

Name: \_\_\_\_\_ Per \_\_\_\_\_

## Acid Base Titration

### Lab

**Purpose:** Vinegar is a solution of acetic acid in water. In this lab, vinegar will be titrated with sodium hydroxide to determine the concentration and percent composition of acetic acid in vinegar.

#### Procedure:

1. Obtain vinegar (approximately 40-50 mL) and sodium hydroxide (approximately 80-100 mL). Record the concentration of sodium hydroxide in the table below.
2. Rinse a 50 mL burette with a small amount of sodium hydroxide. Fill the burette with sodium hydroxide and empty a small amount through the tip and remove any air bubbles. Claim the burette to a ring stand.
3. Determine the initial reading of the burette and record the volume in the table below (Trial 1)
4. Rinse a pipette with a small amount of vinegar. Using the pipette, measure 10.00 mL of vinegar into an Erlenmeyer flask.
5. Add 3 drops of phenolphthalein to the Erlenmeyer flask.
6. Put the Erlenmeyer flask under the burette and arrange the height of the burette so that it will empty into the flask.
7. Slowly add the sodium hydroxide solution to the Erlenmeyer flask, stirring the flask constantly. As the sodium hydroxide solution is added, the color of the vinegar will change pink. The complete color change indicates that the neutralization reaction is complete. Determine the final reading of the burette and record the volume in the table below. (Trial 1)
8. Repeat steps 2-8 for Trial 2 and Trial 3 (It is not necessary to rinse the burette or the pipette between trials. Rinse the Erlenmeyer flask with water between each trial. Refill the burette with sodium hydroxide as necessary and be sure to record the initial and final volume of the burette for each trial.
9. Discard the liquid waste in the sink.

#### Observation:

| Concentration of NaOH<br>= _____ M  | Trial 1 | Trial 2 | Trial 3 |
|-------------------------------------|---------|---------|---------|
| Initial Reading of the burette (mL) |         |         |         |
| Final Reading of the burette (mL)   |         |         |         |
| Volume of NaOH used (mL)            |         |         |         |

#### Questions:

1. Determine a balanced chemical equation for the neutralization reaction between acetic acid and sodium hydroxide.
2. What observation indicates that the reaction has been completed? Why is this change seen?
3. A. Determine the average volume of sodium hydroxide used in the experiment.

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B. From the concentration of sodium hydroxide and the average volume of sodium hydroxide, determine the moles of sodium hydroxide reacting.

C. From the moles of sodium hydroxide reacting, determine the moles of acetic acid reacting.

D. From the moles of acetic acid reacting and the volume of vinegar used, determine the concentration of acetic acid in vinegar.

E. If the products in this reaction were boiled leaving only a solid behind, what would the identify of the solid? What would be the expected mass of the solid?

4. A. From the moles of acetic acid reacting and the molar mass of acetic acid, determine the mass of acetic acid (mass of solute)

B. From the volume of vinegar used and the density of vinegar (1.005 g/ml), determine the mass of vinegar used (mass of solution)

C. Calculate the percent concentration of acetic acid in vinegar.

**Conclusion: Answer these questions on a separate piece of paper and attach to this lab.**

1. What would be the effect on the results if too much sodium hydroxide is added during the titrations (as indicated by the solution becoming too dark pink)? What is the effect on the results if a small amount of sodium hydroxide remains in the Erlenmeyer flask between trials?
2. Explain how you were able to determine the concentration of acetic acid in vinegar.
3. What are other sources of error in this experiment? Explain how this error would affect your results.