Writing a Laboratory Report

by

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INTRODUCTION

This paper presents the basic techniques for the preparation of a laboratory report or, more specifically in Chem 002, a report of work performed in response to a request from management. Although most students do not understand this while at a university, once they have obtained employment by far the majority of their effort will be devoted not to science or engineering work in the laboratory, but to writing reports to management on the work of their technicians. Indeed an individual's progress in a company will very much depend upon his or her ability to effectively communicate with management. Thus, one of the goals of Chem 002 is to introduce the effective communication of scientific or engineering results through the preparation of written reports.

This paper will first introduce a proposed outline for such a report and then will provide some of the technical details which are important in its preparation. One of the most important aspects of effective report preparation is the appropriate and consistent use of English grammar. Many of these points are covered in some detail toward the end of this paper. Finally, Appendix I indicates how the Chem 002 laboratory reports will be evaluated by the teaching assistants.

If carefully followed during the writing of a report, these guidelines will help in preparing articulate, well organized, laboratory reports for Chem 002. Please note that, for the purposes of the Chem 002 reports, you *must* respond directly and specifically to the letters in the packet of experiments. This means that for the two experiments you must *both* prepare a cover letter to your supervisor responding to his request and ensure that your attached report responds directly to his or her request. Failure to do so and to comply with the expectations of the letter will lower your grade, and you may be required to rewrite your report.

Brevity

Technical reports should be as concise as possible for complete and unambiguous communication of the required information. Reports should *not* be any longer than is necessary to communicate the requested results and conclusions. Remember that supervisors do not have time to read a 20 page report, especially when a 5 page report can communicate the same information.

Audience

In writing a report it is important to determine the background of the anticipated reader. For a technical report, it is usually acceptable to assume that the reader will have the scientific or engineering background typical of an individual with a B.S. in the field. Indeed this is the assumption to make in writing a Chem 002 report because the teaching assistants do have such a background. However, reports prepared in a commercial environment may well be passed up the chain of command, and hence it is often desirable to include a non-technical summary.

Plagiarism

To plagiarize is defined as "to appropriate as one's own the writings, ideas, etc., of another" [1] or "t take and use another person's thoughts, writings, inventions, as one's own" [2]. Plagiarism is an act o academic dishonesty which, if discovered in Chem 002 laboratory reports, may result in a grade of zer for the report, failing Chem 002, or dismissal from the university. So the writer *must* be sure to bot enclose in quotation marks any quotes from the work of another person and give a reference to the sourc of the work. Summaries and paraphrases of another person's work or ideas, even though expressed i your own words, must also be referenced.

OVERALL CONCERNS

Format

Your reports *must* be prepared on a computer using a commonly available word processing program Virtually all your future reports will be prepared in this way, and you must learn to use such systems Reports should *not* include handwritten changes and/or corrections; such changes are the sign of a sloppy, hastily prepared, report. For the purposes of the two Chem 002 laboratory reports, th handwritten and signed experimental data sheets *must* be included as an appendix at the end of the report.

Laboratory reports are typically printed on one side of white 8.5 x 11 inch paper and stapled in th upper left corner. In some cases it may be appropriate to present the title page on the stationery of you laboratory or company. In the past it was often stipulated that reports should be double spaced, but wit the current use of computer word processing programs, it often seems better to use single or 1.5 lin spacing. This paper has used Word 6.0, the Times 12 point font, 14 point single spacing, double spacin to offset the major headings, and 1.5 cm margins. It is preferable to indent paragraphs by about 0.5 cm in which case there should not be a blank line between paragraphs. The pages should be numbered in th upper right-hand corner, but usually 1 is omitted from the first page.

As will be discussed in more detail below, references, figures, and tables should be numbere sequentially and the figures and tables introduced into your report near the point at which they are firs mentioned. Normally the references are gathered together at the end of the report. One exception to thi rule is a typescript which has been prepared for publication in a scientific or engineering journal. In thi case the tables are grouped together after the references and are followed by one or more pages of figur captions and then the figures.

