A. A voltaic cell is constructed in the usual manner having Cu metal in contact with a 1.0M Cu(NO3)2 solution and Ni metal in contact with a 1.0M Ni(NO3)2 solution at 25°C.

1. (2.0 pts.) Write the equation for the spontaneous cell reaction and determine the voltage associated with this cell.

2. (1.0 pts.) Write the shorthand notation used to represent this cell.

3. Draw a diagram representing this cell. Be sure to indicate the salt bridge; the anode; the cathode; and the direction of anion, cation, and electron movement.

B. (2.0 pts.) For the following standard cell give the spontaneous cell reaction and the voltage associated with the cell.

\[ \text{Co}/\text{Co}^{2+}//\text{MnO}_2(\text{H}^+)/\text{Mn}^{2+} \quad \text{Co}^{2+} \quad (-0.28V) \quad \text{Co}^{2+} \quad (+1.22V) \quad \text{Mn}^{2+} \]

C. (2.0 pts.) Determine the voltage associated with the following half-reaction at 25°C if \([\text{Co}^{2+}]=1.5\times10^{-2}\text{M}\) and \([\text{Co}^{3+}]=8.9\times10^{-3}\text{M}\).

\[ \text{Co}^{3+} + e^- \leftrightarrow \text{Co}^{2+} \quad E^0=1.81V \]

D. (1.0 pts.) List the following oxidizing agents in order of increasing strength under standard state conditions.

\[ \text{O}_2, \text{Cr}_2\text{O}_7^{2-}, \text{SO}_4^{2-} \]

\[ \text{O}_2 \quad (+1.23V) \quad \text{H}_2\text{O}; \quad \text{Cr}_2\text{O}_7^{2-} \quad (+1.33V) \quad \text{Cr}^{3+}; \quad \text{SO}_4^{2-} \quad (+0.17V) \quad \text{H}_2\text{SO}_3 \]