Part A: Calculating Standard Potentials for Electrochemical Cells

1. Use tabulated standard electrode potentials to calculate the standard cell potential for the following reaction occurring in an electrochemical cell at 25°C. (The equation is balanced)
   - hint: refer to page 827 for table 18.1 Standard Electrode Potentials at 25°C

\[ 3\text{Pb}^{2+}(aq) + 2\text{Cr}(s) \rightarrow 3\text{Pb}(s) + 2\text{Cr}^{3+}(aq) \]

Part B: Cell Potential, Free Energy, and the Equilibrium Constant

2. Calculate the following standard cell potentials ($E^{\circ}_{\text{cell}}$) using the standard reduction potentials in the book, and determine if the forward reaction is spontaneous.

\[ \text{F}_2(g) + 2\text{Li}(s) \rightarrow 2\text{F}^-(aq) + 2\text{Li}^+(aq) \]

\[ \text{Fe}^{3+}(aq) + \text{Au}(s) \rightarrow \text{Au}^{3+}(aq) + \text{Fe}(s) \]

\[ \text{Cl}_2(g) + \text{H}_2(g) \rightarrow 2\text{H}^+(aq) + 2\text{Cl}^-(aq) \]

\[ \text{Al}^{3+}(aq) + 3\text{K}(s) \rightarrow 3\text{K}^+(aq) + \text{Al}(s) \]
3. Calculate $\Delta G^\circ$ for each reaction in problem #8, and determine the spontaneity of the forward reaction. $\Delta G^\circ = -nF E^\circ_{cell}$ $F = 96,485 \text{ C/mol e}^-$ 

4. Calculate $K$ for each reaction in problem #8, and determine the spontaneity of the forward reaction. $\Delta G^\circ = -RT \ln K$ 

5. Calculate $E^\circ_{cell}$ for each reaction in problem #8, and determine the spontaneity of the forward reaction. $E^\circ_{cell} = (1/n)0.0592 \text{ V (logK)}$ 

---

**Part C: Cell Potential and Concentration**

6. Qualitatively explain how a concentration cell with just Cu(s), 2.0 M Cu(NO$_3$)$_2$ (aq), and 0.0010 M Cu(NO$_3$)$_2$ (aq) can produce a current. (Hint: equilibrium and potential energy)