

Unit 12 – Chapter 16: Thermodynamics

Name _____

Assignment #5: Equilibrium Temperature & ΔG , Spontaneity Predictions

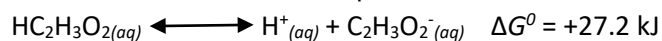
Period _____

- 1) Organ pipes in unheated churches develop “tin disease”, in which white tin is converted to gray tin. Given the below information, calculate the equilibrium temperature for the transition:

White Sn: $\Delta H_f^\circ = 0.00 \text{ kJ/mol}$; $S^\circ = 51.55 \text{ J/mol} \cdot \text{K}$

Gray Sn: $\Delta H_f^\circ = -2.09 \text{ kJ/mol}$; $S^\circ = 44.14 \text{ J/mol} \cdot \text{K}$

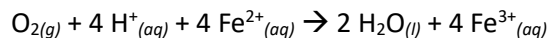
- 2) Show by calculation whether the reaction is spontaneous at 25°C



a. When $[\text{H}^+] = [\text{C}_2\text{H}_3\text{O}_2^-] = 0.85 \text{ M}$; $[\text{HC}_2\text{H}_3\text{O}_2] = 0.15 \text{ M}$

b. When $[\text{H}^+] = [\text{C}_2\text{H}_3\text{O}_2^-] = 2.0 \times 10^{-3} \text{ M}$; $[\text{HC}_2\text{H}_3\text{O}_2] = 1.0 \text{ M}$

- 3) For the reaction:



a) Calculate ΔG° at 25°C . (G° for $\text{Fe}^{3+} = -4.1 \text{ kJ/mol}$; $\text{Fe}^{2+} = -78.9$)

b) Calculate ΔG° at 25°C when $[\text{Fe}^{2+}] = [\text{Fe}^{3+}] = 0.250 \text{ M}$, $P_{\text{O}_2} = 0.755 \text{ atm}$, and the pH of the solution is 3.12.

- 4) Consider the reaction:



a. Calculate ΔG° at 25°C .

b. What should the concentrations of Ag^+ and Cl^- be so that $\Delta G^\circ = -1.0 \text{ kJ}$ (just spontaneous)?

Take $[\text{Ag}^+] = [\text{Cl}^-]$.

c. The K_{sp} for AgCl is 1.8×10^{-10} . Is the answer to b) above reasonable? Explain.