In general you should avoid using underlining to highlight items in the text. This is a practice whic remains from the days of the manual typewriter when boldface and italic fonts were not available. Now is much better to use italic or bold face fonts to emphasize certain words, but such use should b restricted to *only* those points which must be emphasized.

Organization and Outline

Careful organization of a report is essential to effective communication and, furthermore, it often help the author to better understand the problem under consideration. Clear and concise writing often force the scientist or engineer to more clearly think through the various aspects of a problem and may well lea to a better solution to the problem.

Normally a format which uses boldface headings and non-boldface subheadings is favored because helps both the writer and the reader to divide the text into convenient sections. An organizational form with the following headings provides easily recognized locations in the text for specific information which the reader may want to return at a later time

Title Page
Table of Contents (if necessary)
Abstract
Non-technical Summary (if necessary)
Introduction
Experimental Methods
Results and Discussion
Conclusions
Acknowledgments
References
Appendices (if necessary)

In a short report these subheadings are typically unnumbered, but in a longer report it may be helpfu to Roman numeral number the headings for easier internal cross reference. This format also permit specific information to be associated with a given section and thus helps the reader to quickly find th material of specific interest. For longer reports it may be helpful to add a table of contents after the titl page and abstract.

SECTIONS OF A REPORT

Title Page

This page should start with a short title for the report. Usually the shorter the title the better. It is ofte useful to write out several different versions of the title because, in so doing, the best title often become obvious. The title should be followed by the full name of the author and his or her complete address. Th author's telephone number, fax number, and e-mail address are usually included. In many instances th date and recipient of the report should also be given on the title page.

In order to avoid confusion between different drafts of a report it is usually advisable to include a dra number and the current date on early drafts of a report. For the purposes of the Chem 002 reports the titl page should also list the names of laboratory partners and the teaching assistant.

Abstract

An experienced reader of the technical literature, with a specific question he or she wants answered often turns first to the abstract of a paper to see if it might provide the answer. The ideal abstract wil allow them to quickly determine whether the report provides the required answer. Thus the abstrac should summarize the main ideas and purpose of the report in one or two sentences. Then the gener scientific or engineering methods should be summarized in one or two sentences. This should b followed by one or two sentences covering the new results and the conclusions that follow from the ne results.

The abstract is in essence the report in a "nutshell." It is probably best to write the abstract after th actual report is finished. The abstract should give the *results* which are presented in the report and shoul *not* be a statement of the experimental procedures used to carry out the work. The reader wants to quickl know the *results* of the work and not necessarily the methods used. The abstract should allow the read to learn the major conclusions of the report without having to read the full report in detail. The abstra should be short, and usually it should not refer to or contain figures, tables, or references. Normally should not refer to earlier work and should not attempt to place the work in the context of earlier work.

Introduction

The introduction should lead the reader into the subject of the report by discussing the problem being investigated, the principal purpose, idea, and/or goal of the work, as well as its nature and scope. The introduction should also set the work in the context of earlier related work and should provide reference to this earlier work.

The writer should remember that the purpose of his or her future professional writing will be to report on the products, processes, investigative capabilities, and services available from your company. It will *not* be to write reports which "give us an understanding of ..." or "teach us to use ..." something. This is often a major downfall of many student laboratory reports. Your introduction and subsequent report should avoid this limitation.

Experimental Methods

This section should provide enough detail about the experimental procedures for a scientist or engineer reasonably familiar with the field to repeat the work. The source and purity of commercial chemicals and specific details of the preparation and purity of any new compounds are usually given in this section. If the work includes the preparation of known compounds it is not necessary to give details, but a reference to the original paper reporting the preparation should be given. The names and manufacturers of commercial instrumentation and/or references to the details of any special instrumentation or procedures should also be given.

This section is a report of what procedures were followed in your investigation; it should be written in the past tense and reflect the actual procedures followed. A later investigator should be able to repeat the experiments based on this section of a report.

