Terminology

Reactants	substances consumed during a chemical reaction
Products	substances formed as a result of a chemical reaction
Chemical Equation	a description of the identities and proportions of the reactants and the products in a chemical reaction
Balanced Chemical Equation	total number of atoms of each element are the same on the right and left side of the reaction arrow
Law of Conservation of Mass	the principle that the sum of the masses in a chemical reaction is equal to the sum of the masses of the products
Stoichiometry	the study of the numerical relationship between chemical quantities in a chemical reaction
Phase Symbols	represent physical states of reactants and products: (g) gases, (l) liquids, (s) solids, (aq) aqueous solution

7.2 Writing Balanced Chemical Equations

Chemical Equations relate the quantities of substances consumed and produced in chemical reactions

Concepts of Mole & Molar Mass describe macroscopic quantities of substances in terms of the number of particles they contain

Combination Reaction a reaction in which two or more substances form a single product

Combustion Reactions a rapid reaction between fuel and oxygen that produces and releases energy

Lack of any coefficients indicates that one atom of something reacts with a single atom of something else to produce one molecule of product

C(s) + O2(g) -> CO2(g)

● + ○○ ->○●○

Any number of moles (X moles) can react with an equal number of moles of another reactant (Y moles) to produce the same quantity of product (XY moles)

7.2 Describing Chemical Reactions

S(s) + O2(g) -> SO2(g)

○ +●● ->● ○●

4 Ways to Describe Chemical Reactions

1) One **atom** of sulfur reacts with one **molecule** of oxygen to produce one **molecule** of sulfur dioxide

2) The **coefficients** tell us that one **mole** of sulfur reacts with one **mole** of oxygen to produce one **mole** of sulfur dioxide

3) **Avogadro's constant** describes that **6.022 x 10^{23} atoms** of sulfur react with **6.022 x 10^{23} molecules** of oxygen forming **6.022 x 10^{23} molecules** of sulfur dioxide

4) The **Molar Masses** of the **reactants** and **products** allow us to say that **32.06 grams** of sulfur react with **32.00 grams** of oxygen to produce **64.06 grams** of sulfur dioxide

General Rules for Balancing Equations

First attempts at balancing equations may not work. Try a different approach starting with a different element.

Balance pure elements last (O2, H2, N2)

Do not break up polyatomic ions ($SO4^{2-}$)

4-Step Method for Writing Balanced Equations

Element	**Sulfur**
1) Write a preliminary expression containing a single particle (atom, molecule, or formula unit) of each reactant and product with a reaction arrow separating reactants from products. Include phase symbols indicating physical states.	
SO2(g) + O2(g) -> SO3(g)	
2) Check whether the expression is balanced by counting the atoms of each element on each side of the reaction arrow.	
Reactant Side	1
Product Side	1
Balanced?	yes
Element	**Oxygen**
Reactant Side	2+2 = 4
Product Side	3
Balanced?	no
3) Choose an element that appears in only one reactant and one product and balance it first.	The only element that occurs only once on each side of the reaction arrow in this equation is sulfur, but it is already balanced, so this step can be skipped.

4-Step Method for Writing Balanced Equations (cont)

4) Choose coefficients for the other substances os that the number of atoms for each element is the same on both sides of the reaction arrow.

Reaction Stoichiometry

Ratio of Coefficients in a Chemical Reaction (Mole Ratio)

* specify the relative amounts in molecules or moles of each of the substances involved in the reaction

* act as a conversion factor between the amount in moles/molecules of the reactants and products

* can be used to determine how much of one reactant is needed to completely react with another quantity of the other reactant

Example Ratio of Coefficients

if 22.0 moles of C_8H_{18} are burned, how many moles of CO_2 form?

Stoichiometric Ratio

22.0 mol C_8H_{18} x 16 mol CO_2/2 mol C_8H_{18} = 176 mol CO_2