Mineralogy

- What is a Mineral?
- Minerals are naturally-occurring, inorganic solids, with a definite chemical composition and crystalline structure.

- Naturally occurring?
- Naturally occurring = From Nature

- Possible Future Problem: Moissanite

Moissanite

Diamond

LIFE GEMS

Created Individually For You

LifeGem diamonds are created by placing carbon, the primary element of all diamonds, in conditions that recreate the forces of nature. The patented LifeGem® process uses an exact carbon source to create a beautiful and meaningful diamond for you and your family.

In summary, here is how we create your LifeGem diamond...

Step One - Carbon Capture

After extensive research and development, we have discovered how to extract the carbon from a lock of hair or existing cremated remains. This process begins with either an amount of hair collected during a routine hair cut, a small portion of the remains from any standard cremation, or both.

Step Two - Purification

Once captured, this carbon is heated to extremely high temperatures under special conditions. This process converts your loved one's carbon to graphite with unique characteristics and elements that will create your one-of-a-kind LifeGem diamond. Your LifeGem will be like no other in this world.

Step Three - Diamond Creation

To create your LifeGem®, we now place this graphite in one of our unique diamond presses, which replicate the awesome forces deep within the earth — heat and pressure. The more time in the press, the larger the rough diamond crystal that results.

Step Four - Di

Finally, our skilled
laser etch your un
diamonds are indi
trained by the Ge
same certification
be created from th

Delivery

We always ship yo
day delivery/signa

Guarantee

Our business repu
happy, we're not h
from the Better B
10 years we have

Each certified, hi
diamond include
guarantee again

MORE THAN A BREAKTHROUGH


Purification


Purified Carbon


LifeGem Diamond Lab


Diamond Creation Press


Rough LifeGems


Finished LifeGem

- Organic?
- Organic – Living (Think – organs)
- Inorganic = Non living
- Solids?
- Solid – (Hard), not gases or liquids

- *definite chemical composition?*
- What is the definite chemical composition of water?
- Water = H20
- Definite Chemical Composition: The mineral will always have the same chemicals arranged the same way.
- Ex: Water = H20, Quartz = Si02
- Minerals are compounds (not easily separated)

- Most common arrangement of minerals?
- Silicates make up most minerals.
- They are made of Silicon and Oxygen
- ex. Quartz SiO_2 (hint, check your ESRT)

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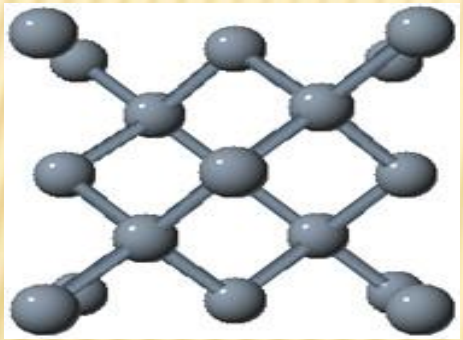
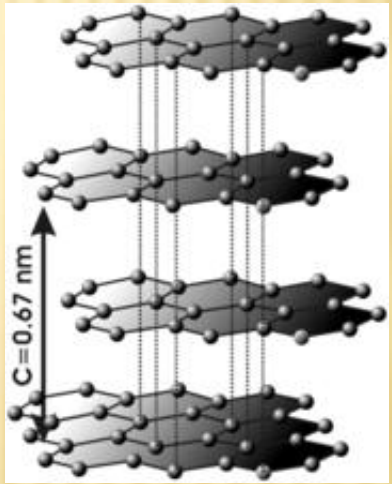
- crystalline structure?
  - Crystalline Structure: Repeating pattern of atoms to build a mineral



Diamond



Graphite

Halite at a Microscopic level

- Most common arrangement of minerals? (R)
- Most minerals are silicates.
- They are made of Silicon and Oxygen
- ex. Quartz SiO2 (hint, check your ESRT)

