

Analytical Chemistry
Problem Set 7—due Monday, April 11, 2005 (at 5 p.m.)

Total Points for this Assignment = 40. However, remember that all problem sets will be equally weighted in determining your overall homework score.

Note: (1) In computing pH values for the problems below, you should always use the methods Harris describes in Chapter 12. However, you are responsible for understanding the approximations underlying Harris's approach. Problem #6 does a nice job of demonstrating when Harris's approach can fail. (2) Unless you have an electronic titrator (like the Mettler instrument we are using for Experiment 4), pH readings will typically be accurate to only two significant figures. Therefore, you should report all the pH calculations below to two decimal places.

1. (5 points) (Based on Harris 12-2) Consider the titration of 100.00 mL of 0.1000 M NaOH with 1.000 M HBr. Find the pH at the following volumes (V_a) of acid added: 0, 5.00, 9.90, 10.00, 10.10 mL.
2. (3 points) Harris 12-5
3. (3 points) Harris 12-8
4. (10 points) Harris 12-17
5. (10 points) (Based on Harris 12-24) A 100.00-mL aliquot of the diprotic acid H_2A ($pK_1 = 4.00$; $pK_2 = 8.00$) was titrated with 1.000 M NaOH. The initial concentration of H_2A is 0.1000 M. Find the pH at the following volumes of base added: 0, 1.00, 10.00, 15.00, 20.00 mL.
6. (9 points) Harris 12-27. Note that the neutral form of the analyte in the problem is called glycine; it is listed in Harris Appendix G. Very briefly state why each of the pH values you compute for part (b) is physically unreasonable.

Note: While I am not assigning problems in which you compute the entire titration curve for a weak acid + strong base (cf. Harris 12-6) or a weak dibasic species + strong acid (cf. Harris 12-23), you are responsible for knowing how to do these kinds of calculations on the next test. (Remember that we did examples of weak acid + strong base and weak dibasic species + strong acid in class.)