

Chapter 18: Elements and Their Properties

Section 3: Writing Formulas and Naming Compounds

Oxidation number: a positive or negative number that indicates how many electrons an atom has gained, lost, or shared to become stable

- Sodium atom
 - 1 valence electron
 - Lose 1 electron
 - Sodium is +1 charge = Sodium ion = Na^{+1}
- Chlorine atom
 - 7 valence electrons
 - Gains 1 electron
 - Chlorine is -1 charge = Chlorine ion = Cl^{-1}
- Fill in the periodic table with charges for groups 1-2 and 13-18
 - Take out your colored periodic tables
- Transition elements
 - These elements vary in the charge
 - To identify what the charge is, a roman numeral is placed after the element name in parentheses
 - Copper (I) = Cu^{+1}
 - Copper (II) = Cu^{+2}
 - Iron (II) = Fe^{+2}
 - Iron (III) = Fe^{+3}
- *Break for worksheet!*

Binary compounds: compounds composed of two elements

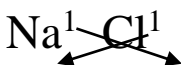
- Easiest to write formulas
- Remember the compound is neutral

- Each ion has an individual charge but added together the charge should be zero

Writing formulas (rules)

- The **positive ion** is ALWAYS written first
 - Tends to be the metals and Hydrogen
 - When written, just write the name
- The **negative ion** is ALWAYS written second
 - Tends to be the nonmetals
 - When written, it will end with the -ide ending
- Criss-cross just the numbers to write a formula
- Example: Sodium Chloride
 - Write the ions:

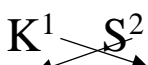
$$\text{Na}^{+1} \text{Cl}^{-1}$$
 - Criss-cross the numbers to make subscripts

$$\text{Na}^1 \text{Cl}^1$$

 - Simplify and write the symbols together as one

$$\text{Na}_1 \text{Cl}_1$$
 - Simplify and write the symbols together as one

$$\text{NaCl}$$
- Example: Potassium Sulfide
 - Write the ions:

$$\text{K}^{+1} \text{S}^{-2}$$
 - Criss-cross the numbers to make subscripts

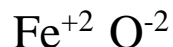
$$\text{K}^1 \text{S}^2$$

 - Simplify and write the symbols together as one

$$\text{K}_2 \text{S}_1$$
 - Simplify and write the symbols together as one

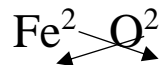
$$\text{K}_2\text{S}$$

○ Example: Iron (II) Oxide

- Write the ions:



- Criss-cross the numbers to make subscripts



- Simplify and write the symbols together as one
FeO

- *Break for worksheet!*

Naming compounds (rules)

- The **positive ion** is ALWAYS written first
 - Identify the metal where it is located on the periodic table
 - If it is a transition metal or metal under the stair-step line, a roman numeral will have to be written in parentheses
 - Write the name as it appears on the periodic table
- The negative ion is ALWAYS written second
 - Write the name as it appears but add the -ide ending
 - chlorine = chloride
 - oxygen = oxide
 - nitrogen = nitride
 - sulfur = sulfide

- Example: NaF
 - Identify the metal = Na = No roman numeral needed
 - Na = sodium
 - Identify the nonmetal = F
 - F = fluoride
 - Put the 2 together
 - sodium fluoride

- Example: Ca₃N₂
 - Identify the metal = Ca = No roman numeral needed
 - Ca = Calcium
 - Identify the nonmetal = N
 - N = nitride
 - Put the 2 together
 - calcium nitride

- Example: CuO
 - Identify the metal = Cu = roman numeral needed
 - Copper has 2 charges Cu⁺¹ or Cu⁺²
 - Which one works? Look to the nonmetal.
 - Identify the nonmetal = O
 - O = oxide = -2
 - Since there are no subscripts, copper has to be +2
 - copper (II) and oxide
 - Put the 2 together
 - copper (II) oxide

- Examples: Cu₂O, Cr₂O₃, Fe₂O₃, FeO

- *Break for worksheet!*

Compounds with polyatomic ions:

- Not all compounds are binary. Some have more than 2 elements. These use ions called polyatomic ions
 - **Polyatomic ion:** positively or negatively charged, covalently bonded group of atoms
 - ions contain two or more elements
 - prefix *poly-* means many (more than 2)
 - *Hand out sheet
 - The good news! Writing formulas and names are similar to binary compounds
 - Just watch the ending on polyatomic ions
 - Polyatomic ions = end in -ite or -ate
 - need a parenthesis around the ion and the charge is a superscript
 - Monatomic (-) ions = end in -ide
- *Break for worksheet using polyatomic vs. monatomic ions*

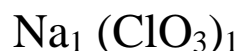
- **Writing formulas:**

- The only difference between using polyatomic vs. binary is a parenthesis will have to be used
- Example: Sodium Chlorate

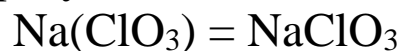
- Write the ions



- Criss-cross the numbers to make subscripts



- Simplify and write the elements together



*The parentheses are not needed since both are 1.

- Examples: Calcium carbonate, Iron (III) sulfate

- **Writing names:**

- Follow the same rules for writing names for binary compounds for writing names with polyatomic ions
- Examples: $\text{Mg}_3(\text{PO}_4)_2$, NaOH , $\text{Cr}(\text{ClO}_2)_2$, PbCO_3

- *Break for worksheet!*

Naming binary covalent compounds

- Occurs between 2 nonmetals
- Similar rules
 - The first nonmetal is written as its name (don't change the ending)
 - The second nonmetal is written with the -ide ending
 - This time use prefixes

mono = 1 (only 2 nd nonmetal)	di = 2	tri = 3	tetra = 4
penta = 5	hexa = 6	hepta = 7	octa = 8
nona = 9	deca = 10		

- Different rules!
 - Do NOT criss-cross
 - Write the formula/name like you see it
 - There is no simplifying
- Example: Dihydrogen monoxide
 - Dihydrogen = H₂
 - monoxide = O₁
 - Put together with subscripts = H₂O

- Example: Phosphorus trichloride
 - Phosphorus = P
 - trichloride = Cl₃
 - Put together with subscripts = PCl₃
- Example: Disulfur dichloride
 - Disulfur = S₂
 - dichloride = Cl₂
 - Put together with subscripts = S₂Cl₂ (don't simplify)
- Writing names from formulas
 - SF₆
 - S = sulfur (no prefix for 1)
 - F₆ = hexafluoride
 - Put together with a small space between each nonmetal
 - Sulfur hexafluoride
 - CO
 - C = Carbon (no prefix for 1)
 - O = monoxide (prefix for 1 because it is the 2nd element)
 - Put together = Carbon monoxide
 - CO₂
 - C = Carbon (no prefix for 1)
 - O₂ = dioxide
 - Put together = Carbon dioxide
- *Put roman numerals on back of periodic table and prefixes*
- *Break for worksheet! We are done!*