

## GASES, LIQUIDS, AND SOLUTIONS

$$PV = nRT$$

$$\left(P + \frac{n^2 a}{V^2}\right)(V - nb) = nRT$$

$$P_A = P_{total} \times X_A, \text{ where } X_A = \frac{\text{moles } A}{\text{total moles}}$$

$$P_{total} = P_A + P_B + P_C + \dots$$

$$n = \frac{m}{M}$$

$$K = ^\circ\text{C} + 273$$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$D = \frac{m}{V}$$

$$u_{rms} = \sqrt{\frac{3kT}{m}} = \sqrt{\frac{3RT}{M}}$$

$$KE \text{ per molecule} = \frac{1}{2}mv^2$$

$$KE \text{ per mole} = \frac{3}{2}RT$$

$$\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}}$$

molarity,  $M$  = moles solute per liter solution

molality = moles solute per kilogram solvent

$$\Delta T_f = iK_f \times \text{molality}$$

$$\Delta T_b = iK_b \times \text{molality}$$

$$\pi = iMRT$$

$$A = abc$$

$P$  = pressure

$V$  = volume

$T$  = temperature

$n$  = number of moles

$D$  = density

$m$  = mass

$v$  = velocity

$u_{rms}$  = root-mean-square speed

$KE$  = kinetic energy

$r$  = rate of effusion

$M$  = molar mass

$\pi$  = osmotic pressure

$i$  = van't Hoff factor

$K_f$  = molal freezing-point depression constant

$K_b$  = molal boiling-point elevation constant

$A$  = absorbance

$a$  = molar absorptivity

$b$  = path length

$c$  = concentration

$Q$  = reaction quotient

$I$  = current (amperes)

$q$  = charge (coulombs)

$t$  = time (seconds)

$E^\circ$  = standard reduction potential

$K$  = equilibrium constant

## OXIDATION-REDUCTION; ELECTROCHEMISTRY

$$Q = \frac{[C]^c [D]^d}{[A]^a [B]^b}, \text{ where } a A + b B \rightarrow c C + d D$$

$$I = \frac{q}{t}$$

$$E_{\text{cell}} = E_{\text{cell}}^\circ - \frac{RT}{n\mathcal{F}} \ln Q = E_{\text{cell}}^\circ - \frac{0.0592}{n} \log Q @ 25^\circ\text{C}$$

$$\log K = \frac{nE^\circ}{0.0592}$$

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

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

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

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

$K_f$  for  $\text{H}_2\text{O} = 1.86 \text{ K kg mol}^{-1}$

$K_b$  for  $\text{H}_2\text{O} = 0.512 \text{ K kg mol}^{-1}$

$1 \text{ atm} = 760 \text{ mm Hg}$

$= 760 \text{ torr}$

STP =  $0.000^\circ\text{C}$  and  $1.000 \text{ atm}$

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