Name: _____

Chem 2113 Test 4 Summer 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. To determine the amount of manganese in a sample, 0.9421 g of that sample was dissolved in nitric acid and diluted to 500.0 mL in a volumetric flask. From this solution, two 50.00 mL aliquots were taken and treated as follows:

Vol. 74.1 ppm Mn	Mass KIO_4	Final Volume	%T for the solution
0.00	0.80 g	100.0	61.3%
5.00	0.80 g	100.0	19.6%

   Calculate the percent manganese in the original sample.

2. Nickel can be determined by complexation with 8-hydroxyquinolinol followed by measurement of the absorption of the solution at 365 nm. Solutions of nickel were treated appropriately, and the following data were obtained:

$[Ni^{2+}]$	% T
0.00	100%
5.0×10^{-5}	69.4%
1.0×10^{-4}	49.2%
2.0×10^{-4}	22.3%

Calculate the following quantities for the **linearly related** data. [HINT: Do you have to manipulate any of the given values?]

Σx _____ Σy _____

Σx^2 _____ Σy^2 _____

Σxy _____ n _____

Determine the values for the following:

S_{xx} _____ S_{yy} _____

S_{xy} _____ m _____

b _____ r _____

An unknown containing nickel was analyzed using the above method. A 0.100 g sample of the unknown was dissolved and diluted to 250.0 mL. A 50.00 mL aliquot of this solution was then treated with the 8-hydroxyquinolinol, and diluted to 100.0 mL. The transmittance for this treated solution was determined to be 12.7%T. Calculate the percent nickel in the original sample.

3. Species M and R are present in a mixture. The following information has been compiled for M and R

	ϵ_M	ϵ_R
425 nm	5700	2940
600 nm	150	3500

At 425 nm, the solution has 32.5 %T, while at 600 nm the solution has 49.4 %T. Calculate the concentration of M and R in the solution. [NOTE: All measurements are in a 1.00 cm cell]

4. A potentiometric determination was used to measure the nitrate ion concentration in well water using a nitrate-specific membrane electrode as the indicator electrode and a SCE as the reference electrode. When pNO_3 (x axis) was plotted vs. cell potential in mV (y axis) for a series of standards in a constant ionic strength buffer the following values were obtained:

$$\Sigma x = 20;\ \Sigma y = -75.6;\ \Sigma x^2 = 82.5;\ \Sigma y^2 = 10{,}002.3;\ \Sigma xy = -451.05;\ n = 5$$

What is the slope, the y-intercept, and the correlation coefficient from this data?

A sample of well water was obtained for determination of nitrate ion concentration. A 25.00 mL aliquot was treated with a constant ionic strength buffer and diluted to 50.00 mL. The potential of this solution was measured 4 times, and the average of these readings was determined to be -4.2 mV. According to EPA regulations, the maximum nitrate ion concentration for potable water is 1.6×10^{-4} M in the nitrate ion. Calculate the concentration and the standard deviation for the nitrate ion in the well water, and determine if the sample can be considered potable.

5. a) Determine the Ksp for lead iodide (PbI_2) from the following electrochemical cell:

SCE || I^- (0.0500 M), PbI_2 (saturated) | Pb

if the measured cell potential is -0.533 V. (Assume $E_j = 0$)

Mercury

$Hg_2Cl_2(s) + 2e^- \rightleftharpoons 2Hg(l) + 2Cl^-$	+0.268	+0.244 in saturated KCl

Lead

$Pb^{2+} + 2e^- \rightleftharpoons Pb(s)$	-0.126	-0.14 in 1M $HClO_4$;

b) The potential of a sulfate specific ion electrode (SCE reference electrode) was measured as -213 mV in a solution that contained 1.00×10^{-5} M sulfate ion, while the potential was -156 mV in a 1.00×10^{-4} M sulfate ion solution. A solution containing an unknown concentration of sulfate ion was measured with a potential of -187 mV. What is the concentration of sulfate ion in the unknown solution?