AP Chemistry – review of concepts from Honors Chemistry I
(You should know most of the things covered in this packet on Day 1 in AP Chemistry.)

Units
Mass – grams (g)
Length – meter (m)
Volume – liter (L)
Time – seconds (s)
Pressure – atmospheres (atm)
Energy – joules (J)

Prefixes
Giga (G) – 10^9
Mega (M) – 10^6
kilo (k) – 10^3
hector (h) – 10^2
deka (da or dK) – 10^1
deci (d) – 10^{-1}
centi (c) – 10^{-2}
milli (m) – 10^{-3}
micro (μ) – 10^{-6}
nano (n) – 10^{-9}

** Don't forget about significant figures***

Metric Conversions
1 J = 1 kg·m^2/s^2
1 cal – 4.184 J
1 Cal = 1000 cal
1 kg = 2.20 lbs
1 mile = 1.61 km
1 mL = 1cm^3
K = ^oC + 273
1 mol = 6.02 x 10^{23} particles

1 inch = 2.54 cm
1 ft = 12 in
1 mi = 5280 ft
1 gal = 4 qts = 3.785 L
1 atm = 760 mm-Hg = 101.3 kPa
$^oC = (^oF - 32) * 5/9$
$^oF = (9/5 * ^oC) + 32$

The Periodic Table
Group 1 = Alkali Metals
Group 2 = Alkaline Earth Metals
Groups 3 through 12 = Transition Metals
Group 17 = Halogens
Group 18 = Noble Gases

s Block = Groups 1 and 2
p Block = Groups 13 through 18
d Block = Groups 3 through 12
f Block = Lanthanides and Actinides

The metalloids are boron (B), silicon (Si), germanium (Ge), arsenic (As), antimony (Sb), and tellurium (Te)

The diatomic elements are hydrogen (H_2), nitrogen (N_2), oxygen (O_2), fluorine (F_2), chlorine (Cl_2), bromine (Br_2), and iodine (I_2)

Two other polyatomic elements are sulfur (S_8) and phosphorus (P_4)

Formula Units and Molecules

* Ionic bond – formed when oppositely charged particles attract; compounds are named using the names of the two unique ions (positive first)

* Covalent bond – formed when two or more atoms share electrons; binary compounds are named using prefixes to indicate the number of each type of atom

Types of Chemical Reactions

- Composition or Synthesis – two (or more) smaller species becoming one large specie
- Decomposition – one large specie breaking down into two or more smaller species
- Combustion – reaction with oxygen to produce oxides of the elements in the starting substance; the most common type of combustion is hydrocarbon combustion and the products are carbon dioxide and water
- Single Replacement (Redox) – a free element replaces a combined element in a compound
- Double Replacement – two types
    - 1) precipitation – two aqueous ions compounds (4 aqueous ions) react to form an insoluble salt
    - 2) acid/base – acid reacts with base to form a salt (ionic compound) and water

Be able to balance chemical equations

Some metal ions:

The +1 group
Alkali Metals--M^{+}
Copper(I)(cuprous)--Cu^{+}(blue)
Gold(I)--Au^{+}
Hydrogen--H^{+}
Silver--Ag^{+}(colorless)
Thallium(I)--Tl^{+}

The +2 group
Alkaline Earth Metals---M^{2+}
Cadmium---Cd^{2+}
Chromium(II)---Cr^{2+}
Cobalt(II)--Co^{2+}(Pink)
Copper(II)(cupric)--Cu^{2+}(Blue)
Iron(II) (ferrous) --Fe^{2+}
Lead(II)--Pb^{2+}(grn-blue)
Manganese(II)--Mn^{2+}(colorless)
Mercury(II)--Hg^{2+}
Nickel(II)--Ni (green)$^{2+}$
Tin(II)(stannous)--Sn^{2+}
Zinc—Zn^{2+}(colorless)

The +3 group
Aluminum--Al^{3+}
Bismuth(III)--Bi^{3+}
Cerium(III)--Ce^{3+}
Chromium(III)--Cr^{3+}(Green)
Cobalt(III)--Co^{3+}
Gallium--Ga^{3+}
Gold(III)--$^{3+}$
Iron(III)(ferric)--Fe^{3+}(yellow-orange)
Indium--In^{3+}

The +4 group
Germanium(IV)--Ge^{4+}
Lead(IV)--Pb^{4+}
Manganese(IV)—Mn^{4+}
Silicon(IV)--Si^{4+}
Titanium(IV)--Ti^{4+}
Thorium(IV)--Th^{4+}
Tin(IV)(stannic)--Sn^{4+}

The +5 group
Niobium(V)--Nb^{5+}
Vanadium(V)--V^{5+}

Some polyatomic ions (composed of two or more atoms, usually different):

