Key and guide to exam #2

Chemistry 342, (01:160:342), Spring 2012
Physical Chemistry of Biochemical Systems

Use the hints below to get you started on problems you had trouble with on the second exam. You should arrange to meet with me if you still don't understand how to do the problems.

Problem 2 From the table:

$$\text{glutathione(red)} \rightarrow \text{glutathione(ox)} + 2\text{H}^+ + 2e^- \qquad \text{E(ox)} = +0.23 \text{ V}$$

$$\text{cystine} + 2\text{H}^+ + 2e^- \rightarrow 2 \text{ cysteine} \qquad \text{E(red)} = -0.34 \text{ V}$$

Add the two equations, so that the electrons cancel; add the cell potentials to get -0.11 V. Use the Nernst equation (5.12) to convert to $\Delta_r G^{\oplus}$. Note that the balanced reaction (sum of the above two half-reactions) does not involve H^+ , so that you can conclude that the reaction should be independent of pH.

Problem 3 See the top half of p. 200.

Problem 5 See Eq. 6.20 (p. 237) and the illustration that immediately follows it.

Problem 6 The equilibrium constant $K = k_a/k_{a'} = [A]^2/[A_2]$; solve this for [A] (this is the pre-equilibrium approximation). Next, write the rate of production of product as $d[P]/dt = k_b[A][B]$; substitute in the pre-equilibrium value for [A]. Overall reaction is 3/2 order in $[A_2]$ and $[B]$. (This is problem 7.20 in your text.)

Problem 7 This is just Example 5.1 on p. 187 of your text. Note that we are dealing with pumping of protons here: redox potentials from the Table (which describe the thermodynamics of the transport of *electrons*) are irrelevant here.