

What is a mineral?

7 Characteristics

1. A mineral is a solid
2. May be an element or compound

Examples:

Element	Compound
S	FeS
Ag	SiO ₂
Cu	NaCl

3. Inorganic origin

- ◆ Mineral-like substances that ARE organic
 - ◆ Coal
 - ◆ Chalk
 - ◆ Limestone
 - ◆ Sea shells
 - ◆ Bone
 - ◆ pearls

4. Found in nature

- ◆ NOT manipulated by man
- ◆ NOT synthetic
- ◆ Naturally occurring

Found in nature cont.

◆ 10 Minerals make up Earth's crust

1. Oxygen – 46.6%
 2. Silicon – 27.72%
 3. Aluminum – 8.13%
 4. Iron – 5.00%
 5. Calcium – 3.63%
 6. Sodium – 2.83%
 7. Potassium – 2.59%
 8. Magnesium – 2.09%
 9. Titanium – 0.40%
 10. Hydrogen – 0.14%
- TOTAL = 99.13%

87% remains?
This is all other elements

How does having 10 minerals making up most of our crust affect us as consumers?

Found in nature cont.

- ◆ Most elements are found as compounds
- ◆ Few exist in pure form
- ◆ Examples...

Gold
Platinum
Sulfur
Silver
Copper
Carbon

How Minerals Form

5. Minerals Have definite crystal structure
 - ◆ Crystal – molecules arrange in a definite repeating pattern
 - ◆ Resembles geometric shape externally



Halite crystal link

How Minerals Form

• Basic crystal systems



Tetragonal

Zircon
wulfenite



Cubic

Salt
galena
Pyrite
diamond



Hexagonal

Quartz
corundum

• How Minerals Form Cont.

Orthorhombic



Sulfur
topaz



Monoclinic

Gypsum
calcite



Triclinic

Albite
turquoise

How Minerals Form

- ◆ From magma
 - Aka freezing of rock material
 - Deep – magma cools slowly and forms large crystals
 - Surface – magma / lava cools quickly and forms small crystals



How Minerals Form

- ◆ From Solution
 - ◆ Water evaporates from a supersaturated solution
 - ◆ Mineral solids left behind
 - ◆ Crystals grow over time
 - ◆ Longer time → larger crystal
 - ◆ [demo](#)

6. Minerals have Definite Chemical Composition

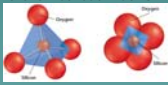
Compositions are Categorized into 7 Groups...

Mineral Groups

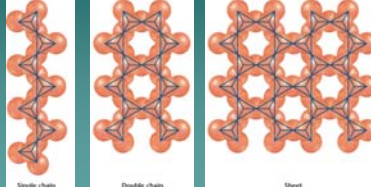
A. Silicates

examples

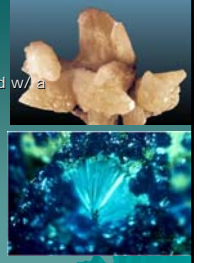
- SiO_2 – quartz – silicon dioxide
- KAlSi_3O_8 – feldspar – potassium aluminum silicate
- Forms a silica tetrahedron



◆ Ways silica can bond...



- B. Carbonates – CO_3 carbonate ion will bond w/ a metal
 - CaCO_3 – calcium carbonate
Calcite
 - $\text{Cu}_2(\text{CO}_3)_2(\text{OH})_2$
copper carbonate
Azurite



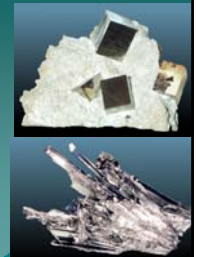
C. Oxides – O_2 bands with metal(s)

- Fe_2O_3 – Iron (2) oxide – hematite
- Fe_3O_4 – Iron (3) oxide – magnetite



D. Sulfides Sulfur bonds with an element

- Fe_2S_3 – Iron Sulfide – Pyrite
- Sb_2S_3 – Antimony Sulfide - Stibnite



E. Sulfates SO_4 –
Sulfate ion

Gypsum -
 $\text{Ca}(\text{SO}_4) \cdot 2(\text{H}_2\text{O})$
Calcium Sulfate



F. Halides – metal
bonds with
halogen

Cl^- , F^- , I^-
 NaCl – sodium
chloride – halite
 CaF_2 – Calcium
Fluoride - Fluorite



G. Native Elements

Copper – Cu

Gold – Au

Sulfur - S