

Useful Equations and Constants:

$$F = mg$$

$$P = \frac{F}{A}$$

$$P = \rho gh$$

$$\frac{dP}{dT} = \frac{\Delta H_m}{T\Delta V_m}$$

$$\frac{dP}{dT} = \frac{\Delta_{\text{vap}} H_m P}{RT^2}$$

$$\ln \frac{P_2}{P_1} = \frac{\Delta_{\text{vap}} H_m}{R} \left(\frac{1}{T_1} - \frac{1}{T_2} \right)$$

$$\frac{dP}{dP_t} = \frac{V_m(l)}{V_m(v)}$$

$$\ln \frac{P}{P_v} = \frac{V_m(l)}{RT} (P_t - P_v)$$

$$P_1 = x_1 P_1^*$$

$$P_2 = k' x_2$$

$$\mu_i = \mu_i^* + RT \ln \frac{P_i}{P_i^*}$$

$$\mu_i = \mu_i^* + RT \ln a_i$$

$$\mu_i = \mu_i^* + RT \ln x_i$$

$$\mu_i = \mu_{i,\text{ideal}} + RT \ln f_i$$

$$\mu_i = \mu_{i,\text{ideal}} + RT \ln \gamma_i$$

$$\Delta_{\text{mix}} G = n_{\text{total}} RT \sum_i x_i \ln x_i$$

$$\Delta_{\text{mix}} S = -n_{\text{total}} R \sum_i x_i \ln x_i$$

$$\ln x_1 = \frac{\Delta_{\text{fus}} H_m}{R} \left(\frac{1}{T_f^*} - \frac{1}{T} \right)$$

$$\Delta_{\text{fus}} T \approx \frac{M_1 RT_f^{*2}}{\Delta_{\text{fus}} H_m} \cdot m_2$$

$$\Delta_{\text{fus}} T = K_f m_2$$

$$\ln x_1 = \frac{\Delta_{\text{vap}} H_m}{R} \left(\frac{1}{T} - \frac{1}{T_b^*} \right)$$

$$\Delta_{\text{vap}} T \approx \frac{M_1 RT_b^{*2}}{\Delta_{\text{vap}} H_m} \cdot m_2$$

$$\Delta_{\text{vap}} T = K_b m_2$$

$$\pi = \frac{n_2 RT}{n_1 V_1^*}$$

$$\pi = \frac{n_2 RT}{V}$$

$$\pi \approx cRT$$

$$F = C - P + 2$$

$$\Delta_{\text{fus}} S = \frac{\Delta_{\text{fus}} H}{T_f}$$

$$\Delta_{\text{vap}} S = \frac{\Delta_{\text{vap}} H}{T_{bp}}$$

$$\frac{n_A}{n_B} = \frac{P_A^*}{P_B^*}$$

$$\vec{F} = \vec{F}(\vec{r}) = -\frac{Q_1 Q_2}{4\pi\epsilon_0 \epsilon r_{12}^2} \vec{r}_{12}$$

$$\vec{F} = q\vec{E}$$

$$\vec{E} = -\vec{\nabla}\phi$$

$$\vec{F} = -\vec{\nabla}V$$

$$\phi = \frac{q}{4\pi\epsilon_0 \epsilon r}$$

$$V = \frac{q_1 q_2}{4\pi\epsilon_0 \epsilon r}$$

$$G = \kappa \frac{A}{l}$$

$$\Lambda = \frac{\kappa}{c}$$

$$\frac{1}{K} = \left(\frac{\epsilon\epsilon_0 k_B T}{e^2 \sum_i c_i z_i^2 L} \right)^{\frac{1}{2}}$$

$$\Lambda = \Lambda^\circ - (P + Q^\circ \Lambda^\circ) \sqrt{c}$$

$$K = \frac{c \left(\frac{\Lambda}{\Lambda^\circ} \right)^2}{1 - \left(\frac{\Lambda}{\Lambda^\circ} \right)}$$

$$K = \frac{c\alpha^2}{1 - \alpha}$$

$$\Lambda^{\circ} = \lambda_{+}^{\circ} + \lambda_{-}^{\circ} \quad \lambda_{+}^{\circ} = F u_{+} \quad t^{+} = \frac{u^{+}}{u^{+} + u^{-}} \quad t^{-} = \frac{u^{-}}{u^{+} + u^{-}}$$

$$D = \frac{kT}{Q} u \quad \Lambda \eta = \text{const} \quad I = \frac{1}{2} \sum_i c_i z_i^2$$

$$\Delta_{\text{hyd}} G^{\circ} = \frac{z^2 e^2}{8\pi \epsilon_0 r} \left(\frac{1}{\epsilon} - 1 \right) \quad \Delta_{\text{hyd}} S^{\circ} = \frac{z^2 e^2}{8\pi \epsilon_0 \epsilon r} \left(\frac{\partial \ln \epsilon}{\partial T} \right)$$

$$\log_{10} \gamma_{\pm} = -0.512 |z_{+}| |z_{-}| \sqrt{I} \quad G_i = G_i^{\circ} + kT \ln c_i \gamma_i \quad \text{pH} = -\log[\text{H}^{+}]$$

$$\Delta G^{\circ} = -zFE^{\circ} \quad E^{\circ} = \frac{RT}{zF} \ln K^{\circ} \quad E = E^{\circ} - \frac{RT}{zF} \ln Q$$

$$E = E^{\circ} - \frac{RT}{zF} \ln \left(\frac{[\text{Y}]^y [\text{Z}]^z}{[\text{A}]^a [\text{B}]^b} \right)^u \quad \Delta \Phi = \frac{RT}{zF} \ln \frac{c_1}{c_2}$$

$$g = 9.81 \text{ ms}^{-2}$$

$$L = 6.022 \times 10^{23} \text{ mol}^{-1}$$

$$R = 8.3145 \text{ J K}^{-1} \text{ mol}^{-1} = 0.082057 \text{ atm dm}^3 \text{ K}^{-1} \text{ mol}^{-1} = 1.98719 \text{ cal K}^{-1} \text{ mol}^{-1}$$

$$k_B = 1.381 \times 10^{-23} \text{ J K}^{-1}$$

$$F = 96485 \text{ C mol}^{-1}$$

$$e = 1.602 \times 10^{-19} \text{ C}$$

$$\epsilon_0 = 8.854 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$$

$$1 \text{ atm} = 101325 \text{ Pa} = 760 \text{ Torr},$$

$$1 \text{ bar} = 100000 \text{ Pa}$$

$$1 \text{ m}^3 = 1000 \text{ liter} = 1000 \text{ dm}^3 = 1000000 \text{ cm}^3$$

$$1 \text{ M} = 1 \text{ mol/liter} \quad 1 \text{ m} = 1 \text{ mol/kg}$$

$$1 \text{ W} = 1 \text{ J s}^{-1} \quad 1 \text{ A} = 1000 \text{ mA} \quad 1 \text{ S} = 1/\Omega = 1 \text{ A/V} \quad 1 \text{ C} = 1 \text{ A s}$$