Results and Discussion

This section constitutes the body of the report, including the majority of the figures and tables, and as such requires the most attention of the author. Because it is the longest part of the report it may require several headings with subtitles tied more specifically to the section contents. These sections should typically cover any new theoretical models and/or procedures used in the analysis of the results, followed by the detailed numerical results, preferably with their standard deviations, presented in tables and then analyzed through a graphical presentation of the results in one or more graphs as a function of the independent variables. The discussion of these variations in terms of the composition and/or the physical and structural properties of the materials or systems under study should be integrated into this portion of the paper.

Unfortunately, many beginning students often think that the results "speak from themselves." But this is seldom true and the good writer will make a distinct effort to illustrate to the reader the important new information or insight into a problem that is contained within the results. Basically this is something that *must* be done and is often the hardest thing to accomplish. Sometime it may be more effective and helpful in overcoming fuzzy thinking to separate the results from the discussion and conclusions portions of the report.

In those cases for which earlier experimental results and/or theoretical models are available, comparison with the newly reported results should be given. At this point it is essential to remember that experimental results confirm theoretical models and not the converse. When possible, percentage error should be reported. In many instances a detailed discussion of the inherent and systematic error associated with the results should be given and any discrepancies in the data should be pointed out and

TECHNICAL WRITING

Writing Style

The most common mistake made in technical writing is the assumption that the reader perceives exactly what the writer is trying to convey. To avoid this problem it is best to be direct and to write in detail what the reader should learn from each section of the report. It may help to imagine yourself as a reader who knows the field, but does not know of your specific work in the field.

A typical error is to refer the reader to a table or figure and then fail to explain what the reader should learn from the table or figure. Good figure captions and table titles can help to eliminate some of these problems, but they are not a good substitute for clear writing.

Poor grammar, spelling errors, and misused words will distract the reader and reduce the credibility of the author. Indeed the opposite is also true; a well written paper devoid of errors will serve to enhance the scientific or engineering credibility of the writer. Some help with these problems is provided in the sections below, but the author must be sure to carefully proof read his or her writing. Failure to do so is often immediately obvious to the reader. Many hints for improving the writing style of your report may be found in the pamphlet *Ten Common Lab Report Errors to Avoid* [3].

Units

Except for unitless quantities which are ratios, the appropriate SI units or SI derived units [4] must be included with all numerical values. Failure to do so makes the numbers meaningless. Units must also be given in tables and graphs. The failure to always include units is a major error found in many student papers and it *must* be avoided. The appropriate SI unit abbreviations, [4] with no period and only capitalized if appropriate, should be used with the appropriate superscripts included to indicate the power, i.e., a cubic centimeter should be abbreviated cm^3 and not cc. Mixed units can be separated by the appropriate arithmetic operation symbols, such as in the case of density, g/cm^3. Note that the abbreviation for absolute temperature is K and not °K, whereas the non-SI unit for centigrade or Celsius temperature it is ℃ and not C. Rather the abbreviation C is used for the coulomb. A good way to determine the appropriate abbreviations is to check in a current chemistry textbook.

Equations

If equations are a part of a report, they should be offset, numbered sequentially, and incorporated into the text in a sentence which explains each term and its associated units. An example follows:

The ideal gas law is given by

$$PV = nRT, \tag{1}$$

where P is the pressure in atmospheres, V is the volume in liters, n is the number of moles, R is the ideal gas constant, 8.31451 J/mol K, and T is the absolute temperature in K. Notice that this is a case where non-SI units are often used. Specifically, in general chemistry the gas constant, R, is often given as 0.0821 L atm/mol K, which is an equivalent, but non-SI, value because the pascal, Pa, and not atmospheres, is the SI unit for pressure. Further, the liter is a non-SI unit. However, this is a case in which non-SI units are acceptable in a report because of their widespread use.

Chemical Reactions

If chemical reactions are a part of a report, they should be offset, numbered sequentially separately from the mathematical equations, and incorporated into the text. An example follows:

The following acid-base neutralization reaction,

$$H_2SO_{4\,(aq)} + 2\,NaOH_{(aq)} \rightarrow 2\,H_2O + Na_2SO_{4\,(aq)}, \qquad \text{(R-1)}$$

yields an aqueous solution of sodium sulfate.

