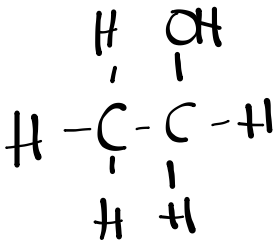
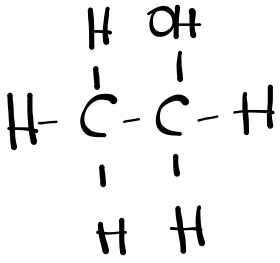




Fe^{3+} SO_4^{2-}

iron(III)sulfate heptahydrate

$Fe_2(SO_4)_3 \cdot 7H_2O$

Chemical Bonding

Valence electrons
electrons in the highest occupied energy level of an element's atoms.

- determines the chemical properties of an element
- only electrons used in chemical bonds
- for a representative element, the number of valence electrons corresponds to the group number

Electron dot structure
diagrams showing the valence electrons as dots

Table 7.1

Table 7.1

Electron Dot Structure of Some Group A Elements

Period	Group 1A	2A	3A	4A	5A	6A	7A	8A
1	H·							He:
2	Li·	·Be·	·B·	·C·	·N·	·O·	·F·	:Ne:
3	Na·	·Mg·	·Al·	·Si·	·P·	·S·	·Cl·	:Ar:
4	K·	·Ca·	·Ga·	·Ge·	·As·	·Se·	·Br·	:Kr:

Octet Rule

To form compounds, atoms usually achieve the electron configuration of a noble gas.
At the highest occupied energy level: ns^2np^6

Formation of Cations
Cations lose valence electrons to form positively charged ions

$Na\ 1s^22s^22p^63s^1 \xrightarrow{-e^-} Na^+\ 1s^22s^22p^6$

Ionization:

$Na \longrightarrow Na^+ + e^-$

Mg

Transition Metals will attempt to form a pseudo noble-gas configuration.

Cu (I)

Formation of Anions
Anions gain electrons to produce a negatively charged ion.

$Cl\ 1s^2 2s^2 2p^6 3s^2 3p^5 \xrightarrow{+ e^-} Cl^-\ 1s^2 2s^2 2p^6 3s^2 3p^6$

Ionization:

$Cl + e^- \quad Cl^-$

O

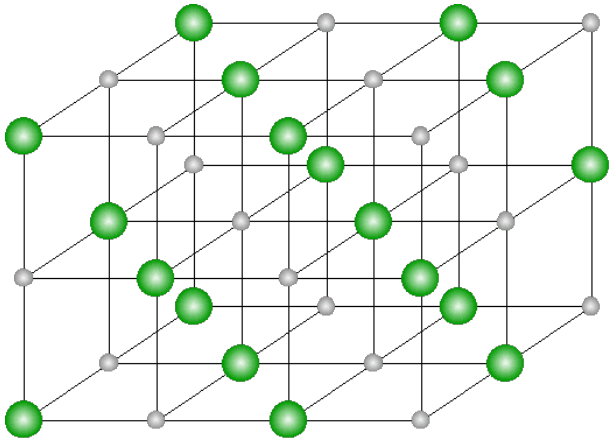
Chlorine atom

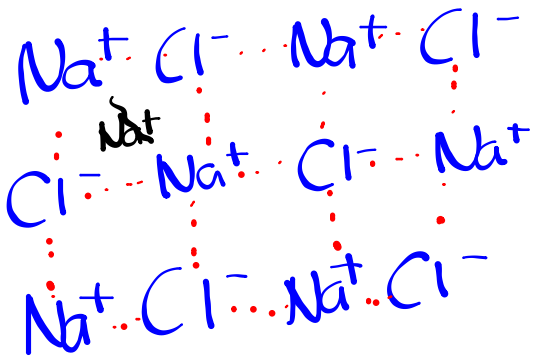
Cl

Chloride ion

Cl

Crystal Structure of Ionic Solids





NaCl

Na^+ Cl^-

+/- attraction

Homework

p. 193 #3-11

Metallic Bonds

Metals are made of closely packed cations rather than neutral atoms.

In metals, the valence electrons drift freely from one part of the metal to another.

