ATOMIC STRUCTURE

$E = h\nu$ $\quad c = \lambda\nu$

$\lambda = \dfrac{h}{m\upsilon}$ $\quad p = m\upsilon$

$E_n = \dfrac{-2.178 \times 10^{-18}}{n^2}$ joule

EQUILIBRIUM

$K_a = \dfrac{[H^+]\,[A^-]}{[HA]}$

$K_b = \dfrac{[OH^-]\,[HB^+]}{[B]}$

$K_w = [OH^-]\,[H^+] = 1.0 \times 10^{-14}$ @ 25°C

$= K_a \times K_b$

$pH = -\log [H^+],\ pOH = -\log [OH^-]$

$14 = pH + pOH$

$pH = pK_a + \log \dfrac{[A^-]}{[HA]}$

$pOH = pK_b + \log \dfrac{[HB^+]}{[B]}$

$pK_a = -\log K_a,\ pK_b = -\log K_b$

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

where Δn = moles product gas − moles reactant gas

THERMOCHEMISTRY/KINETICS

$\Delta S^\circ = \sum S^\circ$ products $- \sum S^\circ$ reactants

$\Delta H^\circ = \sum \Delta H_f^\circ$ products $- \sum \Delta H_f^\circ$ reactants

$\Delta G^\circ = \sum \Delta G_f^\circ$ products $- \sum \Delta G_f^\circ$ reactants

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

$= -RT \ln K = -2.303\, RT \log K$

$= -n\mathcal{F}\, E^\circ$

$\Delta G = \Delta G^\circ + RT \ln Q = \Delta G^\circ + 2.303\, RT \log Q$

$q = mc\Delta T$

$C_p = \dfrac{\Delta H}{\Delta T}$

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

$\dfrac{1}{[A]_t} - \dfrac{1}{[A]_0} = kt$

$\ln k = \dfrac{-E_a}{R}\left(\dfrac{1}{T}\right) + \ln A$

E = energy $\quad \upsilon$ = velocity

ν = frequency $\quad n$ = principal quantum number

λ = wavelength $\quad m$ = mass

p = momentum

Speed of light, $c = 3.0 \times 10^8$ m s^{-1}

Planck's constant, $h = 6.63 \times 10^{-34}$ J s

Boltzmann's constant, $k = 1.38 \times 10^{-23}$ J K^{-1}

Avogadro's number $= 6.022 \times 10^{23}$ mol^{-1}

Electron charge, $e = -1.602 \times 10^{-19}$ coulomb

1 electron volt per atom $= 96.5$ kJ mol^{-1}

Equilibrium Constants

K_a (weak acid)

K_b (weak base)

K_w (water)

K_p (gas pressure)

K_c (molar concentrations)

S° = standard entropy

H° = standard enthalpy

G° = standard free energy

E° = standard reduction potential

T = temperature

n = moles

m = mass

q = heat

c = specific heat capacity

C_p = molar heat capacity at constant pressure

E_a = activation energy

k = rate constant

A = frequency factor

Faraday's constant, $\mathcal{F}$ = 96,500 coulombs per mole of electrons

Gas constant, $R = 8.31$ J mol^{-1} K^{-1}

$= 0.0821$ L atm mol^{-1} K^{-1}

$= 8.31$ volt coulomb mol^{-1} K^{-1}