It should be noted that a chemical reaction is *not* an equation and hence should be referred to as a chemical *reaction*, especially in all formal writing.

Figures

Figures include photographs, photomicrographs, graphs, schematic drawings, reaction schemes, and any related visual material that will aid in communication. Note that a table is *not* a figure and that the tables should be numbered separately. If there is more than one, the figures should be numbered sequentially in the text, i.e., Fig. 3 should be the third figure mentioned in the text. When a specific numbered figure or several figures are mentioned, figure should be capitalized and abbreviated, i.e., Fig. 3 or Figs. 4 and 5, but in other cases, as in this sentence, "figure" should be spelled out and not be capitalized. All figures in the report must be cited in the text and must have a caption placed below the figure, just as it would be in a book or newspaper. Additional redundant titles should not appear above or within the figure. The figure caption should contain enough descriptive text to permit the figure and caption to be understood, at least to some extent, without direct reference to the text. The number of figures should be limited to the minimum number required to communicate the results of the report.

Graphs

Graphs, which are vital to communication in a scientific report, require special attention. Carefully planned graphs can greatly enhance the appearance of a report and they are often essential for the effective communication of quantitative scientific results. In preparing a graph the nature of the ordinate and the abscissa should be carefully considered. In many cases a more effective graph can be obtained by simply switching the abscissa and the ordinate. In general it seems preferable for the independent variable, the variable for which you have the least control, to serve as the abscissa. Thus, in most cases time, temperature, concentration, energy, atomic number, and atomic weight are best plotted as the abscissa.

Whenever possible it is best to use a computer plotting program, such as DeltaGraph or KaleidaGraph, both of which are available in the chemistry department computer learning laboratory, to prepare your graphs. Several modern word processing programs allow you to insert the graph in the appropriate place in your report. A typical graph, prepared with DeltaGraph is shown in Fig. 1.

The words in the axes legends, other than articles and prepositions, should be capitalized. The units associated with the plotted values *must* be given and are usually separated from the axis legend by a comma, as is shown in Fig. 1, which shows a plot of the density of several bead samples [5].

In general it is best *not* to include the grid lines in the plot as they often detract from the easy observation of the data points. If the tick marks for the axes values appear inside the plot frame, the resulting graph appears more professional. The format of the axes values should be the same for all entries, i.e., the values should read 2.50, 2.55, 2.60, 2.65, 2.70, and not 2.5, 2.55, 2.6, 2.65, 2.7. In general it is good practice to use the appropriate number of significant figures for these values, i.e., in some cases the above values might have enough significance to be presented as 2.500, 2.550, 2.600

2.650, 2.700. Another good practice, when feasible, is to make the size of the data points reflect the erroi associated with their values. This is an especially good idea if error bars are not shown on the graph.

