CH301 Final Exam equations, constants, conversions

Constants and Conversions:

1 atm = 1.013×10^5 Pa = 760 torr = 760 mmHg

1000 g = 1 kg

R = 0.082 l atm/K mol

R= 1.987 cal/mol K

R = 8.314 J/mol K

k = 1.38×10^{-23} J/K

N = 6.022×10^{23}

R =kN

N = 6.022×10^{23}

K = $^oC + 273$

c = 3.0×10^8 m/s

h = 6.626×10^{-34} Js

$h_{bar} = h/2\pi = 1.054 \times 10^{-34}$ Js

$m_e = 9.109 \times 10^{-31}$ kg

$m_p = 1.674 \times 10^{-27}$ kg

R (Rydberg) = 3.289×10^{15} Hz

STP = 1 atm and 273K

Water spec. heat = 4.18 J/g °C

Useful equations:

$\nu = c/\lambda$

$\Delta E = h\nu$

$1/\lambda = (R/c)(1/n_1^2 - 1/n_2^2)$

$E = (hR)(1/n_1^2 - 1/n_2^2)$

$\nu = R(1/n_1^2 - 1/n_2^2)$

$T\lambda_{max} = c_2/5$

$0.5mv^2 = h\nu - \Phi$

$\lambda = h/mv = h/p$

$\Delta p \Delta x \geq 1/2hbar$

$m\Delta v\Delta x \geq 1/2hbar$

$H\Psi = E\Psi$

$E_n = m^2h^2/8mL^2$

$k = PV$

$V = kT$

$P_1V_1 = P_2V_2$

$V_1/T_1 = V_2/T_2$

$P_1V_1/T_1 = P_2V_2/T_2$

$PV = nRT$

$n = g/MW$

$\rho = g/ml$

$M = n/V$

$E = 0.5\ mv^2$

$v = (3RT/MW)^{0.5}$

$(P - n^2a/V^2)(V-nb) = nRT$

relative rate = $(MW_1/MW_2)^{0.5}$

$m_1v_1^2 = m_2v_2^2$

$\Delta E = \Delta U = q = mC\Delta T$ at constant volume

E = 0.5 kT per degree of freedom

$\Delta E = \Delta U = q + w = q - P\Delta V$

$\Delta H = q = mC\Delta T$ at constant pressure

$\Delta H_{rxn}^\circ = \Sigma\ n\ \Delta H_f^\circ{}_{products} - \Sigma\ n\ \Delta H_f^\circ{}_{reactants}$

$\Delta H_{rxn} = \Sigma$ B.E.$_{rxn} = \Sigma$ B.E.$_{react} - \Sigma$ B.E.$_{prod}$

$C = q/\Delta T$

$H = E + PV$

$\Delta H = \Delta E + \Delta nRT$

$w = -P\Delta V = -\Delta n_g RT$

$w = -nRT\ ln(V_2/V_1)$

$\Delta S_{rxn}^\circ = \Sigma\ n\ S_m^\circ{}_{products} - \Sigma\ n\ S_m^\circ{}_{reactants}$

$S = k\ ln\ W$

$\Delta S_{sys} = q_{sys}/T$

$\Delta S_{surr} = -\Delta H_{sys}/T$

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

$\Delta G_{sys} = \Delta H_{sys} - T\Delta S_{sys}$ (constant T, P)

$\Delta G_{rxn}^\circ = \Sigma\ n\ \Delta G_f^\circ{}_{products} - \Sigma\ n\ \Delta G_f^\circ{}_{reactants}$