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Extra Practice Questions for Final (Part I, Electrochemistry)

1. Calculate the emf of a battery at 298 K when the concentrations of CuSO_4 and ZnSO_4 are 0.5 M and 0.1M, respectively. What would be the emf if activities were used instead of concentrations? (The mean activity coefficients for CuSO_4 and ZnSO_4 at their respective concentrations are 0.068 and 0.15, respectively).

2. The standard electrochemical potential for $\text{Cu}^{2+}|\text{Cu}$ and $\text{Pt}|\text{Cu}^{2+}, \text{Cu}^+$ are 0.342V and 0.153 V respectively. Calculate the standard electrochemical potential for $\text{Cu}^+|\text{Cu}$.

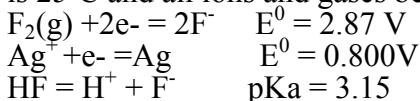
3. Concentrations difference of the same half reaction can be used to build up an electrochemical cell. Consider a concentration cell consisting of two hydrogen electrodes. At 298 K, the cell emf is 0.0267 V. If the pressure of H_2 (g) at the anode is 4.0 bar, what is the pressure of the H_2 (a) at the cathode? (The H^+ concentration is the same in the two half cells)

4. The magnitudes of the standard electrode potential of two metals, X and Y, are



$|E^0|$ denotes the absolute value in magnitude but not the sign of E^0 . When the half-cells of X and Y connected, electrons flow from X to Y. When X is connected to a standard hydrogen electrode (SHE), electrons flow from X to SHE. (a) What are the signs of the standard electrode potential for the above two half-cell reactions? (b) What is the standard emf of a cell made of X and Y?

5. An electrochemical cell consists of a half-cell in which a piece of platinum wire is dipped into a solution that is 1.25 M NaF and 0.10 bar of F_2 gas at pH 7.5. The other half-cell consists of a silver wire immersed in a 2.10 M $AgNO_3$. Assume the temperature is $25^\circ C$ and all ions and gases behave ideally.



- Which electrode is the anode and which is the cathode? What is the emf of the cell?
- What is the spontaneous overall electrochemical reaction? What is the equilibrium constant of the electrochemical reaction?
- What is the emf of the cell if the electrochemical cell is operated under 4.00 bar of pressure?
- What is the emf of the cell if the pH of both half-cells is buffered at 1.50?

