Chem 121 / Dr. Rusay

Understanding Solubility: Preparing Graphs and Spreadsheets with Excel

Refer to:

http://chemconnections.org/general/chem121/Video_of_how_to_plot_a_graph_on_Excel.swf

Plotting *ln* K vs. 1/T(K):

1. **Prepare the following table in Excel. From the link below: either cut and paste (uni-code text) the on-line data or download the Excel file, or prepare the Table manually. Enter in cell 1B the Group ID (A, B, C, etc.) and your lab section time(AM or PM), eg. C-PM.**

http://chemconnections.org/general/chem121/Ksp-Excel%20Plot%20Data-2011.htm

When done, the spreadsheet should look like table below.

	A	B	C	D	E	F	G	H	I	J
1	Group #:									
2	Na_2SO_4	$K_2Cr_2O_7$	NaCl	Li_2CO_3	T	1/T	Na_2SO_4	K_2Cr2O_7	NaCl	Li_2CO_3
3	Ksp	Ksp	Ksp	Ksp	oC	1/T(K)	ln Ksp	ln Ksp	ln Ksp	ln Ksp
4	0.151	0.0189	29.5	0.0354	0	0.003663	-1.89048	-3.96859	3.38439	-3.34104
5	0.989	0.0498	29.4	0.0283	10	0.003534	-0.01106	-2.99974	3.380995	-3.56489
6	9.1	0.237	29.3	0.0227	20	0.003413	2.208274	-1.4397	3.377588	-3.78539
7	72.9	1	29.5	0.0188	30	0.0033	4.289069	0	3.38439	-3.9739
8	113	2.05	29.5	0.0153	40	0.003195	4.727388	0.71784	3.38439	-4.1799
9	90.8	7.65	30	0.00972	60	0.003003	4.508659	2.034706	3.401197	-4.63357
10	80.4	18	30.8	0.0055	80	0.002833	4.387014	2.890372	3.427515	-5.20301
11	72.3	33.3	32.5	0.0032	100	0.002681	4.280824	3.505557	3.48124	-5.7446

2. Prepare a figure of ln K_{sp} vs. 1/T (K) following the Video or the instructions below. (NOTE: The instructions were developed for PCs using an older version of Excel and the keystrokes may vary.)

a) Left-click and hold on cell F3. Drag the mouse to the right, and then down, so that cells F3 through J11 (except F3) have a black background.

b) On the toolbar at the top of the screen select, left-click Insert. On the pop-up menu select Chart. Follow the four steps on the Chart Wizard. Specifically,

1. Step 1 of 4: For the chart type select XY (scatter). For the chart sub-type select the graph on the left in the center, with the caption, scatter with data points connected by smooth lines. Select Next. 2. Step 2 of 5: Select type of chart:. Select Next

2. Step 2 of 4: Verify that Range=$F$3:$J$11, series in columns. Select Next

3. Step 3 of 4: *Type* in the Chart Title - ln K_{sp} vs.1/T (K) . Value (X) Axis Titles: Category x- 1/T(K). Value y - ln K_{sp}.

4. Step 4 of 4: Select As a new sheet. Select Finish.

The graph (chart) now appears on the screen, as Chart 1. If you wish to rename the chart, right-click on the "Chart 1" tab on the bottom of the screen. On the pop-up menu, select Rename. In the Name field in the Window that appears, *Type;* Figure 1.

3. Determine linear curve-fitting equations (except sodium sulfate)

a. With the mouse, move the arrow on the screen so that the tip just touches the NaCl line of ln K_{sp} vs 1/T(K). Right-click and a pop-up menu appears. On the pop-up menu, select Insert Trendline

b. On the Trendline Window Select Linear. Select the Options tab.

c. On the Options Window, select the square input fields "Display Equation in Chart," and "Display R-squared Value on Chart." (checks appear in the boxes). Select OK.

d. The linear curve-fit equation and R-squared values now appear on the figure. These can be placed where desired by left-clicking and dragging. Arrows can be added using the drawing toolbar.

e. Repeat steps 3a-3d for potassium dichromate and lithium carbonate.

4. Figures and linear curve-fitting for sodium sulfate

a. Separate plots and linear curve-fit equations are necessary for the decahydrate and anhydrous sodium sulfate. Label these as Fig 2 and 3, respectively.

b. Prepare Figure 2. Highlight cell F4. Left click and drag to highlight cells F4 through G7 (corresponding to T=0 to 30 C). On the toolbar at the top of the page select Insert. On the pop-up menu, select Chart. Prepare the figure and determine the linear curve-fit, as described earlier. The title should reflect that this is the hydrate. Follow steps **3a-4d** above to display the linear curve-fit equations. Right-click on the tab to rename Figure 2. The equation can be added to fig. 2 as text.

c. Prepare Figure 3. Highlight cell F8. Left click and drag to highlight cells F8 through G11 (corresponding to T=40 to 100 C). On the toolbar at the top of the page select Insert. On the pop-up menu, select Chart. Prepare the figure and determine the linear curve-fit, as described earlier. The title should reflect that this is the anhydrous sodium sulfate. Follow steps **4a-4d** above to display the linear curve-fit equations. Right-click on the tab to rename Fig. 3. The equation can be added to fig. 3 as text.

Save your Workbook/Worksheet to the desktop and Flash Drive if you have one. Name the file with your group number & lab section time: eg. Ksp D-AM.xls

Either print the file or send an e-mail to Dr. R. with the file as an attachment:
Subject: *Ksp: D-AM*; (*Be sure to indicate:* ***Group number & Lab Section Time)***
If printed, provide the names of everyone in the group, who contributed to the assignment; If e-mailed provide the names in the body of the message.

Answer the Worksheet questions using the graphs.