

Quick Titration Lab

Name _____

Period _____

Partners _____

Introduction

The point at which the acid and base solutions are present in chemically equivalent amounts (equal numbers of H^+ and OH^- ions) is the **equivalence point**. The point in a titration when the indicator changes color is the **endpoint**. In this activity the equivalence point and endpoint are the same. The indicator used in this lab is phenolphthalein. Phenolphthalein is a solution that is clear under acid conditions and turn bright pink in basic conditions. In other words, when the $[OH^-] > [H^+]$, a phenolphthalein solution is pink. By finding the exact volume of base that will cause an acidic solution to become pink, you find the exact point at which the $[OH^-]$ go from being less than $[H^+]$ to being greater than $[H^+]$. At this point $[H^+] = [OH^-]$

PreLab Questions **Must be completed before you may begin the lab activity**

1. Phenolphthalein in solution of basic pH gives a _____ color.
2. Phenolphthalein in a solution of acidic pH gives a _____ color
3. Write the neutralization reaction that occurs when solutions of HCl and NaOH are mixed.
4. How does the number of H^+ ions compare with the number of OH^- ions compare in an acid solution?
5. How does the number of H^+ ions compare with the number of OH^- ions compare in basic solution?
6. How does the number of H^+ ions compare with the number of OH^- ions compare in a neutral solution?
7. Does the volume of the acid need to equal the volume of base in neutralization? Explain.

Procedure

Titration (part I)

1. Add 10 drops of .1M HCl (aq) into a clean flask.
2. Add one drop of phenolphthalein to the flask and swirl flask to mix.
3. Add drops of the unknown concentration of NaOH (aq) until one drop turns the solution pink and it stays pink (swirl flask after every drop of NaOH (aq) is added)
4. Record the total number of drops of NaOH (aq) needed to have the pink color stay pink.
5. Rinse flask with distilled water.
6. Perform steps 1-5 two more times (total of 3 trials)

Titration Data Table

Trial #	Volume of Acid (drops)	Volume of Base (drops)
1	10	
2	10	
3	10	

Titration with a buffer (Part II)

- Place 10 drops of .1M HCl_(aq) into a clean flask.
- Add one drop of phenolphthalein to the flask and swirl flask to mix
- Add two drops of the **buffer** to the flask and swirl flask to mix.
- Add drops of the unknown concentration of NaOH_(aq) until one drop turns the solution pink and it stays pink (swirl flask after every drop of NaOH_(aq) is added)
- Record the total number of drops of NaOH_(aq) needed to have the pink color stay pink.
- Rinse the flask with distilled water.
- Perform steps 7-12 two more times (total of 3 trials)

Titration with a buffer Data Table

Trial #	Volume of Acid (drops)	Volume of buffer (drops)	Volume of Base (drops)
1	10	2	
2	10	2	
3	10	2	

Questions (Show All Work with units)

- Calculate the average volume of base needed to reach the equivalence point (end point) for the titration without a buffer.
- Calculate the **unknown molarity** of the base using the average volume of base.

$$M_{\text{acid}}V_{\text{acid}} = M_{\text{base}}V_{\text{base}}$$

- Use the actual value of the Base molarity provided by the teacher and determine your percent error for the activity.

$$\% \text{error} = \frac{|\text{Actual Value} - \text{Lab Value}|}{\text{Actual Value}} \times 100$$

- What is the purpose of phenolphthalein in the lab?
- Calculate the average volume of base needed to reach the equivalence point when a buffer was added to the solution.
- What happened when you added the base to the acidic solution containing a buffer?
- What is the purpose of a buffer?
- Did the buffer achieve its purpose in this lab? Explain.