

TECHNICAL REPORT GRADE SHEET

1/3

Experiment: <u>Voltammetry</u>	Project # _____
Date: _____	Section # _____
Report Grade: _____	Group # _____
E1: _____	E2: _____
E3: _____	

Criteria	Description	Points Possible	Points Received
Cover Memo or Abstract	Complete. State objectives. Gives precise “big picture” statement of most important results and conclusions. State methods as needed.	10	
Intro. & Objectives	Interesting, relevant. Objectives clear, concise, quantitative, specific to project.	10	
Literature Review	Three research articles. Relevant. Concise but informative summary.	10	
Apparatus and Procedure	Good schematic and discussion thereof. Relates measurements to data needed to meet objectives. No 2 nd person. Not written to operator or technician. Does not assume Instructor has prior knowledge.	10	
Principles/ Equations	Complete and correct. Relates to objectives. Shows physical meaning. Relates to experiments. Equations numbered. Standard symbols used. Sufficient references. Does not assume instructor’s prior knowledge.	10	
Experimental Plan	Concise but clear description of the conditions, levels, exact runs performed. Total number of runs.	5	
Results and Discussion	Logical and orderly. Relates to project objectives. Each figure and table called out & discussed thoroughly. Good topic sentences followed by strong paragraphs. Each observation and conclusion supported. Thorough. Does not assume Instructor has prior knowledge. Critical	20	
Conclusions	Supported by Results and Discussion. Consistent w/ Objectives. Repeat quantitative, specific findings. Relevant and useful. Critical Thinking	5	
Literature Cited	Cite all relevant journal articles, books, handbooks, etc. wherever needed in the main body. Use standard (ACS Guide) methods to call out citations. Provide complete bibliographic info. In the Lit. Cited section. No footnotes. Minimize direct quotes. No titles cited in the text.	5	
Appendix I	Copies of Laboratory Notebook pages.	5	
Appendix II	Copy of Sample Calculations.	5	
Appendix III	Copy of three articles cited in Lit Review.	5	
Lab Notebook Appendix	Submit raw data; copy pages from notebook	5	
Documentation Appendix	Document sample calculations; provide sufficient narrative, working equations, units, etc. so that TA can follow the calculations.	5	
Appearance	All required sections. Margins observed. Neat handwriting if necessary. Stapled or clipped. Neat. Conform to Lab Manual instructions	5	

Figures	Informative titles and legends. Only 1 title per fig. Clear symbols and lines. Corrected Excel or PowerPoint defaults. Margins. Large enough to read. No excessive frames or borders. Discuss every figure. Capitalize "Figure x"	5	
Tables	Informative titles and headings. Describe content of tables (columns & rows). Only 3-4 significant digits. Show units. Useful information. Corrected Excel or PowerPoint defaults. Margins. Large enough to read. No excessive frames or borders. Discuss every table. Capitalize "Table y"	5	
Grammar and Spelling	Check verb use with "data." Complete sentences. Homonyms. Apostrophes. Minimal use of possessives. No 2 nd person. Noun / verb agreement.	5	
Digital Report	CD Included with the final report (in a single word document) and all files used to calculate the results recorded.	10	
Required Content			
	<u>Cyclic Voltammetry</u>		
1	Using the cathodic peak currents measured from the series of voltammograms acquired at different sweep rates, prepare a plot of peak current versus the square root of the sweep rate. (Make sure that each of the voltammograms was acquired using the same standard solution.)	8.24	
2	Perform a linear least squares analysis on the data to find the equation of the best straight line that fits the data.	8.24	
3	Use the slope of the line to calculate the diffusion coefficient for the ferricyanate cation in 1.0M potassium chloride.	8.24	
4	Using the voltammogram obtained with the slowest sweep rate, determine the formal potential, E_o , for the ferricyanate/ferrocyanide redox couple. Express the result in volts versus the standard hydrogen electrode (SHE), and compare it to an accepted value from a reference textbook.	8.24	
5	Using the diffusion coefficient obtained from the RDE experiment (if performed), calculate the concentration of the solution you are using and compare with actual solution concentration.	8.24	
6	Explain, in terms of what happens in the diffusion layer immediately adjacent to the electrode surface, why faster sweep rates give higher peak currents.	8.24	
	<u>Rotating Disk Voltammetry</u>		
7	Combine equations 2.1 and 2.2 to obtain an expression for the limiting current as a function of rotation speed. Use this relationship to obtain the diffusion coefficient from the experimental data.	8.24	
8	Plot the dimensional concentration profile for $\text{Fe}(\text{CN})_6^{3-}$ at the limiting current for three different rotation speeds. Indicate on the plot the diffusion-layer region at the different rotation speeds. Explain the	8.24	
9	Plot the diffusion-layer thickness as a function of rotation speed, and explain the observed trends.	8.24	
10	Use the current versus potential data and equation 2.1 to plot the surface concentration as a function of potential for different rotation speeds. Explain the results.	8.24	

11	The diffusion coefficient for dilute species in water is not a strong function of temperature, but there should be some dependency (see reference 4, pp. 513-516). Perform a literature search for theories which predict the diffusion coefficient of a dilute species in water as a function of temperature. Summarize the physical significance of these theories and state whether or not they are consistent with the temperature dependency observed experimentally?	8.24	
12	What terms in the material balance equation were used to obtain equation 2.2? What assumptions went into obtaining these terms? What role does KCl play in this experiment? How would the material equation have to be modified if no KCl was added (see reference 2, pp. 241-244)?	8.24	
	Chronoamperometry		
13	Using ten data points extracted from your chronoamperometry result, prepare a plot of the current versus the reciprocal of the square root of time (<i>current vs. 1/ time</i>). Such a plot is called a Cottrell plot.	8.24	
14	Perform a linear least squares analysis on the data to find the equation of the best straight line which fits the data.	8.24	
15	Use the slope of the line together with the Cottrell equation to estimate the diffusion coefficient for the ferricyanide anion. Pay close attention to proper units and report your answer in cm^2/sec .	8.24	
	Overall Questions		
16	List the three diffusion coefficient results that you obtained. Which of the three techniques do you believe yielded the most reliable result?	8.24	
17	For all three techniques, the method by which the analyte arrives at the electrode surface is diffusion. The distance that a molecule diffuses in a given amount of time is always related to the square root of the time. Show how this dependence on the square root of time manifests itself in each of the three voltammetric techniques studied. (Hint: examine the units on each of the variables appearing in the Randles-Sevcik, Levich, and Cottrell equations.)	8.24	
	Total	280	
	Percentage of Total		