



Lab 6: Titrations

Standardization of NaOH and Determination of Acetic Acid Concentration

Procedure Overview

- Set up the buret and ringstand then rinse the buret with tap and DI water
- Obtain NaOH in a beaker and rinse the buret twice with small portions of NaOH
- Fill the buret with NaOH, making sure any air bubbles are removed from the tip
- Record the initial level of NaOH in the buret
- Weigh out KHP – record the mass
- Transfer the KHP to an Erlenmeyer flask, add a stir bar and DI water, and stir until dissolved
- Add the phenolphthalein indicator and titrate to the faint-pink endpoint
- Record the final volume of NaOH in the buret
- Calculate the concentration of NaOH
- Refill the buret and repeat for a second titration; if the two calculated values for [NaOH] are more than 5% different, perform a third titration to obtain reproducible agreement

- Refill the buret with NaOH, making and record the initial level in the buret
- Use the automatic dispenser in the hood to deliver an exact volume of acetic acid to a clean Erlenmeyer flask
- Add a stir bar and phenolphthalein indicator
- Titrate to the faint-pink endpoint
- Record the final volume of NaOH in the buret
- Calculate the concentration of the acetic acid
- Refill the buret and repeat for a second titration; if the two calculated values for [acetic acid] are more than 5% different, perform a third titration to obtain reproducible agreement



Materials

To be Checked Out from the Stockroom:

Note: In order to check out these items, it is required to leave your UW Student ID card and also a photo ID (i.e., driver's license) if your UW ID does not have a photo on it.

50 mL buret (Handle with care! Burets are expensive!)
Magnetic stir bar

From your Lab Drawer:

150 mL beaker
250 mL Erlenmeyer flask
100 mL graduated cylinder
Spatula

Provided in the Lab:

~0.10 M sodium hydroxide (NaOH) solution
~0.10 M acetic acid (HOAc) solution
Solid potassium hydrogen phthalate (KHP)
Phenolphthalein indicator solution in dropper bottles
Magnetic stirrer
White cards with black tape for reading burets
Kimwipes
Plastic wash bottle of deionized water
Disposable plastic pipets

Waste Disposal:

The titration products may be flushed down the drain. **DO NOT PUT TITRATION PRODUCTS IN THE WASTE CONTAINERS!**

Excess sodium hydroxide should be placed in the waste containers in the hood.

Rinse disposable plastic pipets with water and put them in the trash.



Procedure

Important: Proceed with speed in order to accomplish all the tasks required.

I. Standardization of NaOH (aq)

1. Use a buret clamp to secure your buret to a ringstand. Make sure the clamp will hold the buret tightly enough so that the buret does not slip out of the clamp and break. Thoroughly rinse the buret with tap water and then deionized water. The final deionized water rinse should drain evenly from the inside surfaces of the buret and leave no droplets behind. If necessary, repeat the deionized water rinsing until the buret drains cleanly.
2. Obtain approximately 100 mL of ~0.1 M NaOH solution in a 150-mL beaker. Rinse the buret twice with 5 mL portions of the NaOH solution, then fill the buret with this solution. Make sure the tip is filled with solution. Air bubbles can be removed by opening the stopcock so that the flowing solution forces out any air bubbles. Adjust the amount of solution in the buret so that the level is between 0 and 2 mL on the scale. It is not necessary that the initial level read exactly 0 mL, but it must be at or below the start of the scale.
3. Record the initial level of the buret, keeping your eye level with the top of the meniscus. Be sure to get an accurate reading to ± 0.05 mL.
4. Weigh out 0.30 ± 0.05 grams of KHP on a sheet of weighing paper; record the exact mass. Transfer this sample to a clean (but not necessarily dry) 250-mL Erlenmeyer flask. Using a wash bottle of deionized water, wash down any crystals of KHP that may be adhering to the walls of the flask.
5. Add a stir bar and ~ 20 mL of deionized water to the flask and stir on the magnetic stirrer until all the KHP has dissolved.
6. Add 2 drops of the phenolphthalein indicator solution to the flask.
7. Titrate the KHP to a pink endpoint. Add the NaOH dropwise near the endpoint. When the solution reaches a permanent faint pink color, record the volume on the buret. Place a sheet of paper under the flask, so the pink will be easier to see.
8. Calculate the concentration of the NaOH solution.
9. Wash the titration products down the drain.



10. Perform a second titration repeating steps 3-9, refilling the buret if necessary. If the two calculated NaOH concentrations differ by more than 5%, perform a third titration in order to obtain reproducible agreement.

II. Acid-Base Titration: CH_3COOH - NaOH

1. Refill the buret with the standardized NaOH solution.
2. Record the initial level of the buret, keeping your eye level with the top of the meniscus. Be sure to get an accurate reading to ± 0.05 mL.
3. Rinse a 250 mL Erlenmeyer flask a few times with deionized water.
4. Using the automatic dispenser in the hood, transfer 20 mL of the acetic acid solution to the Erlenmeyer flask.
5. Add 2 drops of the phenolphthalein indicator solution to the flask. The solution should be colorless.
6. While stirring with the magnetic stirrer, add the NaOH rapidly until you have added ~ 15 mL. Beyond 15 mL, proceed with care watching for the first permanent pink color. Do not over titrate.
7. Calculate the concentration of the acetic acid solution.
8. Wash the titration products down the drain.
9. Perform a second titration by repeating steps 2-8, refilling the buret if necessary. If the two acetic acid concentrations differ by more than 5%, perform a third titration in order to obtain reproducible agreement.
10. Place any excess NaOH in the waste container in the hood.



Before You Leave the Lab

1. Upon completing your work (includes all required calculations), show your notebook to your TA.
2. Clean your lab bench and have your TA check your equipment drawer, lab bench, and lab notebook.
3. Obtain your TA's signature in your lab notebook and turn in the duplicate pages of your lab notebook associated with this experiment.
4. ***The report for this experiment is due by the end of the lab period.*** You need to print out a copy of the template and bring it with you to lab to fill out once you are finished with the experiments.

Information to Enter in your Notebook during the Lab

- Mass of KHP for each KHP-NaOH titration
- Initial and final volume readings from the buret for each titration
- Calculation of NaOH concentration for each KHP titration showing that your data is reproducible (within 5% of each other)
- Calculation of acetic acid concentration for each titration showing that your data is reproducible (within 5% of each other)
- Perform all of your calculations in your notebook and then NEATLY transfer everything to the report sheet
- Any other notes or observations that will help when you work on your post-lab report or need to explain your results