CHEMISTRY 1220

EXAM #1 USEFUL INFORMATION

CONVERSIONS AND CONSTANTS

1 inch= 2.54 cm, 1 nm = 10^{-9} m, 1 pm = 10^{-12} m, 1 Å = 10^{-10} m, 1 cm^3 = 1 mL

N = kg-m/s^2, Pa = N/m^2, J = kg-m^2/s^2

760 mmHg=760 torr=1 atm=1.01325 bar=101,325 Pa=101.325 kPa=14.696 psi

Molar Volume at STP = 22.4 L, T(K) = T(°C) + 273.15

The speed of light is c = 3.00 x 10^8 m/s, Planck's constant, h = 6.626 x 10^{-34} J s

N_A = 6.022x10^{23}, R = 0.08206 L-atm/mol-K = 8.314 J/mol-K

d = m/V, density of H_2O at 25ºC = 1.00 g/cm^3, density of Hg at 20ºC = 13.55 g/cm^3

FORMULAS

Energy states of the hydrogen atom: E = (-2.18 x10^{-18} J)(1/n^2)

λ = h/mv, E = hc/λ

$\Delta H^\circ_{rxn} = \Sigma\, \Delta H^\circ_{products} - \Sigma\, n\Delta H^\circ_{reactants}$, $\Delta H^\circ_{rxn} = \Sigma$ bonds broken - Σ bonds formed

q = mass x specific heat x ΔT , PE of two interacting charges E = $k(Q_1Q_2)/d$

F = ma, P = F/A, KE = ½ mv^2

$\left(P + \frac{n^2 a}{V^2}\right)(V - nb) = nRT$, and for an ideal gases: PV = nRT

$v = \sqrt{\frac{3RT}{M}}$ where *v* is rms speed

$z^2 = x^2 + y^2$ (diagonal of right angle triangle), $V_{box} = l \cdot w \cdot h$

$S_g = k_H P_g$, $P_A = X_A P^\circ_A$, $\Delta T_b = K_f m$, $\Delta Tf = K_f m$, $\Pi = (n/V)RT$

$$\Delta P = X_{solute} P^o_{solvent} \qquad P_{solution} = X_{solvent} P^o_{solvent}$$

$$ln\left(\frac{P_2}{P_1}\right) = \frac{\Delta H_v}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right) \qquad \log\left(\frac{P_2}{P_1}\right) = \frac{\Delta H_v}{2.303R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right) \qquad ln(P) = \frac{-\Delta H_v}{R}\left(\frac{1}{T}\right) + C$$

For the general equation: $aA + bB \leftrightarrows dD + eE$

$$\text{Rate} = -\frac{1}{a}\frac{\Delta[A]}{\Delta t} = -\frac{1}{b}\frac{\Delta[B]}{\Delta t} = \frac{1}{c}\frac{\Delta[C]}{\Delta t} = \frac{1}{d}\frac{\Delta[D]}{\Delta t} \qquad Q = \frac{[D]^d[E]^e}{[A]^a[B]^b}$$

$$K_c = \frac{[D^d][E]^e}{[A]^a[B]^b} \qquad K_p = \frac{(P_D)^d(P_E)^e}{(P_A)^a(P_B)^b} \qquad K_p = K_c(RT)^{\Delta n}$$

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

$$t_{1/2} = -\frac{\ln 1/2}{k} = \frac{0.693}{k} \qquad t_{1/2} = \frac{1}{k[\mathrm{A}]_0}$$

$$\ln k = -\frac{E_a}{RT} + \ln \mathrm{A}$$

$$\ln\left(\frac{k_2}{k_1}\right) = \frac{E_a}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right) \qquad \log\left(\frac{k_2}{k_1}\right) = \frac{E_a}{2.303R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$

$$k = A\, e^{-E_a/RT} \qquad \ln(k) = -\left(\frac{E_a}{R}\right)\left(\frac{1}{T}\right) + \ln(A)$$

$$\text{Molarity}, M = \frac{\text{moles of solute}}{\text{liters of solution}} \qquad \text{Molality}, m = \frac{\text{moles of solute}}{\text{kilograms of solvent}}$$

$$A = \varepsilon bc \qquad \pi = \left(\frac{n}{V}\right)RT = MRT$$

at 25^{o}C, $K_w = 1.0\text{x}10^{-14}$ $\qquad K_c = [H_3O^+][OH^-] = K_{w.}$

$$K_a = \frac{[H^+][A^-]}{[HA]} \qquad pH = -\log[H^+] = -\log[H_3O^+]. \qquad K_a \times K_b = K_w \qquad pOH = -\log[OH^-]$$

$$\%\ \text{ionization} = \frac{[H^+]_{\text{equilibrium}}}{[HA]_{\text{initial}}} \times 100\% \qquad pH = pK_a + \log\left(\frac{[base]}{[acid]}\right)$$

$$\text{for } ax^2 + bx + c = 0, \qquad x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$