

LONG REPORT FORMAT

A typical lab report should include the following sections:

1. Title Page
2. Table of Contents
3. List of Figures
4. Abstract
5. Introduction
6. Apparatus
7. Procedure
8. Safety
9. Results
10. Recommendations and Conclusion
11. Appendix
12. References

Follow the detailed instructions in the CHE writing guide. Make sure to include page numbers.

1. Title Page

Follow the sample on page 15 of this document. Although counted in the pagination, this page is not numbered. (A sample title page is provided in section 3.7.)

2. The Table of Contents:

The table of contents should lead the reader to the major sections of your report. Be careful to insure that the page numbers of the sections are properly represented in the table of contents.

3. The List of Figures

The figures in your report should be listed in this section. The figure numbers and captions of the figures must correspond exactly to the figure numbers and captions in your report. If you use abbreviations in your List of Figures, then these same abbreviations should be used in the legend of your figure. Be sure to check the page numbers of your figures.

4. The Abstract

The most important section of your technical report or paper is the abstract. In fact, the first significant impression of your report is formed in the reader's mind by the abstract. A well-prepared abstract enables a reader to identify the basic content of a document quickly and accurately, to determine its relevance to his interests, and thus, to decide whether or not he needs to read the document in its entirety.

Normally, a lab report is too brief to require an abstract; however, for ChE 353M you are required to write an abstract in order to help you gain experience in both thinking and writing concisely. As a student, you should learn to think, speak, and write in abstracts. For example, when the TA asks you a question, respond with an abstract-style answer, that is, give a complete but concise answer.

A useful abstract is a complete, accurate, and concise summary of the report. It is an actual condensation of the subject matter of the report itself; consequently, the reader of the abstract should be able to obtain a comprehensive grasp of the facts presented and knowledge of their relative importance and relationship. **The abstract should include a quantitative summary of what you did, the results you obtained, and the conclusions based on these results.** The range of numerical values should be given for important parameters, variables, and results. The abstract is not a textual table of contents.

Although the abstract is the first section to be read, it is the last part of the paper to be written. The construction of the abstract is the last step of an arduous job. Despite its importance, students are apt to throw the abstract together as fast as possible. For many students, it is a relief to finish the report; hence, they spend very little time on the abstract. The time spent in learning the "rules" that govern the construction of a good abstract will pay high dividends in the end.

Guidelines for Writing the Abstract:

- 1) Write the abstract last, after you have written the entire lab report.
- 2) Center the word **ABSTRACT** at the top of the page and underline it.
- 3) **Content/Organization.** Make sure you cover these five main points in your abstract:
 - a) state the principal objectives and the scope of the experiment
 - b) briefly describe the methodology employed
 - c) summarize the results and accuracy of results quantitatively
 - d) state the conclusions
 - e) state the recommendations.
- 4) Do not exceed 250 words.
- 5) Do not cite references to the literature, that is, references to sections, figures, tables, bibliographic information, etc. in the abstract. Do not put figures or tables in the abstract. Equations should not be numbered.
- 6) Do not include historical information.
- 7) The abstract may contain standard abbreviations and numerals.
- 8) The abstract is self-contained; that is, it is a complete report in miniature. Most abstracts will at some point be separated from the parent report. Thus, the more important results, conclusions, and recommendations, together with enough additional information to make them understandable, must be included. The program committees of many engineering conferences will often use abstracts as the sole basis for accepting papers to be presented.

- 9) The abstract should never give any information or conclusion that is not stated in the report. Since your abstract may be recorded by various abstracting services that publish reference volumes used for literature searching, you will not want to include irrelevant information. These abstracting services include: *Engineering Index*, *Chemical Abstracts*, *Science Abstracts*, etc.

5. Introduction

Write a brief statement, **no more than four sentences long**, of the purpose(s) and approaches of the experiment. Be specific in your description. For example, the leading sentence of this section could be as follows: "The technique of batch distillation was used to determine the feasibility of separation of 15/85 weight percent mixture of methanol / n-propanol to obtain a 98% purity n-propanol product and a 90% recovery of the methanol." Because you are writing about an experiment that you have already completed, make sure to write in past tense. The product of the distillation presumably still exists so reference to it is made in present tense. "The n-propanol distillate is a clear colorless liquid."

