To CH 131 lab students
From Bruno I. Rubio, Ph.D.
Subject Experiment # 5 van't Hoff *i* factor Excel spreadsheet
Date 12 Oct 2014

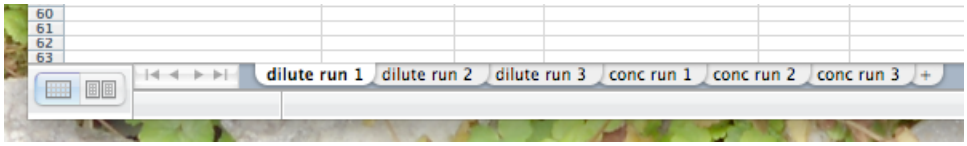
I created an Excel spreadsheet at

http://people.bu.edu/birubio/ch131/vantHoffCalculator.xls

to help you present and analyze your data from Experiment # 5 (Freezing-point depression).

Open Excel

The file **`vantHoffCalculator.xls`** has six tabs at the bottom of its window: the tabs correspond to runs using the dilute or concentrated $CoCl_2$(aq) solution:



Input solution data

In cell **B2** enter the mass in grams of $CoCl_2$ dissolved (about 1 g for the dilute runs and about 3.5 g for the concentrated runs). In cell **B3** enter the volume in milliliters of water used in preparing the solution (about 15 mL). The solution's molality (i.e., the moles of $CoCl_2$ per kilogram of water) updates in cell **B6**. The theoretical freezing point ΔT_f calculated from the Freezing-Point Depression Law

$$\Delta T_f = T_{f,soln} - T_{f,solv} = T_{f,soln} - 0.0\,^\circ\text{C} = T_{f,soln} = -iK_f m$$

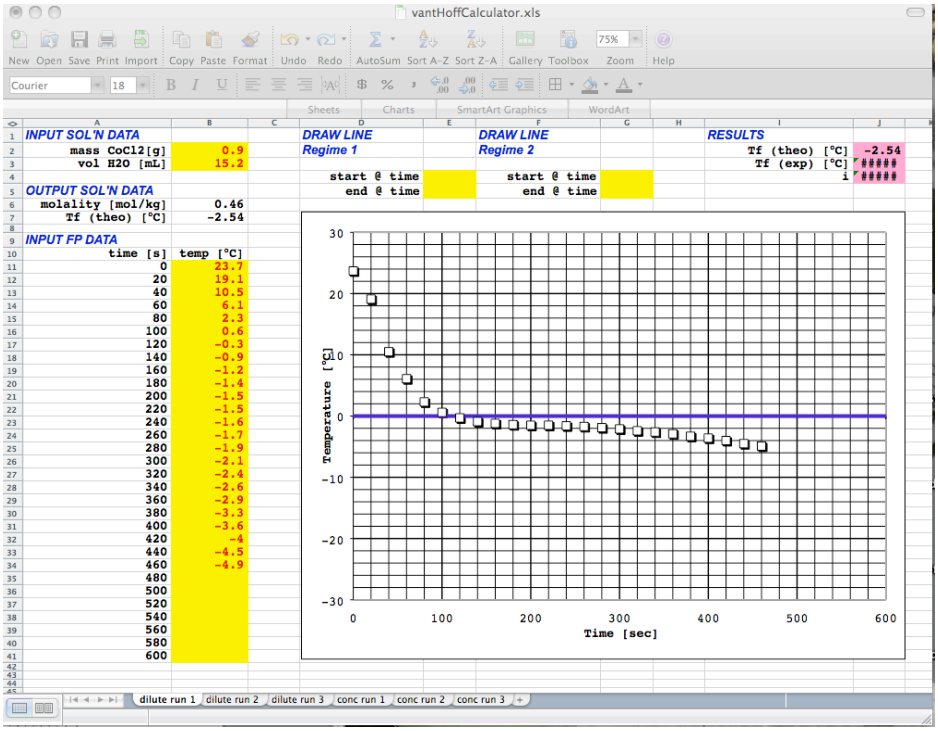
where K_f is the freezing-point depression constant of water (1.86 °C · kg/mol), m is the molality, and based on the assumption that $CoCl_2$ is dissociating according to

$$CoCl_2(s) \rightarrow Co^{2+}(aq) + 2\ Cl^-(aq)$$

that is, the van't Hoff *i* factor is equal to 3, updates in cells **B7** and **J2**.

