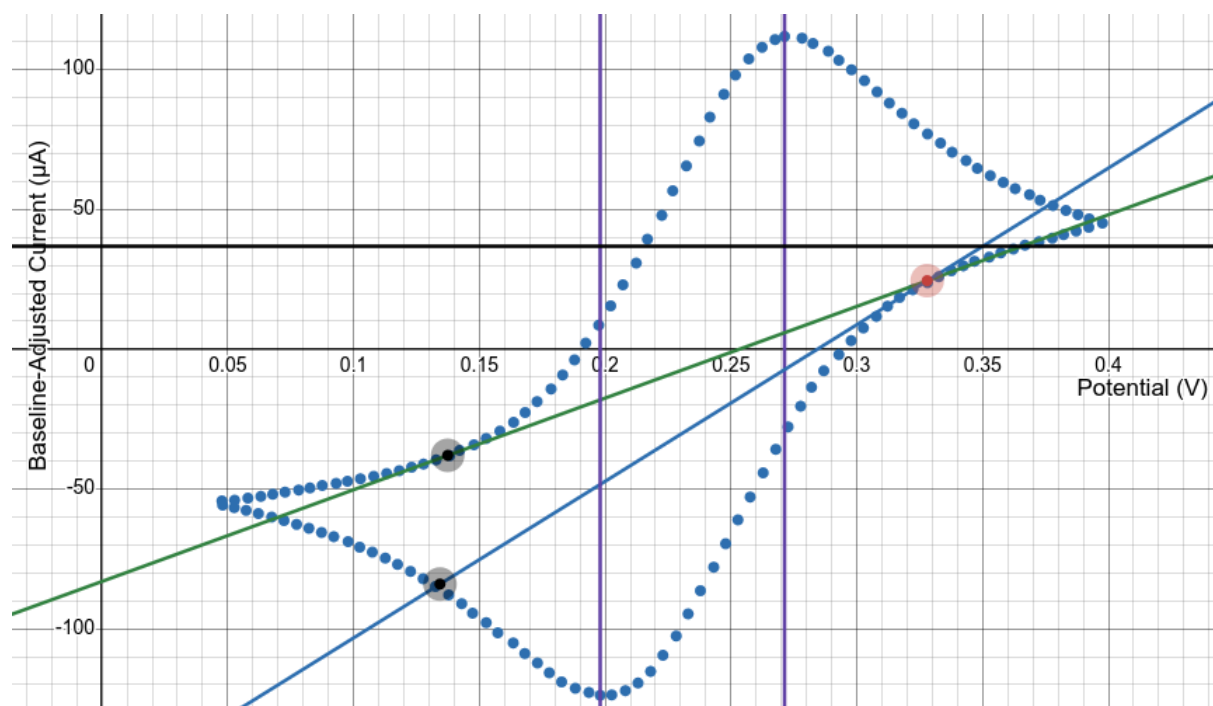


## Lab 8: Chronoamperometry and Cyclic Voltammetry

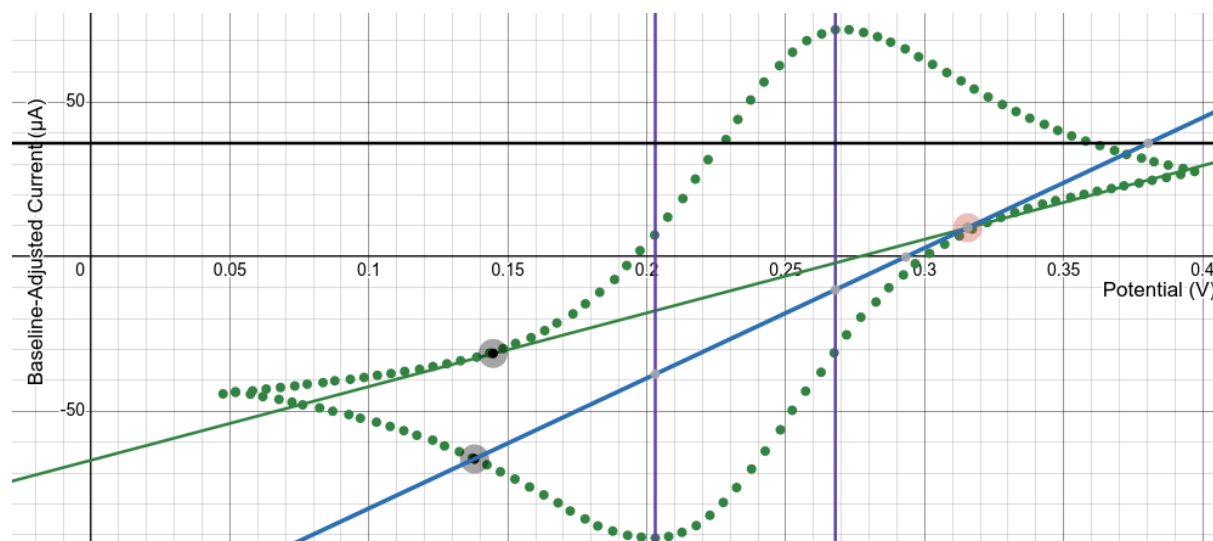