	Mineral/Formula	Cleavage	Silicate Structure	Example
	Olivine group $(Mg, Fe)_2SiO_4$	None	Independent tetrahedron	Olivine
	Pyroxene group (Augite) $(Mg,Fe)SiO_3$	Two planes at right angles	Single chains	Augite
	Amphibole group (Hornblende) $Ca_2(Fe,Mg)_5Si_8O_{22}(OH)_2$	Two planes at 60° and 120°	Double chains	Hornblend
Micas	Biotite $K(Mg,Fe)_3AlSi_3O_{10}(OH)_2$	One plane	Sheets	Biotite
Micas	Muscovite $KAl_2(AlSi_3O_{10})(OH)_2$	One plane	Sheets	Muscovite
Feldspars	Potassium feldspar (Orthoclase) $KAlSi_3O_8$	Two planes at 90°	Three-dimensional networks	Potassium feldspar
Feldspars	Plagioclase feldspar $(Ca,Na)AlSi_3O_8$	Two planes at 90°	Three-dimensional networks	
	Quartz SiO_2	None	Three-dimensional networks	Quartz

- How many different minerals exist?
- There are approximately 3,000 different minerals.
- This varies depending who you ask.

- What is a Gemstone?
- A gemstone is a mineral that has been cut and polished to be used for jewelry
- How many common gemstones are there?
- There are approximately
- 20 common Gemstones.
- (Think 12 Birthstones)

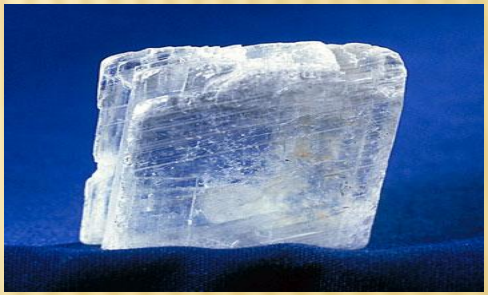
BIRTHSTONES

	**January**	Garnet
	**February**	Amethyst
	**March**	Aquamarine
	**April**	Diamond
	**May**	Emerald
	**June**	Pearl

	**July**	Ruby
	**August**	Peridot
	**September**	Sapphire
	**October**	Opal
	**November**	Citrine
	**December**	Topaz

- How can we tell minerals apart?
- 5 tests to identify minerals.
- 1) Color –
- The color of the mineral.

- Least scientific because:



- 1 mineral may come in several colors
- Many minerals are the same color

- So never Judge a mineral by its color

2) Luster – How a Mineral reflects Light.

- Metallic – Looks like a metal (not just shiny).
- Nonmetallic – Does not look like a metal

include shiny and clear.

- (Transparent – Clear, Translucent – Lets light through, Opaque – light does not pass)

Metallic

Non Metallic

Non Metallic

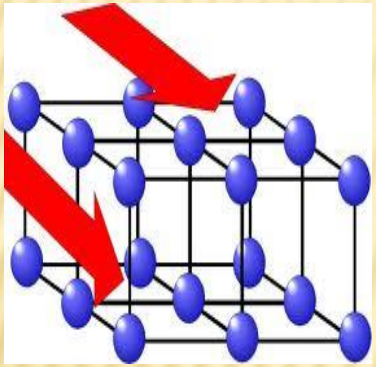
Metallic

Metallica

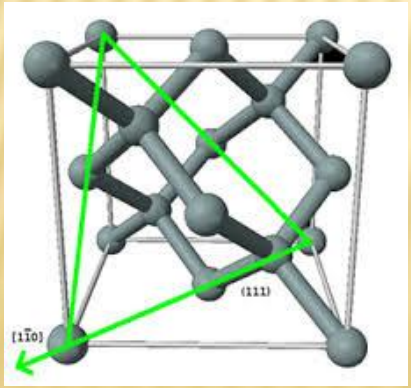
3) Breakage – How a mineral breaks along its atomic plane.

A) Cleavage – Smooth (think - cut with a meat cleaver.)

