What is a mineral? 4000 minerals on Earth !!!!

A naturally occurring, inorganic solid crystalline substance with a definite chemical composition.

A mineral must have these 5 major aspects:

If even just one of these requirements are not satisfied, then the substance is NOT a mineral.

- Naturally occurring
- Inorganic
- Solid
- Crystal
- Definite Chemical composition

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What do these products have in common?

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Dig A Little Deeper

A Bright Smile

From Toothpaste and Minerals

Toothpaste cleans your teeth and keeps them healthy.

Language Arts: *Read "Ira Sleeps Over." Let students bring PJs & toothpaste.*

Social Studies: *What was used before toothpaste was "invented."*

Science: *What minerals are found in toothpaste. Read about or research fluorite. Compare fluoride content in various brands.*

Math: *Survey class on brands used, chart or graph.* **Health:** *Discuss dental hygiene & special ingredients.* **P.E.:** *Stomp & squirt contest, use toothpaste & butcher paper.*

Naturally Occurring

Naturally Occurring

- **Something formed in nature, not man-made.**
- **Example: Diamond, Copper, Salt**

Minerals are a girl's best friend !

- Diamond is a mineral

- Cubic Zirconia is not

WHY ?

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Inorganic

Inorganic

- Something that was never living.
- An inorganic substance was formed by earth processes.

Is ice inorganic?
Is paper inorganic?
Is rock from magma inorganic?
Is a dead cat inorganic?

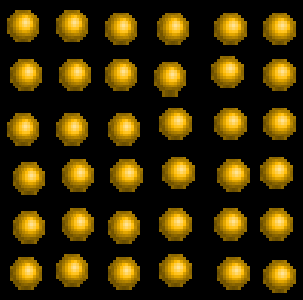
Are synthetically created substance minerals?
After all, they were never alive ????

Solid

Solid

- Something that has a definite, ridged shape and volume.
- Gas and liquids are not minerals.

Is air a mineral?
Is mercury a mineral?



Crystalline Substance

Definite chemical composition

Definite chemical composition

- Every mineral has its own chemical composition.
- A chemical composition is like a recipe for baking.
- A mineral has certain elements combined in certain amounts.

Na + Cl = Salt
Si + O_2 = Quartz

Just like baking, you must have the ingredients in just the right amounts.

Si + O_2 is not the same as Si + O_3

1 egg
1 cup of flour
2 cups sugar

... will make something totally different than....

5 eggs
1 cup flour
8 cups sugar

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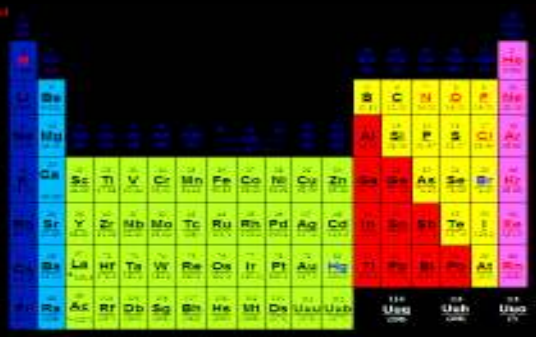
What are minerals made of?

Most minerals are made up of a combination of two or more elements.

Elements such as Na, Cl, Fe, C, O, Si – and others that you might recognize from the periodic table of elements combine together to form minerals.



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How do minerals form?

Minerals form through processes called crystallization.

Crystallization is a "crystal-forming process." As you know, minerals are crystals!

