

NOMENCLATURE - Summary Notes

1. METAL + NON-METAL

- metal written first (more electropositive or left-most)
- non-metal written second (more electronegative or right-most)
- name of the second (non-metal) element modified to end in "**ide**"
- numbers are **reduced** to the lowest ratio

Examples: Zn^{2+} S^{2-} ZnS
 zinc and sulfurzinc sulfide

Br^- Na^+ NaBr
 bromine and sodiumsodium bromide

2. TRANSITION METAL (With More Than One Combining Capacity) + NON-METAL

- roman numerals** after the metal to indicate the oxidation number.
- Same rules as for metal + non-metal (reduce, "ide" ending)

Examples:

Fe^{2+} with Cl^{-1} iron (II) chloride Cu^{+1} with Cl^{-1} copper (I) chloride
 Fe^{3+} with Cl^{-1} iron (III) chloride Cu^{2+} with Cl^{-1} copper (II) chloride

3. POLYATOMIC IONS

- names of ions are capitalized, but **names of compounds are not**
- common polyatomic ions are listed on a table to which you may refer during all homework, quizzes and tests.
- You are not required to memorize the names and formulae, but it is **strongly recommended** that you memorize the list of common polyatomic ions below. (failure to do so could cost you a great deal of valuable time)

Carbonate	CO_3^{2-}	Chromate	CrO_4^{2-}	Phosphate	PO_4^{3-}	Ammonium	NH_4^+
Sulphite	SO_3^{2-}	Dichromate	$\text{Cr}_2\text{O}_7^{2-}$	Hydroxide	OH^-	Nitrate	NO_3^-
Sulphate	SO_4^{2-}	Permanganate	MnO_4^-	Acetate	CH_3COO^-	Bisulphate	HSO_4^-

4. HYDROGEN

Some areas of common confusion concerning hydrogen are listed below:

HBr hydrogen bromide	$\text{Na}_2\text{S} \cdot 9\text{H}_2\text{O}$ sodium sulfide nonahydrate
NaH sodium hydride	$\text{Ca}(\text{OH})_2$ calcium hydroxide

5. NON-METAL + NON-METAL (COVALENT/MOLECULAR)

- These compounds have THEIR OWN RULES
- prefixes written to indicate the number of atoms of each element in the compound
- Never reduce the numbers
- prefix "mono" never used in front of the first element
- "WYSIWYG" (what you see is what you get): do **not** use combining capacities/charges

Prefixes: You **must memorize** these; not given on quizzes and tests!

1 mono	2 di	3 tri	4 tetra	5 penta
6 hexa	7 hepta	8 octa	9 nona	10 deca

Examples: PCl_3 phosphorus trichloride CO carbon monoxide
 P_2O_5 diphosphorus pentoxide C_2H_4 dicarbon tetrahydride

6. ELEMENTS

- Monatomic elements: Na, K, Fe, etc.
- Diatomic gases: I₂ Br₂ Cl₂ F₂ O₂ N₂ H₂
pneumonic: "**I Bring Clay For Our New House**" or "L" plus one
- Polyatomic elements: P₄, S₈, etc.

9. OTHERS

- Some compounds are known only by their old-fashioned, or common, names

Examples: H_2O**water**

NH_3**ammonia** not to be confused with the ion:

NH₄⁺.....Ammonium

Chemical Nomenclature: IONIC BONDING

A. METAL + NON-METAL

Each of these compounds is composed of a positive metal ion and a negative non-metal ion. Complete the chart.

Elements	Ions	Formula	Name	Number of Atoms in Formula
lithium fluorine	Li^+ F^-	LiF	lithium fluoride	2
lithium oxygen	Li^+ O^{2-}	Li_2O	lithium oxide	3
sodium nitrogen				
magnesium chlorine				
calcium sulphur				
strontium phosphorus				
aluminum bromine				
silver nitrogen				
zinc iodine				
cesium selenium				
scandium sulphur				
sodium oxygen				
calcium fluorine				
gallium iodine				
aluminum sulphur				
strontium nitrogen				
potassium phosphorus				

B. TRANSITION METAL + NON-METAL

When the transition metal has multiple ion charges, a Roman numeral indicates its charge.

