Homework # 1
Learning to plot data with Python

Plotted data is the primary way that scientists communicate their results. It is imperative that you know how to plot data efficiently and in varied methods. This exercise will get you up to speed using Python, which is a powerful scripting language that is used in many physics labs, computer science courses, and even in industry. Python is free, so everyone can learn to use it.

1) Install Python on your own personal computer, using instructions listed in the PythonInstall.txt document. If you do not own your own computer, you may instead use the laboratory computer. Since this is a public computer, please use your own named directory and back it up on a USB stick.

2) Run the program example_plot.py. Please read the program script to understand how the python code makes the 3 plots. Rename and edit this script to make other plots.

3) The file RateT.txt is a comma separated value table of temperature (in Celsius) versus reaction rates. This data file is on the class website, along with this homework file. **(a)** Convert the temperature data to Kelvin, and then **(b)** graph the data in an Arrhenius plot. **(c)** Why does the data plotted in this way lie on a straight line? **(d)** From this plot, obtain the activation energy and prefactor.

4) HeatCapacity.txt is a file giving temperature (in Kelvin) versus heat capacity of a metal. Given that the metal heat capacity scales as $C_V = AT + BT^3$, where A and B are constants describing the electron and phonon heat capacity, **(a)** figure out a way to plot the data so that it lies on a straight line. **(b)** What are the coefficients A and B for this data?

5) Flow.txt is a file describing tube diameter versus water flow rate. **(a)** Plot the data using the 4 possible combinations of linear and logarithmic plots: plot(), semilogx(), semilogy(), and loglog(). **(b)** What plot gives the clearest and most descriptive presentation of the data, and why? **(c)** What is the power law behavior at small d and large d? **(d)** Guess an approximate formula for the flow rate versus diameter.