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

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

(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

$PV = nRT$

or $PV_m = RT$, 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)

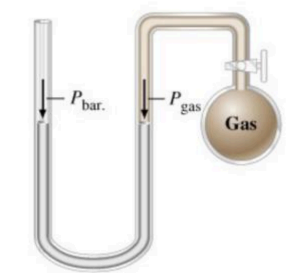
$y_A = \frac{n_A}{n} = \frac{P_A}{P} = \frac{V_A}{V}$

$n_A = y_A n$

$P_A = y_A P$

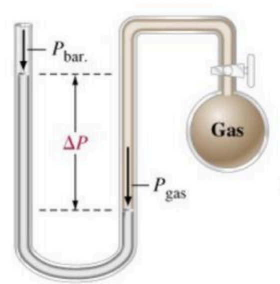
$V_A = y_A V$

Measuring Pressure with an Open-End Manometer



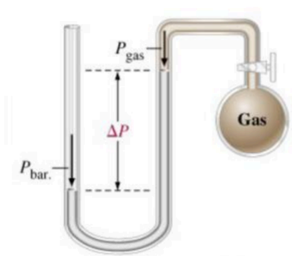
$P_{gas} = P_{bar.}$

(a) Gas pressure equal to barometric pressure



$P_{bar} + P_{Hg} = P_{gas}$

(b) Gas pressure greater than barometric pressure



$P_{bar} = P_{gas} + P_{Hg}$

(c) Gas pressure less than barometric pressure

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