### Questions

#### Part A

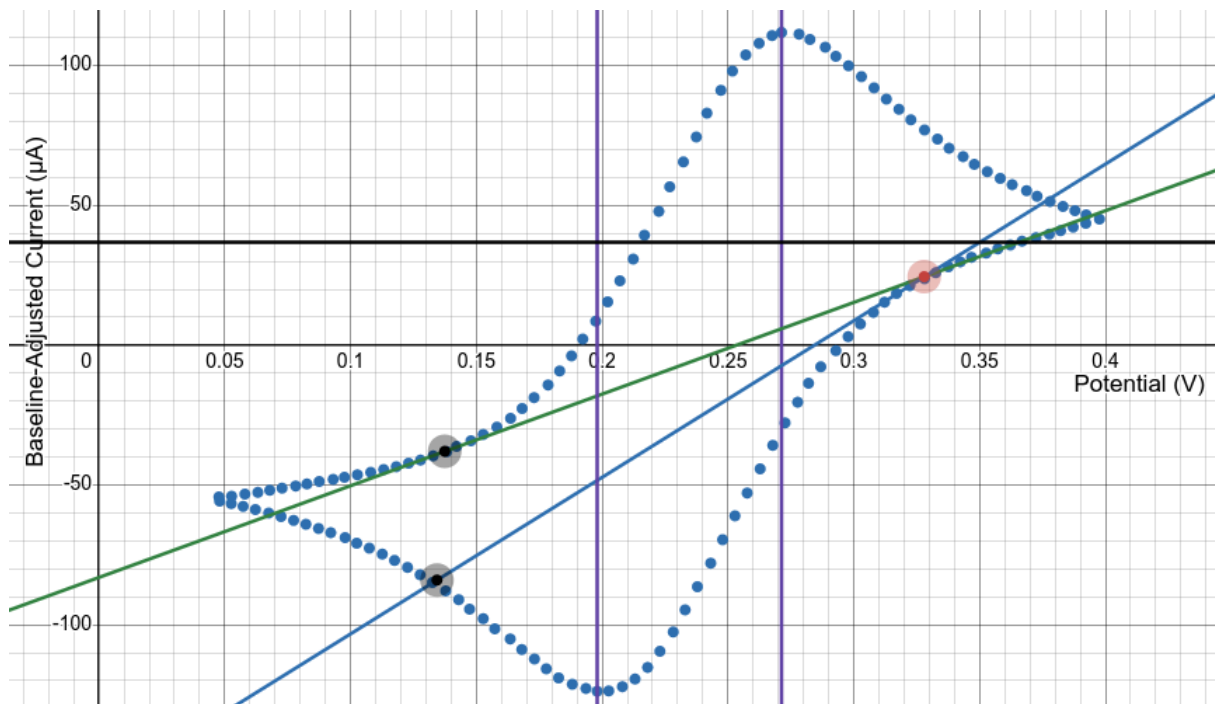
Scan Rate 100 mV/s



