CHEM 331
Physical Chemistry
Revision 1.0

The Gibbs Free Energy

Gibbs Function

$G = U - TS + PV$

$dG = -S\,dT + V\,dP$

$= \left(\frac{\partial G}{\partial T}\right)_P dT + \left(\frac{\partial G}{\partial P}\right)_T dP$

Temperature Dependence

$\left(\frac{\partial G}{\partial T}\right)_P = \frac{G-H}{T}$

$\left(\frac{\partial (G/T)}{\partial T}\right)_P = -\frac{H}{T^2}$

Pressure Dependence

$G(T,P) = G^o(T) + \int_{P^o}^{P} V\,dP$

Liquids/Solids: $G(T,P) \approx G^o(T)$

Ideal Gases: $G(T,P) = G^o(T) + nRT \ln P$

Chemical Potential - Part 1

$\mu(T,P) = \frac{G(T,P)}{n}$

Liquids/Solids: $\mu(T,P) \approx \mu^o(T)$

Ideal Gases: $\mu(T,P) = \mu^o(T) + RT \ln P$

Real Gases: $\mu(T,P) = \mu^o(T) + RT \ln (f/P^o)$

$\ln\left(\frac{f}{P}\right) = \frac{1}{RT}\int_0^P (\bar{V} - \bar{V}_{id})\,dP$