Chem 101- Midterm Exam #2 is on Wednesday, Feb. 24, 2010. Test #2 will focus on Chapters 4, 5(but not including reduction and oxidation).

Part of the experiment will be multiple choice but expect more of it to be problem solving. Expect it to be more challenging than the first test.

Use this test to practice "time management" during the actual examination.

It is important to review earlier chapters like nomenclature, density, empirical formula determination. It is particularly useful to be very good at writing ionic compound formulas. Know the polyatomic ions and their charges to avoid predictable mistakes.

Remember that you are expected to still know chapters 1-3 very well. No table of solubilities will be supplied. (It is assumed that you know the table of solubilities!). Bring your own scantron. Know your assigned seating.

It is suggested you consult with a study group outside of class time to go over this test guide AFTER you have tried it alone by yourself. That way, you can explore different approaches to problem-solving. It is important to learn how to approach questions like the ones below rather than memorizing solutions to specific problems. Remember that the actual test will probably differ significantly from the questions given below.

It should be clear to all students that it is not enough to be able to do the homework problems. Try the exercises within the chapter . The midterm will check if you know a lot more BEYOND the basic concepts.

Some comments on the chapters:

Chapter 4 - 5: Stoichiometry

1) Be able to recognize and name the various types of reactions. Balance equations. (we'll not have difficult redox balancing)

2) Be prepared for stoichiometric calculations involving conversions from grams of reactants to grams of product. Know how to determine % yield and how to determine limiting reactants. Know when to use Avogadro's number.

3) Know the solubility rules in your textbook. Be able to predict if a precipitation reaction will occur. Be able to write both the full and the net ionic equations.
Know: concentrations and solutions.
Know molarity. Know other forms of expressing concentration: g/mL, g/L and ppm.
Dilution calculations.

4) Acid-Base: Be able to do calculations involving acid-base titrations. What is an "equivalent"? How many equivalents of H_2SO_4 are in 2.5 moles of H_2SO_4? Practice with monoprotic, diprotic and triprotic acids. Determine [analyte] given the

equivalence point, [titrant] and the volume of the analyte. Be able to determine [analyte] when specific volumes of titrant are added to the analyte. (before and after the equivalence point). Be sure you can do all this.

5) We'll skip oxidation-reduction equations.

Sample problems:

1) How many grams of sodium carbonate are needed to make a 250. mL solution which contains .14 M of sodium ions. (Use atomic wts: Na = 23.0; C= 12.0, O = 16.0; Note that atomic wt of Na^+ = same as that of Na)

2) Which aqueous solutions are expected to react? Write down chemical equations. Show if there is a gas forming. Show chemical formula of expected products:
a) sodium sulfate & barium chloride. React? ____(yes/no) If so, product(s): _ , .
b) silver chloride & potassium nitrate. React? ___ (yes/no) If so, product(s): ____ .
c) Lead acetate & ammonium iodide. React? ____ (yes/no) If so, product(s): _ , .
d) sulfuric acid and sodium hydrogen carbonate? _____ (yes/no) If so, product(s).

3) Write balanced equations for the following reactions:
a) phosphoric acid with sodium bicarbonate: (exchange reacion)
b) ammonium sulfate with barium nitrate: (exchange reacion)
c) SKIP.

4) Titration of a 25.0 mL NaOH solution requires 15.0 mLs of 0.25 M sulfuric acid to reach equivalence.
a) What is the concentration of the original NaOH solution?
b) What would be the concentration of NaOH be after the first 10.0 mLs of the sulfuric acid were added?

5) 18 M sulfuric acid solution has a solution density of 1.48 g/mL. Suppose that a diluted acid solution was prepared by adding 25.0 grams of the above concentrated acid to enough water to make a total of 500.0mLs of diluted acid.

a) What is the molarity of the diluted H_2SO_4 solution?

(b) How many mLs of a 5% (mass%) NaOH is required to titrate 50.0 mLs of this diluted acid to the equivalence point? (Note that the density of the NaOH solution is 1.10 g/mL) Use atomic wts (in g/mol): Na=23.0, O=16.0, H=1.0.

6) 6.0 moles of N_2 are mixed with 12.0 moles of H_2 according to the following equation: N_2 (g) + 3 H_2 (g) --> 2 NH_3 (g)

a) Which chemical is in excess and by how many grams?
b)What is the theoretical yield of NH_3 is produced?
c) If the percent yield of NH_3 is 80%, how many moles of NH_3 are actually produced?
d) How many grams of ammonia (NH_3) will be produced at 80% yield?
e) How many molecules of ammonia (NH_3) will be produced at 80% yield?
f) What volume of ammonia will be produced at 80% yield if its gas density is 0.76 g/L?

7) Copper metal can react completely with nitric acid to form a blue solution containing the products: copper(II) nitrate, a brown gas known to be nitrogen dioxide and liquid water. If 0.15 cm^3 of copper metal are reacted with excess nitric acid, how many liters of the brown gas do you expect to produce if the actual yield is 70%? (Note density, ρ:Cu = 8.95 g/cm^3; NO_2 gas = 2.05 g/L)
The balanced equation is: $Cu + 4\ HNO_3 \rightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$

8) If the titration of 16.0 mLs of $H_2C_2O_4$ requires 20.0 mLs of 0.400M KOH to reach the endpoint, what is $[H_2C_2O_4]$ initially?
What is $[H_2C_2O_4]$ in the resulting solution after only 10.0 mLs of KOH have been added?
What is [KOH] after a total of 25.0 mL of KOH has been added to the acid?