Minerals (crystals) can form in two ways:

1. Cooling of Magma
2. Solution Evaporation

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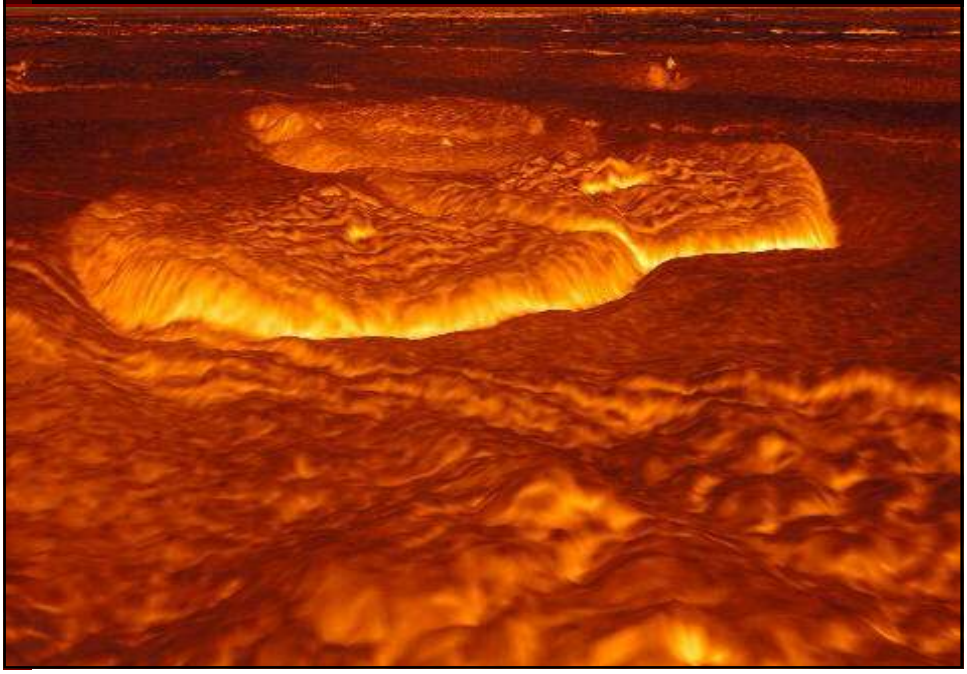
Cooling of Magma



Cooling of Magma

Solution Evaporation

Minerals dissolve in water and create a solution.

Eventually, the water will evaporate and the minerals will fall out of solution and be left behind.

When minerals fall out of a solution they are said to precipitate.

Ex: Salt Water evaporating with salt crystals left behind.

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Identifying Minerals…

Hardness

Fracture

Color

Cleavage

Luster

Streak

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Identification of Minerals

- What if you have two minerals that look exactly alike?
- How will you be able to tell one from the other?
  Study their characteristics.

There are a number of different properties or characteristics that can give you clues to recognize different minerals.

Those properties include: Color, luster, streak, hardness, cleavage, fracture, specific gravity, and a number of useful others.

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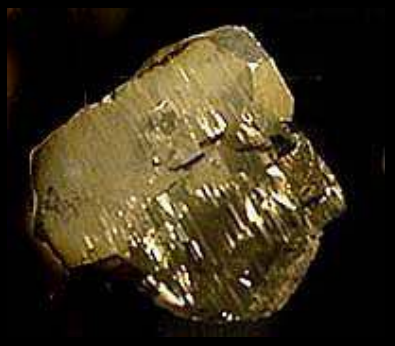
Identification of Minerals: Which is Gold?



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Identification of Minerals: There are over 4000 !






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Color

Although color is an obvious feature of a mineral, it is often unreliable for identification.

Slight impurities can contaminate the mineral changing its color.



Example: Quartz can be white, pink, purple.

