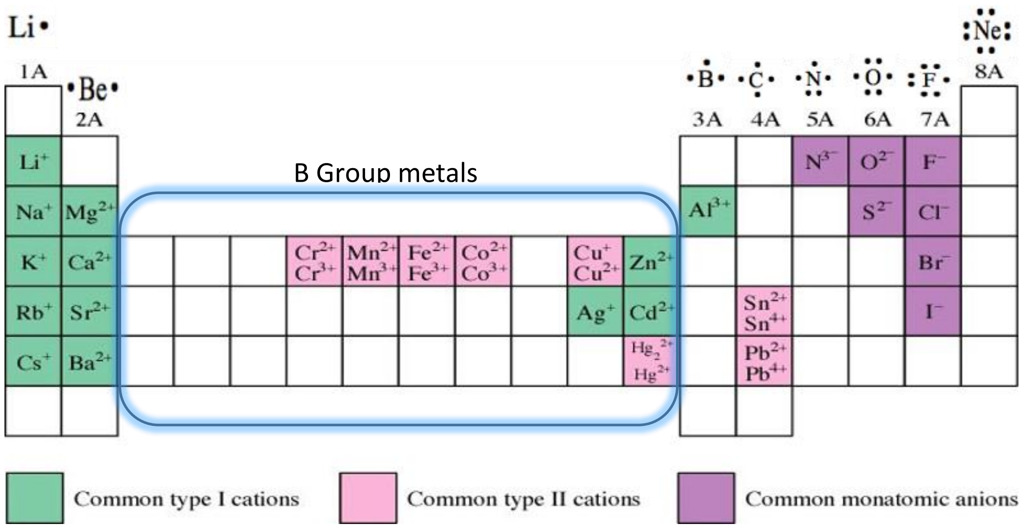
AP Stoichiometry and Nomenclature Review



POLYATOMIC IONS YOU SHOULD HAVE MEMORIZED:

1.) Ammonium – NH_4^{+1}
2.) Hydroxide – OH^{-1}
3.) Acetate – $C_2H_3O_2^{-1}$
4.) Nitrate – NO_3^{-1}
5.) Chlorate – ClO_3^{-1}
6.) Chromate – CrO_4^{-2}
7.) Carbonate – CO_3^{-2}
8.) Oxalate – $C_2O_4^{-2}$
9.) Sulfate – SO_4^{-2}
10.) Phosphate – PO_4^{-3}

Memorize all of the –ates

Remember the –ites are one less oxygen
The hypo-ites are 2 less oxygens
The hyper-ates are one more oxygen

Diatomic Elements (exist only as pairs):

Horses (H_2) Need (N_2) Oats (O_2) For (F_2) Clear (Cl_2) Brown (Br_2) Iyes (I_2)

Naming Compounds: ALWAYS IDENTIFY THE TYPE OF COMPOUND BEFORE TRYING TO NAME IT!

Acids (H is first element)

Binary – (H + single element)
element is root word
Hydro – root word – ic

Ternanry - (H + polyatomc)
NO PREFIX! Only the end of the polyatomic changes
-ate changes to –ic
-ite changes to -ous

Ionic Compounds

Type 1 (Group A metal is first element)

Without polyatomic:
Metal name + nonmetal-ide
(change ending of nonmetal to –ide)

With polyatomic:
Metal name + polyatomic name

Type 2 (Group B metal is first element)

Without polyatomic:
Metal name + (Roman Numerals) + nonmetal-ide
(change ending of nonmetal to –ide)

With polyatomic:
Metal name + (Roman Numerals) + polyatomic name

Covalent Compounds

Type 3 (non-metal is first element)

Prefix-nonmetal name + -prefix-nonmetal-ide
Prefixes based on how many atoms present (subscript!)
Prefix mono- will NEVER go in front of first name

Common prefixes

mono = 1	tetra = 4
di = 2	penta = 5
tri = 3	hexa = 6

Writing Formulas: ALWAYS IDENTIFY THE TYPE OF COMPOUND BEFORE TRYING TO Write Formula!

Acids (H is first element)

Ionic Compounds

Type 1 (Group A metal is first element)

Type 2 (Group B metal is first element)

Use Criss-Cross Method to write formulas
(For all three of these)

1. Write out element abbreviations
2. Ionic charges (oxidation #'s) go up top
3. Cross charges diagonally to bottom of each element

Note: to double check, the total charges should add up to zero for neutral molecules!

