

# Volumetric analysis: Accuracy and precision of a pipette

by Tamsin Kelly, Dijana Townsend

## Experiment Overview

This experiment is designed to introduce students to volumetric analysis, and in particular to develop the student's skill of accurate pipetting. Many of the students in the unit have had no previous chemistry background, and therefore do not know how to use a pipette. The experiment is followed up with an experiment in the following week that moves onto using volumetric glassware (including volumetric flasks and burettes) to perform a titration. The experiment also enables the students to recognise the difference between accuracy and precision and undertake a titration based calculation (in preparation for the experimental based activities the following week).

## Learning Experience

While the skills developed in this experiment are absolutely critical for the first year science students, the experiment itself can be seen as rather mundane and boring. Through submission into the ASELL workshop it is hoped that we can improve the experiment to enhance the student experience and engagement with the activity.

## Aims and Objectives

- 1) Acquire the skills of accurate and precise pipetting;
- 2) Explain the difference between accuracy and precision in volumetric analysis;
- 3) Perform the calculations used in the standardisation of an approximately 0.1 M hydrochloric acid solution, using a primary standard of borax;
- 4) Determine the absolute and relative errors associated with volumetric analyses.

## Level of Experiment

First year undergraduate chemistry

Keyword Descriptions of the Experiment

### **Domain**

general chemistry

### **Specific Descriptors**

volumetric analysis, pipetting, titration calculations

## Course Context

The experiment is the first experiment undertaken in the first semester 1<sup>st</sup> year chemistry unit (Chemistry 1A). The objective of Chemistry 1A is to provide a unified introductory course in chemistry as a framework for future studies in chemistry and biochemistry. Topics covered in the

unit include stoichiometry, atomic structure, periodic table, bonding, oxidation and reduction, acids and bases, precipitation reactions, titrations, phase diagrams, solutions, and gas laws.

## Prerequisite Knowledge and Skills

This unit does not assume the students have any prior knowledge of chemistry. The experiment is undertaken in conjunction with a five hour stoichiometry lecture series. This lecture material is supplemented by the introductory material included in the experimental notes.

The experimental procedure is relatively simple and easily completed by students with no prior experience in chemistry.

## Time Required to Complete

**Prior to Lab:** 30 minutes

**In Laboratory:** 2 hours

**After Laboratory:** ~30 minutes to complete optional post-lab questions if time did not permit in the 2 hour laboratory session

## Experiment History

This experiment was written by Tony Di Michel and Ian McNaught. It is a well-established exercise that has been utilised in the first year laboratory program at the University of Canberra for more than 15 years.

Dr Kelly took over the coordination and teaching of the first year Chemistry unit Chemistry 1A within the Faculty of Applied Science at the University of Canberra from 2010. Dijana Townsend is the Senior Tutor for Chemistry 1A who provides academic support in the unit. Dr Kelly and Dijana are submitting this experiment to ACELL on the behalf of the Faculty.

## References

Chemistry 1A Laboratory and Tutorial Workbook, L2 Volumetric analysis: Accuracy and precision of a pipette.