Numbers in Science

By Simon Dalley, Southern Methodist University

Introduction

This "lab" is a warm-up to give you, or remind you of, the basic ideas for handling numbers in labs. In scientific labs you measure things and then represent and calculate with the results of your measurements. In this session you will only be representing and calculating with numbers (data) that are already provided.

Scientific Form

1. **Without using a calculator, write in scientific form**
   - **(a) 0.00125**
   - **(b) 20700**
   - **(c) $(2.5 \times 10^{6}) \times (2 \times 10^{-12})$**
   - **(d) $(1.25 \times 10^{4})/(5 \times 10^{-3})$**
   - **(e) $(4 \times 10^{6})^{1/2}$**
   - **(f) $3 \times 10^{10} + 3.07 \times 10^{12}$**

2. **Rewrite in scientific form without prefixes on the units**
   - **(a) 0.01 mm**
   - **(b) 22 kms^{-1}**
   - **(c) 144 nm^{2}**

Precision

3. **Write to 3 significant figures**
   - **(a) 2.222**
   - **(b) 2.226**
   - **(c) 0.074007**
   - **(d) 704239** (use scientific form)

4. **Write to 2 decimal places**
   - **(a) 34.6582**
   - **(b) 0.00007**

Tables

Always put data from your measurements neatly in tables (use a ruler for vertical lines; your notebook already has horizontal lines). Label the column headings and don't forget the units. For example

Trial	Diameter (cm)
1	4.5
2	4.7

5. **Represent the following data pairs in a table**

   (distance, time) = {(2.7cm, 5.9s), (2.9cm, 6.8s), (3.3cm, 7.5s)}

Calculations

Often you will need to repeat the same calculation several times using data that you have measured. You should always clearly show the general formula or idea you are using and display the actual steps of the calculation for at least one set of data. For example

height $y = \frac{1}{2} g\, t^2$

$y = 0.5 \times 9.8 \times (0.6)^2 = 1.764$ m

6. **Using a calculator, calculate the speed for each of the data-pairs in question 5 (rounded to 2 digits) and add a 3rd column to your table to represent the results**

Graphs

Graphs are good for seeing trends in data. You should draw on graph paper if it is in your lab notebook. Draw axes with a ruler and label the quantity (and its units) being represented on each axis. Decide the scale for each axis so that the graph is as large as possible for your data range and label several regularly-spaced values of the quantity on each axis. Do all this before you plot the data.

7. **Plot points on a graph to represent the distance-time data from your table.**

A trend in the data can be highlighted on a graph by drawing the best smooth line among the data points. Although there are precise mathematical fitting techniques to do this, you can also do this conceptually (by eye). Do not force the line to go through each data point exactly; if the points do not lie on a smooth curve, nearby points should scatter evenly either side of the curve.

8. **Draw the best straight-line through the data on your graph**