Great Ideas that Shook Physics and the World
Physics 296 Laboratories

A little guide to the world of experiments and labs

Appetizer (avoiding fears and inhibitions):

The following guidelines should be viewed as a set of recommendations rather than rules and orders of a higher authority. We assume no previously acquired knowledge of science and we want you to have fun with the experiments. Unless explicitly stated, you are invited to take advantage of your creativity and choose the order in which you want to do your measurements and how you want to organize them. Nothing should prevent you from going beyond the scope of the general instructions. As a matter of fact, scientific advancement often requires rethinking certain rules and this implies an open mind and the desire to go beyond the achieved.

Equipment and tools:

"What is this meter stick good for ?" It is always a good idea to make sure you find all the equipment you actually need, whether tools, electrical devices or specific instructions to the measurements you are currently working on. In your notebook you should always state at the beginning what you have used and for what purpose. This can be very brief and should not be longer than a few lines.

Collecting data and interpreting them:

Write down what you have measured (whether a distance, a time interval *etc.*) or – in case there is no need for numerical values – what you have observed. Discuss in which order you have done things and how you have proceeded. If applicable, write down your collected data in tables or generally in a structured manner so one can see what the parameters of your measurements were. It is also very important to know not only the magnitude of a value but also its unit. It makes a difference whether someone is 1.80m tall or 1.80km ! This is the main part of your lab report and should be roughly one page long. Teamwork, as in any science, is crucial in physics. Often more than one measurement of something is appropriate. Hence, provided you have sufficient equipment, in a group you can save time by measuring simultaneously. For instance while you are reading off values from a ruler your partner may write down these values. This method enables you to have different perspectives of one and the same object. But it is up to you to find the most efficient method.

We suggest you collect a sample of data rather than measure a value once and take for granted that it is correct. A simple statistical method is perhaps to calculate the average value of a data set by summing up all the values and dividing them by the number of data. This yields not only a more reliable result for your measurement; it also displays how far off certain data points are from this average value, thus providing a certain measure (or feeling) for the fluctuations in your data set. It tells something about how consistent your measurements are.

Conclusions:

The most detailed and in depth analysis makes no sense if it is not followed by some concluding critical and self-critical remarks. It may only look like the closing paragraph but it is most important that you commit to a statement. You should clearly explain whether you appreciate the results of your experiment and whether these results fulfill your expectations. In case you are in disagreement with what you expected try to find out what could have gone wrong. If possible, numerical results should be compared with those calculated with the help of the formulae provided in the specific labs. Constants used in the labs (or those you will have to measure) will be introduced and explained in class. Suggestions are welcome and perhaps you might want to let us know possible improvements of the labs.