CP Chemistry *Unit-VI (Solutions, Rates & Eqm, and Acid-Base Chem) Exam Outline* **Mr. Thaler**

Formulas and constants you should how to use (not memorize):

M = mol solute / L soln ; m = mol solute / kg solvent ;

$\Delta T_f = K_f m$; K_f for H$_2$O = 1.86°C/m ; $\Delta T_b = K_b m$; K_b for H$_2$O = 0.52°C/m

K_w = [H$_3$O$^+$][OH$^-$] = 1.0 x 10^{-14}; pH = –log[H$_3$O$^+$] ; pOH = –log[OH$^-$] ; pH + pOH = 14

HA + H$_2$O ←→ H$_3$O$^+$ + A$^-$; K_a = [H$_3$O$^+$][A$^-$] / [HA] ; B + H$_2$O ←→ BH$^+$ + OH$^-$; K_b = [BH$^+$][OH$^-$] / [B] ;

$M_A V_A = M_B V_B$ (when H$_3$O$^+$: OH$^-$ is 1:1)

KNOW AND UNDERSTAND:

Concentration: molarity (M) = mol solute/ L soln; AND molality (m) = mol solute/ kg solvent

Reaction rates and equilibrium: factors (temp., concentration, surface area, catalyst) affecting reaction rate (i.e., collision theory) and equilibrium (Le Chatelier's principle), as they are the basis for understanding weak acids and bases as well as buffer solutions

Affect of a catalyst on reaction rate: lowers activation energy (E$_a$)—see energy diagram

Properties of acids and bases: taste, feel, electrical conductivity, indicator color change

Naming acids and bases: **3** rules for acids: **1.** binary acid: change *–ide* of anion to *–ic*, add *hydro-* prefix, ex. HCl = hydrochloric acid; **2.** change *–ate* of anion to *–ic*, ex. HNO$_3$ = nitric acid; **3.** change *–ite* of anion to *–ous*, ex. HNO$_2$ = nitrous acid.
Name common bases as ionic compounds (except for ammonia, NH$_3$).

Strong vs. weak acids and bases: 6 strong acids (memorize: 3 binary involving halides, and 3 involving polyatomic anions), and strong bases (alkali metal hydroxides and alkaline-earth metal hydroxides, from calcium down)

Arrhenius definition of acids (H$^+$ producers) and bases (OH$^-$ producers)

Brønsted-Lowry definition of acids (H$^+$ or proton donors) and bases (H$^+$ or proton acceptors)

Weak acid and base dissociation constants—K_a and K_b: calculations of K_a and K_b given appropriate data (i.e., initial and equilibrium concentrations)

Conjugate acid-base pairs: steps to identifying a-b pairs (see notes)

Salt hydrolysis: Judging from parent acids and bases, will the solution be acidic, basic, neutral, or dependent on K values—in which case, knowing the K values (below), will the solution be acidic, basic, neutral?

Auto-ionization of water and the ion-product constant for water (K_w) as the basis for the pH scale:
K_w = [H$^+$] [OH$^-$] = 1.0 x 10^{-14};
pH = –log[H$^+$] (or –log[H$_3$O$^+$]);
pH scale: 0-14; 0 most acidic, 14 most basic

Acid-base titration: Identify equivalence point on a titration curve, determine if unknown is strong or weak acid or base (standard solution always strong), and calculate molarity of unknown using $M_A V_A = M_B V_B$.

Buffers: Which way will the equilibrium shift (i.e, reaction rate increase) if an acid or base is added to a buffer solution? What is buffer capacity and what determines it?

Affect of pH on the activity of an enzyme, namely catalase—a catalyst

Colligative properties: **4 of them**: **1**. vapor-pressure reduction, **2.** boiling-point elevation ($\Delta T_b = K_b m$), **3.** freezing-point depression ($\Delta T_f = K_f m$)—and how a phase diagram illustrates these properties, and **4.** osmotic pressure