Scan Rate 50 mV/s



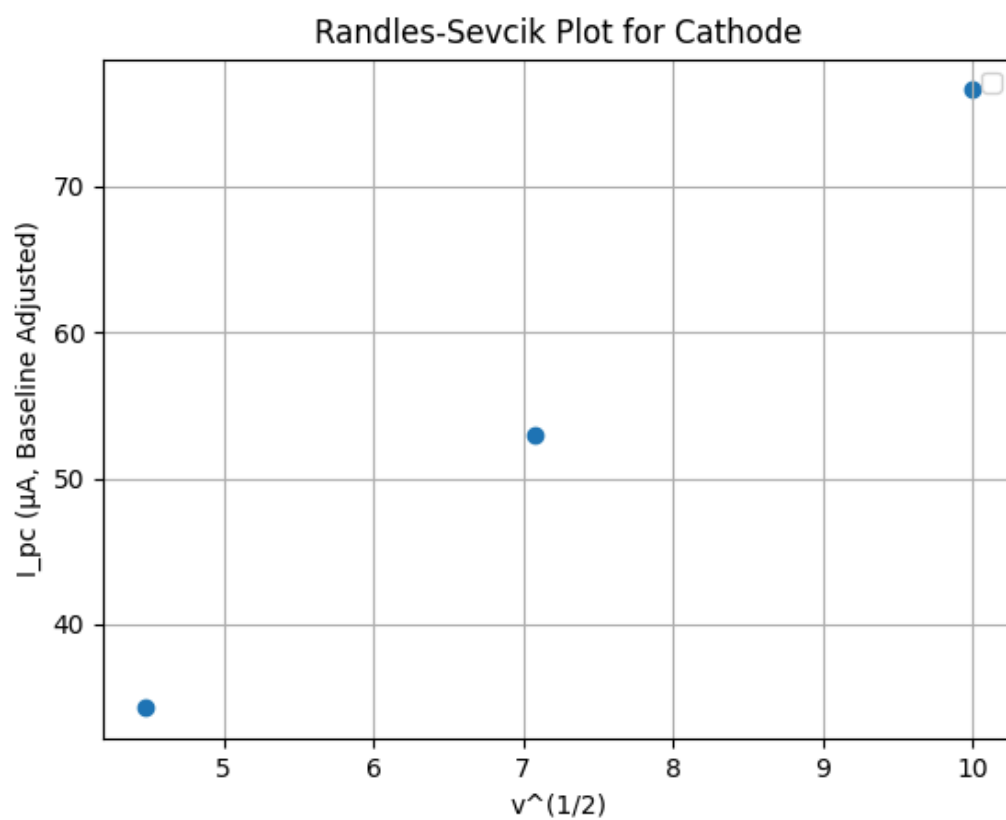
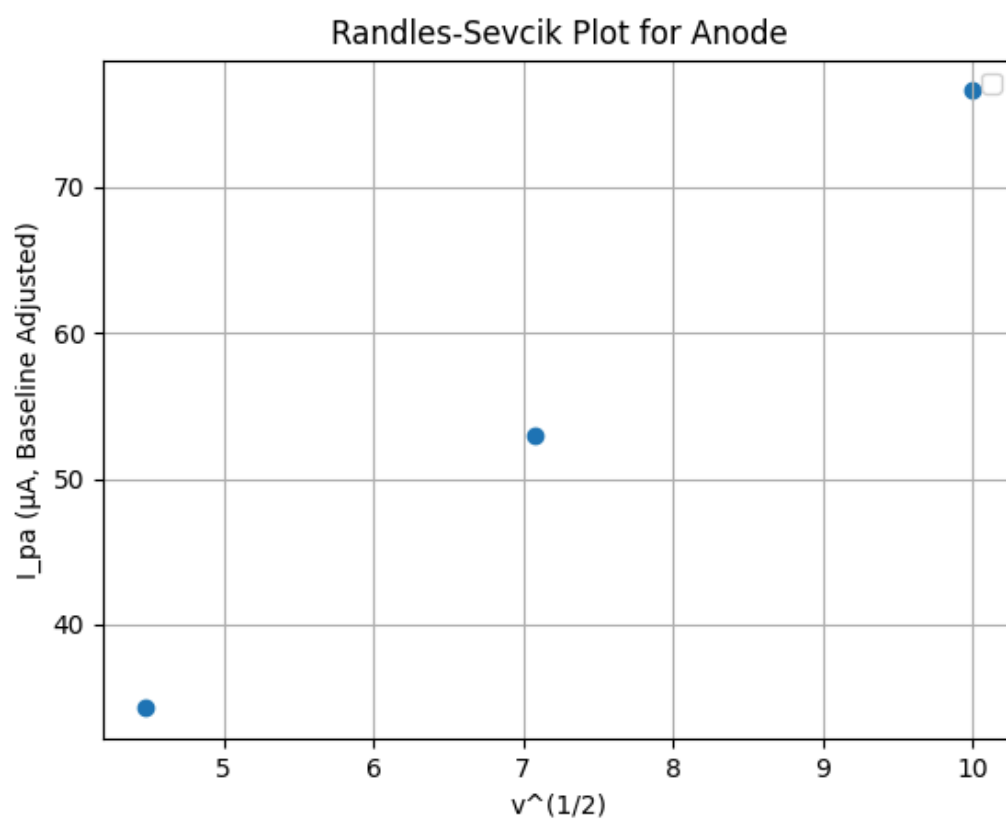
Scan Rate 20 mV/s