6. The Apparatus

Briefly describe the experimental apparatus. Include a drawing or schematic of the apparatus to present details and minimize textual discussion. Describe how the apparatus was set up and include a list of all the parts involved. If applicable, include the brand and model of each piece of equipment. The purpose of this section is to enable another scientist to duplicate the experiment you conducted by using the information you give in your lab report. Again, remember that you have completed this experiment, so you must write in the past tense.

7. The Procedure

Give a detailed but concise description of the steps you took to complete the experiment. Write in normal prose style; do not list instructions. Be clear: another scientist should be able to repeat your experiment at a later date using your procedure. You should describe what **you** did, in past tense, even if what you did was different from the instructions given in the lab guide. Discuss features necessary to scale-up the results and to interpret errors in the data. Briefly describe measurements and calculations necessary to obtain final results. This section should be no longer than a page in length—be brief,

8. Safety

In this section, briefly list all potential safety hazards in the experiment and what **was done** to minimize them. Do not use commands in this section (or in any other section)!

9. Results

In this section, you will describe and analyze your results. Often the best way to present your results will be in tabular or graphical form; you should refer to the resulting pertinent graphs using corresponding figure numbers. The graphs are to be included in this section, not in the Appendix, unless specifically stated in the lab handout. Any graphs included in the Appendix are supplementary in nature; they are not a way to sneak more information into your report. You should not expect your reader to refer to graphs included in your Appendix. Discuss and refer to the tables or figures in the text. This section should be organized with the most significant results first, followed by lesser results. In addition to stating the results of the experiment, you should also include an analysis or discussion of the results. Detailed calculations should appear in this section, but quantitative calculations need to be reported with confidence limits.

You should also include a discussion of the **errors** associated with your measurements, as these may have some bearing on your conclusions. Try to determine the magnitude of the error introduced into the results by each experimental error. Be quantitative: do not simply list some errors. Include the results of your statistical analysis here. Each experimental value must include its experimental uncertainty unless otherwise indicated in the lab description. Include a subsection on possible sources of error in your experiment, and explain the manner in which they could have affected your results.

Also in this section, you should start to develop some conclusions that you can expand upon in your formal Conclusion.

10. Recommendations and Conclusion

In your conclusion, briefly restate what you did in the experiment and your findings without being redundant. Enumerate and expand upon the conclusions you began to lay out in the previous section. Compare your results with theory, previous work, and your own expectations. If possible, draw larger conclusions and explain the significance of your work to Chemical Engineering more broadly.

11. Appendix

The Appendix should contain the following information in the order given:

- 1) Supplementary figures and graphs not appropriate for the body of the report. These should be presented in the sequence in which they are mentioned in the report, but numbered in the order of their actual appearance in the report.
- 2) Tabular results not appropriate for the body of the report. These should be presented in sequence also.
- 3) Lengthy theoretical arguments, if any.
- 4) Sample calculations, with units. Include one sample of each type of calculation made, complete with units. Use one set of data in those calculations. Even if you used a spreadsheet for computation, you must show any one sample calculation by hand.
- 5) Appropriate calibration curves, if any, unless calibration is the topic of the report.

- 6) Raw data in tabular form. Provided that you are neat and well organized, the raw data may simply be that which was taken while you were doing the experiment. Photocopies are acceptable.

12. References

All references in your report should be numbered and listed in this section. This section is called the Reference section, as opposed to the Bibliography Section. A bibliography differs from a reference section in that it is not confined to publications cited in the text, and may include annotation. An example of the format is included in the CHE writing guide.

Just a word to the wise from G.W.

The generation of the first long report is an arduous and time consuming task. It may take more than 15 hours to produce the first long report. Success demands that you start work on this report well in advance of the due date. You have a scheduled 5 hour laboratory period one week prior to the due date. I encourage you to regularly dedicate at this time period to report writing. If you put off the writing task until the last night, you will be under so much pressure that you will become desperate. As stated in the Integrity Section, "Desperation clouds judgment and leads to poor decision making. What you may see a short cut could actually be scholastic dishonesty." Start the writing task early. You simply can not do it properly in one evening.

Please do not make the mistake of coming to campus with your report on a Diskette or a CD and planning to print it the morning it is due. If you take this chance, there is a high probability that the printer or the network will malfunction and you will have no product to hand in at the time it is due. Late reports are not accepted so please print a copy of the report before the due date. Every year someone gets into trouble by trying to print at the last minute. Please do not let that someone be you!