

PROPERTIES OF MINERALS

What is a mineral?

- **A mineral is a naturally occurring, inorganic solid that has a crystal structure and a definite chemical composition**

5 Characteristics that all minerals share

- 1. Naturally occurring**
- 2. Inorganic**
- 3. Solid**
- 4. Crystal structure**
- 5. Definite chemical composition**

Naturally Occurring

- Naturally Occurring means that the substance must occur in nature, it can not be created or manufactured by people.

Inorganic

Inorganic means that a mineral can not come from something that was once living.

Solid

A Solid has a definite volume and shape, its particles are tightly packed together and can not move easily.

Crystal structure

- Crystal structure means the particles that make a mineral line up in a pattern that repeats over and over again, this pattern creates a crystal. A crystal has flat sides called faces that meet at sharp edges and corners

Crystal structure



Top left from <http://www.tuspirits.com/images/ArkansasCrystal867.jpg>

Top Right http://judie.co.nz/wp-content/uploads/2010/02/quartz_crystal_cluster_black.jpg

Bottom Left <http://www.mindat.org/photos/0554307001221343359.jpg>

Bottom Right http://t1.gstatic.com/images?q=tbn:ANd9GcSML6stZDnpe1vLvdPfB3uOjrscEi3qsGmQpQ4LGwERlyB-lww&t=1&usg=__7mdDC9sp-_A5hsegmp5Tp6eDizY=

Definite chemical composition

Definite chemical composition means that a mineral always contains certain elements in definite, or exact, proportions

Almost all minerals are compounds in which two or more elements are combined so they no longer have their distinct properties.

Some elements occur in a pure form in nature and are considered minerals (almost all are metals such as copper, silver, and gold)

Which 2 of the following are not minerals? Why?

- Talc
- Fluorite
- Galena
- Crude Oil
- Quartz
- Pyrite
- Coal

Which 2 of the following are not minerals? Why?

- Talc
- Fluorite
- Galena
- Crude Oil- liquid (not solid) and organic (made of plant and animal remains)
- Quartz
- Pyrite
- Coal- Organic (made of plant and animal remains)

Identifying Minerals

- Each mineral has its own specific properties that can be used to identify it, this is due to the fact that each mineral has its own unique make-up.
- Hardness- Mohs Hardness Scale
- Color
- Streak
- Luster
- Density
- Crystal Systems
- Cleavage and Fracture
- Special Properties
 - Fluorescence
 - Double Refraction

Identifying Minerals

- **Each mineral has its own specific properties that can be used to identify it.**

Hardness- Mohs Hardness Scale

- Hardness (how hard a mineral is) is one of the best properties that can be used to help identify a mineral
- Mohs Hardness Scale ranks 10 minerals from softest to hardest, Talc is softest and Diamond is hardest

Hardness- Mohs Hardness Scale

Mineral	Mohs relative Hardness	Scratch Test	Rosiwal absolute Hardness	Vickers kp / mm^2
Talc	1	scrapeable with fingernail	0.03	2,4
Gypsum	2	scratcheable with fingern.	1.25	36
Calcite	3	scr. with copper coin	4.5	109
Fluorite	4	easily scr. with knife	5	189
Apatite	5	still scr. with knife	6.5	536
Orthoclase	6	scr. with steel file	37	795
Quartz	7	scratches window glass	120	1,120
Topaz	8	scratches quartz	175	1,427
Corundum	9	scratches topaz	1,000	2,060
Diamond	10	scratches corundum	140,000	10,060

