File: Naming Compounds Rules 15-Feb-2008

These Notes are to <u>SUPPLIMENT</u> the Text, They do NOT Replace reading the Text Material Additional material that is in the Text will be on your tests!

To get the most information, <u>READ THE CHAPTER</u> prior to the Lecture, bring in these lecture notes and make comments on these notes. These notes alone are NOT enough to pass any test!

BINARY COMPOUNDS: composed of 2 elements

1. Compounds that contain a metal and a nonmetal
2. Compounds that contain 2 nonmetals

Roman Society – boiled wine in lead containing containers -> produced Lead Acetate Pb (C2H3)2. It tasted sweet. The fall of the Roman Empire is due in part to lead poisoning.

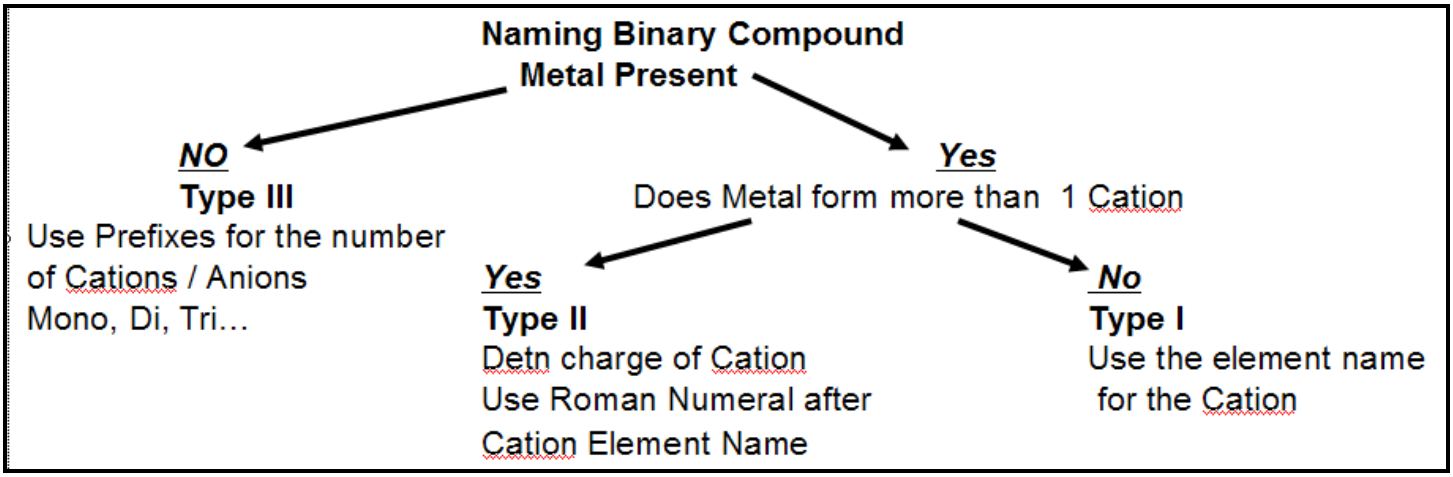
<u>NAMING COMPOUNDS</u>

Table 5.1 Common Simple Cations and Anions [Plus some extras]

Cation	Name	Comment	Anion	Name
H^+	Hydrogen	Group 1A – Alkali Metal	H^-	Hydride
Li^+	Lithium	Group 1A – Alkali Metal	F^-	Fluoride
Na^+	Sodium	Group 1A – Alkali Metal	Cl^-	Chloride
K^+	Potassium	Group 1A – Alkali Metal	Br^-	Bromide
Rb^+	Rubidium	Group 1A – Alkali Metal	I^-	Iodide
Cs^+	Cesium	Group 1A – Alkali Metal	O^{-2}	Oxide
Be^{+2}	Beryllium	Group 2A – Alkaline Earth Metal	S^{-2}	Sulfide
Mg^{+2}	Magnesium	Group 2A – Alkaline Earth Metal		
Ca^{+2}	Calcium	Group 2A – Alkaline Earth Metal		
Sr^{+2}	Strontium	Group 2A – Alkaline Earth Metal		
Ba^{+2}	Barium	Group 2A – Alkaline Earth Metal		
Ra^{+2}	Radium	Group 2A – Alkaline Earth Metal		
Al^{+3}	Aluminum			
Ag^+	Silver			
Zn^{+2}	Zinc			

