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Introduction

This Guide is designed to be used in preparing laboratory reports for all general science and engineering courses at IIT. It describes the structure of a good laboratory report, outlines the different sections of the report and explains the need for each of them. It also introduces some standard conventions and rules for writing reports of professional quality.

Laboratory reports will be graded not only for technical content but also for writing and style. The quality of your written report will strongly affect your grade for the course. You are required to follow the general rules in this Guide and the specific formatting instructions given to you by your laboratory instructor.

Need for Report Writing

According to recent nationwide surveys, engineers and other professionals in the sciences spend at least fifty percent of their time writing reports and memoranda. The quality of oral and written reports presented by working professionals is invariably one of the criteria used by their superiors in performance evaluations, making the ability to write a good, professional-quality report an essential, marketable skill. For these reasons, training and practice in report writing are important parts of your education. IIT is committed to providing you with the incentives, opportunities and guidance to develop your report-writing skills.

Advantages of a Standardized Format

Engineering and science professionals write several different kinds of laboratory reports. The form, length, content and emphasis are determined by the purpose of the report and the intended audience[s]. However, the structure of all reports is similar and includes sections that describe objectives, methods or procedure, results and conclusions. This is a format that has evolved over time in practice, and, although there is no single perfect format, there are several very good approaches that are similar to one another in most respects. By using a standardized format, you can ensure that the final report is complete and that readers who have different interests and needs can access the information they seek from the report with minimal effort. The use of a standardized format also cuts down on the time required to write a report.

Use of Computer-based Word Processing

All laboratory reports for IIT courses must be prepared using computer-based word processing. This procedure is the standard practice today in most organizations. If you do not have independent access to a computer, you may use the PCs and Macs with word-processing software and printers are available throughout the campus. Most word-processing software incorporates useful features that substantially enhance the capability to produce a professional-quality report. These features include formatting, graphing, drawing and spell-check.
**Time Required for Report Writing**

The most frequent complaint from students about laboratory courses is based on the perceptions that an excessive amount of time is needed for the preparation of laboratory reports and that the return on this investment of time (in terms of the GPA) is not proportional. In fact, however, students who are able to describe their laboratory work in clear, organized reports receive higher grades than those who cannot. While report writing can indeed be time intensive, the time is well spent because it provides students with the opportunity to develop or improve a skill that will be extremely valuable in their future careers.

Below are a number of strategies that can be deployed to lessen the time spent writing reports.

- **Plan ahead.** Many frustrations and problems related to report writing can be minimized by proper planning. It is essential that students schedule their weekly activities to allow enough time to write laboratory reports. The time required to complete a report varies for each individual. As you become more proficient, the time required decreases.

- **Use technology to your advantage.** Using word-processing software and one standard format in all laboratory courses will increase your writing efficiency.

- **Give yourself time to write, revise and edit.** For longer reports, time is usually spent most efficiently by working on a report in more than one session. A rough draft is written first and set aside. The rough draft is then reconsidered, edited and polished into the final version after one or more revisions. The final version must be read for errors carefully before submission. You should allow time to write and edit the report and check for errors before the final version is printed.

You are on the path to becoming professionals whose successful careers will be based in part on how well you can communicate in writing. Start practicing now!

**Audience**

As a student, you can expect that the grader will read your report in its entirety, but professionals know that only a few experts in their own field will read a complete report—and only if they continue to be impressed by the relevance of each individual part of it. Reports are typically read by a number of people, with differing backgrounds, interests and needs. Individuals who want to replicate the experiment might be interested in the details of method, analysis and interpretation. Those looking to find out about developments in the field might be interested in the significance of the results and the conclusions drawn from them. At yet another level, a manager who seeks specific information to make important decisions about a project might look at only a brief summary of the report, together with a set of conclusions and recommendations. Professional laboratory reports are written to meet the needs of all these individuals, and these reports are organized and formatted so that each reader can easily find the information that is most relevant to him or her.
Because they are an important part of your pre-professional training, laboratory reports written at IIT should also be written to satisfy the needs of this diverse readership. Thus, some repetition of information in different sections of the report, perhaps with a difference in emphasis or detail, is often necessary. As in all professional writing, clarity and precision in both language and calculations are essential in a laboratory report. Figures, charts, tables and graphs should be used whenever they would be helpful. This Guide describes a report structure that satisfies these varied requirements.

**Chemistry Laboratory Report Format**

Laboratory reports should always be written for the convenience of the reader. Thus, for example, each section of the report should be headlined and the sections should be arranged in an appropriate, easily-understood sequence. In the context of the course for which it is written, the laboratory report serves to describe what you did during the laboratory session, how you manipulated the raw data, what you identified as your result and what you concluded about the experiment. Although it may seem logical to you to write a report in a chronological or historical sequence, such an approach is not the most useful for your readers because the report would be more difficult to scan for the items of interest. Think of the document as a performance document; that is, *proof* that you understand what you did and can apply it in practical situations.

The sections to include in your Chemistry Lab Report are

1. Objective
2. Procedure
3. Specialized Chemical Techniques
4. Final Result
5. Conclusion
6. Attachments

An example of the required format for a Chemistry Lab Report follows (instructions are italicized):
Density of a Solid  
(Experiment Title)

Objective:
The purpose of this experiment was to determine the density of an irregular solid using the displacement method developed by Archimedes.

