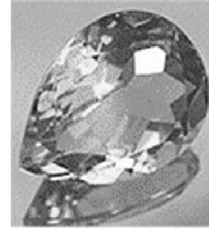


## Minerals

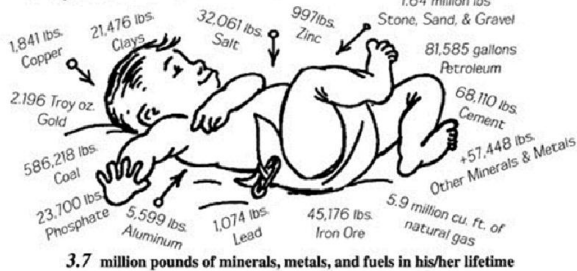
## Minerals



- Natural
- Solid
- Inorganic
- Crystal Structure
- Definite Chemical Structure

**All minerals of the same kind have the same structure**

### Every American Born Will Need . . .



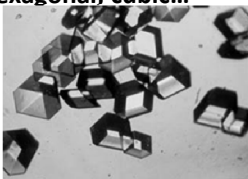
© 2001 Mineral Information Institute Golden, Colorado

- Between 2 - 3,000 have been identified
- A few are "native elements" -- made of only one element (such as sulfur, gold, copper, and graphite (carbon))

## Formation of Minerals

- Crystallization is the process by which atoms are arranged to form a crystal structure (highly ordered, symmetric pattern of atoms)

**Characterized by flat surfaces and angled sides = hexagonal, cubic...**



## Crystallization from Magma or Water

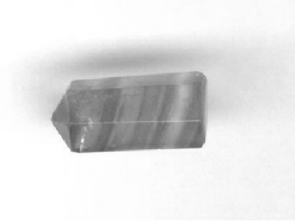
- Magma (and Lava, magma that reaches the surface) cools quickly on the Earth's surface = small crystals
- Magma below the Earth's surface cools slowly = large crystals
- Sometimes mineral forming elements dissolve in water and form crystals

## Common Uses of Minerals

- Aluminum--packaging, transport, building
- Beryllium--gemstones, fluorescent lights
- Copper--electric cables, wires, switches
- Feldspar--glass and ceramics
- Iron--buildings, automobiles, magnets
- Calcite--toothpaste, construction

## Physical Properties of Minerals

### 1. Color – External appearance

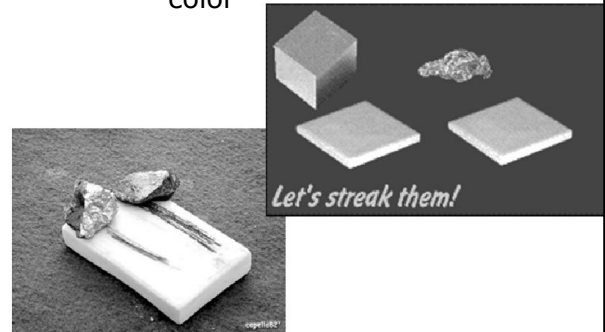


### Color can vary as a result of:

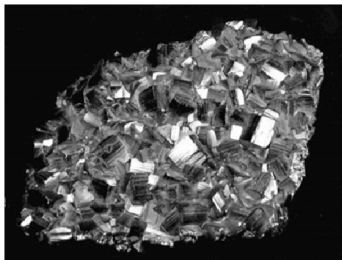
Impurities – natural coloring agents

Weathering - exposure to the environment: humidity, temp changes, pollution

### 2. Streak - Color of the powdered indicates the minerals true color



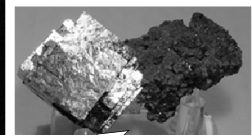
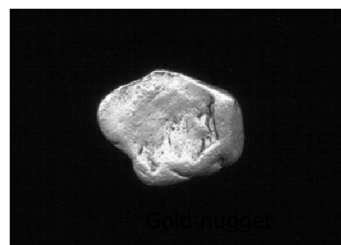
Streak is a very reliable way to identify minerals. (more reliable than color alone)



Pyrite

### 3. Luster - the way a mineral reflects light

#### a. Metallic – shines like a polished metal



Galena

## b. Non-metallic – not like a polished metal

Examples of non-metallic luster:

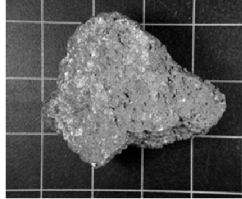
Pearly – mica

Glassy – quartz, halite

Dull, Earthy – red hematite

Waxy – talc, sulfur

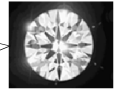
Brilliant – diamond



## 4. Hardness – a measure of resistance to being scratched



Talc  
Diamond



### Mohs Hardness Scale

This is a modified scale. The softest is #1 and the hardest is #10.

