

## How to write a Senior Physics Lab report

The style of the Senior Physics Lab reports is that of a scientific journal paper. The main difference is that journal papers are about new research, whereas the lab report is about an established experiment that you conducted in the lab. Nevertheless, the intention is that you obtain some practice in the concise and accurate style of writing that scientists use. This is an essential skill for a science graduate.

To gain an idea of the structure of a scientific paper, it is recommended you visit some physics journal WebPages and look at recently published papers. You can try the Journal of Applied Physics on:

<http://jap.aip.org/>

If you are using a University of Sydney account to do your web-browsing, then this will give you access to all the papers. However, if you are using a provider other than the University, then chances are you will not have access to all the papers since that needs a subscription fee. However, you will have access to sample papers, which will serve the same purpose. Caution – do not choose a review article. These are generally very lengthy and do not follow the same structure as a standard paper.

The following is the general structure of a paper, but as you will find from browsing the published literature there are variations that depend on the content of the paper. However, use the following as a basis from which to work.

### **Abstract**

This is a paragraph at the beginning of a paper that summarizes the experiment, the major results and their implications. As a result, many people write the abstract after they have finished writing the paper. When conducting a literature search, it is the abstract that is accessible to everyone even when the whole paper is not (you usually have to be a subscriber to a journal to obtain the full paper). So the abstract is very important for informing the readers of the contents of a paper. This enables readers to decide whether to obtain and read the full paper. A good abstract will save the reader a great deal of time.

### **Introduction**

This section is where the paper starts and does not rely on the abstract. It includes some background or history to the area of research. It is very rare for an idea to arise by itself since there is always some precedent that has led to the ideas being tested in an experiment. It might also include some application of the principle behind the experiment. For example, say the experiment was about the sign of the charge carriers in a semiconductor. One application is a magnetic field sensor that uses the Hall Effect. Finally, some motivation is required for conducting this experiment. Why would anyone want to conduct this experiment? What did you test or examine? That is, give the reader a “road-map” about where you are headed.

### **Theory**

If there is some background mathematical theory or qualitative ideas that need to be introduced so that the experimental results can be understood, then this is the place to do it. The section itself doesn't have to be called “Theory”. In fact, you will find it missing in some papers because there was no background theory to discuss. In many cases the theory is not extensive enough to place it in a dedicated section and is simply incorporated in the Introduction.

## **Experimental Setup**

Since the paper is about an experiment, then there must be some description of the apparatus used. A reader can only gain confidence in the results if they are confident that you had appropriate apparatus and were able to describe its function and limitations (every piece of apparatus has its limitations, no matter how expensive it is!). In many cases you need to describe in some detail those parts of the apparatus that are critical to the understanding of the experimental results. A diagram goes a long way in helping the reader understand your description of the setup. If more than one apparatus was used then you can use subsections.

## **Results and Discussion**

A discussion of the results is best placed along with the presentation of the results. It is very awkward for the reader and author to separate the results and discussion into two different sections. It is easiest to say that these are the results and this is what they mean. This section also includes an analysis of the results – if that is required. The experiments may have contained different parts. Then you can have subsections under the results and discussion section. Remember that the more you can connect the different parts of the experiment in your writing, then the better the paper/report will appear.

## **Conclusions**

A conclusion IS NOT a place where you say “... therefore, I conclude that I have discovered the following new physical principles ...” It is nothing more than a summary of what the experiment was about, the results, and what they mean. It is really an extended abstract (there is usually a word limit for an abstract). Quite often people skip reading the paper and go straight to the conclusion to save some time. This section is usually the weakest part of most student reports since they just want the report to be over and done with. Try to spend some time on this section. This will also help you in writing the abstract.

## **Common mistakes and helpful hints**

- Remember to write in the correct tense. You have already completed the experiments that you are reporting about. So they WERE done – they are NOT being now as you write the report. They are NOT going to be done as the reader reads further into the report. For example, the experiment WAS carried out and the results ARE presented in Fig. XX.
- Do not write instructions as if you are writing a laboratory manual.
- Do not write in dot point format. The writing must be in a narrative style.
- Do not do join-the-dots plots for your graphs. They do not convey any extra information. However, if you have more than one plot on the same graph and the points are scattered and interleaved, then it is legitimate to join the points simply to distinguish the points that belong to the same plot.
- Explain how you determined your errors. There must always be a reason for an error estimate.
- Always compare experimental and accepted values.
- Express discrepancies in terms of errors, not as small, large or 5%!
- Use Origin/Excel routines to determine errors in fitted parameters, but be aware of their limitations.
- Exclude any waffle when trying to explain discrepancies – show physical insight.