

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 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 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
NO_3^-	Nitrate	ClO_4^-	Perchlorate
NO_2^-	Nitrite	ClO_3^-	Chlorate
SO_4^{2-}	Sulfate	OH^-	Hydroxide
SO_3^{2-}	Sulfite	MnO_4^-	Permanganate
PO_4^{3-}	Phosphate	$\text{Cr}_2\text{O}_7^{2-}$	Dichromate
CO_3^{2-}	Carbonate	CrO_4^{2-}	Chromate
HCO_3^-	Hydrogen Carbonate	NH_4^+	Ammonium
$\text{C}_2\text{H}_3\text{O}_2^-$	Acetate	H_3O^+	Hydronium
CN^-	Cyanide	Also look at Table 2.3 in Chapter 2!!	

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 (Ag^+), Zinc ion (Zn^{2+}), and Cadmium ion (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
Cu^+	+1	copper one	Cu(I)	cuprous
Cu^{2+}	+2	copper two	Cu(II)	cupric
Fe^{2+}	+2	iron two	Fe(II)	ferrous
Fe^{3+}	+3	iron three	Fe(III)	ferric
Co^{2+}	+2	cobalt one	Co(II)	cobaltous
Co^{3+}	+3	cobalt three	Co(III)	cobaltic
Hg_2^{2+}	+2	mercury one	Hg(I)	mercurous
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
N_2O	Dinitrogen oxide	Nitrous oxide; laughing gas
CCl_4	Carbon tetrachloride	NA
CHCl_3	NA	Chloroform (very toxic)
CS_2	Carbon disulfide (very toxic)	NA
H_2O_2	Dihydrogen dioxide	Hydrogen Peroxide
NH_3	Nitrogen trihydride	Ammonia
CH_4	Carbon tetrahydride	Methane
PH_3	Phosphorous trihydride	Phosphine (very toxic)
CO	Carbon Monoxide	NA
CO_2	Carbon dioxide	NA

2. Ionic but Covalently Bonded Compounds

Formula	Name	Formula	Name
H_2SO_4 (aq)	Sulfuric Acid	$\text{HC}_2\text{H}_3\text{O}$ (aq)	Acetic Acid
H_2SO_3 (aq)	Sulfurous Acid	H_2CO_3 (aq)	Carbonic Acid
HCl (aq)	Hydrochloric Acid	H_3PO_4 (aq)	Phosphoric Acid
HNO_3 (aq)	Nitric Acid	HF (aq)	Hydrofluoric Acid
HNO_2 (aq)	Nitrous Acid	Na_2CO_3 (aq)	Sodium bicarbonate
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		