Scan rate, mV/s	$E_{pa}$	$E_{pc}$	$E_{p/2}$	$E_{pa} - E_{p/2}$	$I_{pa} (\mu A)$	$I_{pc} (\mu A)$
100	0.271282	0.198041	0.2301	0.041182	118.1728	76.59921
50	0.267902	0.203031	0.2272	0.040702	84.16323	53.01171
20	0.268224	0.20287	0.2270	0.041264	53.21656	34.27879

1. 50 : 0.06487, 20 : 0.06535, 100 : 0.07324
2. 50 : 0.62987, 20 : 0.64414, 100 : 0.6482
3. 50 : 0.0407, 20 : 0.04126, 100 : 0.04118

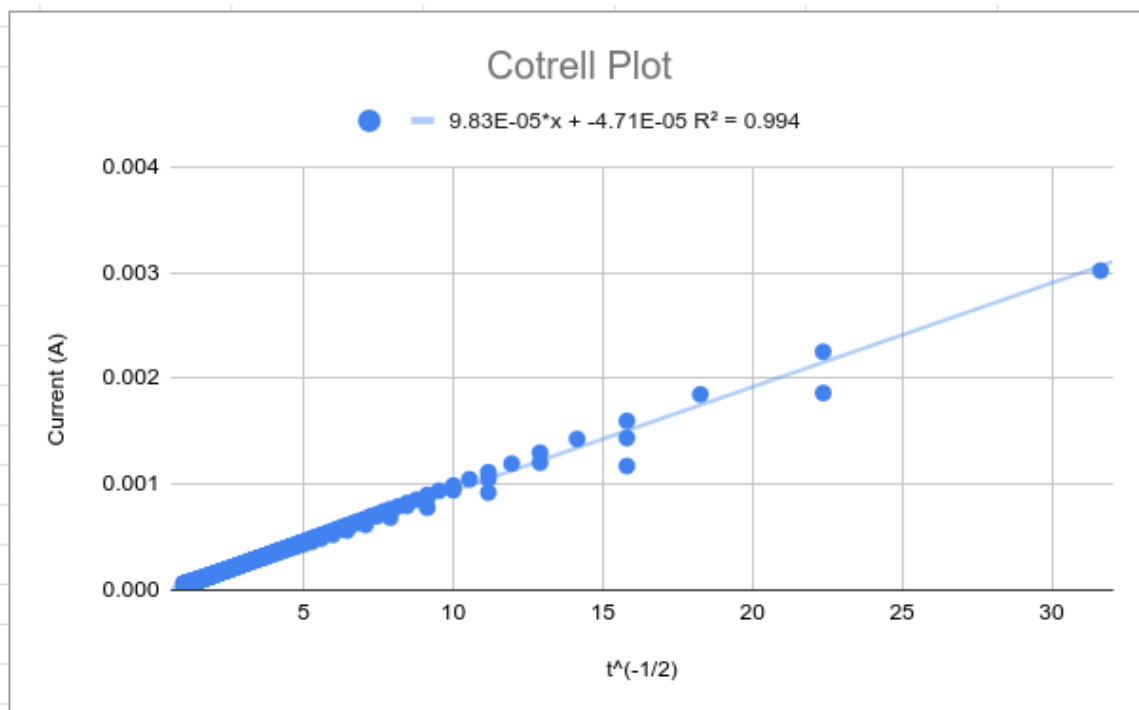
4.



