

## AP Chemistry 30 – Lab Activity 10: Titration of a Strong Acid with a Strong Base

### Learning Objective

1. Prepare a solution using appropriate equipment
2. Perform a titration and related calculations using a strong acid and a strong base,

### Pre-Lab Question:

1. For a titration of 50.0 mL of 0.200 M  $\text{HNO}_3$  with 0.100 M NaOH, calculate the pH of the solution at the following points in the titration:
  - a. No NaOH has been added
  - b. 10.0 mL of NaOH has been added
  - c. 20.0 mL total of NaOH has been added
  - d. 50.0 mL total of NaOH has been added
  - e. 100.0 mL total of NaOH has been added
  - f. 200.0 mL total of NaOH has been added
2. Determine the range of mass of sodium hydroxide needed to make a solution with a concentration between 0.080 M and 0.12 M.

### Materials:

- Solid sodium hydroxide
- Distilled water
- Hydrochloric acid (unknown concentration)
- Phenolphthalein
- 50-mL volumetric flask and stopper
- Small funnel
- Weigh dish
- Scoopula
- Electronic balance
- Two small beaker
- Volumetric pipette and bulb
- 50-mL burette
- Ring stand with burette clamp
- 250-mL Erlenmeyer flask

### Procedure

#### Part A – Preparing a Solution from a Solid Reagent

1. Thoroughly clean equipment and rinse with distilled water.
2. Tare the weigh dish on the balance, then add the correct amount (within the calculated range from the pre-lab) of solid sodium hydroxide using the scoopula. Record this mass.
3. Prepare the solution using the procedure outlined in the course notes. Use a 50-mL volumetric flask.
4. Shake the solution well until the solid has all dissolved, then pour it into a clean, dry beaker.

#### Part B - Titration

1. Rinse and fill the burette with your NaOH solution.
2. Record the starting volume in the burette to the nearest 0.01 mL.
3. Pipette 10.0 mL of the hydrochloric acid solution into the Erlenmeyer flask.
4. Add three drops of phenolphthalein indicator to the acid solution. It should remain clear.
5. Titrate the acid sample with the standard solution of NaOH from the burette until a single drop produces a permanent colour change in the solution from colourless to light pink.
6. Record the final volume of the burette to the nearest 0.01 mL.
7. Wash your Erlenmeyer flask and repeat steps 4-7 at least two more times until you get three consistent results. Consistent results should be within 0.20 mL of each other. Record all observations and data.

Name: \_\_\_\_\_ Date: \_\_\_\_\_

**Calculations:**

1. Calculate the molarity and pH of the hydrochloric acid.
2. Assuming your calculated molarity of hydrochloric acid is correct, determine the pH of the acid-base mixture if you accidentally added an extra 1.0 mL of sodium hydroxide past the endpoint of the titration.

**Discussion:**

1. Identify three sources of experimental error in this lab. Explain how each would affect the calculated acid molarity (i.e. too high or too low, and why).
2. Draw a picture of each of the following pieces of glassware. Identify each of the following pieces of lab glassware as very accurate, somewhat accurate or not accurate, then state one specific use for each in the lab:
  - a. Beaker
  - b. Volumetric pipette
  - c. Erlenmeyer flask
  - d. Graduated cylinder
  - e. Burette