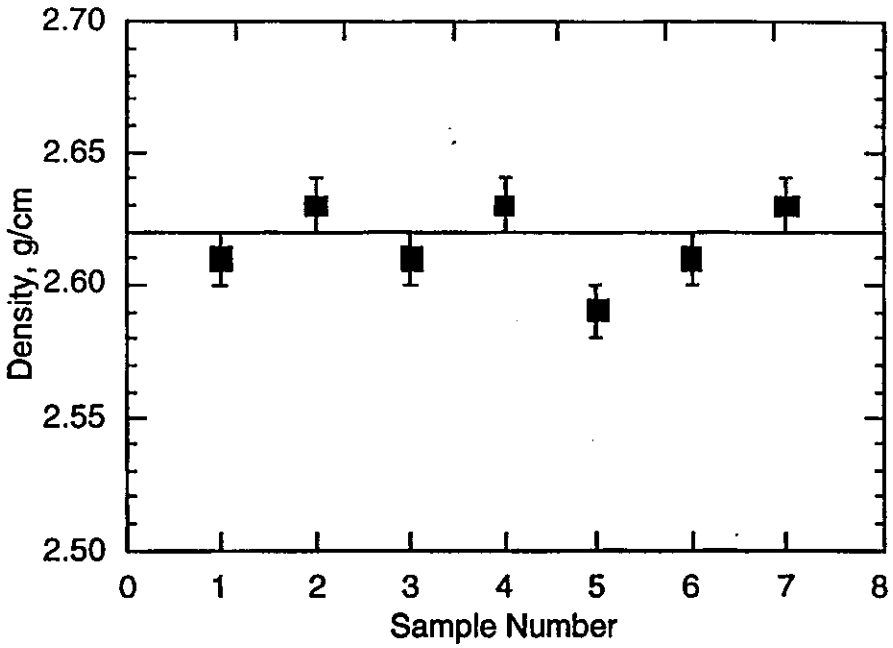

Figure 1. The density of several glass bead samples.

Tables

A table provides an efficient method for presenting and archiving experimental data. Unlike the graphical format, tables provide the exact numbers for future study and reanalysis. If there is more thar one, the tables should be sequentially numbered, and all tables must be referred to in the text. Many fields, including chemistry, use capital Roman numerals to number the tables, and thus the fourth table should be referred to as Table IV.

A table must start with the table number and a title above the numerical data. The body of the table and the headings should then be separated by lines. A table should normally contain at least six entries in two or more columns and rows. It is usually more efficient to avoid smaller tables and simply list the data in the text. However, for large data sets, well designed tables are a very effective method o communication. In designing a table it is often worthwhile to see if a more effective or compact table can be obtained by inverting the rows and columns. Sometimes it is convenient to give specific details abou the entries in footnotes which should be indicated with small italic letters in the table.The units for al quantities must be given either at the top of the column or at the beginning of the line, just after the quantity has been defined. A typical table of experimental data from the glass bead density experiment [5 is given in Table I.

Table I. The Density of Glass Beads.[a]

Mass, g	Volume, cm^3	Density, g/cm^3
3.78	1.45	2.61
4.00	1.52	2.63
3.89	1.49	2.61
4.16	1.58	2.63
3.57	1.38	2.59
3.84	1.47	2.61
3.94	1.50	2.63

[a]The average density, and its standard deviation, is 2.62 ± 0.01 g/cm^3.

References

Statements of fact or the citation of earlier work must be referenced in the text in order that the reader can have access to the pertinent work upon which the report is based. In general it is preferable for the references to be collected together on a separate page at the end of the report, a practice which also permits essential footnotes to be presented at the bottom of each page and separate from the references. The reference numbers must appear in the text in numerical sequence as either superscripts or in brackets, i.e., [1]. It is important to remember that the reference section of a paper is different from a bibliography, and only papers cited in the report should be listed.

One of the major difficulties that students have in writing a paper is using a consistent format for the references. A good way to avoid such difficulties is to select an important journal in the field and consistently use the format found in this journal. In this way one quickly becomes familiar with a specific format. Because Chem 002 is a chemistry course, the style of references used by the journals of the American Chemical Society seems an obvious choice. Thus the following reference formats are those used by the *Journal of the American Chemical Society*, one of the premier research journals in chemistry.

A reference should contain all the pertinent information necessary for the reader to find the cited paper or book. By convention most references to research papers cite only the first page of the paper and normally in chemistry journals the titles of such articles are not given as a part of the reference. Normally in chemistry journals only the initials of the author's given names are given.

If one is not sure of the correct form of a reference, often the easiest solution is to look at the references in a recent issue of the journal. Perhaps more important than the exact format of the references is the consistency of the reference style. It should be noted that the italic font and not an underline is used for journal and book titles. In this style no connecting article "and" is used in the author list, but in those formats where the conjunction is used it should be preceded by a comma only if there are three or more authors listed.

journal:	Grandjean, F.; Long, G. J.; Hutchinson, B. B.; Ohlhausen, L.; Neill, P.; Holcomb, J. D. *Inorg. Chem.* **1989**, *28*, 4406.
book:	Long, G. J.; Grandjean, F., Eds. *Mössbauer Spectroscopy Applied to Inorganic Chemistry*; Plenum: New York, 1989; Vol. 3.
book chapter:	Long, G. J.; Grandjean, F. In *Mössbauer Spectroscopy Applied to Inorganic Chemistry*; Long, G. J.; Grandjean, F., Eds.; Plenum: New York, 1989; Vol. 3, p 513.

report:	The AM1 calculations were performed with the MOPAC program, Quantum Chemistry Program Exchange, Department of Chemistry, Indiana University, Bloomington, Indiana, 47405.
thesis:	Mishra, S. R. *Doctoral Dissertation*, University of Missouri-Rolla, 1996.
communication:	Long, G. J. private communication, 1998.
unknown author:	*Webster's Third New International Dictionary of the English Language, Unabridged*, G. and C. Merriam Co.: Chicago, 1966.

