

CE8392

ENGINEERING GEOLOGY

MINERALOGY



CHAPTER 2: PROPERTIES OF MINERALS (2.3)



MINERALS: THE BUILDING BLOCKS OF ROCKS

◉ **Definition of a Mineral:**

- ✓ naturally occurring
- ✓ inorganic
- ✓ solid
- ✓ characteristic crystalline structure
- ✓ definite chemical composition

HOW DO WE IDENTIFY MINERALS?

◎ **Physical properties:**

- ✓ Color
- ✓ Streak
- ✓ Luster
- ✓ Hardness
- ✓ Crystal form
- ✓ Cleavage
- ✓ Fracture
- ✓ Density
- ✓ Distinctive

PHYSICAL PROPERTIES OF MINERALS

◉ **Color:**

- Most obvious, but often misleading
- Different colors may result from **impurities**



Example:
Quartz

PHYSICAL PROPERTIES OF MINERALS

◎ **Streak:**

Streak – color of a mineral in powdered form
(used for **metallic** minerals)

Obtained by scratching
a mineral on a piece of
unglazed porcelain.

Example:
Hematite



PHYSICAL PROPERTIES OF MINERALS

◉ Luster:

- How a mineral surface reflects light
- Two major types:
 - Metallic luster
 - Non-metallic luster

*Metallic
example:
Galena*



*Non-metallic
example:
Orthoclase*



PHYSICAL PROPERTIES OF MINERALS

◎ **Hardness:**

- How easy it is to scratch a mineral
- **Mohs Scale** of Hardness
 - relative scale
 - consists of 10 minerals, ranked 1 (softest) to 10 (hardest)

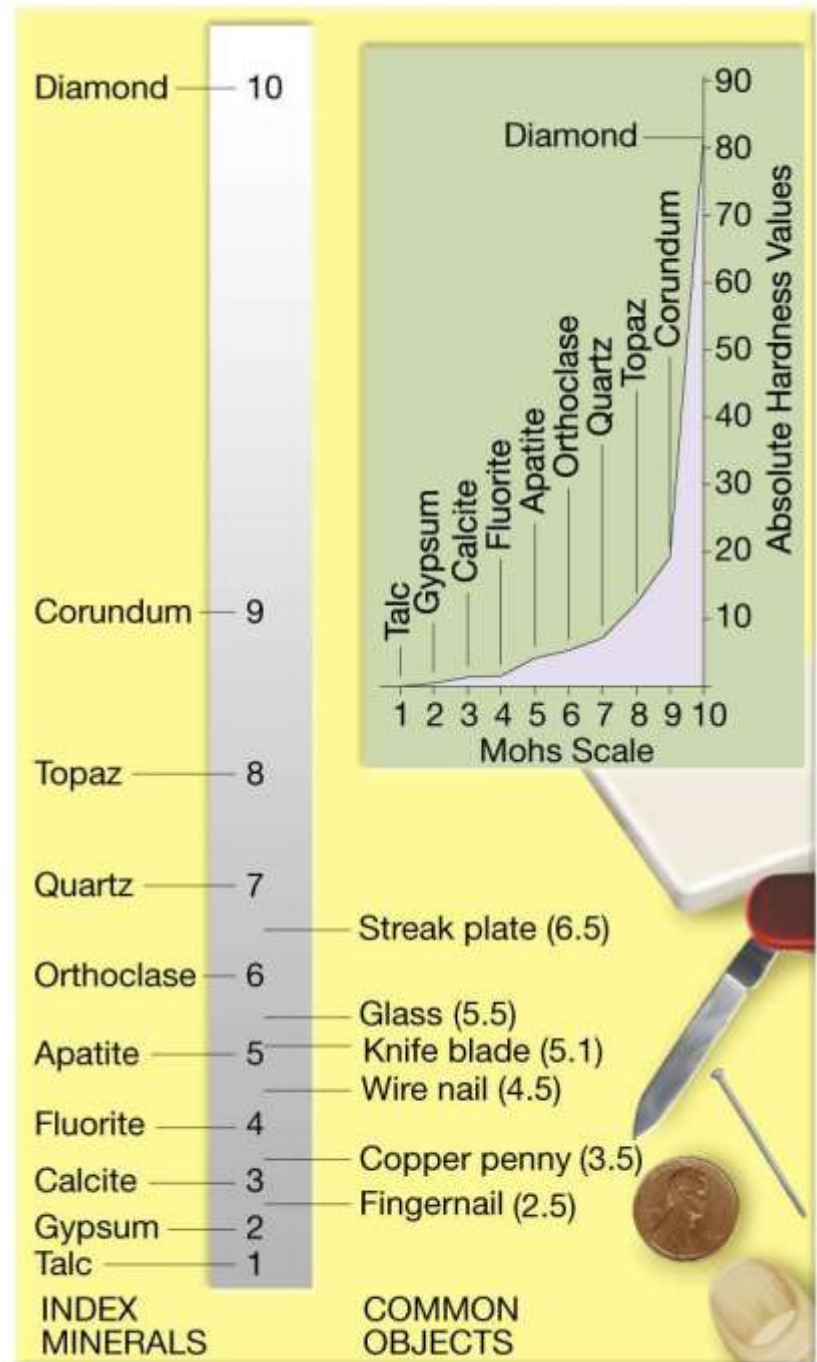
Mohs Scale of Hardness

Hardest (10) – Diamond

Softest (1) – Talc

Common objects:

