# CHM202:
# *Energetics and dynamics of chemical reactions*

Slides for online lectures

Must be followed along with recommended textbook by Atkins (8th or later edition) or any other reference book

$$dU = TdS - PdV \quad + \sum_i \mu_i dn_i$$

Reversible change

$$\boxed{dG = -SdT + VdP \; + \sum_i \mu_i dn_i}$$

Reversible change

$$G = G^0 + nRTln\left( {}^{P}/_{P^0} \right)$$

Reversible change, constant temp, **ideal gas**

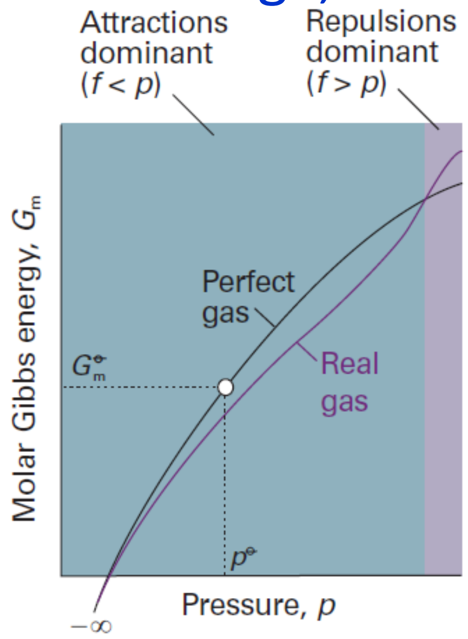
$$G = G^0 + nRTln\left( {}^{f}/_{P^0} \right)$$

***f: fugacity***

Reversible change, constant temp, **ALL gases**

$$f = \varphi \times P$$

$$\boxed{ln\varphi = \int_0^P \frac{Z-1}{P} dP}$$




*Atkins' Physical Chemistry*, 8th Ed, page 111

$$\mu_A = \mu_A^0 + RT\ln\left({}^{P_A}/_{P^0}\right)$$

Reversible change, constant Temp, ideal vapour

$$\mu_A = \mu_A^* + RT\ln\left({}^{P_A}/_{P_A^*}\right)$$

**Exact!** (no approximation yet other than vapour behaves ideally)

Vapour
A + B
$y_A + y_B = 1$
$P_A$ & $P_B$

Liquid
A + B
$x_A + x_B = 1$

$$P_A \approx x_A \times P_A^*$$

Raoult's Law (Ideal solution)
Solvent in almost pure form

$$\boxed{\mu_A \approx \mu_A^* + RT\ln x_A}$$

$$y_A \approx \frac{x_A \times P_A^*}{P_B^* + (P_A^* - P_B^*) \times x_A}$$

$$P_B \approx x_B \times K_B$$

Henry's Law
("Ideal" dilute solution)
Solute in low concentration

$$\mu_B \approx \mu_B^* + RT\ln x_B$$

*Atkins' Physical Chemistry*, 8th Ed, page 145