Guidelines for Writing an Effective Lab Report

Lab reports should be computer generated, free of grammatical errors, double spaced, and written in complete sentences. You will be graded on the content, clarity, organization, and overall appearance of your report.

All lab reports contain the same sections in the same order. These are: cover page, abstract, introduction, methods/procedures, results, discussion/conclusions, and a list of references. Below you will find detailed information on the content and formatting of each of these sections. While other tenses are allowable in specific sections, in general, scientific papers are written in the past tense in a third person passive voice. In this tense, the object (not the writer) is the subject of the sentence (example: A beaker of water was heated).

Cover Page:

The cover page is the first page of your lab report and should include all of the items below:

**Descriptive Title:** The title should accurately reflect the nature of the experiment, including the purpose of the lab and the analytical technique. It is not a complete sentence, but should still read in a coherent and informative way. The title should be centered horizontally on a line that is about 1/3 of the way down the page (approximately where “Title” is written in the example to the left).

**Your Name:** Include your name separately from your lab partner’s name.

**Lab Partner:** In group labs, it is important to give your peers due credit. List the other members of your group here.

**Lab Section:** The days and time of your lab (example: TTh am)

**Dates:** These are the dates during which the lab was performed, not the current date nor the due date. Use the international format, in which the day is written before the month, and there is no comma (examples: 15 September 2014 or 15–17 September 2014).

The rest of your lab report may be continuous, for example the introduction can follow the abstract on the same page. However, you may need to leave space or insert a page break if a graph, figure, or data table needs to be inserted before the next section of your lab report begins. While proof reading your report for content and grammatical errors, also check the formatting and make adjustments to avoid bad page breaks and other issues which make the report more difficult to read and look less professional.
Abstract:
The abstract appears at the beginning of a lab report or scientific paper, but it is generally the last portion to be written. It is a brief synopsis of the entire report, and is done as a courtesy to other scientists. The abstract allows your peers to quickly determine if your experiment and results are of interest to them, so that they may focus their research on relevant materials. This is the only portion of your report that many people will read, so your wording should be considered carefully. It is where you try to sell the importance of your research to your peers, as you want them to read the rest of your report and hear your ideas. In as concise a language as possible, state the rationale for the experiment, a brief statement about the analytical technique, a summary of your results (including important numbers), and a summary of your conclusions (including error analysis). In publications, the abstract often has a strict word limit, so try to include all this information in roughly 3 – 6 sentences.

**Necessary components** (See separate Abstract Guidelines for more details on each component):
- Purpose and Analytical Technique
- Summary of Results
- Summary of Conclusions and Error Analysis

**Tense:** Mixed
The abstract can be written in a mixture of past tense (third person passive voice) and present tense for the work already completed and your current ideas, respectively.

Introduction:
Begin this section by providing the reader with background information on the subject of the lab (example: The boiling point of a liquid is determined by the strength of the intermolecular forces between the molecules, the molar mass, and…). Center any equations on a separate line, and be sure to define all variables. Your background information should be as concise as possible, while still being thorough. Next, clearly identify the purpose and analytical technique of the lab (example: The objective of this experiment was to determine the temperature at which water boils using a thermocouple temperature probe). End this section by describing the hypothesis being tested (example: As the water is heated, the temperature (kinetic energy) should continue to increase until a phase change occurs, during which the added heat is then stored as potential energy in the gas phase, and no further increase in temperature of the liquid occurs. By measuring the maximum temperature the liquid water reaches, the boiling point can be determined).

**Necessary components:**
- Background information, chemistry, and equations
- Purpose and Analytical Technique
- Hypothesis and how was tested by the experiment

**Tense:** Mixed
Methods/Procedures:
Begin with a list of the materials used in the lab. Do not include everyday items such as pencils and safety goggles. Include a figure (picture) of the experimental set-up (the lab equipment). You may draw the diagram by hand, or include a computer-generated diagram. Include a figure legend, and label all parts of your figure (see “Figures and Tables” below). Next, include a step-by-step summary of what actually occurred during the lab. This can be in list form or paragraph form. If there is any deviation from the steps in the lab handout, be sure to include how you did it. Your goal is to provide a brief, but detailed enough explanation, so that a stranger could pick up your lab report in ten years and be able to repeat your experiment exactly as you did it.