The objective can only be one sentence long, so choose your words carefully. Include the chemical property that you are trying to measure and the chemical technique used.

Procedure:
A graduated cylinder filled with water to a volume of 60 mL was placed on a balance, and the balance was zeroed. A sufficient amount of an unknown irregular solid was carefully placed in the graduated cylinder so that the volume of water displaced was approximately 5.0 mL. The weight, initial volume, and final volume were recorded.

The procedure section should only be one paragraph. Do not copy from the book! Describe the procedure in your own words without using complicated chemical terms.

Specialized Chemical Techniques:
The fundamental technique of measuring liquids was studied using a graduated cylinder. The proper use of an electronic balance was also explored.

Summarize any new chemical technique learned during the experiment.

Final Result:
The final result of the experiment revealed an irregular solid, similar to solid gold. The use of the electronic balance was unsuccessful because the graduated cylinder fell off the balance and broke.

Describe your interpretation of the experiment’s outcome.

Conclusion:
Based on the final result and on known literature values, the irregular solid was most likely solid gold. Trial 2 had to be eliminated from the final results because the graduated cylinder fell off the balance and broke.

Write two sentences at the most for this section. State the conclusions of your experimental findings and any observations that had an effect on the final results.

Attachments:
• Data Sheet
• Post Lab Exercises

List any additional sections that you have attached to the report. Data Sheet and Post Lab exercises (with answers) should always be attached.
Professionalism: Formatting and Language

Like all other modes of communication, laboratory reports are most effective if the language and style are selected to suit the background of the principal readers. Reports are judged not only on technical content, but also on clarity, ease of understanding, word usage and grammatical correctness. The following are several trouble spots for report writers:

Tables, Graphs and Equations

All tables, graphs and equations should be introduced by a sentence of explanation. They should also have an explanatory label. The labels should be executed using the same formatting and numbered sequentially throughout the report. Units and variables must always be identified (see sample lab report).

Don't expect figures or equations to serve where sentences and paragraphs are needed. Visual and verbal descriptions must always go together. There are two reasons for this coupling: first, it assures that the information contained in the report is clear; second, it allows the author of the report to take credit for interpreting the significance of the data. Good reports will demonstrate to readers that the author is more than just a technician plugging in numbers.

Verb Tense

Reports should be written in the past tense using the passive voice without direct reference to the individuals who participated in the lab.

NO: The TA set up the equipment before we began the experiment.

YES: The equipment was set up before the experiment was begun.

NO: We calculated distance using the data from Table 2.

YES: Distance was calculated using the data from Table 2.

Objective

The “objective” of the lab is RARELY, IF EVER, to learn how to use a piece of equipment (the exception is the oscilloscope experiment for Physics 221). Use action verbs such as “investigate,” “determine,” “measure” or “plot” in stating your objective.
Equations

Equations should be embedded in the text of the report and formatted using the “Equation Editor” tool on your word processor, as in the following example:

Using the results listed in Table 1, a percentage difference was calculated for each set of readings taken by the two different instruments (the CMM and Vernier Calipers). Equation 1 was used to calculate this percentage difference. It can be written as:

\[
E = \left( \frac{m_1 - m_2}{\Delta m} \right) \times 100
\]

Equation 1

where:
- \( E \) is the percentage difference;
- \( m_1 \) is the measurement by CMM;
- \( m_2 \) is the measurement by Vernier Calipers
- \( \Delta m \) is the difference of the two instruments.

It is extremely important to define all variables used, although it is necessary to define a variable only one time in the report (i.e., if \( m_1 \) is defined in Equation 1, it is not necessary to define it again in Equation 2). The equations should be numbered sequentially throughout the report.

Section Headings

Use separate headings for each section. The headings should be in bold type. The format used for the headings should be consistent throughout the report. Allow space between sections.

Language

As you edit your report, delete unnecessary words, rewrite unclear phrases and clean up grammatical errors.
Note on Plagiarism

Experiments are usually carried out by groups of students. It is therefore expected that each member of a group has followed an identical procedure in the laboratory and has the same set of data. Members of a group are also encouraged to discuss the analysis of data with one another. However, preparation of the report and the discussion and interpretation of the results contained therein must be the sole effort of the individual student submitting the report. IIT’s policy on plagiarism will be strictly enforced in all laboratory courses. See http://www.iit.edu/~osa/Handbook/FinePrint.html#honesty for IIT’s complete Academic Honesty policy.

Checklist

The checklist is designed to help you write a complete, professional-quality report, and it will help you to ensure that all essential information is included in the appropriate place and that the report has been prepared in the proper format. Careful use of the checklist will likely result in better grades.

Getting Help at the CAC (Communication Across the Curriculum)

The CAC program helps students with IIT writing requirements during their entire career at IIT, particularly when they are enrolled in Introduction to the Profession courses (ITPs), writing-intensive classes (C-courses), and interprofessional projects (IPROs).

Location: CAC/IIT Writing Center, Siegel Hall, Room 232

Office Hours (fall 07): M/W: 10 a.m. – 3:30 p.m.; T/TH: 10 a.m. – 5:30 p.m.

Phone: (312) 567-3476

Website: http://cac.iit.edu