Name:_____

Biology 3515/Chemistry 3515
Biological Chemistry Laboratory
Spring Semester 2015
Quiz 1 - 12 February 2015

Please write your name on each page.
Be sure to show your work and include correct units in all of your answers!
25 points total.

1. In your new job after graduating, you have been given a sample and told that it contains 1.3 mg/mL of a newly discovered and purified protein. You are also told that the molecular weight of the protein is 37,000 Daltons (1 Dalton = 1 atomic mass unit). Your job is to determine the extinction coefficient for this protein at 280 nm.

   (a) (5 points) You measure the absorbance of the sample using a 1 cm cuvette and obtain a value of 0.93. Calculate the molar extinction coefficient. Be sure to express your answer with the correct units.

   (b) (3 points) Also calculate the extinction coefficient for concentration units of mg/mL, i.e. with units of $cm^{-1}(mg/mL)^{-1}$.

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(c) (4 points) Later in the day, your boss comes in to apologize. It turns out that the sample you were given is contaminated with 0.01 mg/mL DNA. But, the original estimate of the protein concentration, 1.3 mg/mL is, in fact, correct. Explain how the contaminating DNA will affect your estimate of the extinction coefficient.

(d) (4 points) Suggest a way in which you could salvage this situation without doing any more experiments. That is, explain how you could estimate the extinction coefficient in spite of the DNA contamination. What key information would you need to look up on the internet or in the library? Carefully explain how you would calculate the extinction coefficient.

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2. The next day on the new job, you are planning an experiment for which you will need a buffer containing 0.1 M tris, adjusted to pH 8.2 with HCl. To your surprise, there doesn't seem to be any solid tris to be found in the lab, or elsewhere at the company. However, one of your lab mates happens to have a solution containing 0.5 M tris, adjusted to pH 8.5 with HCl. Being resourceful, you realize that you could take some of this stock solution, adjust the pH to 8.2 by adding additional HCl, and then adjust the final concentration to 0.1 M by adding water.

   Since you need 200 mL of the new buffer solution, you start by measuring out 40 mL of the original buffer. You also look up the pK_a of tris, which is 8.1.

   (a) (4 points) For the original (pH 8.5) solution, calculate the ratio of concentrations of the basic and acidic forms of tris. Be sure to make clear in your answer which species is which in the ratio.

   (b) (5 points) Make a *very approximate* estimate of how many moles of HCl you would need to add to the solution to adjust the pH to 8.2. You should not have to do any extensive calculations, but explain how you arrived at your estimate. You may use the back of this sheet to continue your answer if it does not fit in the space below.