Our textbook lists Feldspar for 6

<http://www.realgems.org/pic/mohs%20en.jpg>

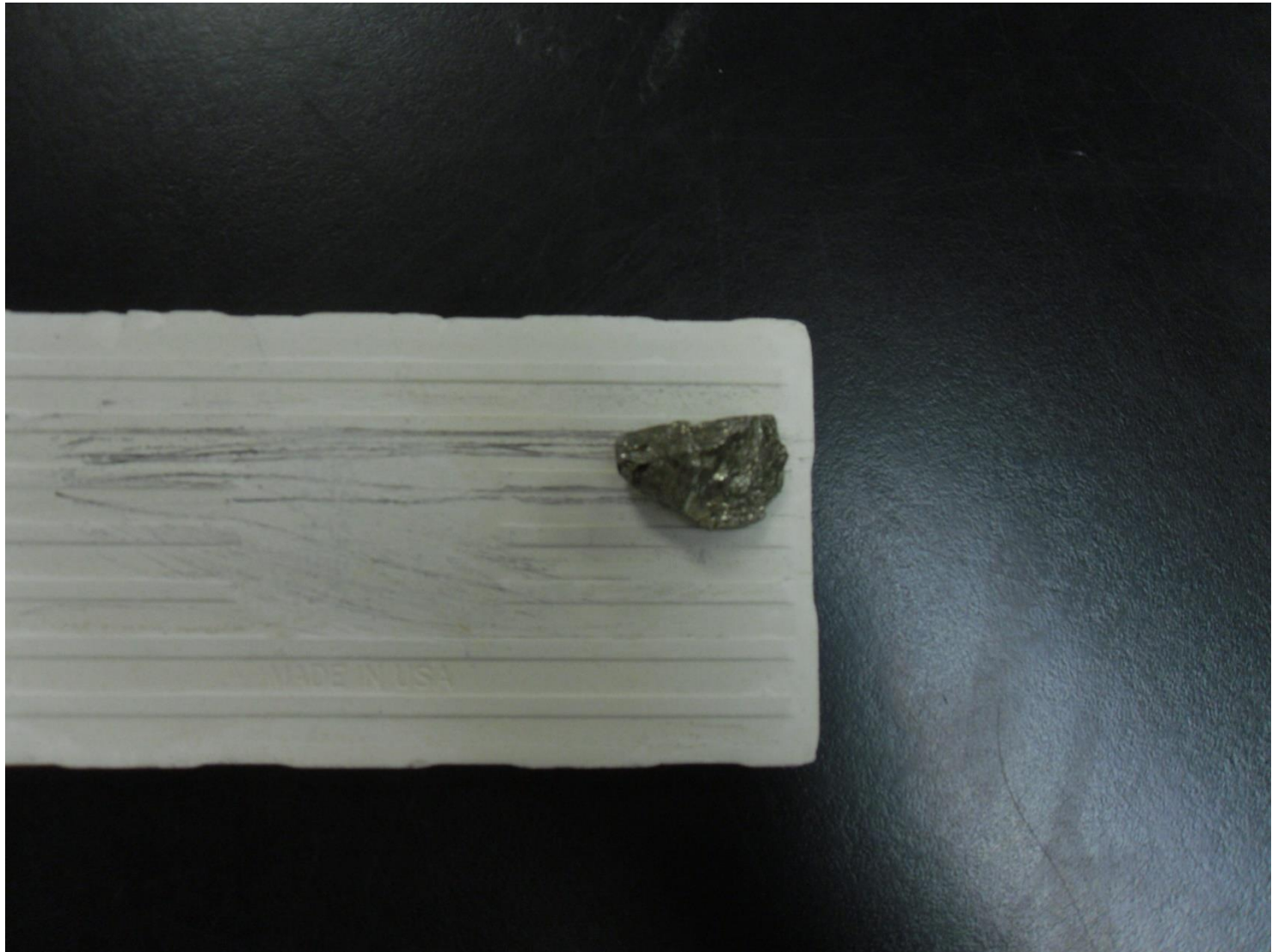
Color

- **The color of a mineral is a physical property that is easy to observe.**
- **Color can only be used for a few minerals that have their own specific color**
- **The color of a mineral alone does not usually give enough information to make a definite identification. Some minerals come in many colors**