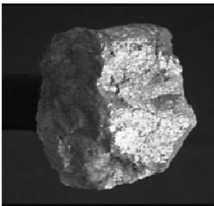
1. talc
2. gypsum
3. calcite
4. fluorite
5. apatite
6. orthoclase
7. quartz
8. topaz
9. corundum
10. diamond

### Field Scale of Hardness

- 2.5 fingernail
- 3.5 copper penny
- 4.5 iron nail
- 5.5 glass plate
- 6.5 steel file
- 7.0 streak plate

## What determines Hardness?

a mineral's internal atomic structure

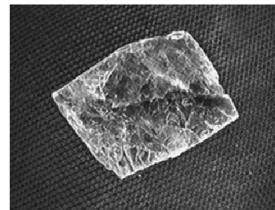


chalcopyrite

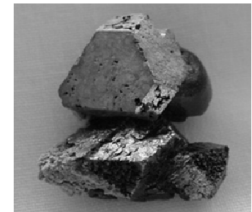


## 5. Breakage—the way a mineral breaks

Cleavage - the tendency of a mineral to split evenly along planes of weakness



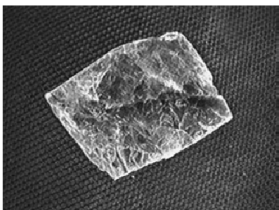
Biotite Mica – one direction



Galena- three directions

## 5. Breakage—the way a mineral breaks

Cleavage - the tendency of a mineral to split evenly along planes of weakness



Biotite Mica – one direction



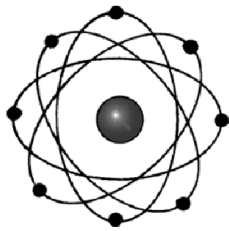
Galena- three directions

## Fracture-when a mineral breaks unevenly



## What determines breakage?

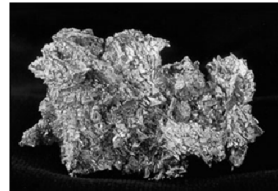
a mineral's internal atomic structure



## 6. Specific Gravity – a mineral's density

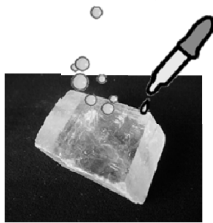
Ratio of a mineral's density in air to its density in water.

A piece of gold has 8 times as much mass as a piece of halite of the same size, therefore it has a much higher density.



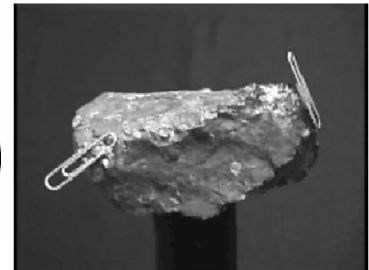
## Chemical Properties

Calcite reacts with hydrochloric acid. It forms bubbles of carbon dioxide gas.



## Special Properties

Lodestone, a form of the mineral magnetite is naturally magnetic.



Iceland spar, a form of the mineral calcite produces double refraction.



## Uses of Minerals

Ore - a mineral that contains metals and nonmetals that can be mined for profit.

1. Metals – elements that have shiny surfaces and are able to conduct heat and electricity.

**Alloy** – a mixture of two or more metals or a mixture of metals and nonmetals.

1. tin + copper – bronze
2. copper + zinc – brass
3. iron + chromium + limestone – steel
4. lead + tin – pewter

The properties of an alloy are more desirable than the properties of either piece alone.

**2. Nonmetals** – elements that have dull surfaces and are poor conductors of heat and electricity.

**Gems** – minerals that have the following desirable qualities:



**Hardness, color,  
luster, rarity,  
durability**

1. Precious stones – diamonds, rubies, sapphires, emeralds
2. Semiprecious stones – amethyst, topaz, garnet
3. Gems that are NOT minerals – pearls, amber