Chapter 19: Chemical Reactions
Section 1: Chemical Changes

Chemical reaction: a change in which one or more substances are converted into new substances

- **Reactants:** the starting substances that react
- **Products:** the new substances produced
- Reactants → Products

Remember law of conservation of mass

- **Law of Conservation of Mass:** in a chemical reaction the mass of all substances that are present before a chemical change equals the mass of all the substances that remain after the change
  - mass is not gained or lost during any chemical reaction
  - Reactants → Products
  - Reactants = Products
- When hydrogen reacts with chlorine, it produces hydrochloric acid. If 18 grams of hydrogen react with 633 grams of chlorine, how many grams of hydrochloric acid are formed?

  Write the reactants and products below:

  _____ + _____ → _____

  Write the masses of the reactants and products below (put a ? for the unknown):

  _____ + _____ → _____

  Mass of hydrochloric acid = _____

Chemical equations: a way to describe a chemical reactions using chemical formulas and other symbols

Symbol	Meaning
→	produces or yields
+	plus
(s)	solid
(l)	liquid
(g)	gas
(aq)	aqueous – a substance is dissolved in water
	reactants are heated
	reactants are exposed to light
	reactants are exposed to an electric current

Example: silver nitrate aqueous reacts with sodium chloride aqueous to produce sodium nitrate aqueous and silver chloride solid

$$AgNO_3\ (aq) + NaCl\ (aq) \rightarrow NaNO_3\ (aq) + AgCl\ (s)$$

Balancing chemical equations

1. Write the formulas for the reactants and products
2. Balance the formula equation according to the law of conservation of mass
    a. **Coefficient:** in a chemical equation, the number written in front of a reactant or product to represent the number of units of each substance in the reaction
        i. When no coefficient appears before a substance, the coefficient of 1 is assumed. Otherwise, use numbers 2 and up to balance the equation

b. This will take trial and error
c. Simplify if needed

3. Count atoms to make sure the equation is balanced
   a. Never change the subscripts on the formulas unless you wrote the formula wrong.
   b. To get a **balanced chemical equation**, add coefficients in front of the substances. Don't split the substance in two. Either it goes in the front or doesn't go there at all.
4. Examples: (*Label the parts of the equation once complete*)
   a. $NiCl_2 + NaOH \rightarrow Ni(OH)_2 + NaCl$

Ni =	Ni =
Cl =	Cl =
Na =	Na =
OH =	OH =

   b. $HgO \rightarrow Hg + O_2$

Hg =	Hg =
O =	O =

**Break for practice worksheets on balancing.*
**Break for practice writing balanced chemical equations.*

Understanding Chemical Equations

- **Mole:** the amount of a substance that contains 6.022×10^{23} particles of that substance
  - 1 dozen of eggs = 12 eggs
  - 1 mole of eggs = 6.022×10^{23} eggs
  - 1 mol of Substance = 6.022×10^{23} representative particles

- **Molar Mass:** the mass in grams of one mole of a substance

Element	Number of Atoms Present	Molar Mass
Hydrogen	6.022×10^{23} atoms/1 mol	1.01 g/1 mol
Carbon	6.022×10^{23} atoms/1 mol	12.01 g/1 mol
Oxygen	6.022×10^{23} atoms/1 mol	16.00 g/1 mol

- For compounds or molecules
  - Label is # g/1 mol Compound/Molecule
  - Example Molar Mass of H_2O

    Hydrogen = H = (2 mol H)$\left(\frac{1.01 \text{ gram}}{1 \text{ mol}}\right)$ = 2.02 grams H

    Oxygen = O = (1 mol O)$\left(\frac{16.00 \text{ gram}}{1 \text{ mol}}\right)$ = 16.00 grams O

    Molar Mass of H_2O = 2.02 g H + 16.00 g O = $\frac{18.02 \text{ grams}}{1 \text{ mol}}$ H_2O

Atom/Compound/ Molecule	Atoms/Particles/ Molecules	# moles	Mass (Molar Mass)
Fluorine (F)			
Calcium Fluoride (CaF_2)			
Oxygen Difluoride (OF_2)			

**Worksheet time!*