

CHE 102 Midterm Reference Sheet - Sean Yang

SI Prefixes and Conversion

| Factor | Prefix | Symbol |
|------------|--------|--------|
| 10^{12} | tera | T |
| 10^9 | giga | G |
| 10^6 | mega | M |
| 10^3 | kilo | k |
| 10^2 | hecto | h |
| 10^1 | deca | da |
| 10^0 | unit | |
| 10^{-1} | deci | d |
| 10^{-2} | centi | c |
| 10^{-3} | milli | m |
| 10^{-6} | micro | μ |
| 10^{-9} | nano | n |
| 10^{-12} | pico | p |

Temperature Conversion Factors

$$\frac{1\text{K}}{1.8^\circ\text{R}}, \frac{1\text{K}}{1.8^\circ\text{F}}, \frac{1^\circ\text{C}}{1.8^\circ\text{F}}, \frac{1^\circ\text{C}}{1.8^\circ\text{R}}, \frac{1^\circ\text{C}}{1\text{K}}, \frac{1^\circ\text{F}}{1^\circ\text{R}}$$

(Relative differences only)

Density

$$\rho = \frac{m}{v}$$

Average Atomic Mass

$$M = \sum_i x_i M_i$$

Mole Fraction and Percentage

$$x_A = \frac{n_A}{n_T} = \frac{n_A}{\sum_i n_i}$$

$$\% = x_A \times 100\%$$

Mass Fraction and Percentage

$$w_A = \frac{m_A}{m_T} = \frac{m_A}{\sum_i m_i}$$

$$\% = w_A \times 100\%$$

Average Molar Mass

$$M = \sum_i x_i M_i$$

Concentration

$$\text{molarity} = \frac{n}{V}$$

$$\text{mass \%} = \frac{m_{\text{solute}}}{m_{\text{solution}}} \times 100\%$$

$$\text{volume \%} = \frac{V_{\text{solute}}}{V_{\text{solution}}} \times 100\%$$

$$\text{weight-to-volume \%} = \frac{m_{\text{solute}}}{V_{\text{solution}}} \times 100\%$$

$$\text{molality} = \frac{n_{\text{solute}}}{m_{\text{solvent}}}$$

$$\text{ppm} = \frac{m_{\text{solute}}}{m_{\text{solution}}} \times 10^6$$

$$\text{ppb} = \frac{m_{\text{solute}}}{m_{\text{solution}}} \times 10^9$$

Percentage Yield and Excess

$$\% \text{ yield} = \frac{\text{actual}}{\text{theoretical}} \times 100\%$$

$$\% \text{ excess} = \frac{\text{amount provided} - \text{amount required}}{\text{amount required}} \times 100\%$$

Boyle's Law (Constant n, T)

$$P \propto \frac{1}{v}$$

$$P_1 V_1 = P_2 V_2$$

Charles' Law (Constant n, P)

$$V \propto T$$

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

Temperature in K

Avogadro's Law (Constant T, P)

$$V \propto n$$

$$\frac{V_1}{n_1} = \frac{V_2}{n_2}$$

At 0°C and 1 atm: 1 mol gas = 22.414 L

At 25°C and 1 atm: 1 mol gas = 24.465 L

Ideal Gas Law

$$PV = nRT$$

$$\text{or } PV_m = RT, \text{ where } V_m = \frac{V}{n}$$

Temperature in K

Ideal Gas Assumptions:

- No intermolecular forces between molecules
- Gas molecules have no volume

Approximation valid at high T , low P

Gas Density

$$\rho = \frac{PM}{RT}$$

Dalton's Law of Partial Pressures

$$P = P_A + P_B$$

Assuming $V = V_A = V_B$

Dalton's Law of Partial Volumes

$$V = V_A + V_B$$

Assuming $P = P_A = P_B$

Dalton's Law (Mole Fraction)

$$y_A = \frac{n_A}{n} = \frac{P_A}{P} = \frac{V_A}{V}$$

$$n_A = y_A n$$

$$P_A = y_A P$$

$$V_A = y_A V$$

Measuring Pressure with an Open-End Manometer



$$\Delta P_{\text{mmHg}} = \Delta h_{\text{Hg}}$$