TITRATION LAB MANUAL

Experiment_ID : 23

Standardization of Acid by Titration with Standard Alkali

EXPERIMENT OBJECTIVE:

To standardize hydrochloric acid using standard sodium hydroxide solution

MATERIALS REQUIRED

Apparatus:

* 2 Burettes - 50 mL each (Acid and Alkaline)
* 3 Conical Flasks - 250 mL (Erlenmeyer)
* 2 Beakers - 500 mL
* 2 Pipettes - 20 mL Volumetric and Dropper
* 1 Round-bottom Flask - 250 mL
* 2 Burette Stands with clamps
* 2 Glass Rods
* 1 Funnel
* 1 White Tile
* Beaker Tongs

Chemicals:

* Standard NaOH Solution - 0.1 M
* HCl Solution - Unknown concentration
* Phenolphthalein Indicator - 1% solution
* Distilled Water

PROCEDURE - STEP BY STEP

STEP 1: Fill the Burette with NaOH
Instructions: Fill the **burette** with NaOH solution by selecting the **beaker** containing NaOH and using the **funnel** if required
Expected Outcome: Burette is filled with NaOH solution without air bubbles and ready for titration

STEP 2: Add HCl to the Conical Flask
Instructions: Add measured HCl solution into the **conical_flask** using the **pipette** from the **beaker**
Expected Outcome: Correct volume of HCl is present in the conical flask for titration

STEP 3: Add Indicator
Instructions: Add 2–3 drops of indicator into the **conical_flask** using the **dropper**
Expected Outcome: Solution remains colorless and ready to show endpoint color change

STEP 4: Perform the Titration
Instructions: Open the **burette** tap to add NaOH while swirling the **conical_flask** placed on the **white_tile**, and stop at the first permanent pale pink color
Expected Outcome: Solution changes from colorless to permanent pale pink indicating the endpoint

STEP 5: Record Final Burette Reading
Instructions: Record the final reading from the **burette** and note it in **observation**
Expected Outcome: Final reading is recorded to calculate the volume of NaOH used for titration

SAFETY PRECAUTIONS

SAFETY PRECAUTIONS AND GUIDELINES

* Always wear safety glasses and lab coat when handling chemicals
* Handle burettes and glassware carefully to avoid breakage
* Never pipette by mouth - always use a rubber bulb
* Ensure burette tips do not touch other glassware to avoid contamination
* Add indicator drop by drop to avoid overdosing
* Perform titration in well-ventilated area
* Do not mix or store chemicals without proper labeling
* In case of chemical splash, rinse immediately with water
* Dispose of chemical waste in appropriate containers only
* Keep MSDS (Material Safety Data Sheet) available
* Know location of eye wash station and emergency equipment
* Never leave heated equipment unattended
* Wash hands thoroughly after handling chemicals
* Report any spills or accidents to your instructor immediately

CALCULATIONS

Formula: N1V1 = N2V2

N1 = Normality of HCl (to find)
V1 = Volume of HCl used = 20 mL
N2 = Normality of NaOH = 0.1 N
V2 = Average volume of NaOH from concordant trials

To convert Normality to Molarity: M = N / number of H+/OH-

EXPECTED RESULTS

* Typical HCl concentration: 0.1 - 0.2 M
* Typical volume of NaOH used: 18-22 mL
* Color change should be abrupt at endpoint
* Concordant values within 0.20 mL difference

CONCLUSION

The titration experiment successfully standardizes HCl using standard NaOH. The concentration of HCl is determined using the formula N1V1=N2V2. Accurate results require careful technique, precision measurements, and adherence to all safety precautions.

------- END OF MANUAL -------

This manual covers all essential aspects of acid-base titration including procedures, expected outcomes, safety, and calculations.