Experiment 3: Acid/basic titration using colorimetric reagents

Introduction

Titration is a common laboratory method of using quantitative chemical analysis. This method is used to determine the unidentified concentration of a known analyte. The volume measurement is known as volumetric analysis, and it is important in the titration.

Types of titration

There are many types of titration when considering goals and procedures. However, the most common types of titration in quantitative chemical analysis are redox titration and acid-base titration.

Acid/basic titration using colorimetric reagents

Acid-Base titrations is a quantitative analysis method to determine the concentration of an acid or base by titrating with a solution of an acid or base of known concentration in the presence of a colorimetric reagent.

Color Indicator

Color reagents are organic compounds with a color range that changes with the pH of the solution.

$$HInd\ (aq) + H_2O = Ind^-(aq) + H_3O^+\ (aq)$$

Principle

Acid-base titration in aqueous solutions is based on the reaction between the acid (HA), the proton carrier, and the base (BOH), the hydroxyl carrier, and the reaction product is always salt and water.

$$HA + BOH \rightarrow AB + H_2O$$

$$H_3O^+ + OH^- \rightarrow H_2O$$

When the color changes the end of the titration :

$$n_{Acide} = n_{Base} \Leftrightarrow C_{acide} . V_{acide} = C_{base} . V_{base}$$

$$C_{acide} = \frac{(C_{base} . V_{base})}{V_{acide}}$$

Objective of the experiment

1. To know the tools and devices and how to use them.
2. Determine the concentration of the strong acid HCI using a strong base (NaOH).

3. Determine the concentration of the weak acid CH_3COOH using a strong base(NaOH).

Materials and Chemicals

Materials	**Chemicals**
• Burette with Burette stand and clamp. • Graduated cylinder • Erlenmeyer flask • Funnel	• HCI solution of unknown concentration • CH_3COOH with unknown concentration • NaOH solution with a concentration of 0.1 mol/L • Color reagents (bromothymol blue and phenolphthalein).

Procedure

Experiment 1 : Titration of strong acid HCl of unknown concentration with a strong base, NaOH of 0.1 mol/L.

- Fill the burette with a 0.1 mol/L solution of NaOH and set it to zero.

- Using a graduated cylinder, take 10 ml of HCl solution of unknown concentration

- Put it in a 250 ml Erlenmeyer flask.

- Add drops of bromothymol blue reagent to it

- Place the Erlenmeyer flask under the burette and start titrating.

-When the color changes, close the burette valve and note the volume of NaOH.

Experiment 2 : Titration of a weak acid CH_3COOH of unknown concentration with a strong base, NaOH of 0.1 mol/L.

- Fill the burette with a 0.1 mol/L solution of NaOH and set it to zero.

- Using a graduated cylinder, take 10 ml of CH_3COOH solution of unknown concentration

- Put it in a 250 ml Erlenmeyer flask.

- Add drops of phenolphthalein reagent to it

- Place the Erlenmeyer flask under the burette and start titrating.

-When the color changes, close the burette valve and note the volume of NaOH.

Answer the questions

1. Write the equations for each experiment.
2. Calculate the molar concentration of HCI acid and CH_3COOH
3. Calculate the mass concentration of HCI and CH_3COOH
4. Based on the table, is it possible to use other reagents for each of the two experiments? Justify your answer.

We give

$M(CH_3COOH) = 60$ g/mol - $M(HCl) = 36.5$ g/mol