Formulas and specific data

Thermal equilibrium: T of the system = T of the surroundings

Mechanical equilibrium: P of the system = P of the surroundings

Chemical equilibrium: No tendency for species to change (phase or chemical rxn)

1. *Phase equilibrium: More than one phase with no tendency to change*
2. *Chemical reaction equilibrium: When chemical species have no tendency to react.*

For irreversible process

$$dSi \geq \frac{Q}{T}$$

Free Gibbs energy

$$Gi \equiv Hi - TSi$$

Chemical phase equilibrium

$$Gi^{\alpha} = Gi^{\beta}$$

Spontaneous or not spontaneous reaction

$+\Delta G$ *Not spontaneous*

$-\Delta G$ *Spontaneous*

For one component system

$\mu = \frac{G}{n}$ *where* μ *is the chemical potential*

Fundamental equation of chemical thermodynamics

$$dG = VdP - SdT$$

In a pure fluid @Constant Temperature

$$G = RT \ln(\frac{P2}{P1})$$

$$dGi = RT \ln fi$$

$$Fugacity = \frac{F}{A}$$

$$\Delta G = RT \ln(\frac{P}{Po})$$

Fugacity coefficient

$$\phi = \frac{fi}{Psystem}$$

Activity coefficient. Fugacity of the liquid phase

$$\chi \equiv \frac{fi}{fideal}$$

$$\int_{\Pr ef}^{P} (\frac{ZRT}{P} - \frac{RT}{P}) dP$$

$$\ln \frac{f}{P} = \frac{1}{RT} \int_{0}^{P} (Vreal - Videal) dP$$