Chemical Bonding

Ionic Bond: Results from the transfer of one or more electrons from one atom to another.

Electrostatic attractions between ions
Increase charge – remove an electron
Decrease charge – add an electron

Ions: atoms which have an electrical charge

Cations - forms when a neutral atom loses one or more valence electrons

Anions - forms when a neutral atom gains one or more valence electrons

Ionic Compounds are formed by ionic bonds
Usually form between a metal and nonmetal
Tend to form noble gas(octet) electron configurations
Lattice energy - The energy required to separate exactly 1 mole of the solid into its component gaseous ions.

Valence Electrons: The electrons in the outer most orbital of an atom.
It is the loss, gain, or sharing of **valence** electrons that determines how elements react.

Ionization Energy
$X + \text{energy} \rightarrow X^+ + e^-$

Electron Affinity
$X + e^- \rightarrow X^- + \text{energy}$

Electron Configurations of Ions & Lewis Structures of Ionic Compounds

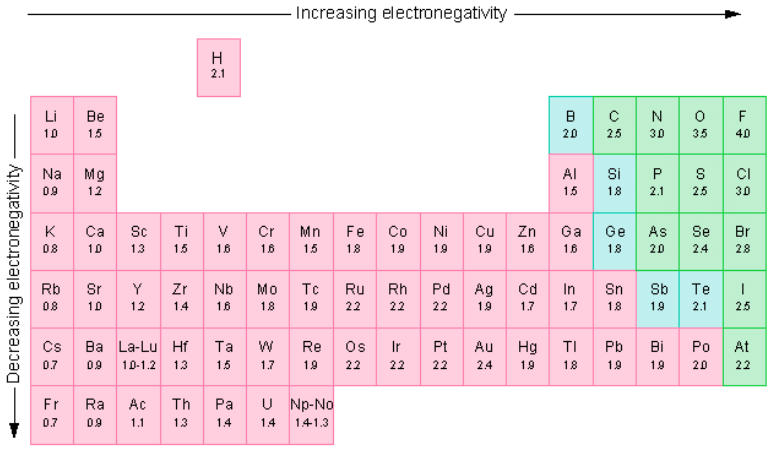
Covalent Bonds: A bond resulting from the sharing of electrons (usually two).
Forms a molecule
The unit of matter resulting from atoms joined by covalent bonds.

Covalent Bonding
Sharing of valence electrons due to an overlapping of singlet orbitals.
Usually occur between nonmetals.
Forms a strong bond holding atoms together to form single units called molecules.
Types of bonds: single, double, & triple

Electronegativity: A measure of the attraction of an atom for the electrons in a chemical bond.
(Developed by Linus Pauli)

Electronegativity Differences between Bonding Atoms

0 – 5% … pure covalent
5 – 50% - polar covalent
50 – 100% - ionic



Lewis Structures
(Electron-Dot)

- Determine the total number of valence electrons in the molecule or ion
  1. Molecules: add the number of valence electrons on each atom in the molecule
  2. Anions: add the number of valence electrons on the atoms in the ion and the number of negative charges on the ion
  3. Cations: add the number of valence electrons on the atoms in the ion and then subtract the number of positive charges on the ion

- Draw a skeleton of the molecule or ion, showing the arrangement of atoms, and connect each atom to another with a single bond.
- Deduct the 2 valence electrons for each bond.
- Distribute the remaining electrons as unshared pairs so that each atom has 8 electrons if possible.

Lewis Structures (know how to draw)

Noble Gas Configuration
vs
non-Noble Gas Configuration

Oxidation State (Number) or Valence Number: A hypothetical charge an atom would have if the electrons in each bond were located on the **more** electronegative atom.

Resonance: If two or more Lewis structures with the same arrangement of atoms can be written for a molecule or ion, then the actual electron distribution is an average of that shown by the various Lewis structures.

Bond Dissociation Energy: The energy required to break a specific covalent bond in exactly 1 mole of gaseous molecules.

Calculation of Enthalpy Change

$$\Delta H = \sum D_{bonds\ broken} - \sum D_{bonds\ formed}$$

Single Bonds

H	C	N	O	F	Si	P	S	Cl	Br	I	
436	415	390	464	569	395	320	340	432	370	295	H
	345	290	350	439	360	265	260	330	275	240	C
		160	200	270	--	210	--	200	245	--	N
			140	185	370	350	--	205	--	200	O
				160	540	489	285	255	235	--	F
					230	215	225	359	290	215	Si
						215	230	330	270	215	P
							215	250	215	--	S
								243	220	210	Cl
									190	180	Br
										150	I

Multiple Bonds

C = C,	611	C = N,	615	C = O,	741	N = N,	418	O = O,	498
C ≡ C,	837	C ≡ N,	891	C ≡ O,	1080	N ≡ N,	946		