Appendices

The details of calculations, the derivation of equations, the documentation of computer codes, etc., may be vital to understanding a report, but often are too long or detailed for inclusion in the body of a report. Such details are better placed in one or more appendices. All appendices must be sequentially numbered, usually with capital Roman numerals, and *must* be referred to in the text, e.g., A complete derivation of Equation 1 is listed in Appendix I. In Chem 002 reports the experimental handwritten laboratory work sheets, signed by a teaching assistant, must be included as an appendix to the report.

Voice, Tense, and Number

In general your reports should be written in the active and passive voices and the imperative voice should be avoided.

The past or perfect tenses should be used in writing a technical report. The past tense is obtained by adding -ed to the end of the verb. A good procedure for maintaining the proper tense is to "set up a time frame" in your mind and remember that things *done* in the past must be *written* in the past tense. In contrast, enduring truths should be in the present tense.

Virtually all technical writing should be in the third person. Pronouns such as **I**, **you**, **we**, and even the editorial **we**, should be avoided. Nobel prize laureates are the only notable exception to this rule and they may write in the first person and not be considered pompous. Another common error is the use of pronouns, such as **it**, **they**, or **them**, when the noun to which they refer is not clear from the context. One should also avoid over-generalized statements, such as: "It is well known that ..." , "It immediately follows that ...", "Most scientists agree that ...".

Spelling

Often the most glaring errors in a report are the misspelled words. Hence, whenever possible, it is advised that the writer use a computer spell-checker or dictionary. But the writer must be aware that such programs can neither detect words that are spelled correctly but used in the wrong context nor detect grammatical errors.

In this paper the *Concise Oxford Dictionary of Current English* [2] has been used for British spelling, the *New International Webster's Concise Dictionary of the English Language* [1] and *Webster's Third New International Dictionary of the English Language, Unabridged* [6] have been used for American spelling.

Perhaps the most difficult and easily mixed up letter pair in the English language is **i** and **e**. A good rule to remember is: **i** before **e** except after **c** and when the sound is "ay" as in neighbor and weigh. Other

exceptions are contained in the unusual sentence: "The weird foreigner seizes neither leisure nor receipts at their height, either being counterfeit and obeisant." Other exceptions to the rule include: sheik, stein, and seismic.

Some commonly misspelled words in technical reports include:

analyze, American spelling, analyse, British spelling
acknowledgment, American spelling, acknowledgement, British spelling
all right (not alright)
asymmetry (not assymetry or assymmetry)
boundary (not boundery)
calendar (not calender)
careful (not carefull)
desiccator (not dessicator)
dictionary (not dictionery)
engineering (not enginering)
enhance (not enhanse)
fourteen, fourth, forty (not forteen, forth, fourty)
fulfill (not fullfil)
height (not heigth or heighth)
license, American spelling, licence, British spelling
metallurgy (not mettalurgy)
precede (not preceed)
prepare (not prepair)
procedure (not proceedure)
proceedings (not procedings)
semester (not semister)
vacuum (not vaccuum or vaccum)

Plurals of some words, especially those of Latin or Greek origin, are often misspelled. Some typical examples follow:

singular	**plural**	**singular**	**plural**
analysis	analyses	maximum	maxima
appendix	appendices	medium	media
axis	axes	minimum	minima
colloquium	colloquia	octahedron	octahedra
crisis	crises	parenthesis	parentheses
criterion	criteria	phenomenon	phenomena
datum	data	spectrum	spectra
equilibrium	equilibria	tetrahedron	tetrahedra
focus	foci	thesis	theses
index	indexes	vacuum	vacua
locus	loci	vita	vitae

Another common error, which in a way can be considered a spelling error, is to capitalize a letter which should not be capitalized. Names of elements are not capitalized although the first letter of a chemical symbol is capitalized. The names of phases, compounds, and minerals are not capitalized.

