How to write a lab report

Scientific communications, including lab reports generally contain the following sections that appear in order; Abstract, Introduction, Methods, Data and Analysis, Discussion and Conclusion. The Introduction, Methods, Data and Analysis, and Discussion and Conclusion sections make up the body of the document. The abstract stands alone because it simply summarizes the other sections. Below is a detailed description of what should be written in each of the sections.

Abstract:

The abstract is a bit like a movie preview or the back cover of a book in that it is designed to help the reader to make a judgment about whether the rest of the paper is worth reading. It summarizes each of the sections.   Therefore, it should always be the last section that is written, even though it appears in the document first. A simple recipe for writing an effective abstract is to start with a sentence that summarizes the experiment that was performed and then form a paragraph by adding summary sentences of each of the other sections of the lab report.

Introduction:

In a scientific research article this section of the paper is devoted to making the case for why the work is important and significant and for discussing the previous work reported in the literature that has led up to the work being reported in this paper.   In a lab report the nature of the introduction section is a little bit different than in a research article. In a lab report you should focus the introduction on the learning goals of the experiment. Discuss how the experiment is designed to achieve these learning goals and how the experiment fits in with the broader curriculum of the corresponding lecture course.

Methods:

This section should provide the details of how the experiment was carried out. It should not be written as a recipe but more as a journal entry; a fairly detailed account of what was done in lab. A description of how the data was processed should also be part of the Methods section.

Data and Analysis

When appropriate you data should be displayed in tables and figures. The figures and tables should have captions that describe what they are illustrating.   You should also prepare sentences that introduce the tables and figures and describe what they show.   To an extent these sentences and the captions will be and should be somewhat redundant.

Discussion

In some papers these are combined and in other they form two different sections. We will keep them separate in this course. The discussion section will discuss the significance of the findings from the data

analysis section. It is also in this section the questions that are being asked are addressed in the context of a well-written paragraph.

Conclusion

Finally, a sentence or two is needed that summarizes what was accomplished in this experiment and perhaps what was learned from the experience.

Writing style: One of the most challenging things for many students is learning the art of writing in the passive voice. Lab report writing is a form of technical writing. It is not like other works you are used to producing, such as email messaging, letter writing or even English composition papers.   In science, the experimenter is immaterial. The experimental details and results are what is important. So, never use any pronouns. Also, do not waste words. For instance, "~~In this lab we~~……~~or the goal of this experiment was~~…..~~or we determined the~~…. Good science writing is written in relative short, clear and concise sentences. It should read a lot more like a newspaper article than a novel.

Here are examples of a poorly-written and a well-written abstract for the first lab in CHEM 117.

Poorly written abstract:

In this lab we determined the density of a polystyrene ball. We measure the volume using three different methods and we measured its mass using two different balances. We used the measured volume and mass to calculate the density. We also combined the uncertainties in these measurements to get the error in the density. We compared the data obtained from the different methods.

What is wrong with the above abstract?

Well-written abstract:

The density of a small polystyrene ball was determined using its measured volume and its measured mass. The precisions of three different strategies for measuring the volume of the sphere and four different strategies for obtaining the average mass of a polystyrene ball were measured and compared. It was found that measuring the volume of ten balls by the water displacement method provided the best precision in measuring the average volume of the polystyrene balls. It was also found that measuring the mass of ten balls using an analytical balance provided the best precision in measuring the average mass of the polystyrene balls. The density was calculated to be 1.129 ± 0.006 g/mL by propagating the uncertainties in the average volume and mass of the polystyrene balls. The precision in the density of the polystyrene ball was limited by the precision in the measurement of its volume. This experiment provided a good framework for gaining a deeper understanding of the concepts of mass, volume, density, precision, error propagation and experimental design.