Naming, Writing Formulae & Equations

11-Sept-2009

SIMPLIFIED RULES FOR NAMING

Rules for naming compounds: **Structure → Name**

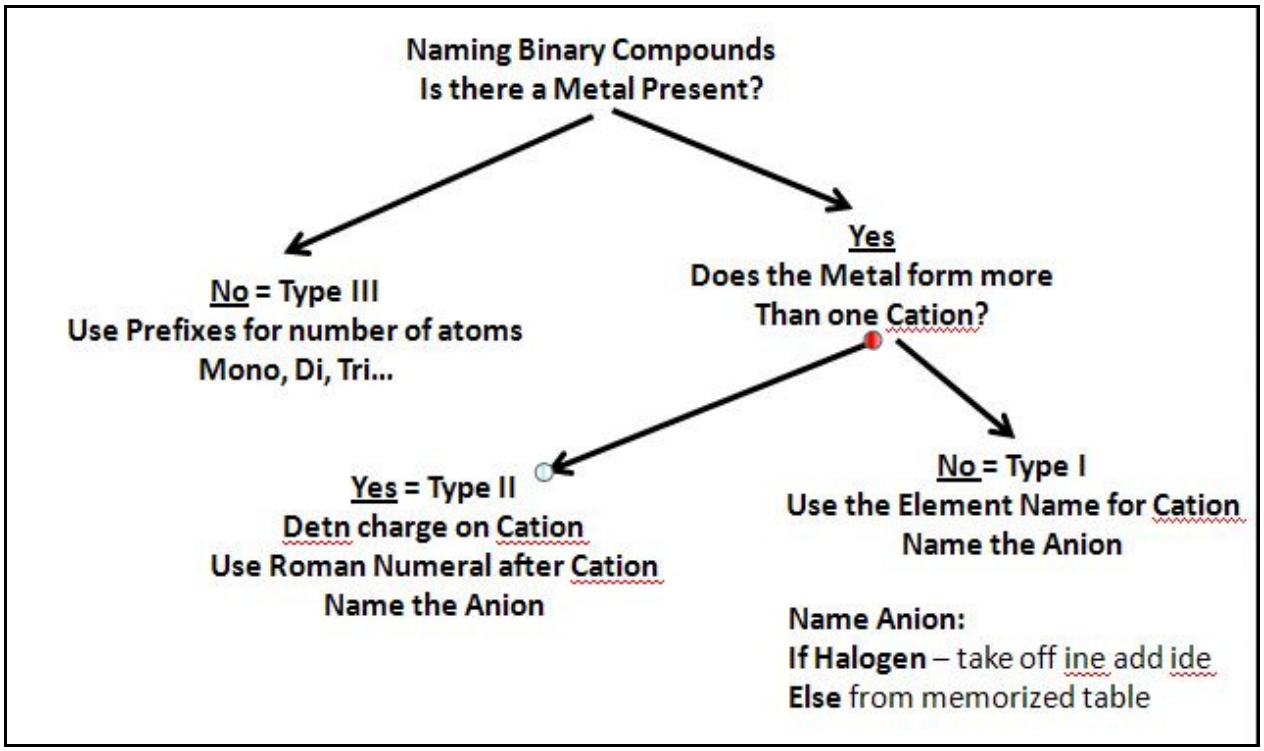
1. If it begins with an H, it's an acid, except for water. You need to memorize the common acids:

H_2SO_4	Sulfuric Acid	**H_2O**	Di-Hydrogen Oxide
HNO_3	Nitric Acid	**H-OH**	Hydrogen Hydroxide [always write like this]
HCl	Hydrochloric Acid		

2. What is the Cation [+], what is the name of the Cation element?

   $MgCl_2$ Mg is the Cation and is Magnesium

3. Follow the rules below for naming.



Rules for naming compounds: Name → Structure

1. Convert the **Cation Name**, the first name of the compound to a Chemical Symbol

Sodium → **Na**	**Sodium Chloride**	**Na**Cl
	Sodium Carbonate	**Na**$_2$CO$_3$
	Iron (III) Carbonate	**Fe**$_2$ (CO$_3$)$_3$

2. Convert the **Anion Name** to a Chemical Symbol — Chloride → **Cl**
3. If the Anion is a Polyatomic, put down the correct formulae for it — Carbonate → **CO_3**
4. Put the charges for the Cation and Anion above the element — **Na^{+1} Cl^{-1}**; **Na^{+1} CO_3^{-2}**; **Fe^{+3} CO_3^{-2}**

These charges come from various locations. Locate the Cation on the Periodic Table

A. If the Cation is in Group I, the Alkaline Metals, its charge is +1

B. If the Cation is in Group II, the Alkaline Earth Metals, it's charge is +2

C. If the Cation is in the middle of the table, you must memorize the charge.

D. If the Cation Name has a Roman Numeral after it, that is the charge — Iron (III) → Fe^{+3}

Locate the Anion on the Periodic Table.