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Color

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Color

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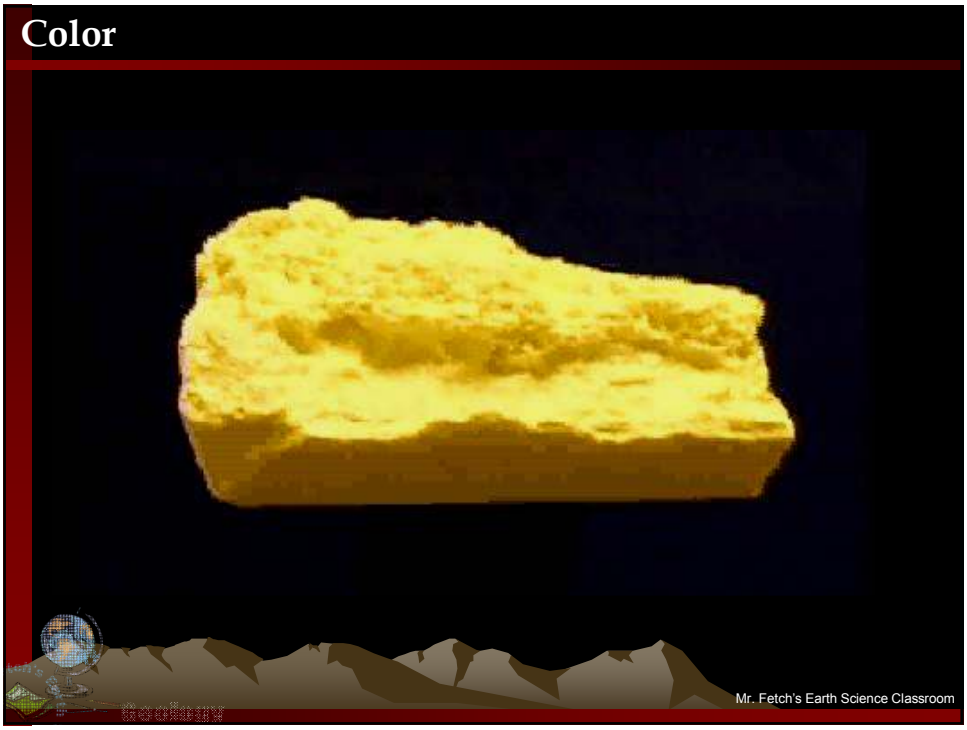
Color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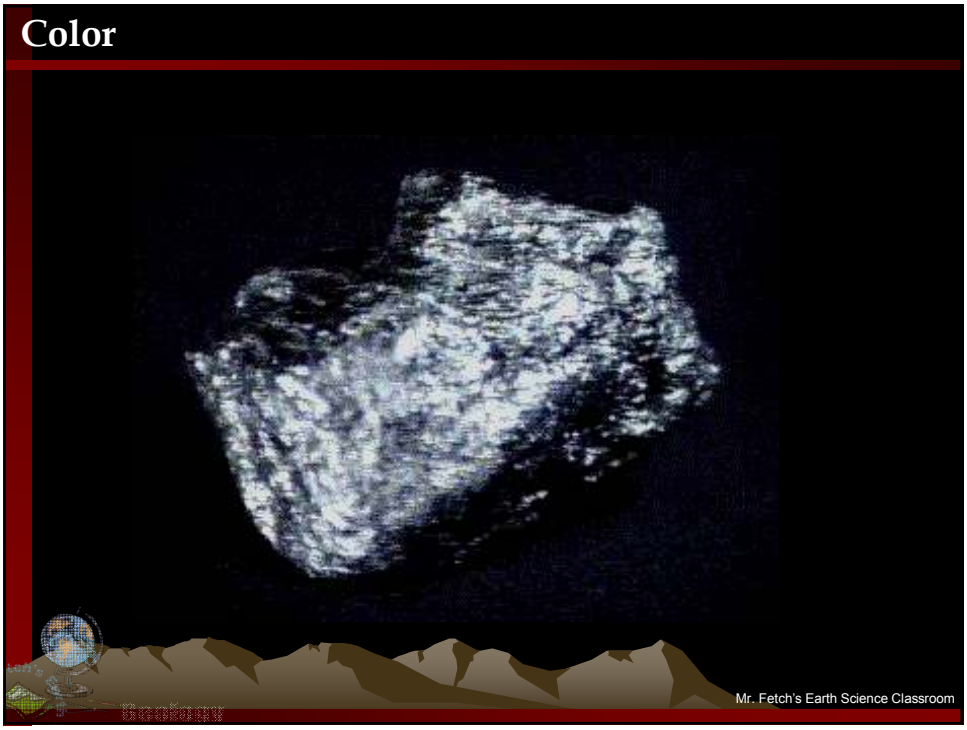
Color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Luster

Luster is the way a mineral reflects light.
It is often described as either metallic or nonmetallic.