The first letter of the names of scientific techniques, such as infrared spectroscopy and nuclear magnetic resonance spectroscopy, should not be capitalized when spelled out in the text, but sometimes may be abbreviated as IR and NMR. However, such abbreviations should be avoided in a text unless they are in common usage, as are IR and NMR, in the technical field covered by the report. With only a few exceptions, Roman numerals should be capitalized. Of course a major exception is the capitalization of the first letters of all words, except for articles and prepositions, in the title and headings of a report, in the title of a table, and in the legends of a graph.

Finally, one should be careful not to mix English and American spelling in the same report. Either spelling is acceptable in a technical report, but one should not use mixed spelling.

Excess Verbiage in Technical Writing

Excess verbiage should be avoided. Some specific examples follow:

Example	**Replace with**
In order to ...	To ...
Irregardless of the fact that ...	Even though ...
At this point in time ...	Now ...
the data points are ...	the data are ...
Because of the fact that ...	Because ...
at a temperature of 298 K ...	at 298 K ...
at different temperature values ...	at different temperatures ...

Commonly Misused Words in Scientific Writing

Several English words are often mixed-up, confused, or wrongly used. Two excellent references for help with such problems are Fowler [7] and Strunk and White [8]. Some example problems, and their correct usage, [1, 2, 7, 8] are:

affect *v.t.* produce an effect or influence
effect *v.t.* to cause or accomplish; *n.* the result or outcome

because *conj.* for the reason that
since *adj.* at some time between the past and the present

complementary *n.* that which makes a thing complete, e.g., the complement of an angle
complimentary *n.* an expression of praise or admiration

distance *n.* the length of space between two points
length *n.* measurement or extent from end to end, usually along the greatest dimension

high *adj.* extending far upwards, extending above the normal level
large *adj.* of considerable size or extent

plain *adj.* simple or ordinary
plane *n.* a geometric surface; *adj.* dealing with two coordinates

principal *adj.* first in rank or order
principle *n.* a general truth or law, an essential constituent

strength *n.* the quality or property of being strong
stress *n.* special weight, importance, or significance, physical or emotional tension

FURTHER ASSISTANCE

In many cases further assistance with specific problems can be obtained by contacting your teaching assistant or the University of Missouri-Rolla Center for Writing Technologies located in the Campus Support Facility building. However, it is a good idea not to wait until the last minute to seek assistance.

ACKNOWLEDGMENTS

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Appendix I

Chem 002 General Chemistry Laboratory

Laboratory Report Critique

Student Name:_____ Date_____

Lab Partner Name:_____ TA Name:_____

Your laboratory report has been graded on the basis of 20 points for the laboratory technical work and 20 points for the quality of the written report. The grading of the technical aspects of your report has been done using the same criteria as for all earlier reports. The basis for the quality grade, and an indication of any specific deficiencies, are given below.

Technical Grade (20 points) Grade_____

Presentation of Report (10 points) Grade_____

Format (does not follow expected format, missing pages, poor order)_____
Neatness (poorly printed, poor legibility, sloppy mechanical presentation)_____
Graphs (missing or poorly designed graphs, missing legends and units)_____
Tables (poorly organized, missing title, missing or unclear units)_____
References (missing, inconsistent format)_____
Spelling (errors, inappropriate capitalization)_____
Punctuation (missing commas, periods, etc.)_____
Cover letter (missing)_____
Other _____

Clarity of Report (10 points) Grade_____

Logical presentation (poor organization, illogical sequence)_____
Appropriate length (too long, too short)_____
Ease of reading (excess verbiage, incomplete sentences, etc.)_____
Appropriate
Introduction_____
Experimental section_____
Results and/or discussion_____
Reasonable Conclusions (poorly supported or missing)_____