Prelab assignment/ Titrations 2—Determining acid concentration

Name _____ Date _____ Lab section _____

1. A 3.05 mL sample of an acetic acid solution (molar mass of acetic acid, 60.05 g/mol) with a mass of 3.010g was titrated to a phenolphthlalein endpoint using 18.05 mL of 0.1207 M NaOH. What is the molarity of the unknown acid?

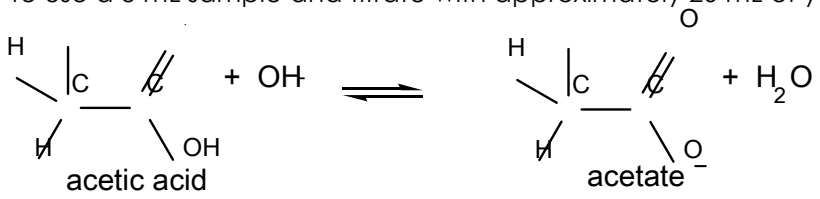
2. What is the mass % acid in the sample (mass acid x 100/mass solution)?

Determining acid concentration

In last week's experiment, we learned that it may be necessary to adjust the amount of sample used in a titration (such as the solid acid) so that the titration can be done on a reasonable scale. What is reasonable for a sample size? We want a sample that is large enough that we can produce results with acceptable precision, but small enough that we don't have to use large volumes of titrant.

In order to get acceptable precision we have seen that we need to use about 20 mL of titrant, and that corresponds to 0.002 mole of base (if [base] is = 0.1M). Therefore, we need to use 0.002 mole acid. How do we figure out how big a sample of an acid contains 0.002 mole of the acid? Sometimes all you know is that the sample solution is an acid (e.g. hydrochloric acid). In that case, you have no choice but to make a judicious guess about the sample size and do the titration with that sample. Once you see what that sample requires for titration you can adjust the sample size appropriately (like you may have done last week).

This week, we have more information about the acid sample, a vinegar solution. The label on the bottle says that vinegar is 4-5% acetic acid. Since the solution is relatively dilute, we can estimate that the density is about the same as water. Therefore, a 1.0 mL sample of vinegar would contain about 0.04-0.05 g of acetic acid. Acetic acid has the formula CH_3COOH and a molar mass of 60.00 g. If we divide 0.04 by 60 we see that we have approximately 0.0007 mole acetic acid in one mL of vinegar. Therefore, you ought to use a 3 mL sample and titrate with approximately 20 mL of your NaOH solution.



Experimental Procedure

1. Weigh an empty vial with a cork stopper.
2. Introduce a suitable amount of sample (assigned by your instructor) into the vial.
3. Stopper and weigh again. Calculate the sample mass.
4. Drop the opened vial and stopper (in case you got some of the liquid on the stopper) gently into a 250 mL Erlenmeyer flask containing about 2 centimeters of water. Add indicator and titrate with the standardized NaOH solution.

In your lab notebook write-up calculate the molarity and mass percent of the acid. What is the solute? What is the solution? Compare the manufacturer's specific analytical data on the label with your results