

## Honors Chemistry Lab #21-Introductory Titration Lab

**Purpose:** To determine the molarity of a NaOH solution by performing a titration using 0.100 M HCl.

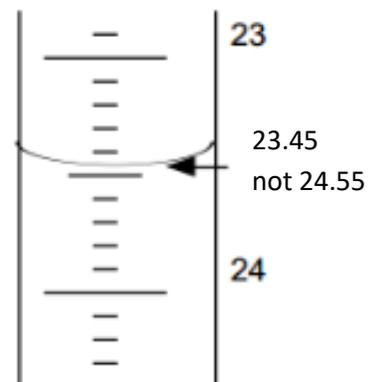
### Procedure:

1. Obtain about 80 mL of 0.150 M HCl solution. You will need to make this from a stock solution of HCl using  $C_1V_1 = C_2V_2$  in the appropriate sized beaker. Use a volumetric wheel pipette for accuracy when measuring.

2. Place 30 mL of the diluted acid into a new clean beaker and add 2 drops of phenolphthalein. The solution should remain clear. Place this beaker under the buret for titration.

3. Make sure the stopcock is closed, which is perpendicular to the buret (horizontal).

4. Pipette 40 mL of the “? NaOH” solution into another clean beaker. Add this to the buret and note the starting volume on the buret. You may want to practice reading the buret using the figure above.



5. Open the stopcock to allow approximately 5-8 mL of the NaOH to flow into the flask while continuously swirling the flask. Observe the color changes occurring. Continue to add the NaOH slowly while swirling the flask. When a faint pink color appears and persists for 10 seconds or more of swirling of the flask, you have reached your endpoint. Note: It is important to realize that if you accidentally pass your endpoint, you can add more HCl to the flask which will cause the solution to become clear again. You can then add the NaOH slowly to the flask again and attempt once more to carefully reach the endpoint. This is known as “back-titrating.”

6. When you have reached the endpoint, record the NaOH final buret readings and the starting HCL amount (50 mL) in an appropriate data table (again to the bottom of the meniscus and again to the hundredth of a mL).

7. Calculate the molarity of the NaOH solution.

8. Pour the solution out of the flask (into the sink) and repeat the titration again. You should estimate how much NaOH you will need for this titration based on the information that you gathered from the first titration. So you might not need all 40 mL.

9. Calculate the molarity of the NaOH solution from the second trial. It should be very close to the molarity you got for the first trial. Then calculate your average. You will be graded on your accuracy, so do a careful job.

### TITRATION RESULTS:

MOLARITY OF NaOH: Trial #1: \_\_\_\_\_ Trial #2: \_\_\_\_\_ Average: \_\_\_\_\_

## POST LAB QUESTIONS:

1. Consider each of the following potential error sources. Answer:

- “H” if it would have caused your calculated value for ?M NaOH to come out too high,
- “L” if it would have caused it to come out too low, or
- “N” if it would have had no effect at all on your value.
  - a. \_\_\_\_\_ There was a little distilled water in the Erlenmeyer flask before you began the titration.
  - b. \_\_\_\_\_ There was a little HCl in the Erlenmeyer flask before you began the titration.
  - c. \_\_\_\_\_ There was a little distilled water in the HCl buret and you forgot to rinse it out with the HCl.
  - d. \_\_\_\_\_ You added 3 drops of phenolphthalein instead of 2 drops.
  - e. \_\_\_\_\_ An air bubble was present in the HCl buret, but it stayed in while you titrated.
  - f. \_\_\_\_\_ An air bubble was present in the HCl buret, and it came out while you titrated.
  - g. \_\_\_\_\_ While you were titrating, some NaOH dripped out onto the table instead of into the flask.
  - h. \_\_\_\_\_ There was a pebble in the bottom of the NaOH buret during the entire titration.
  - i. \_\_\_\_\_ You forget to add the phenolphthalein indicator.

2. What is meant by “priming” the glassware? Why is this done?

3. Why did you use burets instead of graduated cylinders to do this lab?

4. Why did you not have to rinse out the flask in between trials?

5. What is the titration equation?

## ADDITIONAL PROBLEMS:

1. You are given a solution of 0.100 M HCl as was used for this lab and are again told to find the unknown molarity of a different NaOH solution. You start with 10.54 mL of HCl and need 13.17 mL of NaOH to reach the endpoint. What is the molarity of this NaOH solution?

2. You are now given a solution of 0.170 M NaOH and are told to find the molarity of an unknown HBr solution. You start with 11.29 mL of NaOH and need 38.55 mL of HBr to reach the endpoint. What is the molarity of the HBr?

3. How many mL of 0.340 M HCl would be needed to titrate 14.91 mL of 0.265 M NaOH?

4. How many mL of 0.340 M HCl would be needed to titrate 14.91 mL of 0.265 M Ca(OH)<sub>2</sub>?

Complete this statement:

Doing a titration without an indicator is like \_\_\_\_\_.