Chapter 4 Summary Notes

Main Concepts

Reactions: **To be able to successfully write reactions, you will need to know the following:** Solubility Rules , Nomenclature Types of Reactions (explained later in this worksheet), How to write net ionic equations **MUST KNOW For AP Chemistry reaction prediction:**

1. *Always write balanced net ionic equations* (meaning dissociate soluble compounds (based on solubility rules),
2. Metal are insoluble and are atomic, written as (s) in these equations. Ex. $Mg_{(s)}$
3. Molecular compounds such as gases (CO_2, H_2S Etc.) are written as (g) and will not dissociate into ions.
4. Water is written as (l) and does not dissociate.
5. Ionic compounds may or may not dissociate depending on solubility rules. Ex. $PbSO_4$ insoluble and $NaNO_3$ soluble.
6. Even a soluble ionic compound may NOT dissociate if it is in solid form (meaning no water present to actually dissociate the ions.)
7. Weak acids and bases partly dissociate or ionize and are written with a reversible arrow.
8. Remember PSHOFBrINCl. Phosphorus occurs as P4, Sulfer as S8 and rest as diatomic.
9. While we are reviewing, remember the difference between Zn and Zn^{2+} and Cl_2 and 2 Cl^-
10. Strong acids (HCl, HBr, HI, HNO_3, H_2SO_4 (first dissociation only!), $HClO_4$ and $HClO_3$) and strong bases (Group 1 alkali metal hydroxide and Ca, Ba, Sr hydroxides from group 2) dissociate in aq. Solutions. Weak acids and bases are not dissociated in net ionic equations.

Solubility Rules Always soluble: alkalies, NH_4^+, NO_3^-, $C_2H_3O_2^-$

Types of Reactions: Double displacement. Precipitation, neutralization, gas forming. H_2CO_3 in water = H_2O & CO_2

***Single displacement* or redox replacement:** (metals displace metals and nonmetals displace nonmetals)

Combination or synthesis = two reactants result in a single product

· Metal oxide + water → metallic hydroxide (base)

· Nonmetal oxide + water → nonbinary acid

· Metal oxide + nonmetal oxide → salt

Decomposition = one reactant becomes several products

· Metallic hydroxide → metal oxide + water

· Acid→ nonmetal oxide + water

· Salt → metal oxide + nonmetal oxide

· Metallic chlorates → metallic chlorides + oxygen

· Electrolysis decompose compound into elements (water in dilute acids or solutions of dilute acids)

· Hydrogen peroxide → water + oxygen

· Metallic carbonates --> metal oxides + carbon dioxide

· Ammonium carbonate → ammonia, water and carbon dioxide.

Hydrolysis = compound reacting with water.

· Watch for soluble salts that contain anions of weak acid the anion is a conjugate base and cations of weak bases that are conjugate acids.

Reactions of coordinate compounds and complex

· Complex formation by adding excess source of ligand to transitional metal of highly charged metal ion such as Al^{3+} Al =4 ligands others 2X ox #

Explanations

Synthesis Reactions:

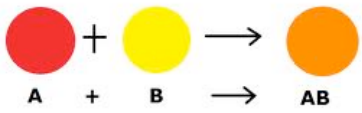
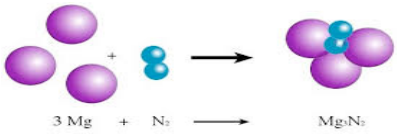
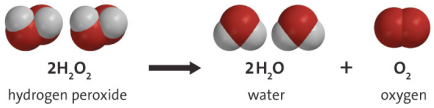


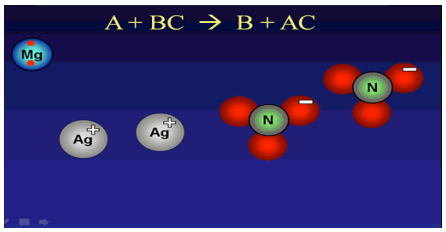
Figure 2.3

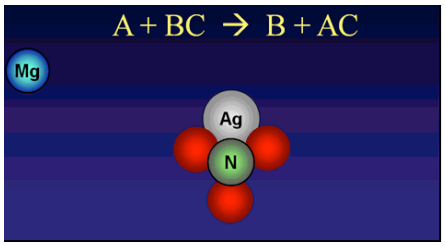


Decomposition

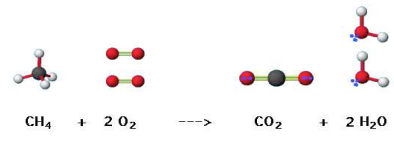


Single Replacement





Combustion Reactions:



