Chemical Nomenclature

Naming Compounds

I. Ionic Compounds

General Rule: Name the cation first, anion second.

*If cation can have variable charges, remember to specify charge in (Roman numerals) after the name of cation.

A. Binary Ionic Compounds: METAL + NONMETAL

1. Cation (Metal)
   a) Monatomic metal cations with fixed charge (mostly main group metals) have same name as the element.
      Eg. Na^+ = sodium ion Ca^{2+} = calcium ion

   b) Monatomic metal cations with variable charges (mostly transition metals) have name of element *followed by a Roman numeral in parentheses to indicate charge.*
      Eg. Cu^+ = copper (I)
      Cu^{2+} = copper (II)

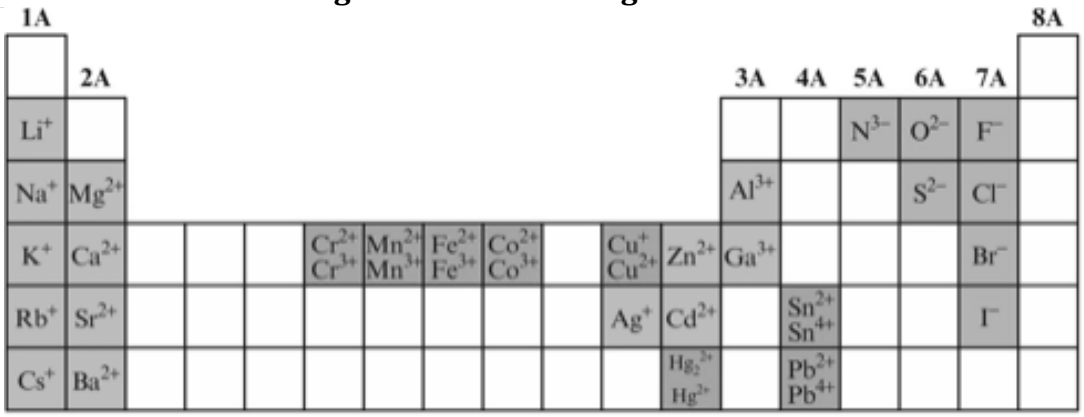
2. Anion (Nonmetal)
   Monatomic anions have name of element followed by –ide.

F^- = fluoride	O^{2-} = oxide
Cl^- = chloride	S^{2-} = sulfide
Br^- = bromide	N^{3-} = nitride
I^- = iodide	H^- = hydride

Examples of Binary Ionic Compounds

KCl potassium chloride	CuBr copper (I) bromide
$MgBr_2$ magnesium bromide	PbO_2 lead (IV) oxide

***Memorize the following Common Ion Charges!**



B. Polyatomic Ionic Compounds: Contain polyatomic ion as the cation, anion, or both.

Memorize the following names and charges of polyatomic ions*!

1. Polyatomic cations: Names end in -ium.
   - NH_4^+ = ammonium
   - H_3O^+ = hydronium

2. Polyatomic anions: Many contain oxygen.
   - OH^- = hydroxide
   - CO_3^{2-} = carbonate
   - NO_3^- = nitrate
   - PO_4^{3-} = phosphate
   - SO_4^{2-} = sulfate
   - CN^- = cyanide

Examples of Polyatomic Ionic Compounds

NH_4Cl	ammonium chloride	Na_2CO_3	sodium carbonate
$Mn(OH)_2$	manganese (II) hydroxide	$(NH_4)_2SO_4$	ammonium sulfate

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A List of Some Polyatomic Ions

Cations

Ammonium = NH_4^+

Mercury(I) = Hg_2^{2+}

Anions

Acetate = $C_2H_3O_2^-$ or CH_3COO^-

Cyanide = CN^-

Hydroxide = OH^-

Carbonate = CO_3^{2-}

Hydrogen Carbonate (bicarbonate) = HCO_3^-

Nitrate = NO_3^-

Nitrite = NO_2^-

Sulfate = SO_4^{2-}

Sulfite = SO_3^{2-}

Hydrogen Sulfate (bisulfate) = HSO_4^-

Thiosulfate = $S_2O_3^{2-}$

Phosphate = PO_4^{3-}

Perchlorate = ClO_4^-

Chlorate = ClO_3^-

Hypochlorite = ClO^-

Chromate = CrO_4^{2-}

Dichromate = $Cr_2O_7^{2-}$

Permanganate = MnO_4^-

II. Molecular Compounds (Binary): NONMETAL + NONMETAL

General Rules: Name first element first, second element second.

1. First element: Greek prefix + parent element (Exception: Don't use "mono-").
2. Second element: Greek prefix + parent element + "-ide" (as if it were an anion).

Examples of Binary Molecular Compounds

N_2O_5	dinitrogen pentoxide
P_4O_6	tetraphosphorus hexoxide
BF_3	boron trifluoride
NO	nitrogen monoxide
CO	carbon monoxide

Greek Prefixes

mono	one
di	two
tri	three
tetra	four
penta	five
hexa	six
hepta	seven
octa	eight

III. Acids

1. **Binary acids:** "hydro" + parent element + "ic acid"
   HCl hydrochloric acid HBr hydrobromic acid

2. **Oxoacids**: Names are derived from oxoanions.
   If oxoanion name ends with –ate, then acid name ends with –ic acid.
   eg. NO_3^- is nitirite → HNO_3 is nitric acid
   If oxoanion name ends with –ite, then acid name ends with –ous acid.
   eg. NO_2^- is nitrite → HNO_2 is nitrous acid.

***Memorize the following common acids!**

Strong Acids		**Weak Acids**	
HCl	hydrochloric acid	$HC_2H_3O_2$ or CH_3COOH	acetic acid
HBr	hydrobromic acid	H_2CO_3	carbonic acid
HI	hydroiodic acid		
HNO_3	nitric acid		
H_2SO_4	sulfuric acid		
$HClO_4$	perchloric acid		

Writing Formulas

I. Ionic Compounds

Balance charges, since compounds must be neutral! (Principle of Electrical Neutrality)
Positive Charge + Negative Charge = 0

eg., magnesium bromide = $MgBr_2$ iron(II) sulfide = FeS

II. Molecular Compounds (Binary)

Greek prefixes indicate number of atoms.
eg., dinitrogen pentoxide = N_2O_5
boron trifluoride = BF_3