Charge	Roman Numeral	Charge	Roman Numeral	Charge	Roman Numeral
1+	I	3+	III	5+	V
2+	II	4+	IV	6+	VI

Complete the following chart.

Ions	Ions	Formula	Name
iron(II) and bromide	Fe ²⁺ Br ⁻	FeBr ₂	iron(II) bromide
iron(III) and bromide	Fe ³⁺ Br ⁻	FeBr ₃	iron(III) bromide
copper(I) and nitride			
gold(III) and chloride			
lead(IV) and phosphide			
lead(II) and sulfide			
nickel(III) and bromide			
manganese(IV) and sulfide			
uranium(VI) and iodide			
rhenium(VII) and fluoride			
titanium(III) and nitride			
Cobalt(II) and oxide			
copper(II) and selenide			
gold(I) and sulfide			
tin(IV) and iodide			
vanadium(V) and phosphide			

C. POLYATOMIC IONS

Complete the table. You can use an ion chart to help you find the names and formulas of polyatomic ions.

You are not required to memorize the names and formulae, but it is **strongly recommended** that you memorize the list of common polyatomic ions. (Failure to do so could cost you a lot of valuable time)

Ions		Formula	Name	# of Atoms in Formula
Na ⁺	SO ₄ ²⁻	Na ₂ SO ₄	sodium sulfate	7
NH ₄ ⁺	SO ₄ ²⁻	(NH ₄) ₂ SO ₄	ammonium sulfate	15
Cu ²⁺	NO ₃ ⁻			
Ag ⁺	ClO ₃ ⁻			
NH ₄	PO ₄ ³⁻			
Zn ²⁺	HCO ₃ ⁻			
Ni ²⁺	OH ⁻			
Al ³⁺	CN ⁻			
U ⁵⁺	SO ₃ ²⁻			
Cr ²⁺	HSO ₄ ⁻			
Mn ⁴⁺	CH ₃ COO ⁻			
Ca ²⁺	CO ₃ ²⁻			
Cu ²⁺	NO ₂ ⁻			
Au ³⁺	PO ₄ ³⁻			
K ⁺	CrO ₄ ²⁻			
Na ⁺	Cr ₂ O ₇ ²⁻			

Ion Name	Ions	Formula	Name
Ammonium & Permanganate	NH_4^+ MnO_4^-	NH_4MnO_4	ammonium permanganate
Gold(III) & Hydrogen Sulfide	Au^{3+} HS^-	$\text{Au}(\text{HS})_3$	gold(III) hydrogen sulphide
Cobalt(II) & Phosphate			
Sodium & Nitrate			
Calcium & Nitrite			
Magnesium & Acetate			
Potassium & Carbonate			
Uranium(VI) & Hydroxide			
Lithium & Nitrite			
Zinc & Perchlorate			
Cesium & Dichromate			
Sodium & Cyanide			
Iron(II) & Chromate			
Ammonium & Sulphate			
Calcium & Hypochlorite			
Aluminum & Permanganate			

D. COVALENT/MOLECULAR COMPOUNDS

Complete the table. You need to memorize the prefixes for covalent compounds; they will not be provided to you on a quiz or test!

Remember: the rules for covalent compounds are COMPLETELY different! NO reducing, NO ion charges, etc.

Formula	Name
N_2O_4	dinitrogen tetraoxide
CO	carbon monoxide
P_4S_{10}	
C_3H_8	
PBr_3	
SCl_6	
I_4O_9	
	arsenic trioxide
	dichlorine heptaoxide
	dioxygen difluoride
	xenon hexafluoride
	phosphorus pentachloride