METALLIC LUSTER

NON-METALLIC LUSTER

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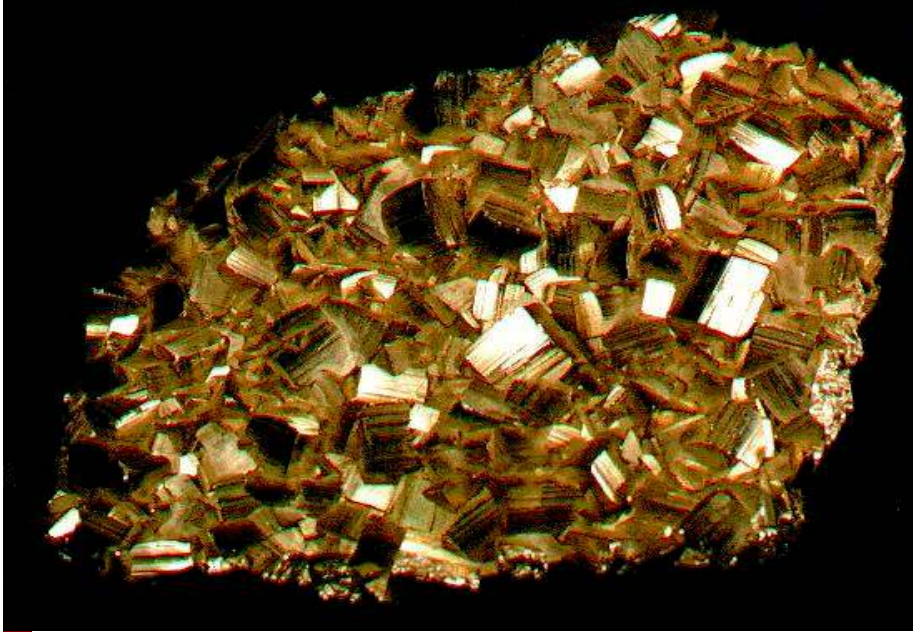
Luster: What luster is it?



Luster: What luster is it?

Luster: What luster is it?

Streak

If you were to scratch a mineral against a hard surface, like a porcelain tile it would leave behind a streak of colored powder.

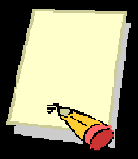
Scientists use a streak plate to do the streak test.

Streak

While a mineral's color may change, the color of its streak usually does not. Streak is often a much more helpful way to use color to identify a mineral.

Where do you use streak in your everyday day life?

Writing with a pencil on paper.

