PHYS 4211 Guide to Writing Lab Reports

T.E. Coan
March 2011

Your lab report needs to have at least: abstract, theoretical motivation, technique and apparatus description, figures, data and error analysis, conclusion and references. Your goal is to convince the intellectually serious reader **who has not yet performed the lab** that the experiment you performed is physically significant and that the experiment was competently performed. How do you do this?

Begin by writing an **abstract**, a *brief* summary of **what** you measured, **why** you measured it and **how** you measured it. If you write more than 5 sentences you are probably too verbose. The abstract should convince the reader that the remainder of the report is worth her time to read. The trick is to do this using a minimum number of words. Label the abstract explicitly so the reader knows where to start.

The report's theoretical section should describe in significant, but not necessarily exhaustive, detail the physics you hope to uncover with the measurement, the measurement technique and apparatus description, the method used to "reduce" or interpret the data, and a conclusion summarizing the lab's results and comparing them to better measured vaues. Include detail sufficient for the reader to have a clear understanding of what was done and **why** it was done. Minimize historical commentary.

Use figures when your writing gets too clumsy. **Take a picture of your experimental setup if you can.** Label the objects in the picture. There should always be a figure of the experimental configuration. The figures do not need to be machine made but do need to be clear. Give them captions so that the reader knows what she is looking at. **If your figure is a plot, label the axes, with units!** It is extremely annoying to stare at a plot and then be forced to guess about what is being plotted. If you are trying to hide something then maybe the reader should spend her time reading something else.

Put raw data in an appendix to your lab report. The plot of the data goes in the body portion of the report. If you have lots of raw data, then share the formatting of it with your lab partner. There is no need to duplicate this effort. Spend time on the intellectual portions of the lab report.

You will need to estimate the accuracy with which you think you measured the physical quantity of interest. So, final results need to have an **error.** "If it doesn't have an error, it ain't a measurement." This idea should be clear from PHYS 1105/1106. Determining the best way to estimate your errors is an important part of your writeup. Regardless of the method you use, you need to be explicit about how you compute your errors since they are the primary gauge of how seriously the reader should take your results.

The report should list **references** so that the reader can read a more complete discussion of some underived result you mention in the report's text. Include only those references that you actually used and found useful. Use a standard way of indicating bibliographic references, such as that found in your modern physics book or any upper level physics course. Also, the majority of your references **cannot** be web references. The web is notorious for being an irresistible venue for any idiot on a soapbox. Place the references at the end of the report on a separate page. Only as a last resort mention my writeups as a reference. When I see my name, I am suspicious that you did any outside reading.

How long should your report be? That depends. The length should be commensurate with what you want to explain, and no longer (or shorter). A good rule of thumb is that "every word should tell." Do not pad the the text like you might be tempted to do in other classes. Doing so in physics tends to make the writer look stupid, ignorant, or both. (What an accomplishment.) If you do not know what you are writing, you can be certain the reader is equally lost. Be certain to **paginate the report and use 12 pt font, double spaced lines** so I have room to comment. (The font size and line spacing can be set in any text editor.)

Write in a style that is comparable to that of your modern physics text. I also suggest that you edit your report until you do not wince when you read it. **Reports must be typed.** I do not find misspellings and lousy grammar endearing.

Finally, some students like to spend money on fancy bindings. This is unnecessary. Just staple the pages of the report together.

Lab Report Check List

- Abstract
- Theoretical motivation
- Apparatus description
- Data analysis and error estimation section(s)
- Conclusion (how do your results stack up against better measured values?)
- Paginate (Look it up if you do not know what the word means.)
- Number figures and plots
- Label plot axes with the variable name and its unit(s)
- Include references
- Print on both sides to save paper