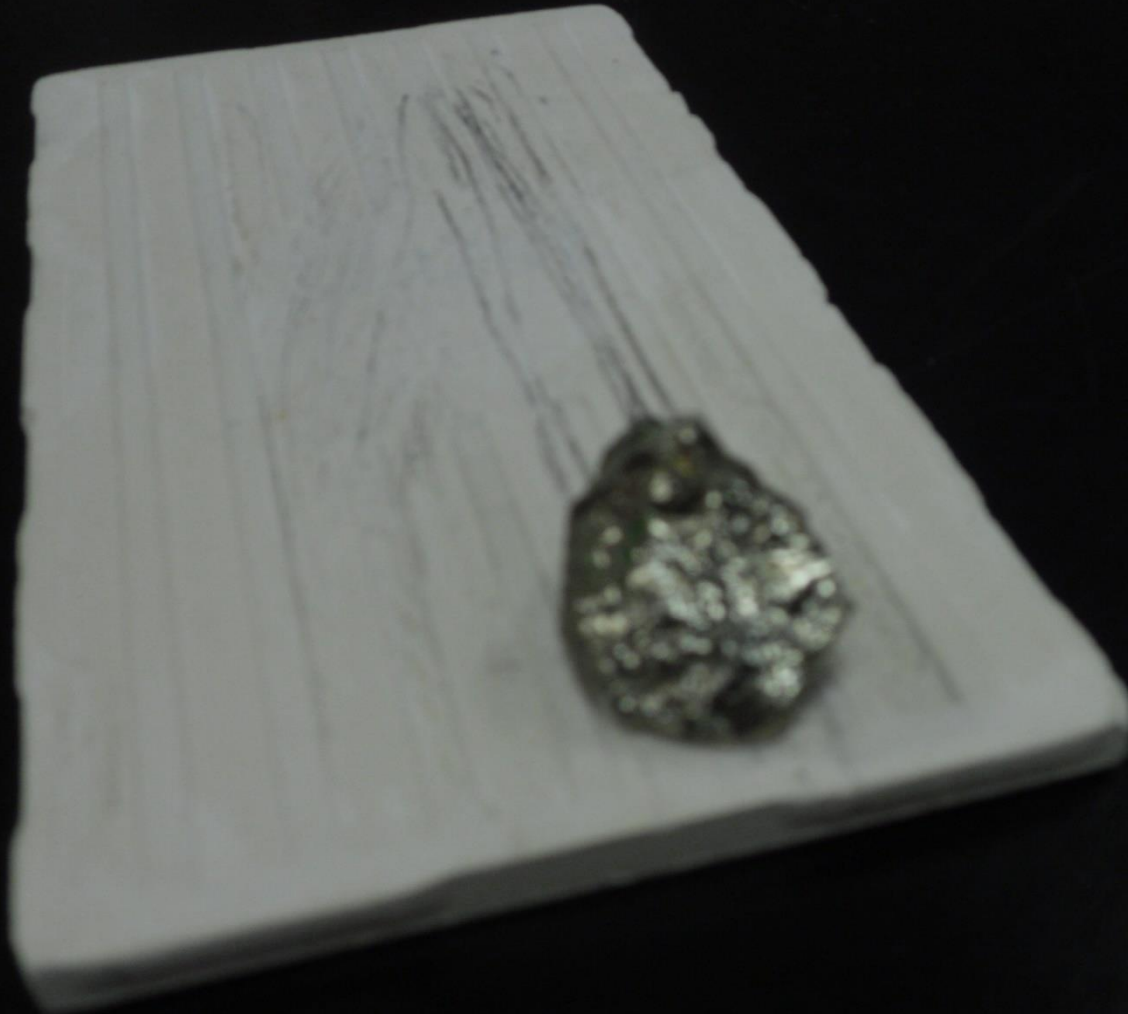
Streak

- **Streak tells the color of a mineral's powder. To find the streak of a mineral you rub the mineral against an unglazed tile called a streak plate.**

Streak



Streak



Is this Gold? How do you know?