Input temperature data

In cells **B11:B41** enter the temperature observed at each 20-sec interval: your data points update on the plot. If you didn't collect data up to the 600-sec mark, just enter whatever you have.



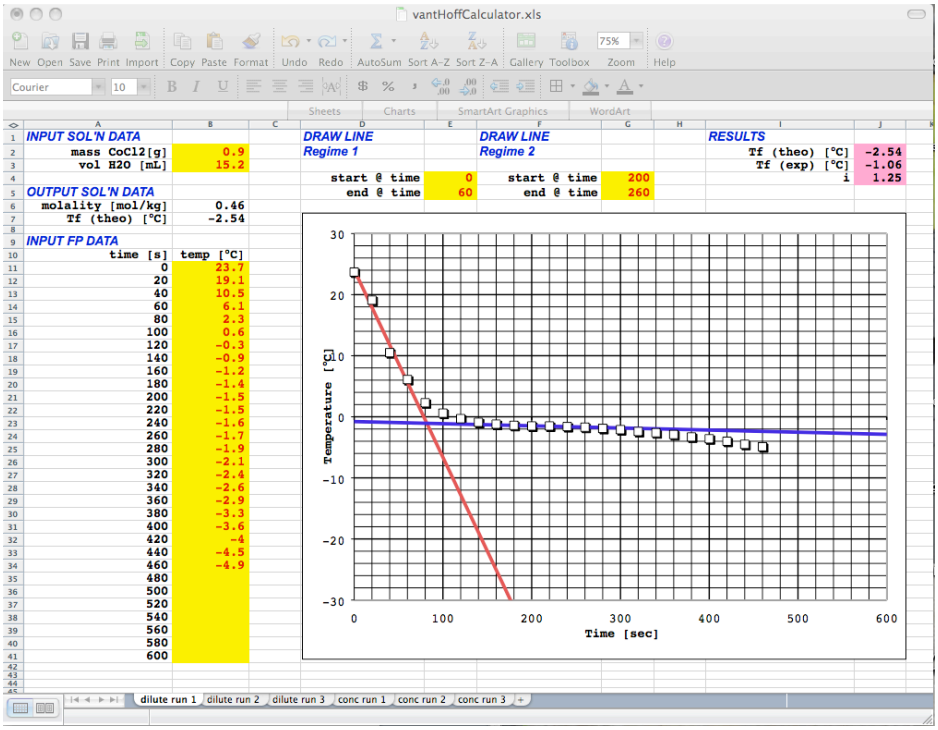
Draw lines through the data in the two cooling régimes

The experimental freezing point is the temperature at which the solution just begins to freeze: this quantity is given by the point at which a line drawn through the data in the initial fast cooling régime intersects a line drawn through the data in the second slow cooling régime. The spreadsheet plots linear least-squares (best fit) lines through the data, but deciding where the lines begin and end is a judgment call on your part.

For régime 1: In cell **E4** enter the time in seconds at which you want the line to begin and in cell **E5** enter the time in seconds at which you want the line to end. These values must be zero or an integer multiple of 20. The line updates on the plot.

For régime 2: In cell **G4** enter the time in seconds at which you want the line to begin and in cell **G5** enter the time in seconds at which you want the line to end. These values must be zero or an integer multiple of 20. The line updates on the plot.

Your experimental freezing point updates in cell **J3** and the value of the van't Hoff *i* factor updates in cell **J4**.



IMPORTANT!

(1) Give each plot a truly informative title: don't just call it "Run 1" – tell me exactly what I'm looking at.

(2) Write the value of the experimental freezing point on each plot – don't make me figure it out and don't make me look for it.

(3) The lab report is not just a printout of the Excel spreadsheet. As always, follow the format of the lab report form at

http://people.bu.edu/birubio/ch131/exp05.pdf

and fill in all requested information in the appropriate location.