

LIQUIDS AND SOLIDS

$$h = (2T \cos \theta) / (r \rho g)$$

$$P = A e^{-\Delta H_{\text{vap}} / (RT)}$$

$$\ln P = -\Delta H_{\text{vap}} / (RT) + \ln A$$

$$\ln(P_2/P_1) = (\Delta H_{\text{vap}} / R) (1/T_1 - 1/T_2)$$

$$n\lambda = 2d \sin \theta$$

FUNDAMENTAL EQUILIBRIUM CONCEPTS

$$Q_c = [C]^c [D]^d / [A]^a [B]^b$$

$$Q_p = [PC]^c [PD]^d / [PA]^a [PB]^b$$

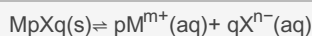
$$P = MRT$$

$$K_c = Q_c \text{ at equilibrium}$$

$$K_p = Q_p \text{ at equilibrium}$$

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

OTHER EQUILIBRIA



$$\text{where } K_{sp} = [M^{m+}]^p [X^{n-}]^q$$

THERMODYNAMICS

$$\Delta S = q_{\text{rev}} / T$$

$$S = k \ln W$$

$$\Delta S = k \ln(W_f / W_i)$$

$$\Delta S^\circ = \sum \nu S^\circ(\text{products}) - \sum \nu S^\circ(\text{reactants})$$

$$\Delta S = q_{\text{rev}} / T$$

$$\Delta S_{\text{univ}} = \Delta S_{\text{sys}} + \Delta S_{\text{surr}}$$

$$\Delta S_{\text{univ}} = \Delta S_{\text{sys}} + \Delta S_{\text{surr}} = \Delta S_{\text{sys}} + (q_{\text{surr}} / T)$$

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

SOLUTIONS / COLLOIDS

$$C^g = k P^g$$

$$(P^A = X^A) (P^A)$$

$$P_{\text{solution}} = X_{\text{solvent}} P_{\text{solvent}}$$

$$\Delta T^b = K^b m$$

$$\Delta T^f = K^f m$$

$$\Pi = MRT$$

ACID-BASE EQUILIBRIA

$$K_w = [H_3O^+][OH^-] = 1.0 \times 10^{-14} \text{ (at } 25^\circ\text{C)}$$

$$pH = -\log[H_3O^+]$$

$$pOH = -\log[OH^-]$$

$$[H_3O^+] = 10^{-pH}$$

$$[OH^-] = 10^{-pOH}$$

$$pH + pOH = pK_w = 14.00 \text{ at } 25^\circ\text{C}$$

$$K_a = [H_3O^+][A^-] / [HA]$$

$$K_b = [HB^+][OH^-] / [B]$$

$$K_a \times K_b = 1.0 \times 10^{-14} = K_w$$

$$\text{Percent ionization} = ([H_3O^+]_{\text{eq}} / [HA]_0) \times 100$$

$$pK_a = -\log K_a$$

$$pK_b = -\log K_b$$

$$pH = pK_a + \log([A^-] / [HA])$$

NUCLEAR CHEM

$$E = mc^2$$

$$\text{decay rate} = \lambda N$$

$$t^{1/2} = \ln 2 / \lambda = 0.693 / \lambda$$

$$\text{rem} = \text{RBE} \times \text{rad}$$

$$\text{Sv} = \text{RBE} \times \text{Gy}$$

KINETICS

$$\text{relative reaction rates for } aA \rightarrow bB = (-1/a) (\Delta[A] / \Delta t) = (1/b) (\Delta[B] / \Delta t)$$

$$\text{integrated rate law for zero-order reactions: } [A]_t = -kt + [A]_0$$

$$\text{half-life for a zero-order reaction } t_{1/2} = [A]_0 / (2k)$$

$$\text{integrated rate law for first-order reactions: } \ln[A]_t = -kt + \ln[A]_0$$

$$\text{half-life for a first-order reaction } t_{1/2} = \ln 2 / k$$

$$\text{integrated rate law for second-order reactions: } 1/[A]_t = kt + 1/[A]_0$$

$$\text{half-life for a second-order reaction } t_{1/2} = 1 / ([A]_0 k)$$

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

$$\ln k = (-E_a / R) (1/T) + \ln A$$

$$\ln k (1/k_2) = (E_a / R) (1/T_2 - 1/T_1)$$

ELECTROCHEMISTRY

$$E^\circ_{\text{cell}} = E^\circ_{\text{cathode}} - E^\circ_{\text{anode}}$$

$$E^\circ_{\text{cell}} = (RT/nF) \ln K$$

$$E^\circ_{\text{cell}} = (0.0257 \text{ V}/n) \ln K = (0.0592 \text{ V}/n) \log K \dots \text{(at } 298.15\text{K)}$$

$$E_{\text{cell}} = E^\circ_{\text{cell}} - (RT/nF) \ln Q \dots \text{(Nernst equation)}$$

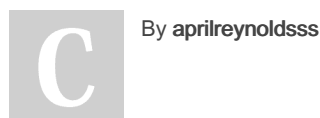
$$E_{\text{cell}} = E^\circ_{\text{cell}} - (0.0592 \text{ V}/n) \log Q \dots \text{(at } 298.15\text{K)}$$

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

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

$$w_{\text{ele}} = w_{\text{max}} = -nFE_{\text{cell}}$$

$$Q = I \times t = n \times F$$



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Page 1 of 1.

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