Chem 201 Guidelines for Test #1 (Thursday, July 15, 2010) NO KEY WILL BE SUPPLIED.
Review Session on Tuesday, July 13, 2010 5:30-6 pm
Preparing for the midterm. It is suggested that you review the following in the order listed.

- lecture notes,
- assigned chapters
- the assigned homework
- Be able to do problems similar to those in the homework or those discussed in class.
- Online quiz questions (I will look into them to see if one may be suitable)
- By the midterm we expect to have covered the following topics (i.e. the topics to be tested in the midterm):

Units, concentrations, basic analytical lab instruments, experimental error, statistics, gravimetric analysis, chemical equilibrium (solubility, complexes, acid/base), volumetric analysis.
The exam is expected to be mainly problem-solving involving some of the following:

- ☐ handling uncertainties/ propagation of errors (significant figures rules should be observed!).
- ☐ Statistics: confidence intervals & Q-test, compare replicate measurements, (i.e the 3 cases)
- ☐ Solutions: adjusting and converting concentration units (sometimes given the density). (eg. M to m, M to ppm, etc).
- ☐ Equilibria: K_{sp} , K_f; thermodynamic quantities, ΔG etc, relate them to K.
- ☐ gravimetry: eg common precipitating reagents, combustion analysis, factors for maximizing precipitation, solving for two unknowns,
- ☐ The nickel experiment should be well understood by all even if you have not done it yet.
- ☐ volumetric analysis: Be able to calculate unknown molarities by titration; Know: Kjeldahl, Volhard, Mohr, Fajans Titrations (some of these are not in the textbook);
- ☐ Calculate $[M^+]$, pM^+ for any point in a precipitation titration.

To provide a concrete example of a midterm exam, sample questions from a previous midterm is given below. This is just a sample to give all students an idea of the level of difficulty to be expected and will not have the same problems as the actual midterm. Don't expect a key to this guideline.

1) In the determination of barium (Ba) in an ore, a 1.701 g sample was dried to a constant weight of 1.677 g and yielded 0.0850 g of the dry precipitate.
a) Report the Ba in the sample as both %Ba and %$Ba(OH)_2$ in the <u>dried</u> sample.
b) What is the %water content of the original sample?
c) What is the reagent needed to precipitate the barium? What is the precipitate form? Is it the same as the weighing form? (a periodic table will be supplied).

2) a) The density of a solution of sulfuric acid is determined from the following measurements: m_1= mass of empty graduated cylinder = 29.5 ± .5 g, m_2= mass of empty graduated cylinder + solution = 41.5 ± .5 g, V =volume of the solution = 10.0 ± 0.5 mL
What is the uncertainty in the density of the sulfuric acid solution?

If it has a molarity of 5.50 M, what is its molality?

3) Experimental rabbits are fed controlled diets to study the effect of diet on cholesterol blood levels*. Suppose that the cholesterol levels in a group of 12 rabbits fed high cholesterol diets is found to be 104±21 mg/dL while those of a group of 15 control rabbits fed a regular diet is found to be 85±17 mg/dL.

Can we be 95% confident that the high cholesterol diet results in significantly different cholesterol blood levels in experimental rabbits? (* blood levels are reported here as mean ± standard deviation)

4) A 0.5235 g dry powder sample containing only $NiCl_2$ and NiO is dissolved and the nickel content is selectively precipitated with dimethylglyoxime. If the dried precipitate has a mass of 1.325g, ...
a) what is the %Ni content of the dry powder sample?

b) What is the % NiO content of the dry powder sample?

Shorter problems. You should be able to do all of them in 75 minutes:

(5) A 0.0150 g of magnesium ore is analyzed using the appropriate precipitating reagent. If 20.0 mg of $Mg_2P_2O_7$ is finally obtained from this ore, what is the % Mg in the original sample?

(6) Titration of 20.0 mL phosphoric acid (H_3PO_4) requires 22.5 mL of 0.250M KOH to reach complete neutralization by the base. What is the concentration of the analyte?

(7) A gravimetric determination of nickel yields the following values (in % Ni). 1.24, 1.27, 1.19, 1.25, and 1.26. Therefore, we should eliminate _____ , (at 90% confidence) and the average should be _____ %Ni.

(8) In the nickel experiment, name 2 factors which may result in an erroneously low % Ni result?

Longer problems: (these should also be solved within the same 75 minutes as the above….)
9) A Standard Reference gold ore sample is certified to contain 3.19 wt % gold. A new spectrophotometric method has been developed to determine gold. By this method, the following values are obtained: 3.22, 3.30, 3.23 & 3.29. Does the spectrophotometric method give a significantly different (ie. At 95% confidence) values than the certified value?

10) A solid mixture weighing 0.550 g contained only ferrous ammonium sulfate hexahydrate ($Fe(NH_4)_2SO_4 \cdot 6H_2O$, 392g/mol) and ferrous chloride hexahydrate ($FeCl_2 \cdot 6H_2O$, 235 g/mol). It is dissolved and precipitated and ignited to produce 0.170g of ferric oxide (Fe_2O_3, 160. g/mol). Calculate the % Fe and % Cl in the original sample.

11) 20.0 mLs of 0.100M $Ag(NO_3)$ is titrated with 0.0800M potassium iodide, KI. (note K_{sp} of AgI = 8.3×10^{-17}). a) What is the equivalence point? b) What are the values of $[Ag^+]$ and pAg^+ at:
(i) V_I = 10.0 mLs (i.e. $V_I < V_{ep}$)
(ii) At exactly $V_I = V_{ep}$,
(iii) At $V_I > V_{ep}$, say, V_I=35.0 mLs,