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5.60 Thermodynamics & Kinetics
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These equations will be provided on Exam 2:

$$R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1} = 0.08314 \text{ L bar K}^{-1} \text{ mol}^{-1}$$

$$T(\text{K}) = T(^{\circ}\text{C}) + 273.15$$

$$1 \text{ Pa} = 10^{-5} \text{ bar}$$

$$\text{Temperature change } \Delta S = C_V \ln \frac{T_2}{T_1} \text{ or } C_p \ln \frac{T_2}{T_1} \quad \left(\frac{\partial S}{\partial T} \right)_p = \frac{C_p}{T} \quad \left(\frac{\partial S}{\partial T} \right)_V = \frac{C_V}{T}$$

$$\text{Reversible phase change, e.g. } \Delta S_{\text{vap}} = \frac{q_p^{\text{rev}}}{T_b} = \frac{\Delta H^{\text{vap}}}{T_b}$$

$$\Delta S_{\text{mix}} = -nR(X_A \ln X_A + X_B \ln X_B)$$

$$H = U + pV$$

$$A = U - TS$$

$$G = U + pV - TS$$

$$U(S, V) \Rightarrow dU = TdS - pdV$$

$$H(S, p) \Rightarrow dH = TdS + Vdp$$

$$A(T, V) \Rightarrow dA = -SdT - pdV$$

$$G(T, p) \Rightarrow dG = -SdT + Vdp$$

$$\Delta G_{\text{rxn}}^{\circ} = -RT \ln K_p$$

$$\Delta G = \Delta G_{\text{rxn}}^{\circ} + RT \ln Q$$

$$\ln K_2 = \ln K_1 + \frac{\Delta H_{\text{rxn}}^{\circ}}{R} \left(\frac{1}{T_1} - \frac{1}{T_2} \right)$$

$$\mu_i(g, T, p) = \mu_i^{\circ}(g, T) + RT \ln p_i \quad (\text{p in bar})$$

$$S(p, T) = S^{\circ}(T) - nR \ln p \quad (\text{p in bar})$$

$$\left(\frac{dp}{dT} \right)_{\text{coexist}} = \left(\frac{\Delta \bar{S}}{\Delta \bar{V}} \right)_{\alpha \rightarrow \beta}$$

$$\left(\frac{dp}{dT} \right)_{\text{coexist}} = \left(\frac{\Delta \bar{H}}{T \Delta \bar{V}} \right)_{\alpha \rightarrow \beta}$$