1. Consider the two reduction processes and their standard reduction potentials ($E°$).

$$Cu^{+}\,(aq) + 1\,e^{-} \rightarrow Cu\,(s) \qquad E° = +0.521\ V$$

$$Ag^{+}\,(aq) + 1\,e^{-} \rightarrow Ag\,(s) \qquad E° = +0.800\ V$$

A) Circle (○) the oxidizing agent and box (□) the reducing agent.

B) Write the net ionic equation for a Galvanic/voltaic cell based on these reactions.

C) Determine the value of the E^{o}_{cell}.

D) Determine the value of the standard free energy change of the cell (ΔG^{o}_{cell}).

$\Delta G^{o}_{cell} = -nFE^{o}_{cell}$

$F = 96500 \dfrac{C}{mol\ e^{-}}$

E) Determine the equilibrium constant (K) for the reaction. Note: 1 J = 1 C·V

$\Delta G^{o} = -RT \ln(K)$

$R = 8.314 \dfrac{J}{mol \cdot K}$

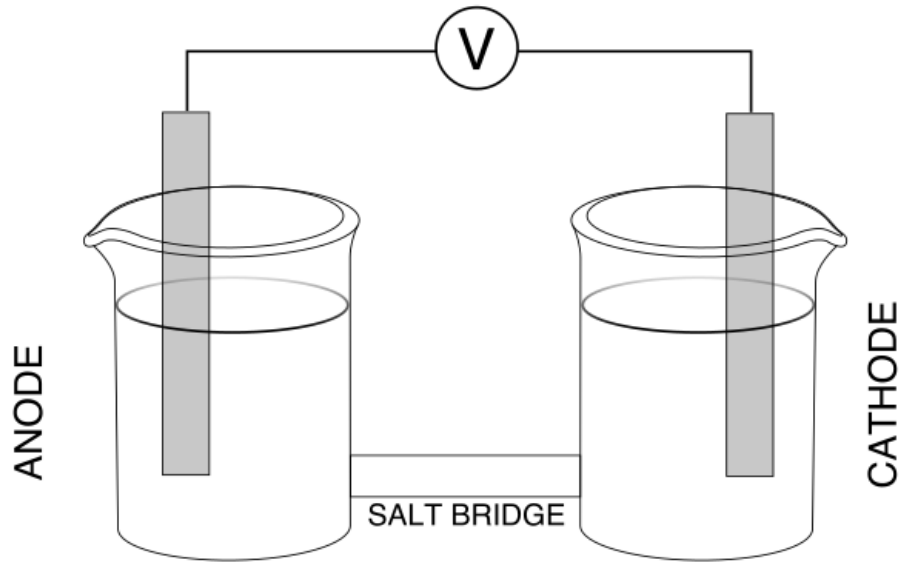
F) Given below is an unlabeled diagram. Label the following components in the diagram:

i. The solid electrodes on the anode and cathode sides.

ii. The ions in solutions on the anode and cathode sides.

iii. The direction of the flow of electrons through the voltmeter and wire.

iv. The direction of the flow of cations and anions in a salt bridge made of KNO_3 (aq).



G) Write the cell diagram for this electrochemical cell.

2. You have constructed a Galvanic cell with the following reaction under standard conditions.

$$Zn\ (s) + Cu^{2+}\ (aq) \rightarrow Zn^{2+}\ (aq) + Cu\ (s) \qquad E^{o}_{cell} = +1.104\ V$$

What will the potential of the cell be when 0.50 M of Cu^{2+} (aq) has reacted?

Assume that volume and temperature do not change.

$$E_{cell} = E^{o}_{cell} - \frac{RT}{nF} \ln Q$$

3. Consider an electrochemical cell with the following cell diagram at 298.15 K.

$$Ni\ (s)\ |\ Ni^{2+}\ (1.25\ M)\ ||\ Cu^{2+}\ (0.225\ M)\ |\ Cu\ (s)$$

Given the following $E°$ values, determine whether each statement is true or false.

$$Cu^{2+}\ (aq) + 2\ e^{-} \rightarrow Cu\ (s) \qquad E° = +0.342\ V$$

$$Ni^{2+}\ (aq) + 2\ e^{-} \rightarrow Ni\ (s) \qquad E° = -0.257\ V$$

A) E_{cell} is a smaller value than E^{o}_{cell}.

B) The oxidation reaction takes place at the anode.

C) Doubling the volume of water in both half-cells will increase the cell potential.

D) Decreasing the concentration of Ni^{2+} will increase the cell potential.

E) Increasing the concentration of Cu^{2+} will increase the cell potential.

F) Using a Pt electrode in place of the Ni electrode will not change the cell potential.

G) The mass of the Cu electrode will decrease over time.