Livingston's Chemistry Formulas

AP Chem

★ Ideal Gas Law - $PV = nRT$

★ Density Ideal Gas Law - $\text{MM} = \frac{dRT}{P}$

★ Decay Rate Constant - $t_{\frac{1}{2}} = \frac{\ln(2)}{k}$

★ First-Order Integrated Rate Law - $\ln[\text{A}] = \ln[\text{A}_0] - kt$

★ Second-Order Integrated Rate Law - $\frac{1}{[\text{A}]} = \frac{1}{[\text{A}_0]} + kt$

★ Third-Order Integrated Rate Law - $\frac{1}{[\text{A}]^2} = \frac{1}{[\text{A}_0]^2} + 2kt$

★ Heat Definition - $q = mc\Delta t$

★ Equilibrium Constant Relation - $K_p = K_c(RT)^{\Delta n}$

★ Henderson-Hasselbalch Equation - $\text{pH} = -\log(K_a) + \log\left(\frac{[\text{A}^-]}{[\text{HA}]}\right)$

★ Buffer Capacity - $\beta = \frac{\Delta n}{\Delta \text{ pH}}$

★ Nernst Equation - $\varepsilon = \varepsilon^\circ - \frac{RT}{nF}\ln Q$

★ Gibbs Free Energy Definition - $\Delta G = \Delta G - T\Delta S$

★ Gibbs Equilibrium Relation - $\Delta G^\circ = -RT\ln\left(K_{\text{eq}}\right)$

★ Gibbs Potential Relation - $\Delta G^\circ = -nF\varepsilon^\circ$

Miscellaneous

★ Formal Charge - $\text{FC} = \text{V} - \text{N} - \frac{\text{B}}{2}$

★ Radial Nodes - $\text{RN} = n - l - 1$

★ Angular Nodes - $\text{AN} = l$

★ Molality - $m = \frac{n}{\text{solvent mass}}$

★ Freezing Point Depression - $\Delta T_f = iK_f m$

★ Boiling Point Elevation - $\Delta T_b - iK_b m$

★ Energy of Light - $E = \frac{hc}{\lambda}$

★ Rydberg Equation - $R_H\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$

★ Graham's Law - $\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}}$

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

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

★ van't Hoff Equation - $\ln\left(\frac{K_2}{K_1}\right) = \frac{\Delta H_{\text{rxn}}}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$

★ Work Done on a Gas - $W = -P\Delta V = -\Delta nRT$

★ Potential Energy Definition - $\Delta U = q + w = \Delta H - P\Delta V$