Writing Guidelines for Laboratory Reports

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A. General Requirements
All written work submitted in the course should meet the following standards:

1. Use proper spelling and grammar in your writing at all times. Be clear and write in a scientific style. Do not use first and second person. Pay attention the tense and voice (active or passive) of the verbs. Use past tense to describe work performed in the lab. Passive voice is usually more appropriate for scientific writing.

2. All work must be typed using a word processor. Use a reasonably large font size (12 or 13) and a readable font such as “Times Roman”. Learn the procedures for formatting all parts of a document as soon as possible.

3. Chemical and physical equations must be correct within your reports. Many equations can be formatted using general format commands and inserted characters or symbols. However, it is advisable to master the use of the equation editor within the word processor. Equations must be numbered and the variables should be defined.

4. Perform repetitive calculations and prepare tables using spreadsheet programs such as Excel, Lotus, or Quattro Pro. Numbers from these programs can be directly imported into the word processor for tables. All tables should be labeled with a caption and numbered.

5. Prepare plots of data and results using the spreadsheet programs. Plots for use as figures in a report can be printed directly from the spreadsheet or imported directly into the main document in the word processor. Label all figure numbers and titles or captions.

6. If recorder or instrument output is submitted with the report, it should be cut to size and attached to 8_ by 11 inch paper.

7. Number the pages if there are two or more pages.

8. Use a cover page on reports and include the title of the report, your name, your lab partner’s name, the dates the experiment was performed, the due date.

9. Staple the report before handing it in. Do not use a paper clip.
10. All written material must be the independent product of the student submitting the work. While students in the course, especially lab partners, are encouraged to work together, all calculations, plots, and writing must be done individually. Cite all material from the textbooks and journal articles used in written work.

B. Parts of an Experimental Report

The written reports required for this course follow the general format of scientific papers. It should be noted that papers written for the various sciences, different fields within a science, or different courses will vary in certain aspects of formatting. A good source of guidelines for chemists is “The ACS Style Guide”, published by the American Chemical Society. Follow the guidelines below:

1. Title
   The title of the experiment should be centered at the top of the first page of text.

2. Summary or Abstract
   In one or two paragraphs an abstract will tell a reader what work was performed, how it was performed, why the work was done, the main results of the experiment (including statistical analysis), and the main conclusions of the work. Try to be complete, but do not overwrite an abstract. Beginning students often start an abstract with the phrase “In this experiment something was measured...”. A better way to begin is “Such and such was determined by a certain technique...”.

3. Introduction
   The introduction section will present a wide variety of information, and should be broken down into parts using subheadings. Explain the purpose of experiment in terms of what is being studied and why it is important to do so. The general analytical and/or instrumental technique used should be explained in enough detail to present general principles and applications, and the specifics of the current work. Give all relevant chemical and physical equations. Give equations their own line and a number, and do not forget to define all variables and constants. For all instrumental experiments, include a figure to illustrate the experimental apparatus. This can be done utilizing a block diagram.

   Avoid using the “kitchen sink” approach to writing an introduction. While everything that is important must be included, the material must be presented clearly and concisely.

4. Experimental
   Experimental sections should contain enough information to allow a reader to reproduce an experiment. Refer the reader directly to the course handout since it will contain all the necessary information. Do not copy the handout or even summarize the procedure. If any changes to the given procedure were made, then note them in this section.
5. Results and Discussion

In general, this section of a report will consist of text, tables, and figures (plots and graphs) and logically move through the different portions of the work performed in the laboratory and the analysis of the data. Present the results of the experiment in an organized manner by dividing this portion with appropriate subheadings as is done in the introduction. Discuss the results produced by the calculations and presented in the figures. Tell the reader how these results relate to the original purpose of the experiment. Refer back to the background material presented in the introduction in order to illustrate the significance of the results.

a. Figures and Tables

All figures and tables should be offset from the text or on a separate page. In either case, they should appear in the report soon after the first time mentioned in the text and be numbered consecutively with Arabic numerals as “Table 17” or “Figure 137”. If a table or figure is not referenced in the text, it does not belong in the report. All tables and figures must have a title or caption.

Tables are best used to organize related data and results, if this will aid the reader in understanding the work. Do not forget to properly label the columns and to give the units.

Figures should illustrate the results clearly, good or bad. Label each axis and do not forget to include the units. For data points, use symbols that are large enough for a reader to see. If a fit line is included, label the fit as such, and indicate the algorithm that was used for the fit.

b. Statistical Analysis of Error

Each experiment performed in this course will require statistical analysis of the results. Both experimental accuracy and precision may need to be considered. If the actual value of the result is known, from calibration with standards or reference materials, then an absolute and relative error may be calculated and accuracy should be discussed. Reasons for deviations should be postulated.

Precision can be considered when multiple trials are performed. Report the standard deviation and relative standard deviation. Consider the factors that contribute to uncertainty. Discuss any least squares analysis or propagation of error calculations that were performed.

Avoid generalities when discussing statistical analysis. Instead of saying the results are good or bad, state the actual error and whether this is acceptable for the subject experimental method or application.

6. Conclusions

This section of the report summarizes the findings of the experiment and should be brief, at approximately one paragraph. Do not simply repeat material found in the discussion. Briefly state what was learned by performing the experiment.

7. References
All sources of ideas presented in the report should be referenced properly at the end of the text of the report as “endnotes” rather than “footnotes”. At this stage it is better for students to over reference rather than under reference. It will be necessary to go to the text, other books, and journal articles, in order to properly write the introduction and discussion sections. So each report will require references. All word processors allow for the easy insertion of references into text and it is expected that students will learn to do this for the first report. In addition, the proper format for referencing textbooks and journal articles must be followed (hint: Use a “manual of style” or look closely at any textbook).

8. Appendices
   Appendix 1 contains the carbon copies of the data from the laboratory notebook. Appendix 2 contains all calculations not presented in the results section. Appendix 3 contains the output, or photocopies, of recorders or instruments. Be sure to label these completely. Refer to them in the text and treat them as figures.