

CH 1: ESSENTIALS

$$\text{density} = \text{mass/volume}$$

$$^{\circ}\text{C} = 59 \times (^{\circ}\text{F} - 32)$$

$$^{\circ}\text{F} = (95 \times ^{\circ}\text{C}) + 32$$

$$\text{K} = ^{\circ}\text{C} + 273.15$$

$$^{\circ}\text{C} = \text{K} - 273.15$$

CH 5: THERMOCHEMISTRY

$$q = (c \times m \times \Delta T) = (c \times m \times (T_{\text{final}} - T_{\text{initial}}))$$

$$\Delta U = q + w$$

$$\Delta H^{\circ} \text{ reaction} = (\sum n \times \Delta H_f(\text{products})) - (\sum n \times \Delta H_f(\text{reactants}))$$

CH 8: ADV. COVALENT BONDING

$$\text{bond order} = ((\text{number of bonding electron}) - (\text{number of antibonding electrons})) / 2$$

CH 10: LIQUIDS AND SOLIDS

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

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

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

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

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

CH 11: SOLUTIONS AND COLLOIDS

$$C^g = kP^g$$

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

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

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

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

$$\Pi = MRT$$

CH 17: ELECTROCHEMISTRY

CH 14: ACID-BASE EQUILIBRIA

$$K_w = [\text{H}_3\text{O}^+][\text{OH}^-] = 1.0 \times 10^{-14} \text{ (at } 25^{\circ}\text{C)}$$

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

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

$$[\text{H}_3\text{O}^+] = 10^{-\text{pH}}$$

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

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

$$K_a = [\text{H}_3\text{O}^+][\text{A}^-] / [\text{HA}]$$

$$K_b = [\text{HB}^+][\text{OH}^-] / [\text{B}]$$

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

$$\text{Percent ionization} = ([\text{H}_3\text{O}^+]_{\text{eq}} / [\text{HA}]_0) \times 100$$

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

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

$$\text{pH} = \text{p}K_a + \log ([\text{A}^-] / [\text{HA}])$$

CH 2: MOLEC, ATOMS, IONS

$$\text{average mass} = \sum i (\text{fractional abundance} \times \text{isotopic mass}) i$$

CH 6: ELECTRONIC STRUCTURE & PERIODIC PROP

$$c = \lambda \nu$$

$$E = h\nu = hc\lambda \dots \text{where } h = 6.626 \times 10^{-34} \text{ J s}$$

$$1\lambda = R_{\infty} (1/n^2(\#1) - 1/n^2)$$

$$E_n = -kZ^2 / n^2 \dots n=1,2,3,\dots$$

$$\Delta E = kZ^2 (1/n^2(\#1) - 1/n^2(\#2))$$

$$\Delta E = kZ^2 (1/n^2(\#1) - 1/n^2(\#2))$$

$$r = (n^2 / Z) a_0$$

CH 9: GASES

$$P = F/A$$

$$p = hpg$$

$$p = hpg$$

$$P_{V\text{Totalv}} = P_{V\text{Av}} + P_{V\text{Bv}} + P_{V\text{Cv}} + \dots = \sum i P_i$$

$$P_{V\text{Av}} = (X_{V\text{Av}})(P_{V\text{Totalv}})$$

$$X_{V\text{Av}} = (n_{V\text{Av}}) / (n^{\text{total}})$$

$$\text{rate of diffusion} = (\text{amount of gas passing through an area}) / (\text{unit of time})$$

$$(\text{rate of effusion of gas A} / \text{rate of effusion of gas B}) = \sqrt{m^B} / \sqrt{m^A} = \sqrt{M^B} / \sqrt{M^A}$$

$$K_{E\text{avg}} = (3/2)(RT)$$

CH 12: KINETICS

$$\text{relative reaction rates for } aA \rightarrow bB = (-1/a)$$

$$(\Delta[A] / \Delta t) = (1/b)(\Delta[B] / \Delta t)$$

$$\text{integrated rate law for zero-order reactions:}$$

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

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

$$[A]_0 / (2k)$$

$$\text{integrated rate law for first-order reactions:}$$

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

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

$$\text{integrated rate law for second-order}$$

$$\text{reactions: } 1/[A]_t = kt + 1/[A]_0$$

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

$$1 / ([A]_0 k)$$

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

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

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



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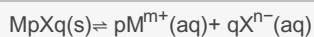
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CH 15: OTHER EQUILIBRIA



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

CH 3: SUBSTANCE/SOLUTION CONCENTRATION

$$\%X = (\text{mass } X / \text{mass compound}) \times 100\%$$

$$(\text{molecular or molar mass}) / (\text{empirical formula mass}) = n \text{ formula units/molecule}$$

$$(A_xB_y)_n = (A_{nx})(B_{ny})$$

$$M = (\text{mol solute}) / (\text{L solution})$$

$$(C_1)(V_1) = (C_2)(V_2)$$

$$\text{Percent by mass} = (\text{mass of solute} / \text{mass of solution}) \times 100$$

$$\text{ppm} = (\text{mass solute} / \text{mass solution}) \times 10^6$$

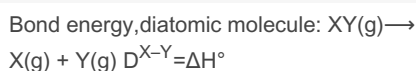
$$\text{ppb} = (\text{mass solute} / \text{mass solution}) \times 10^9$$

CH 4: STOICH/CHEM. REACTIONS

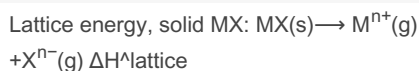
$$\text{percent yield} = \{(\text{actual yield}) / (\text{theoretical yield})\} \times 100$$

CH7: CHEM. BONDING & MOLECULAR GEO.

$$\text{formal charge} = (\# \text{ valence shell electrons (free atom)}) - (\# \text{ lone pair electrons} - (1/2) \# \text{ bonding electrons})$$



$$\text{Enthalpy change: } \Delta H = \sum D^{\text{bonds broken}} - \sum D^{\text{bonds formed}}$$



$$\text{Lattice energy, ionic crystal: } \Delta H^{\text{lattice}} = (C(Z^+)(Z^-)) / R_o$$

CH 13: FUNDAMENTAL EQUILIBRIUM CONCEPTS

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

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

$$P = MRT$$

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

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

$$KP = Kc (RT)^{\Delta n}$$

CH 16: THERMODYNAMICS

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

$$S = k \ln W$$

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

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

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

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

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

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



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