Advanced Chemistry
Notes: Naming Compounds

Elements are the building materials of the substances that make up all living and nonliving things.
*Only the noble gas elements exist as isolated atoms, also known as monatomic.

Molecular compounds are compounds composed of molecules that tend to have relatively low melting and boiling points. Many are gasses or liquids.

Molecule is the smallest electrically neutral unit of a substance that still has the properties of the substance. They are made up of two or more atoms that act as a single unit
*Ex. oxygen molecules (O_2) because it is made up of 2 different atoms of oxygen
*Diatomic molecules are molecules that have 2 atoms such as O_2
*Triatomic molecules are molecules that have 3 atoms such as O_3 (Ozone)

Ionic compounds are compounds composed of cations and anions, and usually composed of metal cations and nonmetal anions.
*Ex. sodium chloride or calcium oxide (lime)
*The total positive charge is equal to the total negative charge
*Melt at high temperatures, and are solid crystals at room temp

Characteristics of Molecular and Ionic Compounds		
Representative unit	**Molecule**	**Formula unit (balance of oppositely charged ions)**
Type of elements	Nonmetallic	Metallic combined with nonmetallic
Physical state	Solid, liquid, or gas	Solid
Melting point	Low (usually below 300^{o}C)	High (usually above300^{o}C)

Ions are atoms or groups of atoms that have a positive or negative charge

- **Cations** are any atom or group of atoms that has a positive charge. Formed when elements lose one or more electrons

- **Anions** are any atom or group of atoms that has a negative charge. Formed when elements gain one or more electrons.

- **Monatomic ions:** ions consisting of only one atom, the ionic charges can often be determined by using the periodic table.

Ionic Charges of Representative Elements							
1A	**2A**	**3A**	**4A**	**5A**	**6A**	**7A**	**0**
Li^{+}	Be^{2+}			N^{3-}	O^{2-}	F^{-}	
Na^{+}	Mg^{2+}	Al^{3+}		P^{3-}	S^{2-}	Cl^{-}	
K^{+}	Ca^{2+}			As^{3-}	Se^{2-}	Br^{-}	
Rb^{+}	Sr^{2+}					I^{-}	
Cs^{+}	Ba^{2+}						

- **Poloyatomic ions** tightly bound groups of atoms that behave as a unit and carry a charge.
  *Ex. sulfate which has a 2- charge

Ammonium	NH_4^{+}	Chlorate	ClO_3^{-}	Peroxide	O_2^{-2}
Acetate	CH_3COO^{-}	Perchlorate	ClO_4^{-}	Chromate	CrO_4^{-2}
Nitrate	NO_3^{-}	Permanganate	MnO_4^{-}	Dichromate	$Cr_2O_7^{-2}$
Nitrite	NO_2^{-}	Carbonate	CO_3^{-2}	Silicate	SiO_3^{-2}
Hydroxide	OH^{-}	Sulfate	SO_4^{-2}	Phosphate	PO_4^{-3}
Hypochlorite	ClO^{-}	Sulfite	SO_3^{-2}	Arsenate	AsO_4^{-3}
Chlorite	ClO_2^{-}	Thiosulfate	$S_2O_3^{-2}$	Arsenite	AsO_3^{-3}
Cyanate	CN^{-}	Thiocyanate	SCN^{-}	Borate	BO_3^{-3}
Bicarbonate	HCO_3^{-}	Bisulfate	HSO_4^{-}	Bisulfite	HSO_3^{-}

Chemical formula shows the kinds and numbers of atoms in the smallest representative unit of the substance.

* Represented by the chemical formulas of monatomic elements
*If the molecules of the element each have more than one atom, a number is used as a subscript

Diatomic Seven

Hydrogen (H_2) Fluorine (F_2) Oxygen (O_2)
Nitrogen (N_2) Chlorine (Cl_2) Bromine (Br_2)
Iodine (I_2)

- **Molecular formula** shows the numbers and kinds of atoms present in a molecule of a compound, but shows nothing about the molecule's structure.

- **Formula unit** is what chemist uses to represent an ionic compound.
  *The lowest whole-number ration of the ions is 1:1

The charges of the ions of the representative elements can be determined by the position of these elements in the periodic table. Most transition metals have more than one common ionic charge

- **Law of definite proportions** states that in samples of any chemical compound, the masses of the elements are always in the same proportions
  *consistent with Dalton's atomic theory.
- **Law of multiple proportions**: Whenever two elements form more than one compound, the different masses of one element that combine with the same mass of the other element are in the ratio of small whole numbers.
  *Stated by Dalton

Compound types:

1. **Binary compounds** composed of two elements
   * Ex. potassium chloride (KCl)
   * named by writing the name of the cation followed by the name of the anion.
   * Generally ends in *ide*

When a cation can have more than one ionic charge, a Roman numeral is used in the name

2. **Ternary compounds** a compound that contains atoms of three different elements.
   * Name generally ends in *ite* or *ate*

3. **Binary molecular compounds** composed of two nonmetallic elements
   *name always ends in *ide*
   *prefixes are used to show how many atoms of each element are present