

The purpose of this laboratory is to gain familiarity with acid/base titration curves and the properties of buffer solutions. You will learn how to use a pH meter. In the second part of this experiment a sample corresponding to the halfway point on the titration curve is produced, and then measurement of the pH of the half-titrated solution is used to determine the K_a of the unknown acid.

Caution: Remember that you are working with acids and bases, some of which may be strong acids and bases and are, therefore, corrosive! Work in pairs for this experiment.

A. Titration of a Strong Acid by a Strong Base

1. Pipet 25.0 mL of 0.100 M HCl in a small beaker. Add a few drops of phenolphthalein indicator to this beaker and stir well. Do **not** forget to add this indicator.
2. Rinse the buret with 0.100M NaOH solution, and then fill the buret with this NaOH. Record the initial reading of the buret.
3. Rinse the pH meter's electrode with deionized water from your wash bottle, pouring the rinse into the drain. Insert the electrode into the solution, and swirl gently. Read the pH of the solution. Thoroughly rinse the electrode with deionized water from the wash bottle, and gently shake the electrode to remove excess water. Record the initial pH reading.
4. Add 4.0 mL of NaOH, swirl the beaker, and then measure and record the pH reading. Continue adding NaOH in 4.0 mL increments until you have added 40.0 mL of NaOH to your solution. Don't forget to swirl the beaker and measure the pH after every 4.0 mL increment. Also make a note of where (at which addition) the color change from clear to pink occurs.

Example data table:

Initial Reading of Buret: _____
 Volume of NaOH added: _____

[illegible]

B. Titration of a Weak Acid with a Strong Base

1. Pipet 25.0 mL of 0.100 M acetic acid ($\text{HC}_2\text{H}_3\text{O}_2$) in a 100 mL beaker. Add a few drops of phenolphthalein indicator to this beaker and stir well. Measure and record the initial pH reading.
2. Add 3.0 mL of 0.100M NaOH and swirl the beaker and then measure and record the pH reading. Continue adding 3.0 mL increments of NaOH until you have added 30.0 mL of NaOH to your solution. Don't forget to swirl the beaker and measure the pH after every 3.0 mL increment. Note where the color change from clear to pink occurs.

Example data table:

Initial Reading of Buret:	_____
Volume of NaOH added:	_____

Initial pH:	_____
pH:	_____
pH:	_____
pH:	_____
pH:	_____
pH:	_____
pH:	_____
pH:	_____
pH:	_____
pH:	_____

II. Buffers

1. Each pair of students should obtain from the designated point in the lab a numbered unknown acid.
2. Dissolve about 1 g of your unknown acid in 100.0 mL of deionized water. Transfer **half** of this solution to a flask, add 1 or 2 drops of phenolphthalein, and titrate to the endpoint with 0.5 M NaOH. You do **not** need to record the volume of NaOH used.
3. Combine the neutralized half with the other half of the solution, and measure the pH of the resulting buffer solution.
4. To about 30 mL of your buffer solution (from step 3), add 1 drop of 0.5 M HCl, mix, and then measure the pH. To a second 30 mL of buffer, add 1 drop of 0.5 M NaOH, mix, and then measure the pH.
5. Measure the pH of about 30 mL of deionized water. Add 1 drop of 0.5 M HCl, mix, and then measure the pH. To a second 30 mL of deionized water, add 1 drop of 0.5 M NaOH, mix, and then measure the pH.
6. Measure the pH of about 30 mL of tap water. Add 1 drop of 0.5 M HCl, mix, and then measure the pH. To a second 30 mL of tap water, add 1 drop of 0.5 M NaOH, mix, and then measure the pH.

After completing the procedure but before leaving lab, write in your notebook a brief statement (two to three sentences) on the quality and reasonableness of the data you collected. Note what you might do differently if you performed the lab again.