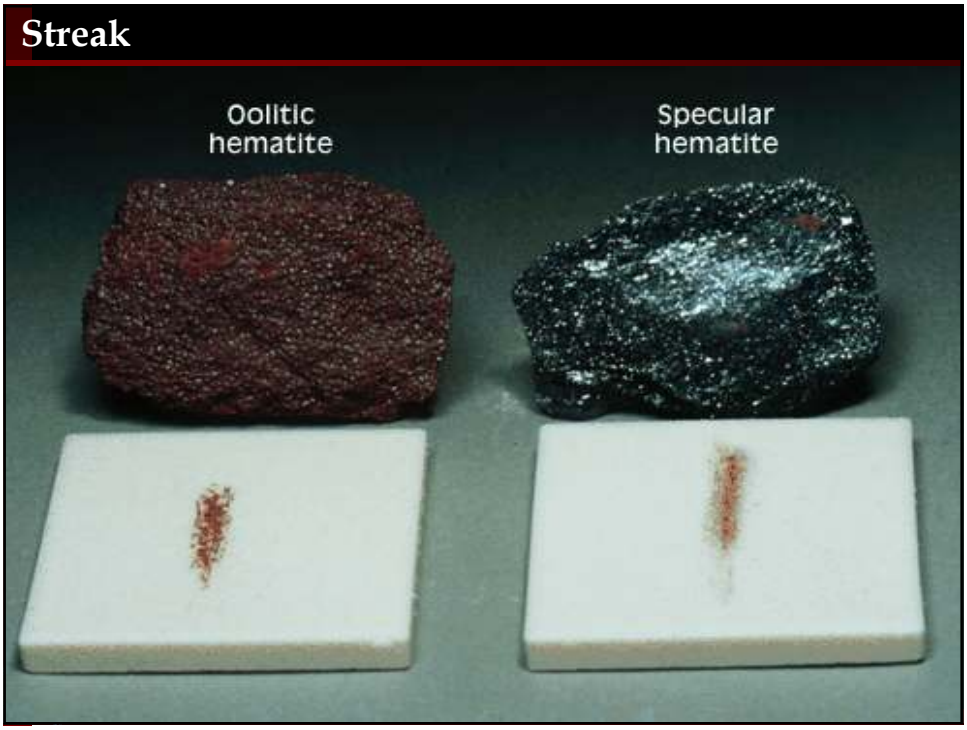


Which mineral do you use to leave the streak?

Graphite

Streak

Streak



Hardness

The measure of how easily a mineral can be scratched is known as its hardness.

Hardness of a mineral has nothing to do with whether it breaks easily or not.

Hardness is measured by using The Moh's Hardness Scale, which is a scale that ranks ten common minerals hardness.

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Hardness

The scale is from 1-10.

Talc is the softest mineral and diamond is the hardest mineral.

Moh's Scale of Hardness of Minerals			
1	Talc	Common Items Hardness	
2	Gypsum	Fingernail =	2-2.5
3	Calcite	Copper coin =	3.5
4	Fluorite	Iron Nail =	4.5
5	Apatite	Glass =	5-5.5
6	Orthoclase	Streak plate =	6.5-7
7	Quartz		
8	Topaz		
9	Corundum		
10	Diamond		

2	Gypsum	Fingernail =	2-2.5
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6	Orthoclase	Streak plate =	6.5-7
7	Quartz		
8	Topaz		
9	Corundum		
10	Diamond		

Cleavage

The way a mineral breaks apart is another way that is helpful in identifying it.

Sometimes when you break a mineral, it will break along flat, smooth surfaces.

This results in a nice clean cuts

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Cleavage

Cleavage

This is called cleavage.

Think of the way a sharp meat cleaver cuts meat. Nice, clean cuts.

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Fracture

Sometimes, minerals do not break in nice clean, flat cuts.

Minerals that break along flat, smooth surfaces are said to fracture.

The way a mineral breaks depends on the strength and arrangement of atomic bonds within the mineral.

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Cleavage and Fracture

Cleavage and Fracture

MINERALS WITH CLEAVAGE

- Mica
- Calcite
- Halite
- Fluorite

MINERALS THAT FRACTURE

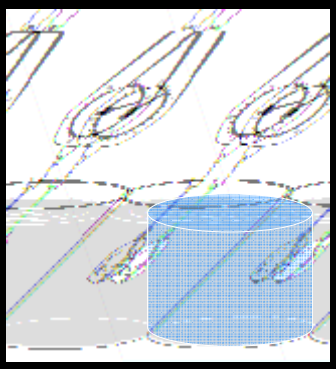
- Quartz
- Olivine

All minerals fracture to some extent… even those with cleavage do not break PERFECTLY all the time.

Specific Gravity

Minerals can be identified by comparing the weights of equal samples.

The specific gravity of a mineral is the ratio of its weight compared to the weight of an equal volume of water.



$$SG = \frac{\text{Weight of mineral}}{\text{Weight in equal volume of water}}$$

Specific Gravity

Gold has a specific gravity of 19.
Pyrite has a specific gravity of 5.

That means the gold is 19 times heavier than water and pyrite is 5 heavier than water.

If gold and pyrite look the same, you can tell them apart by finding their specific gravity.

If you were to heft or lift two different minerals, the one with the higher specific gravity would feel heavier.

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Magnetism

Magnetism: Some minerals are attracted to magnets and metals.

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Acid Test

Acid Test: Weak HCl acid on carbonate minerals (those with CO_2) will produce a chemical reaction.

