Cyclic Voltammetry Problems

1] What would the scan rate have to be in a LSV or CV experiment in order to obtain the same peak current with a 0.1 mM cupric solution as was obtained with a 3 mM thallium(I) sample run at 1 V/s given the diffusion constant for thallium is 2e-5 cm2/s and the diffusion constant for cupric is 7.2e-6 cm2/s assuming both cations exhibit reversible behavior when they are reduced to the corresponding metal amalgams.
ANS: 312.5 V/s

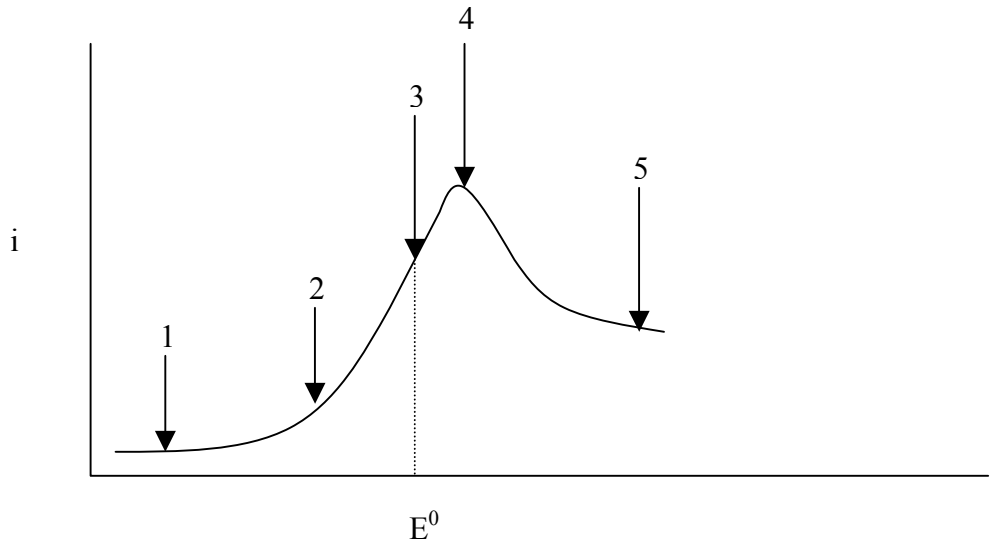
2] The data shown below was obtained for potassium ferrocyanide ($Fe^{II}(CN)_6^{4-}$)scanned anodically. Are the data consistent with a Nernstian response?

$Fe^{II}(CN)_6^{4-} \rightarrow Fe^{III}(CN)_6^{3-} + e$

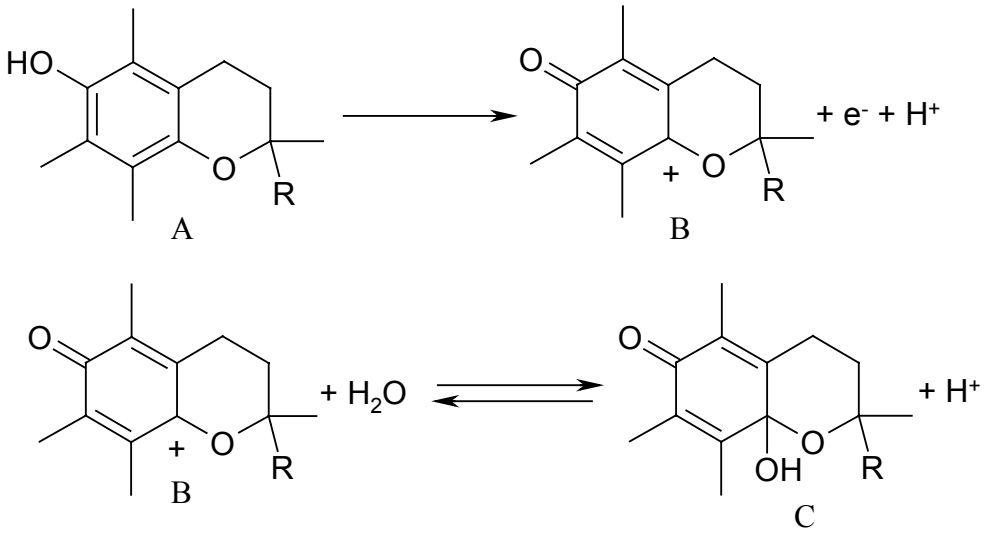
ν, mV/s	E_{pa}, mV	E_{pc}, mV	$E_{p/2a}$, mV	i_{pa}, µA	i_{pc}, µA
16.7	311	254	239	9.8	9.6
33.3	316	257	234	14.0	13.7
50.0	314	256	236	17.1	16.9

ANS: yes

3] For the following electrode reaction: Ox + ne- ➔ Red
Draw the concentration profiles for each of the labeled points along the following LSV



4] Tocopherol (vitamin E) undergoes the following set of reactions:



Sketch two possible limiting cases for CV's at fast, and slow ν for this sequence of reactions. Assume the E^0_{red} for B is 0.8 V.

5] Do Bard Problem 12.1

6] Bard Problem 12.3

7] For the week of March 8, will be required to present one recent publication (past 10 years) that describes the use of cyclic voltammetry for

a] the elucidation of a chemical mechanism
b] the measurement of D, k_0, or E^0.

Your presentation should be about 10-15 minutes in length. You are welcome to use the overhead projector, and bring enough copies of the publication for everybody. Please obtain my approval for the paper by March 5, 12:00 PM.