**Introduction to Microsoft Excel and Basic Spreadsheet Uses**

The days of graph paper and the meticulous drawing of graphs by hand is gone. Since the personal computer has become widely available, spreadsheet programs have taken the place of paper and pencil when it comes to the analysis and manipulation of numerical data. It will be necessary for you to utilize Excel or other graphing programs throughout this course and others.

Excel is the most readily available spreadsheet program on campus so the instructions are given for this application. Other spreadsheet programs have similar functions and can also be used to graph your data. However, your instructor might not be able to help you if you have problems with other programs. A sample data set is provided below for you to enter into a spreadsheet and graph in order to learn how to use the program.

|  |  |
| --- | --- |
| Temperature (°C) | Pressures (mmHg) |
| -14.0 | 1 |
| 19.2 | 10 |
| 45.1 | 40 |
| 65.7 | 100 |
| 104 | 400 |
| 125.6 | 760 |

Over the course of this tutorial, we will

* convert the temperature from degrees Celsius to units of Kelvin.
* find the inverse of the temperature.
* find the ratio of Pi/P\* (Pi = pressure at a temperature, i and P\* is the maximum pressure seen in the experiment).
* take the natural log of data.
* create graphs of selected data.
* use Excel to determine the equation of the line for the linear data set as well as the R2 value for the data.

*All directions are written for a PC using Excel 2010. If you are using Excel 2007, they will be nearly identical but earlier versions will vary significantly.*

Entering Data and Generating a Basic XY Scatter Plot:

1. Starting with Cell A1, enter the label Temp. (C) followed by Pressure (mmHg) in Cell B1.
2. Next, enter the above data into your spreadsheet columns below the appropriate title.
3. Once all of your data has been entered, highlight your data and titles by clicking and dragging over the appropriate cells.
4. Click insert to open the appropriate ribbon at the top of the window and select “Scatter”, “Scatter only with markers.” A scatter plot is frequently used because it makes it easy to visualize trends in experimental data.
5. When your chart is selected, a menu labeled “Chart Tools” will be available.
6. Select the “Layout” tab to format your graph.
7. Double click on the existing chart title and change the name to “Vapor Pressure of Octane vs. Temperature”.
8. Choose the “Axis Title” option to add appropriate labels for the horizontal axis (“Temperature (°C)”) and the vertical (“Pressure (mmHg)”) axis.
9. A section called chart tools will appear. Choose “Layout,” then “Axes,” then “Primary Horizontal Axis,” then “More Primary Horizontal Axis Functions” and set the minimum value at 0.
10. Since we are only displaying one set of data, a legend is not needed. Click on the legend to select it and press delete.
11. Your plot should look like the following.

Manipulation of Data:

*Note*: *As we manipulate the data, it may be necessary to change column widths to accommodate titles and/or to move the chart created in the first part of the tutorial. For assistance with these functions, use the Help menu in Excel.*

1. We now need to manipulate the data that we entered so that a linear plot can be generated. Select Cell C2 and enter the following: =A2+273.15 (you must include the equal sign). This will convert your temperature values from Celsius to Kelvin. Be sure to enter an appropriate label in Cell Cl.
2. Select Cell C2 and do one of the following.
   1. You will see the cell outlined by a black rectangle with a darker black box in the lower right-hand comer. Click on this small box and drag it down to Cell C7. This "fills" your formula into all the remaining cells and keeps you from entering in any other equations manually. When you fill down like this, the Cell referenced in the formula (Le. A2) automatically shifts down to A3, A4, etc.
   2. Click on the “Home” tab and choose “Copy”, then highlight cells C3 through C7 and click “Paste”.

|  |  |  |
| --- | --- | --- |
| Temperature (°C) | Pressures (mmHg) | Temperature (K) |
| -14 | 1 | 259.15 |
| 19.2 | 10 | 292.35 |
| 45.1 | 40 | 318.25 |
| 65.7 | 100 | 338.85 |
| 104 | 400 | 377.15 |
| 125.6 | 760 | 398.75 |

1. Select Cell D2 and enter the formula =1/C2. Repeat the previous step to fill down and then give your new column of data an appropriate title. Your data table should now appear like the following table.