Covalent Compounds

Type 3 (non-metal is first element)

1. Write out abbreviations
2. Prefixes tell you what subscripts should be

Average Atomic Mass

Mass of elements based on relative abundance of all isotopes

Basic steps to calculate:

1. Convert % to decimals
2. Multiply mass of isotopes by decimal
3. Add all together

Different ways you might see this:

Graphical data:

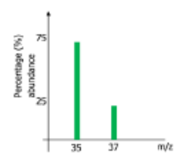


Table Data:

Isotope	Mass (amu)	Relative abundance
Mg-24	23.985	78.70%
Mg-25	24.986	10.13%
Mg-26	25.983	11.17%

Different isotope notations:

Hyphen notation: Mg - 24

Nuclear notation: $^{24}_{12}Mg$

Balancing Chemical Reactions:

1. Make a list and count atoms on each side
2. Use coefficients to balance
3. If you get stuck with an odd number remember to double

Ionic equations: (used to show all ions that are reacting in solution)

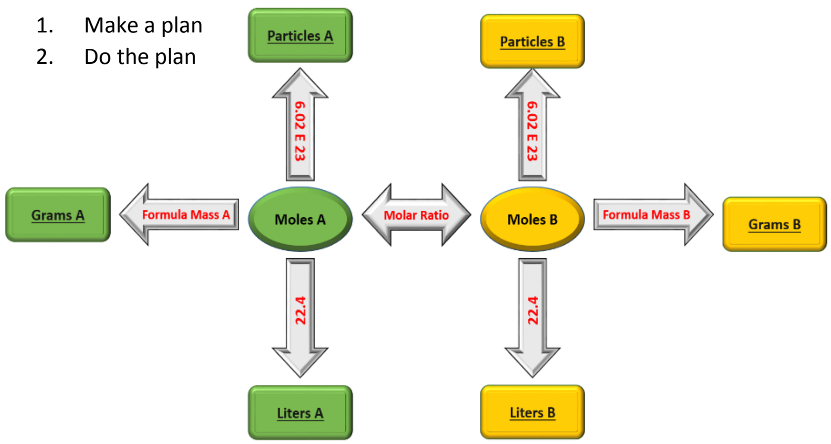
1. Everything that is aqueous splits in to ions (think formula writing)
2. Pure substances (solids, liquids, gases) remain "whole"

Net Ionic Equations: (shows only ions involved in formation, no spectators)

1. After writing out ionic equation just cancel out spectators.
2. Usually these are used to show formation of pure substances

Reaction Stoichiometry

1. Make a plan
2. Do the plan

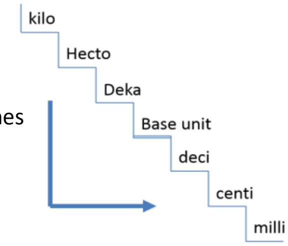


Traveling in the direction an arrow is pointing = MULTIPLY
If going opposite of arrow then DIVIDE
**mole ratio (coefficients) is multiply both ways - want on top, don't on bottom

Conversions

Converting with Scientific Prefixes

1. # of jumps tells you how many times to move decimal
2. Up or down determines left of right



Converting with dimensional analysis

1. Conversion factors are created when two things equal (ex. 1 atm = 101.3 kPa)
2. Units you want on top, what you don't on bottom

Example: convert 33 kPa to atm

$$33\ kPa \times \frac{1\ atm}{101.3\ kPa} = 0.33\ atm$$

Percent Composition by Mass

$$\%\ Comp = \frac{\text{Mass of desired}}{\text{Total mass}} \times 100\%$$

Two ways we might see this:

Calculating mass desired, then calculating the total mass to determine the percentage

We will be given a % and then have to use it to determine either the desired or the total (don't freak out… it's just a conversion!)

Calculating Limiting Reactants

Don't over think this….
A limiting reactant runs out first because there is not enough of it (which also means there is too much of the other reactant)
******If you are ever given amounts of more than one reactant you MUST determine which is limiting******

To calculate which is the limiting reactant:

1. Convert one of the given amounts to the units of the other given
   a. Then it is a comparison problem (do you have too much, too little, or the exact amount)
   b. Remember a limiting reactant will have too little present

Determining Formulas (Empirical and Molecular)

Empirical formula – simplest molar ratio of elements in a compound
Molecular formula – not the simplest ratio… this will always be a multiple of empirical formula

To calculate an empirical formula:

1. Convert everything to moles
2. Create a molar ratio (divide all by smallest)
3. The molar ratios are your subscripts

Calculating molecular formulas:

*Remember molar mass of molecular is ALWAYS a whole number multiple of the empirical formula molar mass

$$\frac{\text{Molecular molar mass}}{\text{Empirical molar mass}} = \text{multiplier}$$

*Multiply subscripts of empirical by multiplier to get subscripts for molecular

Percent Yield

Ratio of what was actually recovered versus a calculated maximum (theoretical)

Actual yield – actually recovered during experiment

Theoretical yield – calculated amount (from stoich)

Reactions are rarely 100% efficient so we rarely see percent yields of 100%

$$\%\ Yield = \frac{\text{Actual Yield}}{\text{Theoretical Yield}} \times 100\%$$