**Acid-Base Titration: Determination of Potassium Hydrogen Phthalate (KHP)**

We review basic titration techniques via a simple base standardization and titration of an unknown solid containing KHP. The base used in this titration (NaOH) is prepared approximately and then standardized via titration with a primary standard (KHP in this situation). The standardized base is then used to determine the percent composition of an unknown containing KHP. Some equations which will be helpful in the completion of this lab can be found in the Proper Use of Lab Equipment handout.

**Prepare 0.1 M Sodium Hydroxide Solution**

Calculate the correct amount of solid NaOH (NaOH = 40 g/mole) needed to make 2 L of 0.1 M NaOH. Add 500 mL of distilled water to a 1 L volumetric flask and add the NaOH to the water. Completely dissolve the NaOH, and then dilute the solution to the 1 L mark. This solution should be transferred to the storage bottle with the rubber stopper. The NaOH does not need to be weighed precisely. This solution will be used in this lab and two others. Any remaining solution will be saved to complete these later labs.

**Standardize Sodium Hydroxide against Potassium Hydrogen Phthalate (KHP)**

Potassium hydrogen phthalate is a white, crystalline solid, which is suitable for use directly as ***a PRIMARY STANDARD***. It is best to dry KHP for a few hours in an oven at 100oC to remove traces of moisture before using it (your TA will have already placed the unknown samples in the oven for you). It is then best stored in a desiccator.

**KHC8H4O4 + NaOH 🡺 KNaC8H4O4 + H2O**

KHC8H4O4 is KHP or the first potassium salt of phthalic acid (benzene-1,2-dicarboxylic acid).

Obtain a quantity of dried primary KHP in a weighing bottle and keep it stored in your desiccator. If you see the blue drierite has turned pink, it’s time to change the drierite in your desiccator.

Weigh a 0.7-0.8 g sample (to the nearest 0.1mg i.e., 0.0001 g) into a 250 mL Erlenmeyer flask, and dissolve in 50-75 mL distilled water. It is best if the samples of KHP are weighed by difference, but not necessary. If a weight has (0.1 mg) behind it, weigh it on the analytical balance. Otherwise use the regular balance.

Add 2-3 drops of the phenolphthalein indicator to the KHP solution and titrate with base until afaint pink tint remains for at least 30 seconds (the endpoint). A good indication of the endpoint is a pink color that is faint close by the flask, but seems clear on the other side of the room. Record the volume of base used in the titration. Calculate the concentration of the NaOH solution. Repeat the titration at least two more times and calculate the average, standard deviation, and ppt values. **Your results should be within 5 ppt**. The ppt (parts per thousand) equation is found at the end of proper uses of lab equipment and equations.

**Determine Percent KHP in and Impure Sample**

To determine the percent composition of the unknown, calculate the appropriate amount of unknown needed to titrate using about 30 mL of your standardized NaOH solution. Weigh out the sample to the nearest 0.1 mg and place it into a 250 mL Erlenmeyer flask. Dissolve the unknown in 100 – 150 mL of distilled water. To the solution add 2-3 drops of the phenolphthalein indicator and titrate with base to the endpoint. Record the volume of base needed to complete the titration. NOTE: This titration will most likely NOT use 40 mL of base to titrate to the endpoint.

As the previous titration most likely did not require 30 mL, calculate the new mass needed to titrate the unknown with about 30 mL of your standardized NaOH solution. Repeat the titration at least two more times using the new calculated mass of unknown recording all necessary data. Calculate the percent composition, standard deviation, and ppt of the unknown titrations. The unknown percentages are in the range 30-70%.