Table 5.2 Common Type II Cations – Metals that have two states and names

Ion	Systematic Name
Fe^{+2} / Fe^{+3}	Iron (II) / Iron (III)
Cu^{+1} / Cu^{+2}	Copper (I) / Copper (II)
Co^{+2} / Co^{+3}	Cobalt (II) / Cobalt (III)
Sn^{+2} / Sn^{+4}	Tin (II) / Tin (IV)
Pb^{+2} / Pb^{+4}	Lead (II) / Lead (IV)
Hg_2^{+2} / Hg^{+2}	Mercury (I) / Mercury (II)



Types I GROUP 1 AND 2 METALS

1. Cation named 1st, Anoin 2nd
2. Simple Cation [single atom] takes name from the element: Na+ = Sodium
3. Simple Anion named taking 1st part of the element name & adding ***–ide*** : S = Sulfur = Sulfide
4. Halides – remove **ine** and **ide:** F = Fluorine = Fluoride

Types II TRANSITION METALS or METALS THAT HAVE MORE THAN 1 CHARGE

1. Cation is always named 1st, Anion 2nd
2. Cation can assume more than one charge - specify the charge with Roman Numeral

PbO_2	Lead (IV) Oxide	
$FeCl_3$	Iron (III) Chloride	$FeCl_2$ = Iron (II) Chloride (ic 1st, ous 2nd not used in this class)
CuCl	Copper (I) Chloride	
HgO	Mercury (II) Oxide	Hg_2O Mercury (I) Oxide
Fe_2O_3	Iron (III) Oxide	
MnO_2	Manganese (IV) Oxide	
$PbCl_4$	Lead (IV) Chloride	

Types III Binary Compounds contain NonMetals (Type III) - There is NO Metal present

1. The 1st element is named first and the full name is used
2. The 2nd element is named as if it were an ANION [ide]
3. Prefixes denote the number of atoms present [See Table 5.3]

Prefix MONO is never used for the 1st element

1. Mono	3. Tri	5. Penta	7. Hepta
2. Di	4. Tetra	6. Hexa	8. Octa

Metals loses one or more electrons to become a **CATION**

$Na \rightarrow Na^+ + 1\ e^-$

NonMetals gain one or more electrons to become an **ANION**

$Cl + 1\ e^- \rightarrow Cl^-$

Combining a Metal and a Non-Metal results in a **Binary Ionic Compound**
Compounds formed from metals and nonmetals are IONIC.
In Ionic compounds, the CATION is always named first.
The **Net Charge** on an IONIC compound **IS ALWAYS ZERO**.

$CsF = Cs^+$ and F^- $AlCl_3 = Al^{+3}$ and three Cl^-

Examples Naming: Positive – Cation – Named First — Sodium Cation is always Na^{+}
Negative – Anion named next — Chlorine Anion is always Cl^{-}

Type I Compunds – Metal is present, forms only one type of Cation

Group 1 Metal gives +1 Cation — Sodium = Na^{+1}
Group II Metal gives +2 Cation — Magnesium = Mg^{+2}

CsF	Cesium Fluoride	Cs Group 1
$AlCl_3$	Aluminum Chloride	Al always forms Al^{+3}
MgI_2	Magnesium Iodide	Mg Group 2 Forms Mg^{+2}
Rb_2O	Rubdium Oxide	
SrI_2	Strontium Iodide	
K_2S	Potassium Sulfide	

Type II Compounds – Metal is present, forms two or more Cations with different charges and names

Fe^{+2} = Iron (II) — Fe^{+3} = Iron (III)

Examples:

Formulae	**Cation charge**	**Comment**	
$CoBr_2$	+2	Cobalt (II) Bromide	forms +2 and +3 Cation
$CaCl_2$	+2	Calcium Chloride	only forms one Cation
Al_2O_3	+3	Aluminum Oxide	only forms one Cation
$PbBr_2$	+2	Lead (II) Bromide	
$PbBr_4$	+4	Lead (IV) Bromide	
FeS	+2	Iron (II) Sulfide	
Fe_2S_3	+3	Iron (III) Sulfide	
$AlBr_3$	+3	Aluminum Bromide	
Na_2S	+2	Sodium Sulfide	
$CoCl_3$	+3	Cobalt (III) Chloride	

Type III Compounds – There is NO Metal present.