Necessary components:
- List of materials
- Figure of experimental set-up
- Summary of procedures

Tense: Past (third person passive voice)

Results:
All qualitative observations and quantitative measurements should be in presented in data table format. Include numbered table titles, and be sure to label the columns and rows of the data table, including units. Reference the appropriate table number when referring to data in the accompanying paragraphs. Some labs will also require figures or graphs to organize the data that you gathered, include numbered titles for these as well. These are followed by any calculations (include equations with variables and plug in numbers with units). A table of results of the calculations may also be helpful. Do not include any discussion or conclusions in this section.

Necessary components:
- Raw data and observations in data table format
- Figures and graphs
- Calculations
- Table of results

Tense: Past (third person passive voice)

Discussion:
Since many readers will skip to this section, begin with a brief summary of your results (one or two sentences, including major data such as the results of your calculations). Then provide a statement on what you can conclude based on these results (your interpretations). Be sure to restate your hypothesis and explain how the data supports or disproves your hypothesis. If accepted values are known, include the accepted value, provide a statement of agreement between the experimental value and the accepted value,
and a percent error. Also discuss each experimental error which is known to have actually occurred. You must follow each error through your calculations and specifically state how it would have affected your results and whether or not this explains any deviation between your results and the accepted value. Be insightful, and put a lot of thought into your discussion.

**Necessary components:**
- Brief summary of results
- Conclusions/interpretations
- Restatement of hypothesis and whether or not it was supported by the experiment
- Accepted values if they are known and a statement of agreement with % errors
- Error Analysis

**Tense:** Mixed
This section should be written primarily in the present tense, as these are your current thoughts based on the results of the experiment.

**References:**
Be sure to give credit to the sources from which you gathered your information, including books, journals, lab handouts, class notes, and websites. At the end of the lab report, include a list of all the references that you used. This should be in alphabetical order by the last name of the first author, and contain all the information needed for someone else to look up this information for them selves. In a typical lab report, you are likely to draw information from your lab manual, text book, class notes, and handouts (including this one). Below are a few examples of how to cite these and other types of references:

**A Website:**

Website Owners: **American Meteor Society**

**When you accessed this information:**

**A Journal Article:**

Author(s): Rodhe, H.
Title of Article: Human impact on the atmospheric sulfur balance
Name of Journal: *Tellus*
Page Numbers: 110-122
Volume (Issue): 51(B)
Year: 1999.
A Book:


A Handout:

Romero, A., Laboratory Report Guidelines handout, CHEM 1B, Cabrillo College, Fall 2013.

Course Notes:

Romero, A., Lecture Notes, CHEM 1B, Cabrillo College, Fall 2013.

You must make a list of references at the end of your report as described above. You may also choose to cite the sources of your information in the text of your report as you go along. This is optional in this class, but good practice for future work. To do this, use the last name(s) of the author(s) and the year in brackets (example: [Seinfeld and Pandis, 1998]). If the material from this source is only used in one sentence, put the citation directly after the information from this source. This could be mid-sentence or at the end of the sentence, and should be placed inside the period. If the reference was used in several sentences, cite the source after the last sentence or at the end of the paragraph, outside of the period. If the reader is interested in finding out more about what you have said, they can then find the full citation at the end of the report, so that they can look up and read the reference materials themselves.
Figures and Tables:
Include a legend (a numbered title and explanation) above each table or graph, and below each figure. Label each part of your figure. Include units on all measurements, and on each axis of a graph.

Table 1. Mass and Volume Data

<table>
<thead>
<tr>
<th>Object</th>
<th>Mass (g)</th>
<th>Volume (mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Object 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Object 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Object 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Object 4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Graph 1. Titration of an Acid

Figure 1. Direct Heating Method
Lab Report Outline:

Cover Page
Title
Your name
Group Members: Names
Lab Section
Date lab was performed

Abstract
Purpose and Analytical Technique*
Summary of Results*
Summary of Conclusions
Error Analysis*

Introduction
Background information, chemistry, and equations
Purpose and Analytical Technique*
Hypothesis and how it was tested by the experiment*

Methods
List of materials
Figure of experimental set-up
Summary of procedures*

Results
Raw data and observations in data table format
Figures and graphs
Calculations
Table of results

Discussion
Brief summary of results*
Conclusions/interpretations
Restatement of hypothesis and whether or not it was supported by the experiment *
Accepted values if they are known and a statement of agreement with % errors*
Error Analysis*

References
Alphabetical list of references

* use third person, passive voice, past tense