Equations and Conversions for CHEM152

$N_A = 6.022 \times 10^{23}$ mol^{-1} $\quad h = 6.626 \times 10^{-34}$ Js $\quad c = 3.00 \times 10^{8}$ ms^{-1}

$m_p = 1.67 \times 10^{-27}$ kg $\quad m_e = 9.11 \times 10^{-31}$ kg $\quad q_e = -1.60 \times 10^{-19}$ C $\quad 1\text{eV} = 1.6 \times 10^{-19}$ J

Pressure conversions: 1 atm = 1.01325×10^{5} Pa = 760 mm Hg = 760 torr

Ideal Gas Constant: R = 8.314 J K^{-1} mol^{-1} = 0.08206 L atm mol^{-1} K^{-1}

$\Delta E = q + w$ $\quad q = nC\Delta T$ $\quad q = n\Delta H_{fus/vap}$ $\quad w = Fd = -P_{ext}\Delta V$

$\Delta H = \Delta E + P\Delta V$ $\quad \Delta H^o = \Delta H_f^o(pdt) - \Delta H_f^o(rct)$ $\quad \Delta H = \text{B.E.}_{\text{rcts}} - \text{B.E.}_{\text{pdts}}$

$\Delta S = \frac{q_{rev}}{T}$ $\quad \Delta S^o = S^o(pdt) - S^o(rct)$ $\quad \ln P_{vap} = \left(\frac{-\Delta H_{vap}}{R}\right)\frac{1}{T} + \text{const.}$

$\Delta G = \Delta H - T\Delta S$ $\quad$ aA + bB → cC + dD

$\Delta G^\circ = -RT \ln K_{eq}$ $\quad K_P = K_C\left(RT\right)^{\Delta n_{gas}}$ $\quad \Delta G = \Delta G^o + RT\ln Q$; $Q = \frac{[C]^c[D]^d}{[A]^a[B]^b} = \frac{P_C^c P_D^d}{P_A^a P_B^b}$

$\Delta G = -nFE_{cell}$ $\quad E_{cell} = E^o_{cell} - \frac{RT}{nF}\ln Q = E^o_{cell} - \frac{0.0592V}{n}\log Q$ $\quad F = 96{,}450$ C mol^{-1}

Ideal Gases: $PV = nRT$ $\quad P_A = \chi_A P_{tot}$ $\quad n_A = \chi_A n_{tot}$ $\quad P_{tot} = P_A + P_B + P_C + \ldots$

Solutions: Solubility = $K_H P$ $\quad \Delta T_{bp} = k_{bp} mi$ $\quad \Delta T_{fp} = k_{fp} mi$ $\quad \Pi = MRT$

Rate = $-\frac{1}{a}\frac{d[A]}{dt} = -\frac{1}{b}\frac{d[B]}{dt} = \frac{1}{c}\frac{d[C]}{dt} = \frac{1}{d}\frac{d[D]}{dt}$ $\quad$ aA + bB → cC + dD

Rate = $k[\text{A}]^m[\text{B}]^n$ $\quad$ Arrhenius equation: $k = A\exp\left(\frac{-E_a}{RT}\right)$

Integrated Rate Laws:

$[A] = -kt + [A]_o$ $\quad t_{1/2} = \frac{[A]_o}{2k}$

$\ln[A] = -kt + \ln[A]_o$ $\quad t_{1/2} = \frac{\ln 2}{k}$

$\frac{1}{[A]} = kt + \frac{1}{[A]_o}$ $\quad t_{1/2} = \frac{1}{[A]_o k}$

$pH = -\log[H_3O^+]$ $\quad pK = -\log K$

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

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

$ax^2 + bx + c = 0$

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$