5. The data does not suggest that the reaction is reversible due to the peak cathode voltage being substantially larger than the peak anode voltage. The data does appear to be diffusion controlled as the Randles-Sevcik plot is linear.

## Part B

1.



2.  $9.85 \times 10^{-5} \text{ A/s}^{-1/2}$

3. The y-intercept is  $-4.71 \times 10^{-5} \text{ A}$ , but the graph shows that this is basically 0 relative to the scale of the data and can be used as a measure of uncertainty.

4. The plot is linear with a correlation coefficient of 0.994

5.

$$\text{slope} = nFAc \frac{\sqrt{D}}{\sqrt{\pi}}$$

Our concentration is  $\frac{0.0333 \text{ g}}{10 \text{ mL}} \times \frac{1000 \text{ mL}}{1 \text{ L}} \times \frac{1 \text{ mol}}{329.26 \text{ g}} = 0.0101 \text{ M}$

$$9.85 \times 10^{-5} \text{ A}\sqrt{s} = 1 \times 96485 \text{ C/mol} \times (\pi \times 1 \text{ mm}^2) \times 0.0101 \text{ M} \times \frac{\sqrt{D}}{\sqrt{\pi}}$$

$$\begin{aligned} D &= \left( \frac{9.85 \times 10^{-5} \text{ A}\sqrt{s} \times \sqrt{\pi}}{96485 \text{ C/mol} \times (\pi \times 1 \text{ mm}^2) \times 0.0101 \text{ M}} \right)^2 \\ &= \left( \frac{9.85 \times \sqrt{\pi}}{96485 \times \pi \times 0.0101} \right)^2 \times 10^{-10} \times \left( \frac{\text{A mol L}}{\text{C mm}^2 \text{ mol}} \right)^2 \text{ s} \\ &= 3.25 \times 10^{-5} \times 10^{-10} \times 10^6 \text{ m}^2/\text{s} \\ &= 3.25 \times 10^{-9} \times 10^4 \text{ cm}^2/\text{s} \\ &= 3.25 \times 10^{-5} \text{ cm}^2/\text{s} \end{aligned}$$

Our results do not agree well with the literature value.

# Lab Notebook

Exp. No. 8	Experiment/Subject cyclic voltammetry	Date
Name	Lab Partner	Locker/Desk No.
		Course & Section No.

Objective: A perform cyclic voltammetry for potassium ferricyanide

B Perform chronoamperometry to calculate  $D_0$  for  $K_3Fe(CN)_6$

A' Only polish working electrode

Mass ferricyanide, make 10mL solution with 1.0M  $KNO_3$  create electrochemical cell with this solution.

Recorded approximate peaks for different scan rates

Scan Rate	$E_{anode}$ mV	$I_{pa}$ $\mu A$	$E_{cathode}$ mV	$I_{pc}$ $\mu A$
100	272	117	199	-122
50	268	77	204	-90
20	268	46	203	-60

The cyclic voltammetry was repeated for each scan rate over the same range with only  $KNO_3$  to confirm that there were no peaks from this alone.

B Prepare electrochemical cell like in part A.

Do chronoamperometry with settings in protocol, with these modifications

0.600V vs ref  
duration 1sec  
sampling control 250, 500, 1000 intervals

0.0333g  $K_3Fe(CN)_6$

Signature <i>[Signature]</i>	Date	Witness/TA <i>[Signature]</i>	Date
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THE HAYDEN-McNEIL STUDENT LAB NOTEBOOK

Note: Place fold-over back cover under copy sheet before writing