Chapter 7: Chemical Reactions: Energy, Rates and Equilibrium

7.3 – Exothermic and Endothermic Reactions $\Delta H$
$\Delta H$ (enthalpy or heat) is negative (exothermic, heat is a product); $\Delta H$ is positive (endothermic, heat is a reactant; $\Delta H$ is measured in kcal/mol
Problems: Worked examples 7.1 and 7.2, 7.1a-b, 7.2a-b,

7.4 – Free Energy $\Delta G$
$\Delta G$ is negative (spontaneous reaction); $\Delta G$ is positive (non-spontaneous reaction)
$\Delta G = \Delta H - T \Delta S$ where $T =$ temperature (degrees K) and $S =$ entropy (cal/mol*K)
For an ideal reaction to be spontaneous, $\Delta G$ is negative, $\Delta H$ is negative and $\Delta S$ is positive.
Problems: Worked examples 7.4-7.5, 7.4, 7.5, 7.7, 7.31. 7.33, 7.38, 7.40

7.5 – Reactions Rates
Reaction Energy Diagrams; activation energy
Problems: 7.42, 7.43

7.6 – Effects of Temperature, Concentration and Catalysts on Reaction Rates
Know the effects of these three parameters on a reaction. What is a catalyst (problem 7.48)?

7.7 – Reversible Reactions and Chemical Equilibrium
Define chemical equilibrium

Chapter 8: Gases, Liquids and Solids (mostly gases)

8.4 – Boyle’s Law: Relation between Volume and Pressure (Temp. held constant)
$P_1V_1 = P_2V_2$ P and V are inversely proportional
Problems: Worked example 8.4, 8.4,8.5,8.40,8.41

8.5 – Charles’ Law: Relation between Volume and Temperature (Pressure held constant)
$V_1/T_1 = V_2/T_2$ V and T (degrees K)are directly proportional
Problems: Worked example 8.5, 8.6,8.46,8.48,8.49

8.6 – Gay-Lussac’s Law: Relation between Pressure and Temperature
$P_1/T_1 = P_2/T_2$ P and T (degrees K) are directly proportional (Volume held constant)
Problems: Worked example 8.6, 8.7,8.52

8.7 – Combined Gas Laws: Relationship between Pressure, Volume and Temperature
$P_1V_1/T_1 = P_2V_2/T_2$ If you learn this equation, you will know the previous three equations
Problems: Worked example 8.7, 8.8,8.56,8.61

8.8 – Avogadro’s Law: Relation between Volume and Moles
$V_1/n_1 = V_2/n_2$ V and number of moles (n) are directly proportional (P =1 atm, T = 273K)
Problems: Worked example 8.8, 8.10, 8.65,8.66,8.69

8.9 – Ideal gas law $PV = nRT$ where $R = 0.0821$ when $P$ is in atm; 62.4 when $P$ is in mm Hg;
V = Liters; n = moles of gas, T is in degrees K
Problems: Worked examples 8.9, 8.10; also 8.11, 8.12
8.10 – Partial Pressure and Dalton’s Law:
\[ P_{\text{total}} = P_{\text{gas } 1} + P_{\text{gas } 2} + P_{\text{gas } 3} \ldots \]
Problems: Worked example 8.11, 8.14, 8.15, 8.16, 8.84

Chapter 9: Solutions
9.6 – Effect of Pressure on Solubility of a Gas: Henry’s Law
\[ \frac{C_1}{P_1} = \frac{C_2}{P_2} \]
Concentration and Pressure are directly proportional
Problems: Worked Example 9.3, also 9.6, 9.7
9.7 – Units of Concentration
Molarity (M) moles solute/Liter solution
Problems: 9.62
Moles solute = Molarity of solution x Liters of solution (mol = M x L)
Problems: Worked examples 9.4, 9.5, also 9.8, 9.9, 9.10, 9.72
Weight/volume percentage (w/v%)
\[ \frac{\text{mass solute (g)}}{\text{volume solution (mL)}} \times 100 \]
Problems: worked examples 9.7, 9.8, 9.9, also 9.13, 9.14, 9.54
9.8 – Dilution
\[ M_1 V_1 = M_2 V_2 \]
molarity and volume are inversely proportional
\[ C_1 V_1 = C_2 V_2 \]
this equation works for any units of concentration (w/v%, e.g.)