|  |  |  |  |
| --- | --- | --- | --- |
| Temperature (°C) | Pressures (mmHg) | Temperature (K) | 1/Temperature (K-1) |
| -14 | 1 | 259.15 | 0.00385877 |
| 19.2 | 10 | 292.35 | 0.003420558 |
| 45.1 | 40 | 318.25 | 0.003142184 |
| 65.7 | 100 | 338.85 | 0.002951158 |
| 104 | 400 | 377.15 | 0.002651465 |
| 125.6 | 760 | 398.75 | 0.002507837 |

1. At this point, you need to find the ratio of Pi/P\*. Select Cell E2 and enter the formula: =B2/$B$7. Inserting dollar signs ($) into the equation creates an absolute reference. When you fill down the column, B2 will become B3, B3 will become B4, etc. However, the absolute reference in the formula means that B7 will always be referenced.
2. As in Step 2, fill down to the last row of data and give the column an appropriate title.
3. We can now take the natural log of Pi/P\*. Select Cell F2 and enter the formula: =In(E2). Fill down and name the column appropriately.
4. You should now see the following in your data table.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Temperature (°C) | Pressures (mmHg) | Temperature (K) | 1/Temperature (K-1) | Pi/P\*. | ln (Pi/P\*) |
| -14 | 1 | 259.15 | 0.00385877 | 0.001316 | -6.63332 |
| 19.2 | 10 | 292.35 | 0.003420558 | 0.013158 | -4.33073 |
| 45.1 | 40 | 318.25 | 0.003142184 | 0.052632 | -2.94444 |
| 65.7 | 100 | 338.85 | 0.002951158 | 0.131579 | -2.02815 |
| 104 | 400 | 377.15 | 0.002651465 | 0.526316 | -0.64185 |
| 125.6 | 760 | 398.75 | 0.002507837 | 1 | 0 |

1. You are now ready to plot the new data points that you have calculated. Select the last column by clicking on the “F” at the top of the column. Hold down the CTRL key while selecting the column with 1/T (K-1). This allows you to plot two columns that are not right next to each other.
2. Follow the steps you used earlier to create a scatter plot. Title this plot “Vapor Pressure of Octane”.
3. Right click on the horizontal axis values and select “Format Axis”.
4. Under the Minimum value, click “Manual” and enter 0.0025, then close the window.
5. Your plot should look like the following
6. Select your second graph and open the “Chart Tools” ribbon, then select the “Layout” tab.
7. Click “Trendline”, then select “More Trendline Options”. Select “Linear” and mark the two checkboxes for “Display Equation on Chart” and “Display R-squared on Chart".
8. Your plot should look like the following
9. Print your data and two charts on one page. If you need help with this, ask one of the TA's to help you. Turn this page in with your name and your TA's name printed on the top before you leave the lab.

Other Tips for Formatting a Chart:

* There are many regions on a chart that can be individually formatted. Each region has its own formatting options associated with it.
* As you can see in the charts presented to you in the body of this handout, the title text, the axes labels, and the numbers are appropriately sized for the size of the printed chart. These are all areas that can be individually selected and formatted.
* Try to maximize the area that the data takes up on the chart. To do this, change the range of the axes so that the data fills the chart area. There is no need to show 0 on an axis where the first data point is at 200. Doing this makes it difficult to view and interpret your data.
* In addition to the above details, a colored background often makes it difficult to read a graph. The best option is a white background.
* Excessive use of gridlines makes it difficult to see data points, especially when plotting more than one series of numbers on a single plot.
* Use simple fonts such as Arial, Times New Roman, or Calibri. Avoid the use of “decorative” fonts.

1. First, click on the title of your graph to select it. Go to the “Home” ribbon to adjust the font size and other attributes.
2. Do the same with the individual axis labels.
3. Click on the x-axis and select “Format Axis”. Make any needed changes to the scale or display.

*Many of these options are also available from the “Format” ribbon under “Chart Tools”.*

1. Repeat the previous step with the y-axis.
2. Next, click in the body of the graph. Make sure you do not click on a data point or a gridline. Right click and select “Format Plot Area”. This allows you to select the color for the background of your plot.
3. You have successfully formatted your chart. Congratulations!