Name: _____

Chem 2113 Test 1 Spring 2005

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. The molarity of an NaOH solution was determined by titration vs. KHP. Individual titrations gave the following concentrations: 0.1127*M*, 0.1112*M*, 0.1132*M*, 0.1134*M* and 0.1174*M*.

   Can any of the points be rejected at the 95% confidence interval? If so, which one(s)?

   NO REJECTION

   For all remaining points calculate the mean, the standard deviation, the relative standard deviation in ppt, and the confidence interval for μ at the 95% confidence level.

   mean = 0.1136 ***M*** NaOH
   s.d.= 0.0023 ***M*** NaOH
   RSD = 2.0×10^{1} ppt
   c.i. for μ = 0.114(± 0.003) ***M*** NaOH

   This particular analysis has been performed thousands of times - enough such that the population standard deviation (σ) can be determined. Assuming that σ is equal to 0.0003*M* for this determination, calculate the 'new' confidence interval for μ at the 95% confidence interval.

   c.i. for μ = 0.1136(± 0.0003) ***M*** NaOH

2. A trainee in a medical laboratory will be released to work on her own when her results agree with those of an experienced lab technician at the 95% confidence level. Following are the results from a blood urea level:

	Mean	Std. Dev	# Samples
Trainee	14.5_7	0.5_3	6
Technician	13.9_5	0.4_2	5

Should the trainee be released to work on her own?

$t_{crit} = 2.262$; $t_{calc} = 2.1146$

The technician should be released to work on her own!

From the above results, should there be a concern that the trainee's standard deviation for her work is (significantly) different than the technicians (at the 95% level)?

$F_{calc} = 1.5924$; $F_{crit} = 6.26$
NO SIGNIFICANT DIFFERENCE at the 95% level.

3. For the following calculations, determine the a) answer and b) the appropriate uncertainty for each result.

   $15.4(\pm 0.3) - 7.0(\pm 0.4)$

   $8.4(\pm 0.5)$

   $44.4(\pm 0.5) / 3.18(\pm 0.02) \times 10^{4}$

   $1.40(\pm 0.02) \times 10^{-3}$

   antilog 6.44 ± 0.04

   $2.8(\pm 0.3) \times 10^{6}$

   $-\log 4.7(\pm 0.2) \times 10^{-6}$

   $5.33(\pm 0.02)$

   $[15.8(\pm 0.6) + 7.3(\pm 0.3) - 23.1 (\pm 0.4)]$

   $0.0(\pm 0.8)$

4. What is the density of 53.4 wt % aqueous NaOH (MW = 40.00) if 16.7 mL of the solution diluted to 2.00 L gives 0.169 *M* NaOH?

   1.52 g/mL

5. Consider the dissociation of strontium carbonate ($BaSO_4$; $K_{sp} = 1.1 \times 10^{-10}$)

   a) Calculate the molar solubility of $BaSO_4$ in water [HINT - assume $\gamma_i = 1$ for all ions **in this situation**]

      1.0×10^{-5} M

   b) Calculate the concentration equilibrium constant for $BaSO_4$ in 0.0050 M NaCl.

      2.0×10^{-10}

   c) Calculate the molar solubility of $BaSO_4$ in 0.0050 M NaCl.

      1.4×10^{-5}

   d) Calculate the molar solubility of $BaSO_4$ in a solution of 0.0033 M K_2SO_4.

      7.5×10^{-8}

   e) Calculate the percent relative error associated with the facile assumption that the activity would equal the concentration for part (c) of this problem. [HINT: Isn't this the assumption that you used (properly) in part (a) of this problem?]

      -30% relative error