Luster

- Luster describes how a mineral reflects light from its surface. Such as:

- Description

- Glassy
- Silky
- Greasy
- Metallic
- Earthy
- Waxy
- Pearly
- Resinous
- Brilliant
- Dull

- Examples

- Quartz
- Gypsum
- Talc, some Quartz
- Gold, Pyrite, Galena etc
- Kaolin
- some Serpentine
- Gypsum, some Talc
- Amber
- Diamond
- Graphite

Density

- Density is the mass in a given space, or mass per unit volume. No matter how large or small the sample of a mineral is, its density will remain the same.
- Density= Mass/Volume $D=M/V$

Density

- Mass is the amount of matter in an object or material and is measured in milligrams, grams, or kilograms
- Volume is the amount of space that an object or material fills and is measured in milliliters, liters, or kiloliters (rarely in kiloliters)
- Density is mass divided by volume so density is typically measured in grams per milliliter

Density

- The density of liquid water is 1.0 grams per milliliter (1.0 g/ml)
 - Anything more dense than 1.0 g/ml sinks in water
 - Anything less dense than 1.0 g/ml floats in water

Density

LOW DENSITY



HIGH DENSITY



Copyright 2003 <http://www.indospectrum.com>

Left image from <http://www.tomw.net.au/travel/balloons/balloon1.jpg>

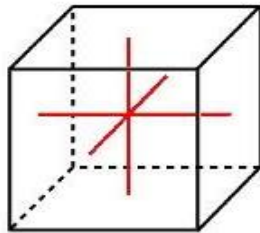
Right image from http://3.bp.blogspot.com/_CpsJ7xlPRFM/TCKs1z8wR8I/AAAAAAAAATs/grlMGndp09w/s1600/cd022_treasure_island_anchor.jpg

Crystal Systems

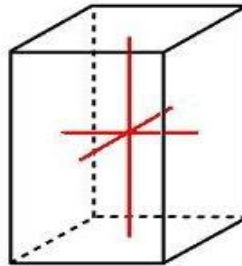
- **The crystals of minerals grow atom by atom to create that mineral's crystal system.**
- **Geologists classify crystal systems into six groups based on the number and angles of the crystal faces**

Crystal Systems

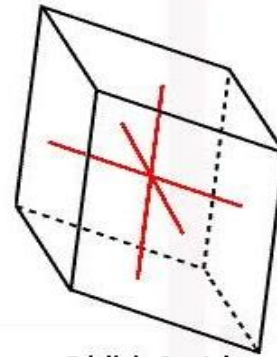
6 BASIC CRYSTAL SYSTEMS



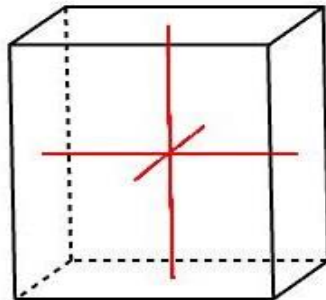
Isometric Crystal



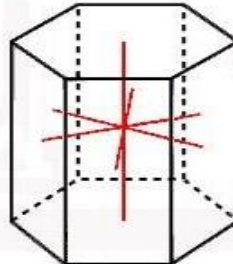
Tetragonal Crystal



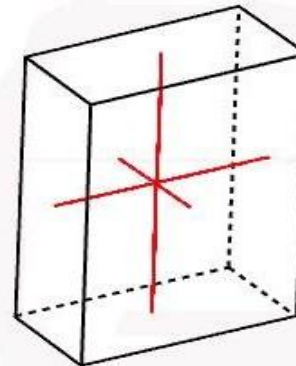
Triclinic Crystal



Orthorhombic Crystal



Hexagonal Crystal



Monoclinic Crystal

Image from <http://www.mindat.org/photos/0547579001219485816.jpg>

Crystal structure



Top left from <http://www.tuspirits.com/images/ArkansasCrystal867.jpg>

Top Right http://judie.co.nz/wp-content/uploads/2010/02/quartz_crystal_cluster_black.jpg

Bottom Left <http://www.mindat.org/photos/0554307001221343359.jpg>

Bottom Right <http://t1.gstatic.com/images?q=tbn:ANd9GcSML6stZDnpe1vLvdPfB>

[3uOjrscEi3qsGmQpQ4LGwERlyB-lww&t=1&usg=__7mdDC9sp-_A5hsegmp5Tp6eDizY=](http://t1.gstatic.com/images?q=tbn:ANd9GcSML6stZDnpe1vLvdPfB)

Cleavage

- Cleavage is a property that describes a mineral that splits evenly along flat surfaces
- Cleavage is due to how atoms are arranged in the crystals of a mineral
- Mica is a mineral that splits easily along a flat surface

