

Determination of the Dissociation Constant of a Weak Acid by Titration

Author: Dr Barry O Grady

Practical:

Title: Determination of the Dissociation Constant of a Weak Acid by Titration

Summary: The acid strength of a weak acid as measured by the dissociation constant, K_a , is of relevance in many areas of chemistry and in biological systems. Weak acids are an integral component of buffer systems and the range of a buffer is controlled by its pK_a . In this experiment students can build on these basic skills by

following the progress of a titration potentiometrically

visually see how the pH changes during the titration

use the pH-volume data to estimate the equivalence point by different methods

determining the dissociation constant of the acid by several techniques including the Gran technique which is not normally covered in a physical chemistry course.

By carrying out the titration at constant ionic strength, students can also see that the value of K_a is significantly different from the thermodynamic K_a usually reported in the literature.

The calculations involved are not complex and can readily be carried out using a spreadsheet. Depending on the time available the titration can be modelled using a spreadsheet to carry out the calculations either as an integral part of the experiment or as an extension. This enables the student to explore the effect of changing the value of K_a , on the fit of the calculated results to the experimental pH/Volume curve.

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Discipline: Chemistry

Abstract

The basic theoretical skills (weak acids and bases, pK a, pK b, pK w, buffers, etc) are covered in the typical textbook of General Chemistry used in first year courses. First year chemistry courses cover the basic skills of titration and in some cases students would use a pH meter to measure pH and so be familiar with its operation. The mathematical skills required are algebraic and should not be beyond the average student.

Acid strength is an important concept in most areas of chemistry but its formal study after first year would normally be limited to analytical chemistry courses. This experiment provides a reinforcement and extension of first year concepts in this area.

Duration

Prior to Lab 1 hr

In Laboratory 3 - 6 hrs

After Laboratory 1-3 hrs

Further comments

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