Use the standard reduction potentials listed in the appendix of your textbook.

Q1. Draw the cell diagram (picture) for a galvanic cell for which the line notation is
Fe (s) | Fe^{2+} (aq) || Ag^+ (aq) | Ag(s)

Label the diagram clearly and indicate the composition of the electrolytes in the two half cells. Show the signs of the electrodes and label the cathode and the anode.

Write down a balanced equation for the overall cell reaction.

Calculate $E^\circ_{\text{cell}}$.

Q2. Draw the cell diagram (picture) for a galvanic cell for which the line notation is
Pt (s) | Fe^{2+} (aq), Fe^{3+} (aq) || Br_2 (aq), Br^- (aq) | Pt(s)

Label the diagram clearly and indicate the composition of the electrolytes in the two half cells. Show the signs of the electrodes and label the cathode and the anode.

Write down a balanced equation for the overall cell reaction.

Calculate $E^\circ_{\text{cell}}$. 
Q3. Using the standard reduction potentials given in Appendix of your text book, calculate the cell potential ($E_{\text{cell}}^\circ$) at 298 K for each of the following reactions.

(A) $\text{Br}_2 (aq) + 2 \text{Cl}^- (aq) \rightarrow 2\text{Br}^- (aq) + \text{Cl}_2 (g)$

(B) $\text{Au}^{3+} (aq) + 3\text{Ag} (s) \rightarrow \text{Au} (s) + 3\text{Ag}^+ (aq)$

(C) A Galvanic Cell with the SHE and $\text{Cr}^{3+}/\text{Cr}(s)$

Q4. For the reactions listed in Question 3, calculate the Standard free energy change $\Delta G^\circ$ at 298 K. Indicate whether the reactions are spontaneous or not.

(A)

(B)

(C)

Q5. Now, calculate the equilibrium constant $K$ for the same reactions in Question 5 at 298 K.

(A)

(B)

(C)
Q6. Given the cell reaction: \(2 \text{Br}^- (aq) + \text{Cu}^{2+} (aq) \rightarrow \text{Br}_2 (aq) + \text{Cu} (s)\)

(A) As written, is the cell galvanic or electrolytic?

(B) Calculate \(E^\circ_{\text{cell}}\).

(C) Calculate \(\Delta G^\circ\).

Q7. A voltaic cell uses the following reaction

\[2\text{Al} (s) + 3\text{I}_2 (s) \rightarrow 2\text{Al}^{3+} (aq) + 6\text{I}^- (aq)\]

(A) Calculate the cell potential \((E^\circ_{\text{cell}})\) under standard conditions.

(B) Calculate the cell potential \((E)\) when \([\text{Al}^{3+}] = 4.5 \times 10^{-3} \text{ M}\) and \([\text{I}^-] = 0.15 \text{ M}\).

Q8. How many grams of Copper are deposited if an electric current of 2.00 A is run through a solution of CuSO\(_4\) for 20.0 minutes?
Q9. How many seconds are required to produce 4.00 g of aluminum metal from the electrolysis of molten AlCl$_3$ with an electrical current of 12.0 A?

Q10. How many moles of hydroxide ions will be produced during the electrolysis of water with a current of 4.00 A for a period of 3.00 min? The reaction taking place is

$$2e^- + 2H_2O \rightarrow H_2 + 2OH^-$$

Q11. A cell was set up having the following reaction

$$Mg(s) + Cd^{2+} (aq) \rightarrow Mg^{2+} (aq) + Cd (s) \quad E^\circ_{cell} = 1.97 \text{ V}$$

The Magnesium electrode was dipped in a 1.00 M solution of MgSO$_4$ and the Cadmium electrode was dipped in a solution of unknown Cd$^{2+}$ concentration. The cell potential was measured to be 1.54 V. What is the unknown Cd$^{2+}$ concentration?