

CHE 107 & 113 Equation Sheet

$$\ln P_{vap} = \frac{-\Delta H_{vap}}{R} \left(\frac{1}{T} \right) + \ln \beta$$

$$\ln \frac{P_2}{P_1} = \frac{-\Delta H_{vap}}{R} \left(\frac{1}{T_2} - \frac{1}{T_1} \right)$$

$$q = mc\Delta T$$

$$\Delta H_{soln} = \Delta H_{solute} + \Delta H_{solvent} + \Delta H_{mix}$$

$$S_{gas} = k_H P_{gas}$$

$$M = \frac{\text{mol solute}}{\text{L solution}}$$

$$m = \frac{\text{mol solute}}{\text{kg solvent}}$$

$$\chi = \frac{\text{mol solute}}{\text{mol solute} + \text{mol solvent}}$$

$$\text{mass \%} = \frac{\text{mass solute}}{\text{mass solution}} \times 100\%$$

$$\text{ppm} = \frac{\text{mass solute}}{\text{mass solution}} \times 10^6$$

$$\text{ppb} = \frac{\text{mass solute}}{\text{mass solution}} \times 10^9$$

$$P_{soln} = \chi_{solvent} P_{solvent}^\circ$$

$$\Delta P = \chi_{solute} P_{solvent}^\circ$$

$$\Delta T_f = i m K_f$$

$$\Delta T_b = i m K_b$$

$$\Pi = i M R T$$

$$[A]_t = -kt + [A]_0$$

$$\ln[A]_t = -kt + \ln[A]_0 \quad \text{or} \quad \ln \frac{[A]_t}{[A]_0} = -kt$$

$$\frac{1}{[A]_t} = kt + \frac{1}{[A]_0}$$

$$t_{1/2} = \frac{[A]_0}{2k}$$

$$t_{1/2} = \frac{\ln 2}{k}$$

$$t_{1/2} = \frac{1}{k[A]_0}$$

$$K_w = 1 \times 10^{-14} \text{ at } 25^\circ\text{C}$$

$$\text{pH} = -\log[\text{H}_3\text{O}^+]$$

$$\text{pOH} = -\log[\text{OH}^-]$$

$$\text{pH} + \text{pOH} = \text{p}K_w$$

$$\% \text{ ionization} = \frac{[\text{H}_3\text{O}^+]_{\text{equilibrium}}}{[\text{HA}]_{\text{initial}}} \times 100\%$$

$$K_a \times K_b = K_w$$

$$\text{p}K_a = -\log K_a$$

$$\text{p}K_a + \text{p}K_b = \text{p}K_w$$

$$\text{pH} = \text{p}K_a + \log \frac{[\text{base}]}{[\text{acid}]}$$

$$\Delta S_{\text{surroundings}} = -\frac{\Delta H_{\text{system}}}{T}$$

$$\Delta G = \Delta H - T\Delta S$$

$$\Delta S_{\text{rxn}}^\circ = \sum n_p S^\circ(\text{products}) - \sum n_r S^\circ(\text{reactants})$$

$$\Delta H_{\text{rxn}}^\circ = \sum n_p \Delta H_f^\circ(\text{products}) - \sum n_r \Delta H_f^\circ(\text{reactants})$$

$$\Delta G_{\text{rxn}}^\circ = \sum n_p \Delta G_f^\circ(\text{products}) - \sum n_r \Delta G_f^\circ(\text{reactants})$$

$$k = A e^{-E_a/RT}$$

$$\ln \frac{k_2}{k_1} = -\frac{E_a}{R} \left(\frac{1}{T_2} - \frac{1}{T_1} \right)$$

$$K_p = K_c (RT)^{\Delta n}$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\Delta G_{\text{rxn}} = \Delta G_{\text{rxn}}^\circ + RT \ln Q$$

$$\Delta G_{\text{rxn}}^\circ = -RT \ln K$$

$$E_{\text{cell}}^\circ = E_{\text{cathode}}^\circ - E_{\text{anode}}^\circ$$

$$\text{or } E_{\text{cell}}^\circ = E_+^\circ - E_-^\circ$$

$$\text{or } E_{\text{cell}}^\circ = E_{\text{oxidation}}^\circ + E_{\text{reduction}}^\circ$$

$$\Delta G^\circ = -nFE_{\text{cell}}^\circ$$

$$\Delta G = -nFE_{\text{cell}}$$

$$E_{\text{cell}}^\circ = \frac{RT}{nF} \ln K$$

$$\text{or } E_{\text{cell}}^\circ = \frac{0.0592 \text{ V}}{n} \log K$$

$$\text{or } E_{\text{cell}}^\circ = \frac{0.0257 \text{ V}}{n} \ln K$$

$$E_{\text{cell}} = E_{\text{cell}}^\circ - \frac{RT}{nF} \ln Q$$

$$\text{or } E_{\text{cell}} = E_{\text{cell}}^\circ - \frac{0.0592 \text{ V}}{n} \log Q$$

$$\text{or } E_{\text{cell}} = E_{\text{cell}}^\circ - \frac{0.0257 \text{ V}}{n} \ln Q$$