Name: _____

Chem 2113 Test 4 Fall 2002

Questions are worth 25 points each. OMIT ONE QUESTION by clearly writing OMIT in the space provided for your work. If you fail to mark OMIT on a question I will omit the last question of the test. Show your work and circle your answers for full credit.

1. In fluorescence spectroscopy, the observed fluorescence is linearly-related to the concentration of the analyte (within limits). Working within the linear range, the following data were compiled:

   $\sum x = 10$ $\sum y = 231.7$ $\sum xy = 671.7$

   $\sum x^2 = 30$ $\sum y^2 = 15{,}088.07$ $n = 5$

   Calculate the slope, y-intercept and the Pearson's correlation coefficient from this data:

   After three replicates, the average fluorescence for an unknown (3 replicates) was measured to be 37.2. Assuming the concentration (x values) was measured in mg/dL, what is the concentration and the standard deviation for the unknown.

2. Standard potentials for electrodes are theoretical values, as it is not possible to determine when an ionic species is truly at unit activity (due to ion-pair formation). The tabulated values for E^O are typically determined by linear extrapolation of experimental data from dilute solutions (in the region where it is safe to assume concentration is equal to activity). The following data were obtained in an effort to determine the standard cell potential for the ½ reaction:

$$M(OH)_3 + 3e^- \rightleftharpoons M + 3OH^-$$

pH	Cell potential (V)
4.00	0.254
7.00	0.080
10.00	-0.100

The cell potentials were all measured using the above ½ cell as the indicator electrode, and the saturated calomel electrode (E = 0.244 V) as the reference electrode. Calculate the standard ½ cell potential (E^O) for the given ½ reaction.

3. A nitrate specific-ion electrode is used to determine nitrate ion concentration in well water. The following cell was used for the determination:

$$\text{SCE} \parallel NO_3^- \mid \text{membrane electrode for } NO_3^-$$

When a solution of known nitrate ion concentration (2.50×10^{-5} M), the cell potential is measured to be 0.388 V. When the known nitrate ion solution was replaced with an unknown, the potential was measured as 0.265 V. Calculate the concentration of nitrate ion in the solution.

The solution was prepared by dissolving 0.124 g of sample in 500 mL of solution. Calculate the ppm nitrate in the original sample.

4. A sample of copper is to be determined using atomic absorption analysis. A 0.0568 g sample of a copper ore is crushed, and the resultant ore flour is digested in 3M HNO_3. The stock solution is then prepared by dilution of the filtrate to 500.0 mL in a volumetric flask. The analysis then proceeds as follows:

mL Stock	mL 13.4 ppm Cu std.	Final volume	% T
10.0	0.00	100.0	64.1
10.0	5.00	100.0	29.7

Calculate the percent copper in the ore sample.

5. A mixture containing cobalt and nickel was dissolved, complexed with 2,3-quinoxalinedi-thiol, and measured spectrophotometrically. At 510 nm, the reading from the Spectronic 21 was 36.1%T, while at 656 nm the reading was 34.4%T. All measurements were in a 1.00 cm cell. Molar absorptivities for the complexes are as follows:

	ϵ_{Co}	ϵ_{Ni}
510 nm	36,400	5,520
656 nm	1,240	17,500

Calculate the concentration of cobalt and nickel in the solution.