Combustion Reaction

· Breakup of complex by adding an acid → metal ion and the species formed when hydrogen from the acid
reacts with the ligand
Redox = change in oxidation state= a reaction between an oxidizer and a reducer.
1. Familiarization with important oxidizers and reducers
2. "added acid" or "acidified"
3. an oxidizer reacts with a reducer of the same element to produce the element at intermediate oxidation state

Molarity (M) = $\frac{\text{moles solute}}{\text{volume of solution}} = \frac{\text{mol}}{\text{L}}$

Titration is a method to determine the molarity of unknown acid or base. In titration, an acid or base of unknown molarity is titrated against a standard solution (whose M is known) of acid or base.The end point in a titration is indicated by a color change by the indicator. Indicators are weak acids or bases and are added in small quantity (1-3 drops) to indicate the end point. At equivalence point (which should be close to end point),

moles of H+= moles of OH-

$M_1V_1 = M_2V_2$ (sometimes used to get moles , M= moles/L , so moles= M XV)

-What other ways can you get the moles- for a solid acid or base? For a gas?

Electrolyte: substance which, in aqueous solution, ionizes and thus conducts electricity. Ex: salt in water.

Non-electrolyte: substance which, in aqueous solution, does not dissociate and thus does not conduct electricity

Strong & weak electrolytes: conductivity depends on degree of dissociation and equilibrium position:

$HA\ (aq) \leftrightarrow H^+\ (aq) + A^-\ (aq)$

Strong = nearly completely dissociated

Weak = partially dissociated

Molecular equation: shows complete chemical equation with states of matter, undissociated

$BaCl_2\ (aq) + Na_2SO_4\ (aq) \rightarrow 2\ NaCl\ (aq) + BaSO_4\ (s)$

Complete ionic equation: shows complete chemical equation with states of matter, dissociated if appropriate

$Ba^{2+}(aq) + 2\ Cl^-(aq) + 2\ Na^+(aq) + SO_4^{2-}(aq) \rightarrow$

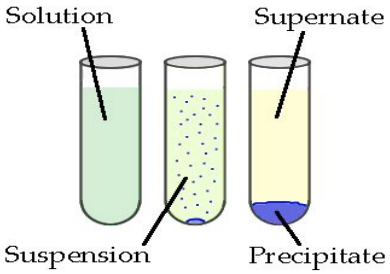
$2\ Cl^-(aq) + 2\ Na^+(aq) + BaSO_4\ (s)$ ***Spectator ions:*** present in reaction but do not "participate"; depend on solubility rules

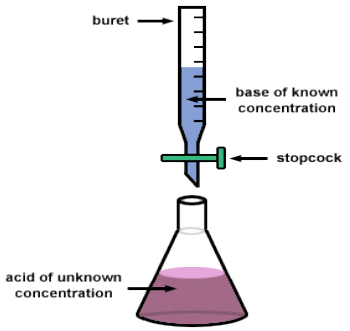
$Cl^-\ (aq)$ and $Na^+\ (aq)$

3. Net ionic equation: shows chemical equation without spectator ions

$Ba^{2+}\ (aq) + SO_4^{2-}\ (aq) \rightarrow BaSO_4\ (s)$

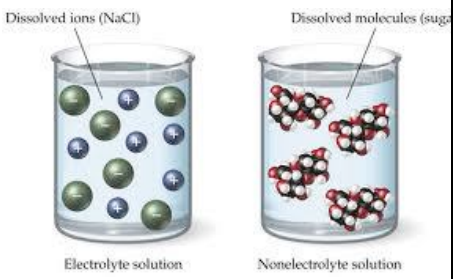
Precipitation





Ex. How many mL of a 3M NaOH solution are required to completely neutralize 20.0 mL of 1.5M H_2SO_4? (Start by writing a balanced equation!) Ans. 20.0 mL

Ex. How many g of NaOH is required to completely react with 100. mL of 1M HCl?



Summary of the page and Important things to remember: