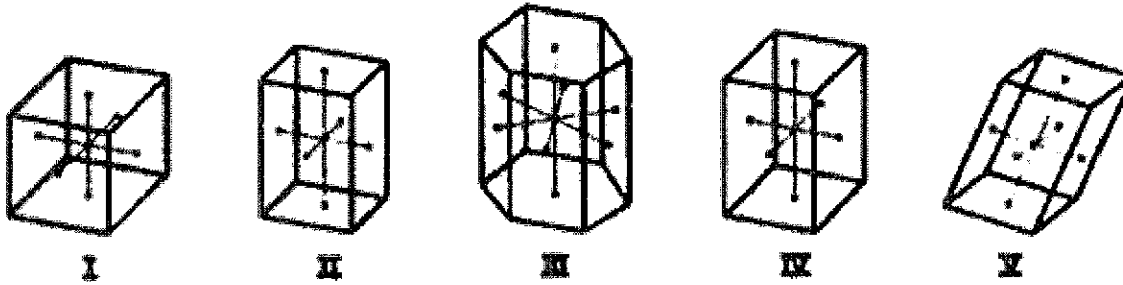
## True or False.

- \_\_\_\_\_ 1. The streak test is a test of mineral density.
- \_\_\_\_\_ 2. Fluorescent minerals glow while being subjected to ultraviolet light.
- \_\_\_\_\_ 3. Cleavage is important in identifying some minerals.
- \_\_\_\_\_ 4. All minerals have the same basic crystal shape.

## Choose the best response.

- \_\_\_\_\_ 5. According to the table, what is the approximate hardness of a mineral that scratches quartz and can be scratched by topaz?  
 a. 6.5      b. 7.5      c. 8.5      d. 9.5
- \_\_\_\_\_ 6. A natural, inorganic, homogenous solid with a characteristic chemical composition is called  
 a. an atom      b. a gemstone      c. a mineral      d. a tetrahedron
- \_\_\_\_\_ 7. Minerals that contain silicon and oxygen are  
 a. sulfides      b. sulfates      c. ores      d. silicates
- \_\_\_\_\_ 8. The appearance of light reflected from the surface of a mineral is called  
 a. color      b. streak      c. luster      d. fluorescence
- \_\_\_\_\_ 9. The words *glassy*, *earthy*, and *dull* describe a mineral's  
 a. luster      b. hardness      c. streak      d. fluorescence
- \_\_\_\_\_ 10. The words *uneven* and *splintery* describe a mineral's  
 a. cleavage      b. fracture      c. hardness      d. luster
- \_\_\_\_\_ 11. Mohs scale is used in measuring a mineral's  
 a. hardness      b. cleavage      c. color      d. luster
- \_\_\_\_\_ 12. Double refraction is a distinctive property of crystals of  
 a. mica      b. feldspar      c. calcite      d. galena
- \_\_\_\_\_ 13. A mineral that splits into even sheets shows which of the following properties?  
 a. low density      b. streak      c. cleavage      d. triclinic system
- \_\_\_\_\_ 14. The most common magnetic mineral is  
 a. hematite      b. magnetite      c. halite      d. uranium

Mineral	Hardness
corundum	9
topaz	8
quartz	7
feldspar	6



- \_\_\_\_ 15. Which of the following systems is crystal I?  
 a. monoclinic      b. isometric      c. triclinic      d. hexagonal
- \_\_\_\_ 16. Which diagram represents an orthorhombic crystal?  
 a. II      b. III      c. IV      d. V
- \_\_\_\_ 17. Which of the following is an unrealistic number of cleavage planes?  
 a. 0      b. 2      c. 4      d. 13
18. What is the most common silicate mineral? \_\_\_\_\_
19. Which property is used to identify the color of a mineral in powdered form? \_\_\_\_\_

**Critical Thinking**

20. Natural gas is a liquid fossil fuel that occurs naturally in the earth's crust and has a definite chemical composition of CH<sub>4</sub>. Is it a mineral? Explain.

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