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Course 565 / 665 Lecturer prof. Cavagnero

Day 4 12 04 Date 9:55 am

Notes Taken By J. Hong Total Number of Pages

Dependence of G on T

$G = H - TS \qquad H = G + TS \qquad$ recall $\quad S = -\left(\frac{\partial G}{\partial T}\right)_P$

at constant P: $\quad H = G - T\left(\frac{\partial G}{\partial T}\right)_P$

$$\left(\frac{\partial (G/T)}{\partial T}\right)_P = \frac{1}{T}\left(\frac{\partial G}{\partial T}\right)_P - \frac{G}{T^2} = \frac{-1}{T^2}\left(G - T\left(\frac{\partial G}{\partial T}\right)_P \right)$$

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

For a process, $\quad S_A = -\left(\frac{\partial G_A}{\partial T}\right)_P, \quad S_B = -\left(\frac{\partial G_B}{\partial T}\right)_P$

$\Delta S = S_B - S_A \;; \qquad \Delta G = G_B - G_A$

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

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

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Day 4.12.04 Date 9:55 am

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H, S are T-dependent ~~are~~ for proteins ...

$$G(T) = H(T) - TS(T)$$

recall $C_p = \left(\frac{\partial H}{\partial T}\right)_p \overset{\text{const. } p}{\Longrightarrow} \int_{T_R}^{T} C_p\, dT = C_p \int_{T_R}^{T} dT = \int_{H_{T_R}}^{H_T} dH$

$$(H_T - H_{T_R}) = C_p (T - T_R)$$

$$dS = \frac{dQ}{T} \underset{\text{const. } p}{=} \frac{dH}{T}$$

$$C_p = \left(\frac{\partial H}{\partial T}\right)_p = T\left(\frac{\partial S}{\partial T}\right)_p \Rightarrow \frac{C_p}{T} = \left(\frac{\partial S}{\partial T}\right)_p$$

$$C_p \int_{T_R}^{T} \frac{dT}{T} = \int_{S_{T_R}}^{S_T} dS \Rightarrow S_T - S_{T_R} = C_p \ln \frac{T}{T_R}$$

$$G(T) = H(T) - TS(T) \; \cancel{= H(T) - TS}$$

$$= C_p (T - T_R) + H_R - T\left[C_p \ln \frac{T}{T_R} + S_{T_R}\right]$$

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Protein stability

$N \rightleftharpoons U$ K_{NU} → equilibrium constant

N → native state

U → unfolded state, disordered, unstructured state

For protein folding:

$G \rightarrow \Delta G_{NU}$

$C_p \rightarrow \Delta C_{p,NU}$. $S_{T_R} \rightarrow \Delta S_{R,NU}$.

$H_{T_R} \Rightarrow \Delta H_{R,NU}$.