

Acid-Base Titration Lab

NAME:

Acid-base titrations involve the neutralization reaction between an acid and a base. They combine to form a salt and water.

In this experiment you will do two types of titrations:

- 1- strong acid with a strong base
the reaction equation is: $\text{HCl(aq)} + \text{NaOH(aq)} \Rightarrow \text{H}_2\text{O(l)} + \text{NaCl(aq)}$
- 2- weak acid with a strong base, using vinegar as a source for acetic acid.
the reaction equation is: $\text{HC}_2\text{H}_3\text{O}_2\text{(aq)} + \text{NaOH(aq)} \Rightarrow \text{NaC}_2\text{H}_3\text{O}_2\text{(aq)} + \text{H}_2\text{O(l)}$

Objectives:

- 1- Determine the concentration of a solution of NaOH.
- 2- Determine the concentration of acetic acid in vinegar.

Procedure:

Part I

- 1) Rinse your burette with 5-10 ml of NaOH.
- 2) Drain and then fill the burette with NaOH to the 50.00 ml mark.
- 3) Measure 25.00 ml of 0.15 M HCl and transfer into a 250 ml Erlenmeyer flask and record.
- 4) Rinse the sides of the flask with distilled water.
- 5) Add 2-3 drops of phenolphthalein indicator.
- 6) Record initial volume of burette.
- 7) Gradually dispense the NaOH into the titration flask. Continuously swirl the flask.
- 8) As the equivalence point is approached, the solution will temporarily turn pink and back to colorless. Now add NaOH drop by drop. Stop the titration when the addition of a single drop causes the solution to remain pink for 30 seconds.
- 9) Record the volume of NaOH needed to reach the equivalence point.
- 10) Repeat the titration using a second 25.0 ml sample of HCl.

Part II

- 1) Measure 5.0 ml of white vinegar into a 250.0 ml Erlenmeyer flask. Record the initial volume.
- 2) Add 15.00 ml of distilled water
- 3) Add 2-3 drops of phenolphthalein.
- 4) Gradually dispense some of the NaOH from your buret. Follow steps 7-10 in part I.

Data and Observations

Part I	Trial #1	Trial #2	Average
Volume of HCl			
Molarity of HCl			
Moles of HCl			
Initial buret reading of NaOH			
Final buret reading of NaOH			
Volume of NaOH used			
Moles of NaOH			
Molarity of NaOH			

Part I	Trial #1	Trial #2	Average
Volume of vinegar			
Molarity of NaOH (from part I)			
Initial buret reading of NaOH			
Final buret reading of NaOH			
Volume of NaOH used			
Moles of NaOH			
Moles of acetic acid in vinegar			
Molarity of acetic acid in vinegar			

Observations:

Calculations

Perform each calculation using the average of trials 1 & 2.

Write the equation for part I

1) In the titration of HCl with NaOH, calculate the volume of NaOH needed to reach the equivalence point.

2) Calculate the number of moles of HCl needed to neutralize the NaOH.

3) Calculate the number of moles of NaOH.

4) Calculate the molarity of NaOH.

Write the equation for part II

1) In the titration of vinegar, calculate the volume of NaOH needed to reach the equivalence point.

2) Calculate the number of moles of NaOH needed to neutralize the vinegar.

3) How many moles of acetic acid are contained in a sample of vinegar?

4) Calculate the molarity of the acetic acid in vinegar.

Analysis and Conclusions

1) Assuming the density of vinegar is about equal to that of water (1.0 g/mL), calculate the percent by mass of acetic acid in vinegar from the molarity you found in the analysis. Compare this to the value stated on the bottle.

2) Why would you use an acid or a base as standard when titrating a solution of soda pop? Why?

3) How would the results in part I differ if a polyprotic acid (e.g. H_2SO_4) of the same molarity were used instead of the HCl solution? Explain using calculations.