A GUIDE TO LABORATORY REPORT WRITING

Typical components of a Laboratory manual are listed below.

1. Title Page:

Times New Roman, 12pts

Title should be informative, concise and simple. The length of the title should be limited to 6 to 12 words. **Use separate page for the title**.

It would be a single page that states:

a) The title of the experiment.
b) Student name and the names of any lab partners.
c) Instructor's name.
d) The date the lab was performed & the date the report was submitted.

2. Title:

The title says what you did. It should be brief (aim for twelve words or less) and describe the main point of the experiment or investigation. An example of a title would be: "Effects of Ultraviolet Light on Borax Crystal Growth Rate". If you can, begin your title using a keyword rather than an article like 'The' or 'A'.

3. Abstract:

Abstract is a summary of the whole experiment, including but not limited to, the main purpose of the experiment, its significance, scope and limitation, methodology used, major investigations, and a concise conclusion. The length of the abstract should be limited to less than or at most 200 words. Readers are expected to be able to understand the clear representation of the experiment without going deeply into the body the report, or they should be able to understand their interests for reading further.

4. Introduction:

Usually the Introduction is one paragraph that explains the objectives or purpose of the lab. In one sentence, state the hypothesis. Sometimes an introduction may contain background information, briefly summarize how the experiment was performed, state the findings of the experiment, and list the conclusions of the investigation. Even if you don't write a whole introduction, you need to state the purpose of the experiment, or why you did it. This would be where you state your hypothesis.

Example :

The main objective of this experiment was to verify the ohms law. In doing so, followings were performed:

a) To design an electrical circuit with relevant parameters and sources.
b) To set up the circuit with appropriate connections, sources, and instruments.
c) To compare the measured value with the theoretical estimated value.
d) To find the reason for error in result, and to draw conclusion on how to overcome.

5. Theory and Methodology:

Any relevant theory which is prerequisite to understand the experiment and to carry out any calculation must be concisely written. Any particular equation, table, etc. must be included in this part so that readers can easily understand any assumption, calculation, etc. in the later part of the report. All tables, graphs and equations should be introduced by a sentence of explanation. They should also have an explanatory label. Use proper citations and references.

6. Pre-Lab Homework:

Attach the answers to all the mandatory assignments that you presented before the start of the laboratory experiment for getting eligible to perform the experiment.

7. Apparatus:

List everything, in details with necessary specifications and numbers, needed to complete your experiment.

8. Precautions:

There's always the potential for danger when working in a lab! List all the necessary precautions here.

9. Experimental Procedure:

Describe the steps, in chronological order, you completed during your investigation. This is your procedure. Be sufficiently detailed that anyone could read this section and duplicate your experiment. Write it as if you were giving direction for someone else to do the lab. It may be helpful to provide a Figure to diagram your experimental setup.

10. Simulation and Measurement:

Numerical data obtained from your procedure, usually, is presented as a table. Data encompasses what you recorded when you conducted the experiment. It's just the facts, not any interpretation of what they mean. This section should also contain any calculations you made based on those numbers.

Then a similar table should be constructed from data's' obtained from computer simulations for the same experimental setup.

Make sure that you specify and scale the units of measured data appropriately.

11. Calculation:

Here you can mention all relevant calculations for theoretical analysis. Take a note that if the calculation in lengthy, only important ones can be pointed out in this part, leaving most of them in the appendices.

12. Results/Finding(s) :

Here you should point out the measured and calculated values, and if needed, any relevant calculation such as error between values found from these two methods. It is always good, not to simply put some quantitative values but to write in few qualitative sentences and if necessary, make references to any real values, attachments, or appendices. You should clearly mention the major outcomes of the experiment.

13. Answer to Report Question:

Here you answer all questions that are mentioned in the lab manual concisely with necessary diagram, table, illustration, theory, etc.

14. Discussion:

This is where you interpret the data and determine whether or not a hypothesis was accepted. This is also where you would discuss any mistakes you might have made while conducting the investigation. You may wish to describe ways the study could have been improved.

15. Conclusions:

Most of the time the conclusion is a single paragraph that sums up what happened in the experiment, whether your hypothesis was accepted or rejected, and what this means.

16. Reference(s):

If your research was based on someone else's work or if you cited facts that require documentation, then you should list these references.

In your lab reports you will typically use information from sources such as your textbook, lab manual, a reference book, and articles published in a science or engineering journal. When you use information from sources, you need to tell the readers where the information came from and where the readers can locate the sources. This is what citations and references are for.

A **citation** tells the readers where the information came from. In your writing, you cite or refer to the source of information.

A **reference** gives the readers details about the source so that they have a good understanding of what kind of source it is and could find the source themselves if necessary. The references are typically listed at the end of the lab report.

You can give the source of your ideas in many ways.

Citations: When you cite the sources of information in the report, you give a number in brackets that corresponds to the number of the source listed in the order in which they appear in the report, the source listed first as [1], the next source [2], etc.

Jenkins and Busher report that beavers eat several kinds of herbaceous plants as well as the leaves, twigs, and bark of most species of woody plants that grow near water [1].

