

### Experiment EC319 Electrochemical Cells: Post Lab Questions

You have experimental measurements of the voltage produced by three "known" electrochemical cells created by the combination of your assigned half-cell with three other known half-cells. You will also have a measurement of the voltage of an electrochemical cell produced by the combination of your known assigned half-cell with an unknown half-cell.

In the questions below you will need to use standard reduction potentials. A table of these values for the half-cells you used is shown below. An example of the calculations you need to perform for Q1 and Q2 is shown on the next page.

- For each of the three known electrochemical cells, calculate the theoretical voltage (cell potential) under standard conditions ( $E^\circ_{\text{cell}}$ ) as follows:
  - show each of the balanced half-cell equations and the overall balanced redox reaction. Indicate how many electrons are transferred in the overall reaction.
  - indicate which half-cell is the cathode and which half-cell is the anode
  - calculate the cell potential under standard conditions,  $E^\circ_{\text{cell}} = E^\circ_{\text{cathode}} - E^\circ$
- For each of the three known electrochemical cells, calculate the theoretical voltage (cell potential) under experimental conditions ( $E_{\text{cell}}$ ). For each cell, use the standard cell potential  $E^\circ_{\text{cell}}$  (calculated in Q1), the concentrations of solutions used to create the known half-cells, and a temperature of 25 °C.
- Calculate the % error between your measured voltage and the theoretical voltage (from Q2) for each of the three known electrochemical cell as follows:

$$\% \text{ error} = \frac{\text{measured voltage} - \text{theoretical voltage}}{\text{theoretical voltage}} \times 100$$

Note: If your experimentally measured voltage is in mV (millivolts) convert your answer from Q2 to millivolts before calculating the % difference.

- For the electrochemical cell produced by the combination of your known assigned half-cell with an unknown half-cell:
  - Based on your measured voltage, what is occurring in the unknown half-cell, oxidation or reduction?
  - Calculate the standard reduction potential of the unknown half-cell. Assume standard conditions for the unknown half-cell.

#### Standard Reduction Potentials for selected half-reactions at 25 °C:

| Half-reaction   | $E^\circ$ (V) |
|---|---------------|
| $\text{Cu}^{2+} (\text{aq}) + 2 e^- \rightarrow \text{Cu} (\text{s})$ | 0.337         |
| $\text{Fe}^{3+} (\text{aq}) + 3 e^- \rightarrow \text{Fe} (\text{s})$ | -0.036        |
| $\text{Ag}^+ (\text{aq}) + e^- \rightarrow \text{Ag} (\text{s})$      | 0.799         |
| $\text{Sn}^{2+} (\text{aq}) + 2 e^- \rightarrow \text{Sn} (\text{s})$ | -0.140        |

# Experiment 22 Electrochemical Cells Post Lab Answers

**RJ Shavelson**



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