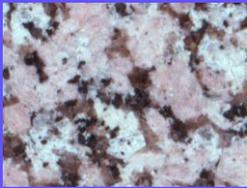




### Rock vs. mineral

- Rock
  - Aggregate of minerals



### Compounds

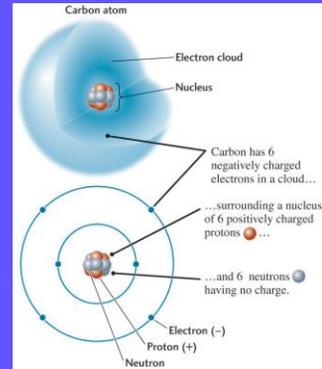
- Combinations of one or more elements



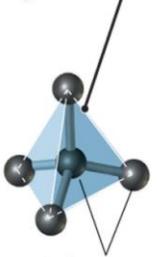
“Layperson” = salt  
Chemist = NaCl (sodium chloride)  
Geologist = Halite (mineral)

## So what is a mineral?

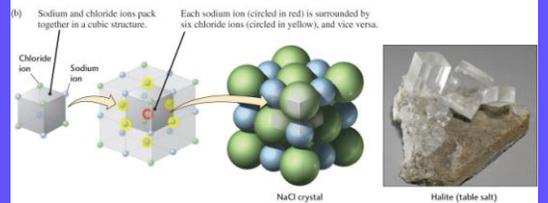
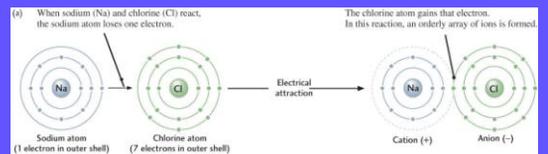
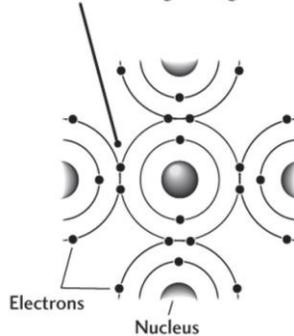
- Solid
- Inorganic
- Natural
- Chemical composition
- Atoms ordered
  - Crystal lattice



Carbon atoms in diamond are arranged in regular tetrahedra...



...that share an electron with each of four neighboring atoms.

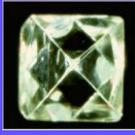


CATIONS	Silicon (Si <sup>4+</sup> )	Aluminum (Al <sup>3+</sup> )	Iron (Fe <sup>3+</sup> )	Magnesium (Mg <sup>2+</sup> )	Iron (Fe <sup>2+</sup> )	Sodium (Na <sup>+</sup> )	Calcium (Ca <sup>2+</sup> )	Potassium (K <sup>+</sup> )
								
	0.27	0.53	0.65	0.72	0.73	0.99	1.00	1.38
ANIONS	Oxygen (O <sup>2-</sup> )	Chloride (Cl <sup>-</sup> )	Sulfide (S <sup>2-</sup> )					
								
	1.40	1.81	1.84					

## Crystals



Halite



Diamond



Staurolite



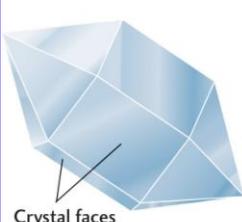
Quartz

## Crystal power?



The Crystalline Crapper





Crystal faces

A perfect quartz crystal

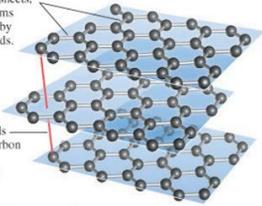


A natural quartz crystal

**Graphite** is formed at lower pressures and temperatures than diamond. Its carbon forms sheets whose atoms are more loosely packed than those in diamond.

Within its sheets, carbon atoms are joined by strong bonds.

Weak bonds connect carbon atoms in alternating sheets.



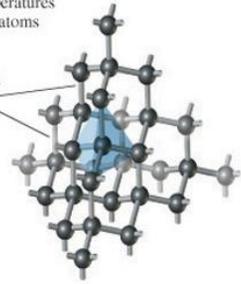
Graphite

Natural **diamond** is formed by very high pressures and temperatures in Earth's mantle. Its carbon atoms are closely packed.

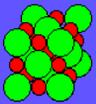
All carbon atoms in diamond are closely packed, and all the bonds are very strong.



Diamond



## Crystal structure



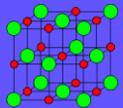
● Na<sup>+</sup>

● Cl<sup>-</sup>

Determined by the way the atoms are packed

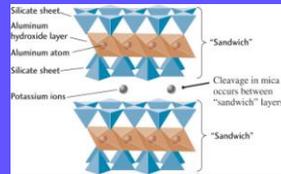
Atoms pack as a cube...

So halite is cubic



● Na<sup>+</sup>

● Cl<sup>-</sup>



Cleavage in mica occurs between "sandwich" layers.



## What makes up minerals?

### Abundant elements in continental crust

- 1) Silicon (Si)
- 2) Oxygen (O)
- 3) Aluminum (Al)
- 4) Iron (Fe)
- 5) Calcium (Ca)