Cleavage



Top Left <http://skywalker.cochise.edu/wellerr/mineral/calcite/6calcite-cleavage2.jpg>

Bottom Left <http://0.tqn.com/d/chemistry/1/0/E/c/mica.jpg>

Top Right http://earthsci.org/mineral/rockmin/mineral/mineral_i_d/cleav.jpg

Bottom Right <http://www.crystalradio.net/minerals/galena.jpg>

Fracture

- Fracture describes how a mineral looks if it breaks in an irregular way and does not split apart evenly
- Think of bones, bones fracture



Fracture



Top Left from <http://geology.com/minerals/photos/quartz-conchoidal-482.jpg>

Top Right from <http://geology.csupomona.edu/alert/mineral/fracture.jpg>

Bottom Left from <http://www.geology.neab.net/pictures/rock348.jpg>

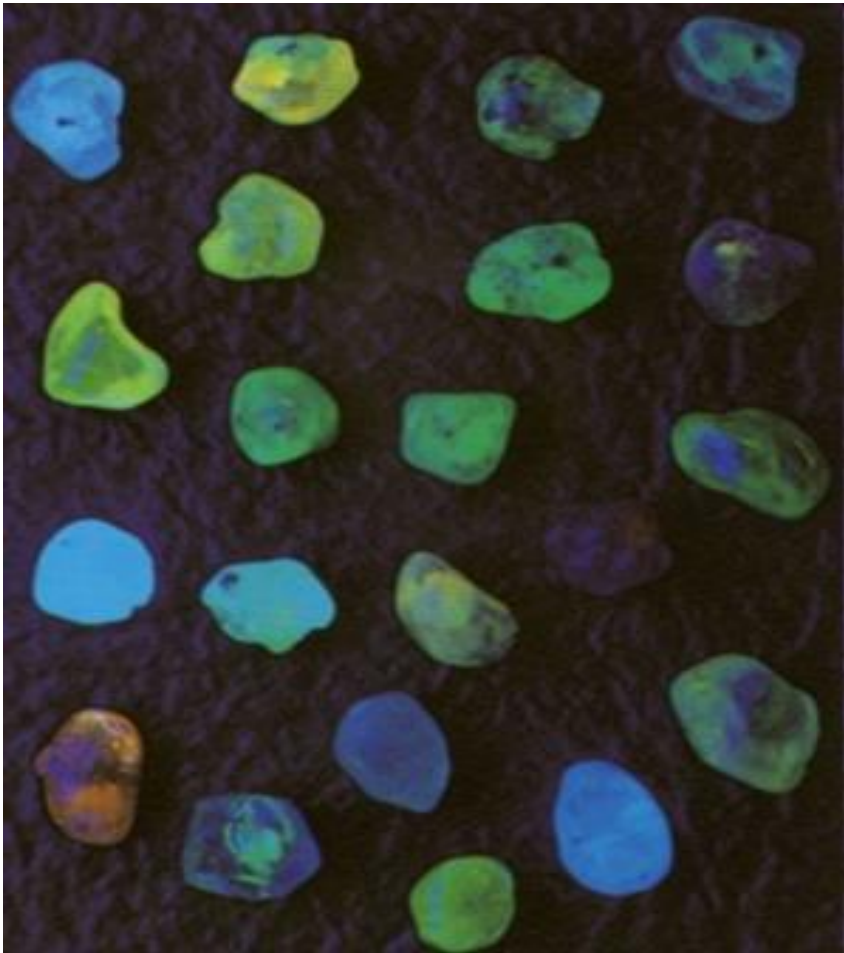
Bottom Right from <http://www.galleries.com/minerals/phosphat/legrandi/legrandi.jpg>

Special Properties

- **Some minerals have special physical properties that help to identify the minerals, such as**
- **Fluorescence means that mineral can glow under ultraviolet light**
- **Double Refraction produces two images when something is viewed through the mineral**

Special Properties

Fluorescence



Double Refraction



Image on left from <http://www.diamondsourceva.com/Education/images/fluorescence-colors.jpg>

Image on right from <http://geology.com/minerals/photos/calcite-double-refraction-124.jpg>