B) Fracture – Rough uneven break



Cleavage

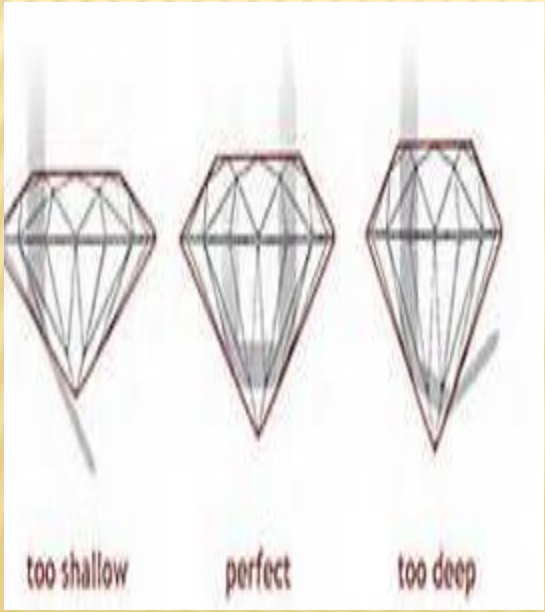


Fracture

- Be careful… Minerals may GROW flat sides but still BREAK with a fracture.
-

Uncut Diamonds

Diamonds are cut on cleavage planes



- 4) Streak: Color of powder left behind when a mineral is rubbed across a streak plate

- A) The same mineral will
  - always have the same
  - color streak.
- B) The color of the mineral
  - Will typically match the
  - streak but it does not
  - have to match.
- C) Some minerals do not
  - streak – that is their streak
  - (be careful with white streaks)

The red-brown streak of the mineral hematite.

- 5) Hardness – The minerals ability to scratch or be scratched.
- A harder mineral will scratch a softer mineral..
- Measured on Moh's hardness scale of 1 -10.
- higher #'s scratch lower #'s

MOH'S HARDNESS SCALE

1 – Talc
Talcum Powder
(Baby powder)
7 – Quartz
(Lucky # 7)
10 – Diamond
(Cuts through anything)

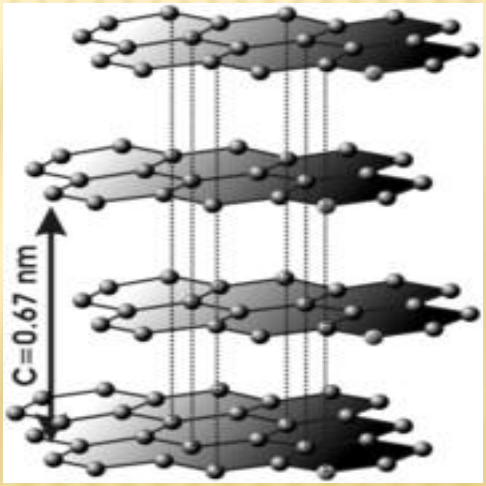
Mineral	Hardness
Talc	1
Gypsum	2
Calcite	3
Fluorite	4
Apatite	5
Feldspar	6
Quartz	7
Topaz	8
Corundum	9
Diamond	10

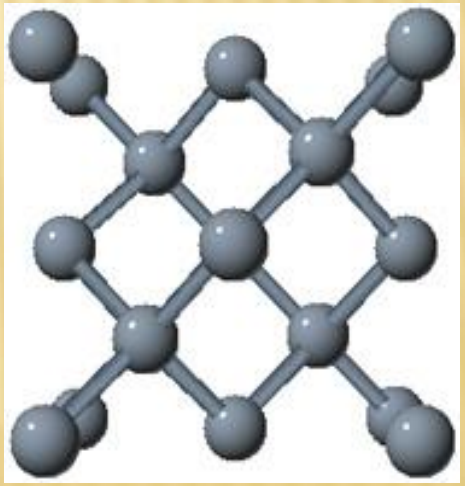
FIGURE 12.1. Mohs Scale of Hardness

- How can you identify a minerals hardness if you are not in a lab with proper equipment?
  - Field testing: Using common materials to identify a minerals hardness.
  - Fingernail = 2.5
  - Penny = 3.5
  - Glass / nail = 5.5
  - If it scratches glass it is considered hard.
  - If not it is said to be soft.
  - These give a range of hardness. (3.5 - 5.5)

- Are there any other ways to identify a mineral?
  - Other quick ways to identify a mineral:
  - Smell
  - Density
  - Taste (obviously do not try this here)
  - Magnetism
  - Reaction to acid

- What determines the most about a mineral is:
- Atomic Arrangement or how the atoms are put together determines the most about a mineral.
- Similar to a houses strength, shape, size, etc being determined by its framework.