1. If the Anion is in Group VII, the Halides, it has a -1 charge
2. Else you must memorize the charge and structure of the Poly Atomic

Now put in the correct number for the subscripts, or multipliers for the charge, so the compound has a net zero charge:

A. $Na^{+1}\ Cl^{-1}$ → $Na^{+1}\ Cl^{-1}$ → **NaCl**

B. $Na^{+1}\ CO_3^{-2}$ → $Na^{+1}{}_2\ CO_3^{-2}$ → **Na_2CO_3**

C. $Fe^{+3}\ CO_3^{-2}$ → $Fe^{+3}{}_2\ (CO_3^{-2})_3$ → **$Fe_2(CO_3)_3$**

Note as a shortcut [but don't tell anyone!]

In C, note Fe has a +3 charge, CO_3 has -2 charge

The +3 charge for the iron now becomes the 3 subscript for the carbonate

The -2 charge for the carbonate now becomes the 2 subscript for the iron.

This Works – Use it!

Rules for Writing and Balancing and Equation:

5.01 grams of Iron (III) Carbonate is reacted with xcs [Excess] Sulfurous Acid. What are the products and how much of each is formed?

1. Translate the English to Chemical REACTANTS using the above rules (forget about charges for now)

   $Fe\ CO_3$ + H_2SO_3 →

2. Balance the ions in each Reactant Compound so the net charge is zero [See Above]

   $Fe^{+3}\ CO_3^{-2}$ + $H_2^{+1\ each\ =\ +2}\ SO_3^{-2}$ → Ions with charges

   $Fe_2^{+3}\ (CO_3)_3^{-2}$ + $H_2^{+1\ each\ =\ +2}\ SO_3^{-2}$ → Need 2 Fe's and 3 CO_3 for a zero charge

   $Fe_2\ (CO_3)_3$ + H_2SO_3 → Correct Reactants Formulae

3. Determine the Products and write down the basic compounds.

   AB + CD → **A**D + C**B** Or **H_1W_1** + H_2W_2 → **H_1**W_2 + H_2**W_1**

   Use the simple ionic exchange (again, forget about charges for now)

   $Fe_2\ (CO_3)_3$ + H_2SO_3 → **$Fe\ SO_3$** + **$H\ (CO_3)$**

4. Balance the ions in each Product Compound so the net charge is zero

$Fe_2\ (CO_3)_3$	+	H_2SO_3 →	**$Fe^{+3}\ SO_3^{-2}$**	+	**$H^{+1}\ (CO_3^{-2})$**	**Ions with charges**
$Fe_2\ (CO_3)_3$	+	H_2SO_3 →	**$Fe_2^{+3}\ (SO_3^{-2})_3$**	+	**$H^{+1}{}_2\ (CO_3^{-2})$**	**Need 2 Fe_2^{+3}** **Need 3 $(SO_3^{-2})_3$** **Need 1 $H^{+1}{}_2$** **Need 1 $(CO_3)^{-2}$**
$Fe_2\ (CO_3)_3$	+	H_2SO_3 →	**$Fe_2\ (SO_3)_3$**	+	**$H_2\ CO_3$**	**Drop the () around CO_3**

5. Balance the equation [See Below]so there are equal number of each element on each side of the reaction arrow

   $Fe_2\ (CO_3)_3$ + 3 H_2SO_3 -> $Fe_2\ (SO_3)_3$ + 3 $H_2\ CO_3$

Rules for Balancing an Equation

$$\underline{Fe_2}\,(CO_3)_3 \quad + \quad H_2SO_3 \quad \rightarrow \quad Fe_2\,(SO_3)_3 \quad + \quad H_2\,CO_3$$

1. Take one Cation, the element on the left side, from one compound on the Left [Reactant] side of the equation. I'll take the Fe – see underscore above. I usually take the most unusual or heaviest element.

2. There are 2 Fe's on the left side. How many are on the right Side.

3. There are 2 Fe's on the right side.

4. Attached to the Fe on the right is SO_3. There are 3 SO_3 on the right side. How many are on the left side?

5. There is 1 SO_3 on the left side. So, make it 3 like on the right side:

$$Fe_2\,(CO_3)_3 \quad + \quad \underline{3}\,H_2SO_3 \quad \rightarrow \quad Fe_2\,(SO_3)_3 \quad + \quad H_2\,CO_3$$

6. Attached to the SO_3 on the left side is 3 * 2 H's or 3 * H_2 or 6 H's. How many are on the right side.

7. There is 1 H_2 on the right side, so make it 3 * 2 H's

$$Fe_2\,(CO_3)_3 \quad + \quad \underline{3}\,H_2SO_3 \quad \rightarrow \quad Fe_2\,(SO_3)_3 \quad + \quad \underline{3}\,H_2\,CO_3$$

The equation is now balanced!

