

# Chemistry Formal Report

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## Title Page

**Title:** Analysis of Acid-Base Titration Accuracy

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## Abstract

This formal report examines the accuracy and reliability of acid-base titration methods used in our laboratory. By comparing different indicators and titration techniques, we aim to optimize our protocols for precise pH measurements.

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## Introduction

Acid-base titration is a fundamental analytical chemistry technique used to determine the concentration of a known reactant in a solution. The precision of titration results is critical for scientific research and industrial applications. This report assesses the methods used in our lab and suggests improvements for increased accuracy.

## Objective

To evaluate the accuracy of different acid-base titration methods and identify the most effective indicator for various titration types.

## Methodology

- **Sample Preparation:** Solutions of known molarity were prepared for both acids and bases.
- **Titration Techniques:** Conducted using phenolphthalein and bromothymol blue as indicators to determine the end point in strong acid to strong base and weak acid to strong base titrations, respectively.
- **Instrument Calibration:** All pH meters and burettes were calibrated prior to use to ensure accuracy.
- **Data Collection:** Measurements were recorded at each titration end point.

## Results

- **Phenolphthalein:** Provided clear end points in strong acid to strong base titrations with a 2% variance.
- **Bromothymol Blue:** Showed a 5% variance in weak acid to strong base titrations, suggesting less accuracy.
- **Repeatability:** Consistent results were obtained when repeating the same titration under identical conditions.

## Discussion

The choice of indicator significantly affects the accuracy of titration results. Phenolphthalein proved to be more effective for strong acid-base reactions due to its sharp color change near the pH of 8–9. Bromothymol blue's broader color change range made it less precise for weak acid titrations.

## Conclusions

The study confirms the importance of selecting the appropriate indicator based on the strength of the acid and base in titration. Phenolphthalein is recommended for titrations involving strong acids and bases due to its higher accuracy and clear end point detection.

## Recommendations

- Utilize phenolphthalein for all strong acid-base titrations within the lab.
- Explore more sensitive indicators for weak acid titrations.
- Regularly calibrate analytical instruments to maintain measurement accuracy.

## References

- Standard titration methods and protocols from the American Chemical Society.
- Recent studies on indicator effectiveness published in the Journal of Analytical Chemistry.

## Appendices

- Appendix A: Detailed Protocols for Sample Preparation and Titration.

- Appendix B: Data Sheets for All Experiments Conducted.
- Appendix C: Calibration Records for Instruments Used.