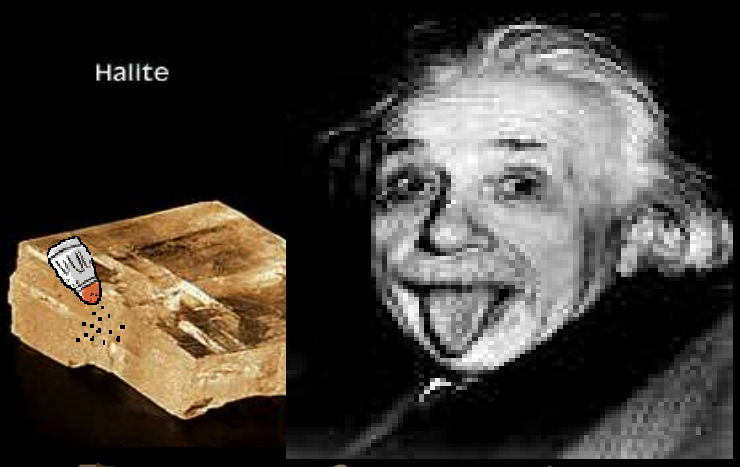
CO_2 is given off as bubbles.

Smell

Smell: Some minerals have a peculiar smell. Ex: sulfur

Taste

Smell: Some minerals have a peculiar taste. Ex: halite



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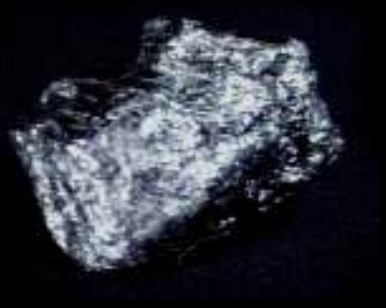
Touch

Smell: Some minerals have a peculiar feel. Ex: talc or graphite



SILKY

SOAPY

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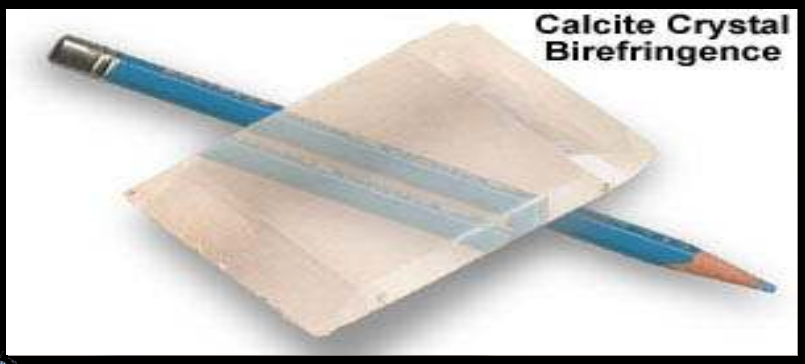
Refraction

Double Refraction: Light enters the mineral as one beam of light, but then it separates into to 2 beams.

You then see DOUBLE. Ex: calcite



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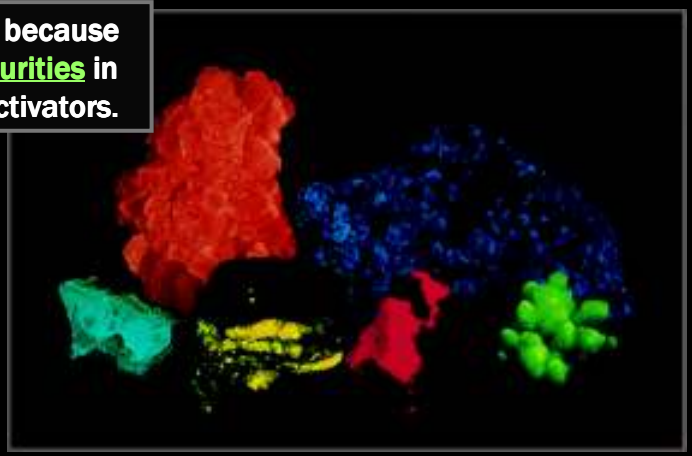
Fluorescence

Fluorescence: Some minerals glow brightly under a black light.

Minerals glow because they have impurities in them called activators.



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