- Fingernail (2.5)
- Copper penny (3.5)
- Wire nail (4.5)
- Glass (5.5)
- Streak plate (6.5)



PHYSICAL PROPERTIES OF MINERALS

◎ Crystal Form (or shape):

- external expression of a mineral's internal atomic structure
- planar surfaces are called **crystal faces**
- angles between crystal faces are constant for any particular mineral



Quartz

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Pyrite

PHYSICAL PROPERTIES OF MINERALS

◎ **Cleavage vs. Fracture:**

- The way a mineral breaks
- **Cleavage:** tendency of a mineral to break along planes of weakness
- Minerals that do not exhibit cleavage are said to **fracture**

Do not confuse cleavage planes with crystal faces!
Crystal faces are just on the surface and may not repeat when the mineral is broken.

PHYSICAL PROPERTIES OF MINERALS




- ◎ **Cleavage is described by:**

- Number of planes
- Angles between adjacent planes

– These are constant for a particular mineral

PHYSICAL PROPERTIES OF MINERALS

◉ Cleavage (1 direction):

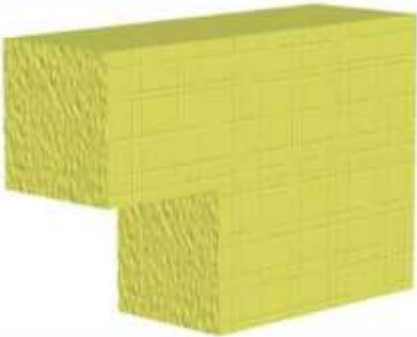
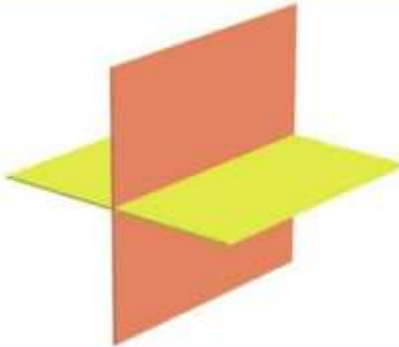


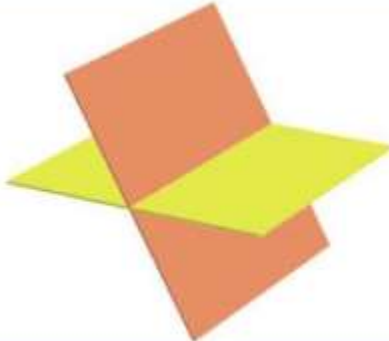

Number of Cleavage Directions	Sketch	Illustration of cleavage directions	Example
1			

Example: mica



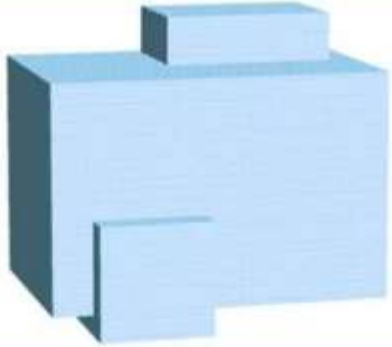


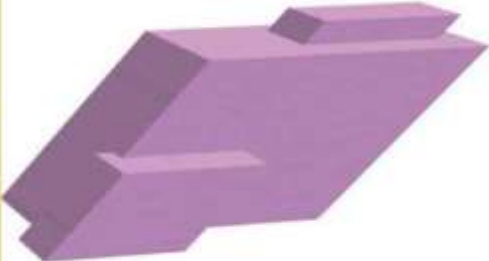


PHYSICAL PROPERTIES OF MINERALS

◉ Cleavage (2 directions):

Number of Cleavage Directions	Sketch	Illustration of cleavage directions	Example
2 at 90°			 orthoclase
2 not at 90°			 amphibole




PHYSICAL PROPERTIES OF MINERALS

◉ Cleavage (3 directions):

Number of Cleavage Directions	Sketch	Illustration of cleavage directions	Example
3 at 90°			 halite
3 not at 90°			 calcite

PHYSICAL PROPERTIES OF MINERALS

◎ Cleavage (4 directions):

Number of Cleavage Directions	Sketch	Illustration of cleavage directions	Example
4			<p>fluorite</p> 

PHYSICAL PROPERTIES OF MINERALS

◎ Fracture:

- minerals that do not exhibit cleavage are said to fracture
 - smooth, curved surfaces when minerals break in a glass-like manner:
conchoidal fracture



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PHYSICAL PROPERTIES OF MINERALS

◎ Density:

- mass of a mineral divided by volume of the mineral
- **metallic** minerals tend to have **higher** densities than non-metallic minerals



PHYSICAL PROPERTIES OF MINERALS

◉ Distinctive properties:

- **reaction with hydrochloric acid** (calcite fizzes)
- **taste** (halite tastes salty)
- **feel** (talc feels soapy, graphite feels greasy)
- **magnetism** (magnetite attracts a magnet)
- **double refraction** (calcite when placed over printed material, letters appear doubled)
- **smell** (sulfur smells like rotten eggs)