Beavers have been shown to be discriminate eaters of hardwoods [2].

References: The sources are listed in the order in which they are cited in the report, as in the following book and article.

[1] *S.H. Jenkins and P.E. Busher, "Castor canadensis,"Mammalian Species. Vol. 20, Jan. 1979.*

[2] *H.S. Crawford, R.G. Hooper, and R.F Harlow, Woody Plants Selected by Beavers in the Appalachian and Valley Province. Upper Darby, PA: U.S. Department of Agriculture, 1976.*

Example of referencing for different sources:

a) Online Article Referencing:

[1] AIUB website, [Online: Date of Online Publication], [Cited: Date of Citation], Available: http://www.aiub.edu/

b) Book Referencing:

[2] S. M. Metev and V. P. Veiko, “Laser Assisted Microtechnology”, Springer-Verlag, 2nd ed., pp.# 236-589, Berlin, Germany, 1998, ISBN: 1256-5890.

c) Journal Referencing:

[3] S. Zhang, C. Zhu, J. K. O. Sin, and P. K. T. Mok, “A novel ultrathin elevated channel low-temperature poly-Si TFT,” IEEE Electron Device Letter, vol. 20, pp. 569–571, Nov. 1999, DOI: 10.1109/55.798046.

d) Conference Proceedings Referencing:

[4] L. Chen, J. Li, M. Spasojevic, and R. Adams, "Nanowires and sidewall Bragg gratings in silicon as enabling technologies for microwave photonic filters," Optics Express, Vol. 21, Issue 17, pp. 19624-19633, 2013, DOI: 10.1364/OE.21.020387.

e) Patent Referencing:

[5] R. E. Sorace, V. S. Reinhardt, and S. A. Vaughn, "High-speed digital-to-RF converter," U.S. Patent 5 668 842, Sept. 16, 1997.

f) Datasheet Referencing:

[6] "PDCA12-70 data sheet," Opto Speed SA, Mezzovico, Switzerland, Available: http://www.datasheetarchive.com/PDCA12-70-datasheet.html

g) Thesis Referencing:

[7] A. Karnik, "Performance of TCP congestion control with rate feedback: TCP/ABR and rate adaptive TCP/IP," M. Eng. thesis, Indian Institute of Science, Bangalore, India, January 1999.

www.wikipedia.org cannot be used as a reference

17. Appendices:

Where applicable, include any attachments such as graph, chart, code etc. with proper labeling. All tables, graphs and equations should be introduced in the main part of the report.

PROFESSIONALISM: FORMATTING AND LANGUAGE

As with 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 on clarity, ease of understanding, word usage, and grammatical correctness. Following are several trouble spots for report writers.

1. 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.

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.

2. Verb Tense

Reports should be written in the past tense in an impersonal style.

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*

3. Objective

The “objective” of the lab is RARELY, IF EVER, to learn how to use a piece of equipment. Use action verbs such as “investigate”, “determine”, “measure”, or “plot” in stating your objective.

4. Equations

Equations should be well defined and numbered, as in the following example:

Example:

$$E = \left| \frac{m_1 - m_2}{\Delta m} \right| \times 100\% \qquad \textbf{Equation 1}$$

where:

E is the percentage difference;
m_1 is the measurement by CMM;
m_2 is the measurement by Vernier Calipers
and Δm 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.

5. Section Headings

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

6. Language

Do not use unnecessary words, rewrite unclear phrases and clean up grammatical errors.

7. Note on Plagiarism

Plagiarism is the "wrongful appropriation" and "purloining and publication" of another author's "language, thoughts, ideas, or expressions," and the representation of them as one's own original work.

Plagiarism is considered academic dishonesty as:

a) Presenting another's original thoughts or ideas as your own.
b) Using another's exact words without proper citations.
c) Passing off as one's own pre-written papers from the Internet or other sources.
d) Cutting and pasting from more than one source to create a paper without quoting or giving credit.
e) Borrowing words or ideas from other students or sources without giving credit.
f) Submitting a paper without citing or incorrectly citing another's ideas.
g) Submitting a paper that you got off the internet or from a friend and presenting it as your own.

Plagiarism of Self:

a) The use of previous work for a separate assignment.

b) Although these were your original words and thoughts, receiving credit for a previous assignment is considered cheating.

Laboratory Ethics:

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. AIUB's policy on plagiarism will be strictly enforced in all laboratory courses. Therefore, Students are expected to behave ethically both in and out of the lab. Unethical behavior includes:

a) Possession of another person's laboratory solutions from the current or previous years.
b) Reference to or use of another person's laboratory solutions from the current or previous years.
c) Submission of work that is not done by your laboratory group.
d) Allowing another person to copy your laboratory solutions or work.
e) Cheating on quizzes.

The work on your labs must be your own work. There can be no verbatim copying or "writing together" when lab work is assigned as homework or is going to be graded. **At the teacher's discretion, unethical behavior will result in a failing grade for the entire course, a reduction of the course letter grade, or a zero score**.