

## Nomenclature Handout: Formulas and Names of Compounds and Ions

### A. Ionic Compounds:

- An ionic compound is composed of a positive ion (cation) and a negative ion (anion).
- The cation is always a metal and the anion is always a non-metal or a polyatomic ion.

#### 1. Monoatomic Ions:

You must learn the symbols and names of the monoatomic (one element) ions:

**For Cations** (these are the positively charged metallic elements!)

- The charge is merely their group number (only for the main group elements!)
- The ion name is the element's name followed by "ion".

For example: Sodium is in Group I so its charge is +1, making its symbol  $\text{Na}^+$ .

The name of this ion is **sodium ion**.

**For Anions** (these are the negatively charged non-metallic elements!)

- The charge is the element's group number minus 8
- For the ion name, take the stem of the element name and add "-ide ion" to the end

For example: Sulfur is in Group VI so its charge is  $6-8 = -2$ , making its symbol  $\text{S}^{2-}$ .

The name of this ion is **sulfide ion**.

#### 2. Polyatomic Ions:

You must learn the symbols and names of the polyatomic (more than one element) ions shown below. There is no easy way to do this outside of memorization!

Symbol	Name	Symbol	Name
$\text{NO}_3^-$	Nitrate	$\text{ClO}_4^-$	Perchlorate
$\text{NO}_2^-$	Nitrite	$\text{ClO}_3^-$	Chlorate
$\text{SO}_4^{2-}$	Sulfate	$\text{OH}^-$	Hydroxide
$\text{SO}_3^{2-}$	Sulfite	$\text{MnO}_4^-$	Permanganate
$\text{PO}_4^{3-}$	Phosphate	$\text{Cr}_2\text{O}_7^{2-}$	Dichromate
$\text{CO}_3^{2-}$	Carbonate	$\text{CrO}_4^{2-}$	Chromate
$\text{HCO}_3^-$	Hydrogen Carbonate	$\text{NH}_4^+$	Ammonium
$\text{C}_2\text{H}_3\text{O}_2^-$	Acetate	$\text{H}_3\text{O}^+$	Hydronium
$\text{CN}^-$	Cyanide	<b>Also look at Table 5.8 in Chapter 5!!</b>	

### 3. Cations of Transition Metals (The Stock System):

- Some of the transition metals can form **more than one** cation
- These cations are named for the parent, followed by the charge in Roman numerals in parentheses followed by the word "ion".
- This is called the **Stock system** of naming cations.
- **Silver ion ( $\text{Ag}^+$ ), Zinc ion ( $\text{Zn}^{2+}$ ), and Cadmium ion ( $\text{Cd}^{2+}$ )** are exceptions because they only form one ion! Memorize these!
- You will always be able to determine the charge of a transition metal from its name or formula!

Ion Symbol	Oxidation State	"New" Name	Stock Symbol	"Old" Name
$\text{Cu}^+$	+1	copper one	Cu(I)	cuprous
$\text{Cu}^{2+}$	+2	copper two	Cu(II)	cupric
$\text{Fe}^{2+}$	+2	iron two	Fe(II)	ferrous
$\text{Fe}^{3+}$	+3	iron three	Fe(III)	ferric
$\text{Co}^{2+}$	+2	cobalt one	Co(II)	cobaltous
$\text{Co}^{3+}$	+3	cobalt three	Co(III)	cobaltic
$\text{Hg}_2^{2+}$	+2	mercury one	Hg(I)	mercurous
$\text{Hg}^{2+}$	+2	mercury two	Hg(II)	mercuric

Also look at Table 6.7 in Chapter 6

### B. Covalent Compounds:

Learn all of the following compounds:

#### 1. Covalently Bonded Compounds

Formula	IUPAC Name	Common Name
$\text{N}_2\text{O}$	Dinitrogen oxide	Nitrous oxide; laughing gas
$\text{CCl}_4$	Carbon tetrachloride	NA
$\text{CHCl}_3$	NA	Chloroform (very toxic)
$\text{CS}_2$	Carbon disulfide (very toxic)	NA
$\text{H}_2\text{O}_2$	Dihydrogen dioxide	Hydrogen Peroxide
$\text{NH}_3$	Nitrogen trihydride	Ammonia
$\text{CH}_4$	Carbon tetrahydride	Methane
$\text{PH}_3$	Phosphorous trihydride	Phosphine (very toxic)
$\text{CO}$	Carbon Monoxide	NA
$\text{CO}_2$	Carbon dioxide	NA

## 2. Ionic but Covalently Bonded Compounds

Formula	Name	Formula	Name
$\text{H}_2\text{SO}_4$ (aq)	Sulfuric Acid	$\text{HC}_2\text{H}_3\text{O}$ (aq)	Acetic Acid
$\text{H}_2\text{SO}_3$ (aq)	Sulfurous Acid	$\text{H}_2\text{CO}_3$ (aq)	Carbonic Acid
$\text{HCl}$ (aq)	Hydrochloric Acid	$\text{H}_3\text{PO}_4$ (aq)	Phosphoric Acid
$\text{HNO}_3$ (aq)	Nitric Acid	$\text{HF}$ (aq)	Hydrofluoric Acid
$\text{HNO}_2$ (aq)	Nitrous Acid	$\text{Na}_2\text{CO}_3$ (aq)	Sodium bicarbonate
$\text{HClO}_4$ (aq)	Perchloric Acid		
$\text{CuSO}_4 \cdot 5 \text{H}_2\text{O}$	copper (II) sulfate 5-hydrate or copper (II) sulfate pentahydrate		