Read Chapter 14 (at least Sections 14.1, 14.2, and 14.3) and Chapter 3, answer the following problems, and indicate with whom you worked: _____________.

(1) Do problems 2.17, 2.18, 2.19, 13.7, 13.14, and 14.2 in Bard and Faulkner (B&F).

(2) In Naegeli, Redepenning, & Anson, *Journal of Physical Chemistry*, 1986, 90, 6227 (see class website), redox-active molecules are embedded in Nafion-coated electrodes and their formal potentials are measured.

a. Based on Figure 2, answer the following:
   i. Why are the potentials called formal potentials and not standard potentials?
   ii. Explain why the formal potential for the reduction of the redox-active molecules in solution at a bare electrode becomes slightly more negative as the concentration of LiCl is increased?
   iii. When a Nafion-coated electrode is used, explain the cause of the LiCl concentration dependence to the formal potentials? (Assume that the Nafion was presoaked in an aqueous electrolyte containing a high concentration of LiCl in a large beaker.)

b. Based on Figure 4, where the ordinate axis should be labeled "fraction of protonated molecules," answer the following:
   i. What is the approximate pK_a of $[Ru^{II}(NH_3)_5(pz\text{-}H^+)]^{3+}$, where pz is pyrazine and pz-H is protonated pz?
   ii. Why does $[Ru^{II}(NH_3)_5(pz\text{-}H^+)]^{3+}$ not deprotonate when it is incorporated into Nafion and the pH is varied? (Assume that the Nafion was presoaked in an aqueous electrolyte containing a high concentration of HCl in a large beaker.)
   iii. If the pH of the solution changed to 11 using NaOH, and the beaker is large, will $[Ru^{II}(NH_3)_5(pz\text{-}H^+)]^{3+}$ in Nafion deprotonate? Explain why or why not?

(3) At steady-state, a human neuron has the following approximate distribution of ions across its cell membrane:

	Inside (mM)	Outside (mM)	Relative permeability
K^+	100	10	100
Na^+	10	100	1
Cl^-	10	100	10

Based on this information, answer the following:

a. What is the resting potential of the membrane at physiological temperature (i.e. 98.6 °F)?

b. When a nerve is stimulated by an action potential, voltage-sensitive sodium channels open up (wide) and the cell depolarizes to roughly +40 mV. However, due to charge neutrality, the concentrations of Na^+ inside and outside of the cell change very little, and the small flux of sodium simply charges the membrane like a capacitor. What is the relative permeability of Na^+ that caused this depolarization?

c. This depolarization causes the Na^+ channels (from part b) to close and another channel to open. If this results in a membrane potential that is slightly more negative than the resting potential (from part a), *could* the chloride *and/or* potassium channel have opened up (wide)? Explain your answer.