

Chemistry 254

Experiment 4

Solubility of a solid

Adam Menne
Stellenbosch University

Last edited on 6th September 2022

Abstract

In this practical the temperature dependence on the solubility of benzoic acid is investigated. This is related to the enthalpy of solution by use of the Van 't Hoff equation

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1 Results

At 20 °C the concentration of benzoic acid was 0.02173 *M*, while at 30 °C it was 0.02929 *M*

The temperature independent ΔH^0 was calculated to be 22.064 *kJ*

A static export of the notebook containing all analysis and figures is available at https://adammenne.github.io/chemistry_254/practical_4/notebook.html.
With full source code available at https://github.com/AdamMenne/chemistry_254/tree/master/practical_4

2 Discussion

The titrations carried out were consistent with both sets having standard deviations below 0.00014.

Appendix A Additional tasks

1. 0.02529
2. This rearrangement of the Van 't Hoff equation is possible due to the fact that $\frac{d\frac{1}{T}}{dT} = -\frac{1}{T^2}$
3. The Van 't Hoff plot for a reaction that has a temperature dependant standard enthalpy will not be linear. With an adequate sample size over an appropriate range of temperatures, a polynomial fit will allow the gradient at any temperature to be found, and thus the standard enthalpy of solution to be calculated.

Appendix B Flow Diagram

1. Heat a 25 cm^3 pipette with a hair dryer, attach cotton filter, and fill past the mark
2. Remove filter, wipe off crystals, and evacuate the pipette to the mark
3. Empty into Erlenmeyer flask, washing with ethanol, add 2 to 3 drops phenolphthalein
4. Titrate with 0.1 M NaOH
5. Clean pipette with ethanol followed by acetone, and dry
6. Repeat 3 times for both temperatures

Appendix C MSDS

Benzoic acid

- Corrosive, health hazard
 - causes serious eye damage
 - may cause respiratory irritation
 - if in contact with skin or eyes wash for several minutes

Sodium hydroxide

- Corrosive
 - may cause skin burns, eye damage
 - if in contact with skin or eyes wash for several minutes