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 (II) = 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:

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

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

    

    $Na_1\ Cl_1$
  - Simplify and write the symbols together as one

    NaCl

- Example: Potassium Sulfide
  - Write the ions:

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

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

    

    $K_2\ S_1$
  - Simplify and write the symbols together as one

    K_2S

- Example: Iron (II) Oxide
  - Write the ions:
    Fe^{+2} O^{-2}
  - Criss-cross the numbers to make subscripts
    Fe^{2} O^{2}
    Fe_2 O_2
  - 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: Ca_3N_2
  - 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: Cu_2O, Cr_2O_3, Fe_2O_3, 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 then 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

      $Na^{+1}\ (ClO_3)^{-1}$

    - Criss-cross the numbers to make subscripts

      $Na^{1}\ (ClO_3)^{1}$

      $Na_1\ (ClO_3)_1$

    - Simplify and write the elements together

      $Na(ClO_3) = NaClO_3$

      *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: $Mg_3(PO_4)_2$, NaOH, $Cr(ClO_2)_2$, $PbCO_3$

- *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 2nd 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 = H_2
  - monoxide = O_1
  - Put together with subscripts = H_2O

- Example: Phosphorus trichloride
  - Phosphorus = P
  - trichloride = Cl_3
  - Put together with subscripts = PCl_3
- Example: Disulfur dichloride
  - Disulfur = S_2
  - dichloride = Cl_2
  - Put together with subscripts = S_2Cl_2 (don't simplify)
- Writing names from formulas
  - SF_6
    - S = sulfur (no prefix for 1)
    - F_6 = 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
  - CO_2
    - C = Carbon (no prefix for 1)
    - O_2 = dioxide
    - Put together = Carbon dioxide

- ***Put roman numerals on back of periodic table and prefixes***

- *Break for worksheet! We are done!*