## ATOMIC STRUCTURE

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

$$\lambda = \frac{h}{m\upsilon} \qquad p = m\upsilon$$

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

## EQUILIBRIUM

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

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

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

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

$$14 = pH + pOH$$

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

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

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

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

where $\Delta n$ = moles product gas − moles reactant gas

## THERMOCHEMISTRY/KINETICS

$$\Delta S° = \sum S° \text{ products} - \sum S° \text{ reactants}$$

$$\Delta H° = \sum \Delta H_f° \text{ products} - \sum \Delta H_f° \text{ reactants}$$

$$\Delta G° = \sum \Delta G_f° \text{ products} - \sum \Delta G_f° \text{ reactants}$$

$$\Delta G° = \Delta H° - T\Delta S°$$
$$= -RT\ln K = -2.303RT\log K$$
$$= -n\mathcal{F}E°$$

$$\Delta G = \Delta G° + RT\ln Q = \Delta G° + 2.303RT\log Q$$

$$q = mc\Delta T$$

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

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

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

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

$E$ = energy
$\upsilon$ = velocity
$\nu$ = frequency
$n$ = principal quantum number
$\lambda$ = wavelength
$m$ = 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$^{-1}$
= 62.4 L torr mol$^{-1}$ K$^{-1}$
= 8.31 volt coulomb mol$^{-1}$ K$^{-1}$

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