Sodium Chloride _____

Potassium Iodide _____

Calcium Sulfide _____

Cesium Bromide _____

Magnesium Oxide _____

Cobalt (III) Chloride _____

Copper (I) Iodide _____

Tin (IV) Bromide _____

Mercury (II) Chloride _____

Lead (II) Sulfide _____

Potassium Nitride _____

Mercury (II) Oxide _____

Rubidium Fluoride _____

Sodium Hydride _____

Chromium (II) Fluoride _____

Magnesium Bromide _____

Manganese (II) iodide _____

Lithium Oxide _____

Diiodine Heptoxide _____

Carbon Dioxide _____

Carbon Tetrafluoride _____

Ammonia _____

Ammonium Hydroxide _____

Phosphorous Trichloride _____

Carbon Monoxide _____

Nitrogen Dioxide _____

Selenium Hexafluoride _____

Silicon Dioxide _____

DiHydrogen Monoxide _____

Aluminum TriChloride _____

$NaClO$ _____

$NaClO_2$ _____

$KClO_3$ _____

$KClO_4$ _____

$(NH_4)_2\ CO_3$ _____

$NH_4\ NO_2$ _____

$NH_4\ NO_3$ _____

$K_2\ SO_3$ _____

$Na_2\ SO_4$ _____

$NaHSO_3$ _____

$NaHSO_4$ _____

K_2CO_3 _____

$NaHCO_3$ _____

H_2SO_4 _____

H_2SO_3 _____

HI _____

HF _____

HNO_3 _____

HNO_2 _____

Naming Compounds Problems & Answers
11-Sept--2009

Sodium Chloride NaCl

Potassium Iodide KI

Calcium Sulfide CaS

Cesium Bromide CsBr

Magnesium Oxide MgO

Cobalt (III) Chloride $CoCl_3$

Copper (I) Iodide CuI

Tin (IV) Bromide $SnBr_4$

Mercury (II) Chloride $HgCl_2$

Lead (II) Sulfide PbS

Potassium Nitride K_3N

Mercury (II) Oxide HgO

Rubidium Fluoride RbF

Sodium Hydride NaH

Chromium (II) Fluoride CrF_2

Magnesium Bromide $MgBr_2$

Manganese (II) iodide MnI_2

Lithium Oxide Li_2O

Diiodine Heptoxide I_2O_7

Carbon Dioxide CO_2

Carbon Tetrafluoride CCl_4

Ammonia NH_3

Ammonium Hydroxide NH_4OH

Phosphorous Trichloride PCl_3

Carbon Monoxide CO

Nitrogen Dioxide NO_2

Selenium Hexafluoride SeF_6

Silicon Dioxide SiO_2

DiHydrogen Monoxide H_2O

Aluminum TriChloride $AlCl_3$

$NaClO$	**Sodium HypoChlorite**
$NaClO_2$	**Sodium Chlorite**
$KClO_3$	**Potassium Chlorate**
$KClO_4$	**Potassium PerChlorate**
$(NH_4)_2\ CO_3$	**Ammonium Carbonate**
$NH_4\ NO_2$	**Ammonium Nitrite**
$NH_4\ NO_3$	**Ammonium Nitrate**
$K_2\ SO_3$	**Potassium Sulfite**
$Na_2\ SO_4$	**Sodium Sulfate**
$NaHSO_3$	**Sodium Bisulfite**
$NaHSO_4$	**Sodium Bisulfate**
K_2CO_3	**Potassium Carbonate**
$NaHCO_3$	**Sodium Bicarbonate**
H_2SO_4	**Sulfuric Acid**
H_2SO_3	**Sulfurous Acid**
HI	**HydroIodic Acid**
HF	**HydroFluoric Acid**
HNO_3	**Nitric Acid**
HNO_2	**Nitrous Acid**

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

$CoBr_2$	**+2 Cobalt (II) Bromide**	**forms +2 and +3 Cation**
$CaCl_2$	**+2 Calcium Chloride**	
Al_2O_3	**+3 Aluminum Oxide**	
$PbBr_2$	**+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 –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**		
PbO_2	**Lead (IV) Oxide**		

$FeCl_3$	**Iron (III) Chloride**
$FeCl_2$	**Iron (II)**
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**
CsF	**Cesium Fluoride**
$AlCl_3$	**Aluminum Chloride**
MgI_2	**Magnesium Iodide**
Rb_2 O	**Rubdium Oxide**
SrI_2	**Strontium Iodide**
K_2S	**Potassium Sulfide**
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**
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**