Chem 116 - Section 1
Spring, 2007
Study Guide for Test III

The test will be given during regular class time on Friday, May 11. When you come to class, please take alternate seating (i.e., every other seat and every other row) to the extent possible. Bring your calculator (with extra batteries, if needed), several sharp pencils (or a mechanical pencil with extra leads), and erasers. Do not use colored pencil or pen. *Nothing else is permitted during the test*. **Do not cheat!**

The test will cover the lecture material corresponding to the assigned sections of chapters 16 and 17. It will consist of questions and problems similar to those assigned for homework and given as examples in class. The test consists of seven pages, including the cover page, the list of conjugate acid-base pairs with K_a's (same as the posted handout), and a copy of the periodic table. Feel free to detach the acid-base table and/or periodic table to use for reference or scratch paper. If you do so, be sure that the staple securely holds the remaining pages. Discard the detached sheets at the end of the test period. The following information will appear on the cover of the test.

$$K_w = 1.00 \times 10^{-14}$$

☞ Be sure to answer all numerical questions with the proper number of significant figures, particularly where logarithms are involved.

The test itself consists of the following three sections.

1. (12 points; 3 points each part) Complete the following table by calculating the missing entries and indicating whether the solution is acidic or basic.

$[H_3O^+]$	$[OH^-]$	pH	pOH	acidic/basic?

One numerical item will be given, from which you will figure out all the others. Be sure your calculator displays antilogs in scientific notation. If not, it may truncate digits that are part of the answer or give a false answer. Here is a test: Antilog $-9.422 = 10^{-9.422} = 3.78 \times 10^{-10}$. If your calculator does not give this answer, get out the manual and figure out how to make it display scientific notation. Be sure you know the rules regarding significant digits for logarithms, and give your answers to the appropriate number of significant digits.

2. (32 points; 4 points each part) Fill in the blanks.

There are between one and four blanks to fill in for each part. Some of these are qualitative and some are straightforward calculations. In some cases, you should be able to do the calculations in your head.

3. (12 points) Calculation of $[H_3O^+]$ or $[OH^-]$ for a solution of a pure acid or base, given K_a or K_b, as needed, and the analytical concentration of the acid or base. You must decide which assumptions are or are not appropriate. *Use the quadratic equation if necessary, but you will be penalized anywhere on this test if you use the quadratic equation unnecessarily.* Be sure you know how to use your calculator to solve a quadratic equation; you do not want to waste time solving it by hand. The second part of this question asks you to calculate the percent hydrolysis of the acid or base in the solution.

4. (44 points) All of the following questions refer to the titration of a certain volume and concentration of either a weak acid or a weak base (the analyte) with a titrant (strong base or strong acid) of given concentration. Be sure that you can do the following: calculate the volume of titrant needed to reach the equivalence point, calculate the total volume at the equivalence point, calculate the millimoles of analyte initially present, calculate the initial pH (solution of pure weak acid or weak base, making appropriate assumptions), calculate the millimoles of analyte and its conjugate at any point throughout the titration, calculate the pH at any point in the buffer region, calculate the concentration of conjugate at the equivalence point from the millimoles and total volume present, calculate the K_b or K_a of the conjugate, calculate the pH at the equivalence point, and calculate the pH at any point beyond the equivalence point.

BONUS (5 points) An additional calculation for the titration in question 4.