The -1 group
Acetate--$C_2H_3O_2^{-1}$or CH_3COO^{-1}
Amide--NH_2^{-1}
Benzoate--$C_7H_5O_2^{-1}$
Bitartrate--$HC_4H_4O_6^{-1}$
Bromate--BrO_3^{-1}
Perchlorate--ClO_4^{-1}
Chlorate--ClO_3^{-1}
Chlorite--ClO_2^{-1}
Hypochlorite—ClO^{-1}
Hydrazide--$N_2H_3^{-1}$
Hydrogen Carbonate--HCO_3^{-1}
Hydrogen oxalate--$HC_2O_4^{-1}$
Hydrogen Sulfate--HSO_4^{-1}
Hydrogen Sulfite--HSO_3^{-1}
Hydrogen Sulfide--HS^{-1}
Hydroxide--OH^{-1}
Triiodide--I_3^{-1}
Periodate--IO_4^{-1}
Iodate—IO_3^{-1}
Hypoiodite--IO^{-1}
Permanganate--MnO_4^{-1}
Thiocyanate—SCN^{-1}

The -2 group
Carbonate--CO_3^{2-}
Chromate--CrO_4^{2-}(yellow)
Dichromate--$Cr_2O_7^{2-}$(orange)
Disulfate--$S_2O_7^{2-}$
Hexafluorosilicate--SiF_6^{2-}
Hydrogen Phosphate--HPO_4^{2-}
Oxalate--$C_2O_4^{2-}$

Metasilicate--SiO_3^{2-}
Peroxide--O_2^{2-}
Selenate--SeO_4^{2-}
Silicate--SiO_3^{2-}
Sulfate--SO_4^{2-}
Sulfite--SO_3^{2-}
Tartrate--$C_4H_4O_6^{2-}$
Tetraborate--$B_4O_7^{2-}$
Thiosulfate--$S_2O_3^{2-}$

The -3 group
Aluminate--AIO^{3-}
Arsenate/AsO_4^{3-}
Borate--BO_3^{3-}
Phosphate--PO_4^{3-}
Phosphite--PO_3^{3-}

The -4 group
Ferrocyanide--$Fe(CN)_6^{4-}$
Pyrophosphate--$P2O_7^{4-}$
Silicate (ortho)--SiO_4^{4-}

Positive Ions:

The +1 group
Ammonium--NH_4^{+}

The +2 group
Mercury(I)--Hg_2^{2+}

SOLUBILITY RULES

1. **Salts containing Group I elements are soluble** (Li^+, Na^+, K^+, Cs^+, Rb^+). Exceptions to this rule are rare. Salts containing the ammonium ion (NH4+) are also soluble.

2. **Salts containing nitrate ion (NO^{3-}) are generally soluble**.

3. **Salts containing Cl^-, Br^-, I^- are generally soluble**. Important exceptions to this rule are halide salts of Ag^+, Pb^{2+}, and $(Hg_2)^{2+}$. Thus, AgCl, $PbBr_2$, and Hg_2Cl_2 are all insoluble.

4. **Most silver salts are insoluble**. $AgNO_3$ and $Ag(C_2H_3O_2)$ are common soluble salts of silver; virtually anything else is insoluble.

5. **Most sulfate salts are soluble**. Important exceptions to this rule include $BaSO_4$, $PbSO_4$, Ag_2SO_4, and $CaSO_4$.

6. **Most hydroxide salts are only slightly soluble**. Hydroxide salts of Group I elements are soluble. Hydroxide salts of Group II elements (Ca, Sr, and Ba) are slightly soluble. Hydroxide salts of transition metals and Al^{3+} are insoluble. Thus, $Fe(OH)_3$, $Al(OH)_3$, $Co(OH)_2$ are not soluble.

7. **Most sulfides of transition metals are highly insoluble**. Thus, CdS, FeS, ZnS, Ag2S are all insoluble. Arsenic, antimony, bismuth, and lead sulfides are also insoluble.

8. **Carbonates are frequently insoluble**. Group II carbonates (Ca, Sr, and Ba) are insoluble. Some other insoluble carbonates include $FeCO_3$, $PbCO_3$. Carbonates become soluble in acid solution.

9. **Chromates are frequently insoluble**. Examples: $PbCrO_4$, $BaCrO_4$.

10. **Phosphates are frequently insoluble**. Examples: $Ca_3(PO_4)_2$, Ag_3PO_4,

11. **Fluorides are frequently insoluble**. Examples: BaF_2, MgF_2, PbF_2

Acids and Bases

Certain acids and bases are considered to be strong, which means they are dissociated 100% in solution.

The following is a list of strong acids. You ought to memorize this list, because almost every other acid is weak.

HCl	hydrochloric acid
HNO_3	nitric acid
H_2SO_4	sulfuric acid
HBr	hydrobromic acid
HI	hydroiodic acid
$HClO_4$	perchloric acid

The following is a list of strong bases.

$LiOH$	lithium hydroxide
$NaOH$	sodium hydroxide
KOH	potassium hydroxide
$RbOH$	rubidium hydroxide
$CsOH$	cesium hydroxide
*$Ca(OH)_2$	calcium hydroxide
*$Sr(OH)_2$	strontium hydroxide
*$Ba(OH)_2$	barium hydroxide

* Completely dissociated in solutions of 0.01 M or less. These are insoluble bases which ionize 100%. The other five in the list can easily make solutions of 1.0 M and are 100% dissociated at that concentration.

To name acids:

Binary acids are named hydro-____-ic acids

Ternary acids are named according to the name of the polyatomic ion they contain

"-ate" ions become "-ic" acids (EX: HNO_3 is nitric acid)

"-ite" ions become "-ous" acids (EX: HNO_2 is nitrous acid)