CLASSIFICATION OF COMPOUNDS - GIVEN THE FORMULA

COMPOUND

BINARY

IONIC

1. OXIDES
sodium oxide
Na_2O

2. SALTS
sodium chloride
NaCl

COVALENT

1. OXIDES
carbon monoxide
CO

2. ACIDS
hydrochloric acid
(hydrogen chloride)
HCl

3. OTHERS
carbon tetrachloride
CCl_4

TERNARY

IONIC

1. TERNARY SALTS
sodium sulfate
Na_2SO_4

2. METAL HYDROXIDES
sodium hydroxide
NaOH

COVALENT

1. OXYACIDS
hypochlorous acid
HClO

chlorous acid
$HClO_2$

chloric acid
$HClO_3$

perchloric acid
$HClO_4$

EXCEPTIONS

MIXED COMPOUNDS

potassium aluminum sulfate
$KAl(SO_4)_2$

Sodium hydrogen carbonate
$NaHCO_3$

HYDRATES

copper(II) sulfate pentahydrate
$CuSO_4 \cdot 5\ H_2O$

VALENCES - MONATOMIC IONS

GROUP # (CAS)

Ia	IIa	IIIa	IVa	Va	VIa	VIIa
1+	2+	3+	+/-4	3-	2-	1-
Li^{1+} Na^{1+} K^{1+} Rb^{1+} Cs^{1+}	Be^{2+} Mg^{2+} Ca^{2+} Sr^{2+} Ba^{2+} Ra^{2+}	Al^{3+}	Sn^{4+} Pb^{4+}	N^{3-} p^{3-}	O^{2-} S^{2-} Se^{2-} Te^{2-}	F^{1-} Cl^{1-} Br^{1-} I^{1-}

Exceptions to the Rules of Nomenclature

(All of these ions and molecular formulas must be memorized!!)

Ions

Positive

ammonium	NH_4^{1+}
hydrogen	H^{1+}
hydronium	H_3O^{1+}
mercury(I) (mercurous)	Hg_2^{2+}

Negative

nitrate	NO_3^{1-}	
cyanide	CN^{1-}	
hydroxide	OH^{1-}	
permanganate	MnO_4^{1-}	
acetate-ethanoate	$C_2H_3O_2^{1-}$	(The term acetate is being
acetate-ethanoate	CH_3COO^{1-}	replaced by the term ethanoate)
thiocyanate	SCN^{1-}	
thiosulfate	$S_2O_3^{2-}$	
chromate	CrO_4^{2-}	
dichromate	$Cr_2O_7^{2-}$	
oxalate	$C_2O_4^{2-}$	
peroxide	O_2^{2-}	
(superoxide	O_2^{1-})	

Molecular Substances - trivial names

water	H_2O
hydrogen peroxide	H_2O_2
ammonia	NH_3
hydrazine	N_2H_4
phosphine	PH_3
arsine	AsH_3
nitric oxide	NO
nitrous oxide (laughing gas)	N_2O

ESCUDERO METHOD
RULES FOR NAMING TERNARY OXYANIONS AND OXYACIDS

OXYACID -IC FORM			OXYANION -ATE FORM			
GROUP (CAS)						
	IIIa	IVa	Va	VIa	VIIa	
n = # of O's	3	3	4	4	3	n = # of O's
m = # of H's	3	2	3	2	1	m = neg. ionic charge

NOTE: Nitic acid (HNO_3) and the corresponding **nitrate ion (NO_3^{1-})** are **EXCEPTIONS** to the above rules. **Their names and formulas MUST be memorized.**

Binary acids such as HCl all have names that begin with the prefix "hydro-" and end with the suffix "-ic acid." These acids are not covered by the rules that follow. All binary acids follow the form " hydro----ic acid."

The naming of oxyacids and oxyanions is based on knowing the name and formula of what I will call the standard form. For an acid the standard form ends in "-ic acid" as in chloric acid. For an oxyanion the standard form ends in "ate" as in carbonate ion. Note that in neither of the two does a prefix appear in the name.

The chart given at the top of the page gives the number of oxygens and either the number of hydrogens in the oxyacid or the negative charge of the oxyanion for the "standard" form. The other oxyacids and oxyanions must be built from this standard form.

If the oxyacid or oxyanion contains one more oxygen than the standard form use the prefix "per" and keep the suffix the same.

If the oxyacid contains one less oxygen than the standard form use the suffix "ous" for the oxyacid.
If the oxyanion contains one less oxygen than the standard form use the suffix "ite" for the oxyanion.

If the oxyacid contains two less oxygens than the standard form use the prefix "hypo" and the suffix "ous" for the oxyacid.
If the oxyanion contains two less oxygens than the standard form use the prefix "hypo"and the suffix 'ite' for the oxyanion.

OXYACID		OXYANION	
$H_m X O_{n+1}$	per - ic acid	per - ate ion	$X O_{n+1}^{m-}$
$H_m X O_n$	**- ic acid**	**- ate ion**	**$X O_n^{m-}$**
$H_m X O_{n-1}$	- ous acid	- ite ion	$X O_{n-1}^{m-}$
$H_m X O_{n-2}$	hypo - ous acid	hypo - ite ion	$X O_{n-2}^{m-}$

Examples:

$HClO_4$	perchloric acid	perchlorate ion	ClO_4^{1-}
$HClO_3$	**chloric acid**	**chlorate ion**	**ClO_3^{1-}**
$HClO_2$	chlorous acid	chlorite ion	ClO_2^{1-}
$HClO$	hypochlorous acid	hypochlorite ion	ClO^{1-}

RELATION OF MONATOMIC ION CHARGES TO THE PERIODIC TABLE

The noble gas electronic configurations are the most stable available. Atoms either gain or lose electrons to achieve a noble gas electronic configuration. If electrons are gained, as in nonmetals, negative ions are formed. If electrons are lost, as in metals, positive ions are formed.

Note that hydrogen can both gain one or lose one electron. It normally loses one to form the hydrogen ion, H^{1+}. This ion is very odd because it is a simple proton. Its size is that of the proton. very small indeed. It has unique properties as a result of its small size. Hydrogen can gain an electron and form the hydride, H^{1-} ion, when it reacts with alkali or alkaline earth metals. The -ide suffix provides the clue that the charge is -1.