

Appendix O

EXTRAPOLATIONS WITH MICROSOFT EXCEL

Data manipulation, graphing, and regression analysis (including linear regression) can easily be accomplished using a spreadsheet program such as Microsoft Excel. For the calorimetry data in Experiment 12A or Experiment 27, follow this extrapolation procedure to determine T_f from your graph. These instructions can be readily adapted to extrapolation in other experiments. Refer to the Excel tutorials for specific details on constructing graphs and using spreadsheets (http://chem.mathsci.usna.edu/plebechem/excel_tutor/homepage.html).

1. In a blank Excel spreadsheet, enter your data into two columns (A and B). Label the columns as 'time (min)' (for the X values) and 'temperature ($^{\circ}\text{C}$)' (for the Y values). Resize and align the columns if necessary. Show data with the correct number of significant figures. Leave column C blank for now.

2. Using the mouse, highlight the data in both columns and click on the chart button icon on the toolbar or select Insert, Chart. Construct an XY(scatter) graph with your data and label the axes appropriately. If necessary, rescale the axes to minimize empty space on the graph.

3. Examine the graph to determine which points are in a sloped, but linear region (this will probably include the maximum temperature and most of the points thereafter). Go back to the spreadsheet and copy these selected temperature values (in the linear region) into column C directly across from their positions in column B.

4. Add these data to your graph by right-clicking in the middle of your graph and selecting 'Source Data'. Click on the Series tab. Under Series, click the Add button. Now select all of the time data (in column A) as the X values and the temperature data (in column C) as the Y values by using the chart icon to the right of each field. Use *all of the data* (including blank cells above the linear values) in each column (A and C only). Click OK.

5. Remove the data points (markers) from the Series2 data since you only need to display the regression line for this fit (the regression will be done in step #6 later). On the graph, point and right-click on the linear points (Series2 from #4 above). Select Format Data Series, and change the marker setting to None.

6. From the toolbar, select Chart, Add Trendline. At the bottom of the open window, change 'Based on series' to 'Series2'. Select the Options tab and check the 'Display equation' and 'Display R-squared' boxes, then click OK. You should have results similar in style to that shown below.

7. From the equation of the line, the extrapolated value for T_f can be determined (T_f is the y-intercept). Record this result on your spreadsheet. Using the values of T_f and T_p , ΔT can be determined for your reaction.

Time (min)	Temp ($^{\circ}\text{C}$)	linear part ($^{\circ}\text{C}$)	
0.0	10.0		$T_f = 32.5^{\circ}\text{C}$
1.0	20.0		$\Delta T = 32.5 - 10.0 =$
2.0	28.0		22.5°C
3.0	29.0		
4.0	29.5		
5.0	30.0	30.0	
6.0	29.5	29.5	
7.0	29.0	29.0	
8.0	28.5	28.5	
9.0	28.0	28.0	
10.0	27.5	27.5	
11.0	27.0	27.0	

