

Chemistry 1210 Electrochemistry

Names of partners : _____ Date: _____

Part A

OBJECTIVE: To verify the Nernst equation: $\varepsilon = \varepsilon^\circ - 2.303 \frac{RT}{nF} \log Q$

PROCEDURE: As in the Chemistry 1210 lab manual, pages _____

OBSERVATIONS:

DATA:

Stock $[\text{Fe}^{2+}]$: _____

Stock $[\text{Fe}^{3+}]$: _____

	$V_i \text{Fe}^{2+}$	$V_f \text{Fe}^{2+}$	$V_{\text{added}} \text{Fe}^{2+} \text{ (total)}$	$V_i \text{Fe}^{3+}$	$V_f \text{Fe}^{3+}$	$V_{\text{added}} \text{Fe}^{3+} \text{ (total)}$	Cell Voltage	$\log \frac{[\text{Fe}^{2+}]}{[\text{Fe}^{3+}]}$
1	_____	_____						
2	_____	_____						
3	_____	_____						
4	_____	_____						
5	_____	_____		_____	_____			
6				_____	_____			
7				_____	_____			
8				_____	_____			
9				_____	_____			

Attach a graph of Cell Voltage vs. $\log \frac{[Fe^{2+}]}{[Fe^{3+}]}$.

CALCULATIONS:

1. Show a sample calculation for solution # 1 for the determination of $\log \frac{[Fe^{2+}]}{[Fe^{3+}]}$

2. Calculate the slope and the y-intercept predicted according to the Nernst equation.

RESULTS:

	Slope	Y-intercept
Predicted from Nernst Equation		
Observed		

DISCUSSION:

Part A: *Was the Nernst Equation verified by the experiment? Explain. Compare the values of the slope and intercept to the expected values. If one (or both) of the experimental values are not close to the expected values (i.e. differ by more than 5%), list source(s) of error and explain how they would lead to such differences.*

CONCLUSION:

Part B:

OBJECTIVE: To verify the stoichiometry of a reaction and to determine the Faraday Constant by electrolysis. $\text{Cu}(s) + 2\text{H}^+(aq) \rightarrow \text{Cu}^{2+}(aq) + \text{H}_2(g)$

PROCEDURE: As in the Chemistry 1210 lab manual, pages _____

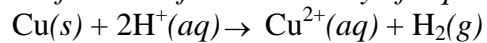
OBSERVATIONS:

DATA:

Mass Cu anode (g)	
Mass Cu anode after electrolysis (g)	
Mass Cu consumed (g)	
Barometric Pressure (show correction) (mm)	
Room temperature (°C)	
Volume of unmarked part of buret between the 50 mL mark & the stopcock (mL)	
Volume reading at top of inverted buret	50.00 mL
Volume reading of solution in buret at end of reaction (mL)	
Total volume of gas in buret (mL)	
Time for reaction (sec)	
Average current passed through solution (amp)	

CALCULATIONS:

Verification of Stoichiometry of Equation



1. Moles Cu consumed
2. Vapour pressure of H₂O at room temperature _____
3. Pressure of H₂ gas
4. Moles H₂ gas produced
5. Mole Ratio $\frac{\text{Cu (consumed)}}{\text{H}_2 \text{ (produced)}}$

CALCULATIONS:

Determination of the Faraday Constant

1. Charge transferred

2. Moles of charge transferred (based on moles Cu consumed)
 a) based on moles of Cu consumed produced
 b) based on moles of H₂ produced

3. Experimental Value for the Faraday Constant
 a) based on moles of Cu consumed produced
 b) based on moles of H₂ produced

4. Experimental Value for Avogadro's Number
 a) based on moles of Cu consumed produced
 b) based on moles of H₂ produced

RESULTS:

Mole Ratio of Cu/H ₂		Faraday Constant (accepted value)
\mathcal{F} (based on moles of Cu)		
\mathcal{F} (based on moles of H ₂)		
		Avogadro's Number (accepted value)
N _A (based on moles of Cu)		
N _A (based on moles of H ₂)		

DISCUSSION:

Part B: *Compare the values of the Faraday determined using (a) moles of copper consumed and (b) moles of hydrogen produced. Which of these is closer to the expected value? Suggest a source of error that would affect the value with the greater deviation from the accepted value. Remember that both values of the Faraday are based on the same amount of charge transferred. Was the stoichiometry of the reaction verified?*

CONCLUSION:

QUESTION:

Explain, if the copper electrode was not completely dry when it was weighed after the electrolysis, how the value for the Faraday be affected?