Chapter 5: Gases

Properties of Gases:

1) Gases fill their containers completely (unlike liquids).
2) Gases occupy far more space than liquids or solids because their molecules have a large amount of space between them.
3) Gases are compressible.

Kinetic Molecular Theory:

1) All molecules are in constant motion.
2) Molecules keep traveling in straight line until they collide with another and change course (this is the reason molecules are considered elastic).
3) Molecules collide with other molecules in an elastic collision so there is no net gain or loss of energy.
4) There is always some empty space between particles so no container is completely packed with gas molecules.
5) The kinetic energy of the molecules depend on the temperature; so warm gas molecules move faster than colder gases.

Pressure:

Units: Force/unit area, Pascal (SI unit), atmosphere, torr, mmHg, newtons.
Measuring atmospheric pressure: barometer, using mercury.
760 mmHg = 1 atm = 760 torr = 101.325 kPa = 14.696 psi
manometer: measuring gas pressures.

Gas Laws:

Boyle's Law	P inversely proportional to V	PV = constant	$P_1V_1 = P_2V_2$
Charles's Law	V directly proportional to T	V = T • constant	$V_1/T_1 = V_2/T_2$
Avogadro's Law	V directly proportional to n at constant P and T	V = n • constant	$V_1/n_1 = V_2/n_2$
Dalton's Law	Total pressure of mixture of gases is equal to the partial pressures of all the gases in the system.		$P_{total} = P_1 + P_2 + P_3 + \ldots\ldots$

Temperature is always measured in Kelvin ($0^oC = 273.15$ K)
STP conditions: T = 273.15 K and P = 1 atm, n = 1 mol, V = 22.4 L

Combined Gas Law	$P_1V_1/n_1T_1 = P_2V_2/n_2T_2$
Ideal Gas Law	PV = nRT (R = gas constant = 0.082058 L atm/mol K) (Values of R changes with different units)
Gas Density	d = MP/RT (M = molar mass)

Key Concepts and Words:

Manometer	Kinetic Molecular Theory	The Laws: Boyle's, Charles's, Avogadro's, Combined Gas Law, Ideal Gas Law, Gay-Lussac's, Dalton's.
Molar Gas Constant	Standard Pressure, Temperature and Volume	Diffusion and Effusion
Real Gas	Gas Stoichiometry	Collecting gas over water