Assignment (combined between this and the prior week’s activity; due Tuesday, February 7, 2017 at 8am PST) (You must show your work for credit on all problems.)

Because these hands-on discussion sections are inquiry based, sometimes you and your lab partner(s) may deviate from the planned laboratory protocol. However, we expect that you will complete at least the first major activity of each protocol. (For this time only, if you do not have the data required to answer the questions and/or perform the analyses below, please seek out a classmate who is willing to share his/her data.)

1. Watch safety video titled “Lab Techniques & Safety: Crash Course Chemistry #21” located at https://youtu.be/VRWRmIEHr3A, and then answer the following questions.
   a. What is the catch phrase related to dumping solutions in the sink?
   b. Where should you hold a glass reference electrode when jamming it into a hole in a rubber septum?

2. For the data you obtained in the lab last week (Lab #2), do the following. Assume that the concentration of ferrocyanide (Fe\text{II}(CN)_6^{4–}) was 10 mM, ferricyanide (Fe\text{III}(CN)_6^{3–}) was 10 mM, and K\text{2}SO\text{4} was 100 mM, and that you used the button electrode (i.e. epoxied and polished carbon rod) for your measurements, with a well-defined geometric area of 7 mm\textsuperscript{2}.
   a. Submit three plots made of your CV data in the absence of stirring (as I vs E (plot 1), E vs time (plot 2), and I vs time (plot 3)), where each plot includes the data taken for the various scan rates that you measured. If possible, use the EC-Lab software.
   b. Diffusion coefficients can be calculated from the peak currents measured in a cyclic voltammogram. Plot the peak current versus the square root of the scan rate for the anodic and cathodic processes of each cyclic voltammogram and use the Randles–Sevcik equation (Google it) and the slope of the data to calculate the diffusion coefficient for Fe\text{II}(CN)_6^{4–} and Fe\text{III}(CN)_6^{3–}. Submit the plots as part of your answer.
   c. Explain what stirring did to mass transport of the redox-active species and in your answer indicate what terms dominated the flux to the electrode surface and at the electrode surface (i.e. within the boundary layer).

3. For the data supplied to you related to the lab this week (Lab #3), do the following. Silica was deposited from a Si(OR)\textsubscript{4} sol gel via a hydrolysis plus condensation reaction.
   a. Using values you calculate for the capacitance, determine the relative surface area (i.e. roughness factor) of a silica electrode versus the bare FTO electrode. Show work.
   b. Determine the faradaic efficiency for electrodeposition of silica, assuming that for every SiO\textsubscript{2} molecule that was deposited, two molecules of H\textsubscript{2} were evolved at the cathode working electrode. Show work.
   c. Explain the differences between electrodeposition of cuprous oxide and electrodeposition of silica. In your explanation, indicate what pH values you assumed, and include balanced chemical equations and redox potentials for the reactions that likely occurred.