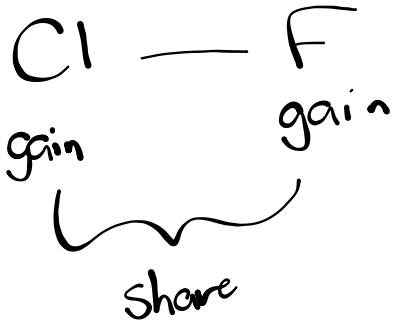
Metallic bonds consist of the free-floating valence electrons for the positively charged metal ions.

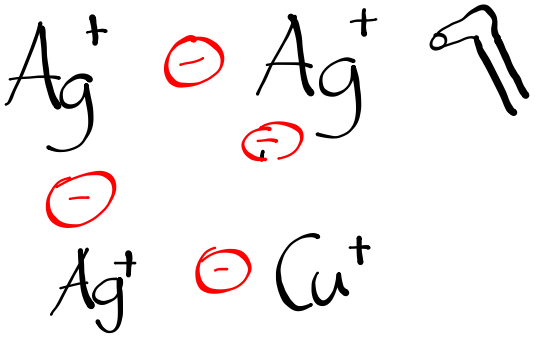
Ductility and Malleability

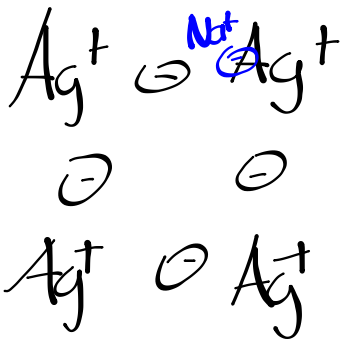
Metals - cations insulated by 'sea' of electrons

Ionic compounds - positive ions pushed together and repel, causing crystal to shatter.

Na^+ Cl^-





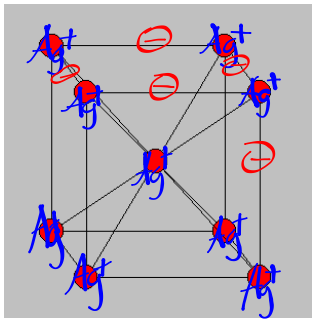


Crystalline Structure of Metals

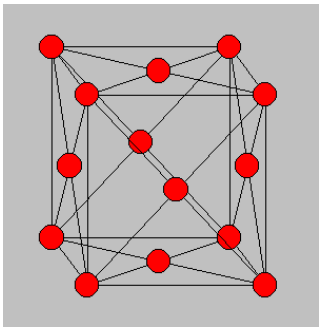
Metals are arranged in very compact and orderly patterns.

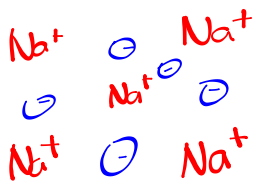
Closely-Packed Arrangements:

- Body-Centered Cubic

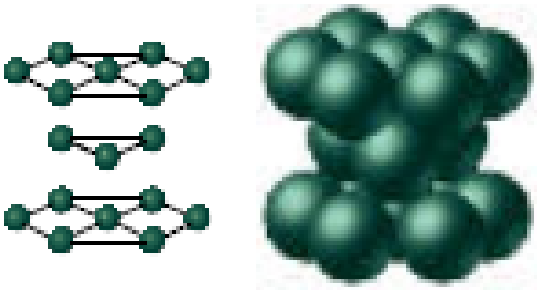


- Face-Centered Cubic





- Hexagonal Close-Packed



Hexagonal close-packed

Alloys

Alloys
Mixtures of two or more elements, at least one of which is a metal.

Table 7.3

Table 7.3
Composition of Some Common Alloys

Name	Composition (by mass)
Sterling silver	Ag 92.5% Cu 7.5%
Cast iron	Fe 96% C 4%
Stainless steel	Fe 80.6% Cr 18.0% C 0.4% Ni 1.0%
Spring steel	Fe 98.6% Cr 1.0% C 0.4%
Surgical steel	Fe 67% Cr 18% Ni 12% Mo 3%

Form in one of two ways:
1) Substitutional Alloys
If atoms of the alloy are about the same size, they can replace each other in the crystal.

2) Interstitial Alloys
If atomic sizes are quite different, smaller atoms can fit into the spaces between the larger atoms.