BF_3	Boron Tri Fluoride	CCl_4	Carbon Tetrachloride
NO	Nitrogen Monoxide	NO_2	Nitrogen DiOxide
N_2O_3	DiNitrogen Pentoxide	IF_5	Iodine Penta Fluoride
CO	Carbon Monoxide		
CO_2	Carbon Dioxide		
H_2O	Di Hydrogen Monoxide		

PCl_5	Phosphorous PentaChloride
P_4O_6	Tetra Phosphorous HexaOxide
SF_6	Sulfur Hexa Fluroide
SO_3	Sulfur Tri Oxide
SO_2	Sulfur Di Oxide

More Examples:

CuO	Copper (II) Oxide
SrO	Strontium (II) Oxide
Br_2O_3	Di Bromine Tri Oxide
$Ti\ Cl_4$	Titanium Penta Chloride
K_2S	Potassium Sulfide

OF_2	Oxygen Di Fluoride
NH_3	Nitrogen Tri Hydride [Ammonia]
ClF_3	Chlorine Tri Fluoride
VF_5	Vanadium (V) Fluoride
CuCl	Copper (I) Chloride
MnO_2	Manganese (IV) Oxide
MgO	Magnesium Oxide
H_2O	Di Hyrogen Monoxide
O_2F_2	Di Oxygen Di Fluoride
XeF_6	Xenon Hexa Fluoride

PolyAtomic Ions – several atoms bonded together – Ya gotta just memorize these:
[See Table 5.4]

NH_4^+	Ammonium
NO_2^-	Nitrate
NO_3^-	Nitrite
SO_3^{-2}	Sulfite
SO_4^{-2}	Sulfate
HSO_4^-	Hydrogen Sulfate -or- Bisulfate
OH^-	Hydroxide
CN^-	Cyanide
PO_4^{-3}	Phosphate
HPO_4^{-2}	Hydrogen Phosphate
H_2PO_4	DiHydrogen Phosphate
CO_3^{-2}	Carbonate
HCO_3^-	Hydrogen Carbonate -or- Bicarbonate
ClO^-	Hypo Chlorite
ClO_2^-	Chlorite
ClO_3^-	Chlorate
ClO_4^-	Per Chlorate
$C_2H_3O_2^-$	Acetate
MnO_4	Permanganate
$Cr_2O_7^{-2}$	Dichromate
CrO_4^{-2}	Chromate
O_2^{-2}	Peroxide

A Trick:				
	ClO^-	1 Oxygen	HYPO chlor ITE	Least Oxygen = HYPO
	ClO_2^-	2 Oxygen	chlor ITE	Fewer Oxygen = ITE
	ClO_3^-	3 Oxygen	chlor ATE	More Oxygen = ATE
	ClO_4^-	4 Oxygen	PER chlor ATE	Most Oxygen = PER

Acids – An Acid is a Proton Donor
Base – A base is an Hydroxide Donor or Proton Acceptor

Common Acids:

H_2SO_3	Sulfurous Acid
H_2SO_4	Sulfuric Acid
HNO_2	Nitrous Acid
HNO_3	Nitric Acid
H_3PO_4	Phosphoric Acid
$HC_2H_3O_2$	Acetic Acid [diluted is vinegar]
HF	Hydrofluoric Acid
HCl	Hydrochloric Acid
HBr	HydroBromic Acid
HI	HyrdoIodic Acid
HCN	HydroCyanic Acid
H_2S	HydroSulfuric Acid