- Graphite (carbon)
- Diamond (carbon)

- What is a Mineral?
- https://m.youtube.com/watch?v=-DSzIxeNCBk

Properties of Common Minerals

LUSTER	HARDNESS	CLEAVAGE	FRACTURE	COMMON COLORS	DISTINGUISHING CHARACTERISTICS	USE(S)	COMPOSITION*	MINERAL NAME
Metallic luster	1–2	✔		silver to gray	black streak, greasy feel	pencil lead, lubricants	C	**Graphite**
	2.5	✔		metallic silver	gray-black streak, cubic cleavage, density = 7.6 g/cm^3	ore of lead, batteries	PbS	**Galena**
	5.5–6.5		✔	black to silver	black streak, magnetic	ore of iron, steel	Fe_3O_4	**Magnetite**
	6.5		✔	brassy yellow	green-black streak, (fool's gold)	ore of sulfur	FeS_2	**Pyrite**
Either	5.5 – 6.5 or 1		✔	metallic silver or earthy red	red-brown streak	ore of iron, jewelry	Fe_2O_3	**Hematite**
Nonmetallic luster	1	✔		white to green	greasy feel	ceramics, paper	$Mg_3Si_4O_{10}(OH)_2$	**Talc**
	2		✔	yellow to amber	white-yellow streak	sulfuric acid	S	**Sulfur**
	2	✔		white to pink or gray	easily scratched by fingernail	plaster of paris, drywall	$CaSO_4 \cdot 2H_2O$	**Selenite gypsum**
	2–2.5	✔		colorless to yellow	flexible in thin sheets	paint, roofing	$KAl_3Si_3O_{10}(OH)_2$	**Muscovite mica**
	2.5	✔		colorless to white	cubic cleavage, salty taste	food additive, melts ice	NaCl	**Halite**
	2.5–3	✔		black to dark brown	flexible in thin sheets	construction materials	$K(Mg,Fe)_3AlSi_3O_{10}(OH)_2$	**Biotite mica**
	3	✔		colorless or variable	bubbles with acid, rhombohedral cleavage	cement, lime	$CaCO_3$	**Calcite**
	3.5	✔		colorless or variable	bubbles with acid when powdered	building stones	$CaMg(CO_3)_2$	**Dolomite**
	4	✔		colorless or variable	cleaves in 4 directions	hydrofluoric acid	CaF_2	**Fluorite**
	5–6	✔		black to dark green	cleaves in 2 directions at 90°	mineral collections, jewelry	$(Ca,Na)(Mg,Fe,Al)(Si,Al)_2O_6$	**Pyroxene** (commonly augite)
	5.5	✔		black to dark green	cleaves at 56° and 124°	mineral collections, jewelry	$CaNa(Mg,Fe)_4(Al,Fe,Ti)_3Si_6O_{22}(O,OH)_2$	**Amphibole** (commonly hornblende)
	6	✔		white to pink	cleaves in 2 directions at 90°	ceramics, glass	$KAlSi_3O_8$	**Potassium feldspar** (commonly orthoclase)
	6	✔		white to gray	cleaves in 2 directions, striations visible	ceramics, glass	$(Na,Ca)AlSi_3O_8$	**Plagioclase feldspar**
	6.5		✔	green to gray or brown	commonly light green and granular	furnace bricks, jewelry	$(Fe,Mg)_2SiO_4$	**Olivine**
	7		✔	colorless or variable	glassy luster, may form hexagonal crystals	glass, jewelry, electronics	SiO_2	**Quartz**
	6.5–7.5		✔	dark red to green	often seen as red glassy grains in NYS metamorphic rocks	jewelry (NYS gem), abrasives	$Fe_3Al_2Si_3O_{12}$	**Garnet**

*Chemical symbols:

Al = aluminum	Cl = chlorine	H = hydrogen	Na = sodium	S = sulfur
C = carbon	F = fluorine	K = potassium	O = oxygen	Si = silicon
Ca = calcium	Fe = iron	Mg = magnesium	Pb = lead	Ti = titanium

✔ = dominant form of breakage

MINERAL LAB (R = 2X) (G = 1X)

- Purpose – To learn how to identify minerals
- Data – Mineral I.D. sheet
- Conclusion –
- Mineral?
- Breakage? (2 types)?
- Hardness? (scale & field testing)?
- Streak? (does it change)?
- Luster? (2 types)?
- Color? (why least scientific)?
- 3 common uses of minerals today?