

5.1 Lab Report and Lab Memo

Within a **Lab Report**, data presentation, analysis, and explanation should be thorough and should make no assumptions about the reader's knowledge of the laboratory background or experiment. A **Lab Memo** assumes that the reader is familiar with the background and procedure of a specific lab, but includes what results were obtained, answers discussion questions, and provides general conclusions and recommendations.

Different instructors or even employers may ask for different content based on the situation and their specific needs or interests, but the organization and information outlined here will provide a solid foundation to build on and adapt in the future.

As always, defer to the specific assignment requirements and documentation for your class and instructor. Outlined in this chapter are the general guidelines, but there may be some variation in practice. For example, in some cases an instructor might ask that each team member write a Conclusion or Summary, but at other times a single Conclusion or Summary will be written by the group.

Lab Reports and Lab Memos should be written in paragraph form, using headings for main sections like Introduction, Experimental Methodology, etc. There is no length stipulation; however, a lab memo will be shorter than a lab report.

Lab Report

Wind Turbine Lab Report

Submitted to:

Inst. Name

GTA Name

Created by:

Team Letter

Team Member 1

Team Member 2

Team Member 3

Team Member 4

Engineering 1181

The Ohio State University

Columbus, OH

Date Month Year

Executive Summary

An executive summary is often provided at the beginning of a report to provide a summary to

readers who may or may not wish to read the full report. An executive summary might also be a standalone document, described [here](#). The executive summary should be one page in length with no subheadings. When included with a Lab Report, the summary should not include or reference tables and figures within the report. It is acceptable to repeat information from the rest of the lab report, however the summary should not include any new information or conclusions that are not already stated elsewhere. For this reason, it is advisable to write the executive summary last.

See [Executive Summary](#) for a complete content and writing guide.

Table of Contents

Formal documents often contain a Table of Contents to help users find specific information or sections. Each major section should be listed in the ToC with the page number.

Introduction	1
Experimental Methodology	1
Results	2
Discussion	4
Conclusions & Recommendations	6
References	7
Appendix A	8
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Appendix C	11

Introduction

The introduction should be a paragraph that contains the goals of the lab and an overview of what the reader can expect to find within the report.

- State the objective of the lab exercise. Though this is provided in the lab documents, the purpose should be restated in your own words.
- Provide a brief overview or “roadmap” of the report contents.

Experimental Methodology

This section should detail the procedure and equipment used in the lab.

- Describe the steps used in the experiment in paragraph form. The goal is for the reader to understand and be able to replicate the experiment.
- Explain how and where equipment is used in the experiment. It is not necessary to explain in detail how common equipment, such as a voltmeter or strain gage, functions, but the report should include what equipment would be needed in order to replicate the experiment. Images should be added to support the text when appropriate.

Results

The Results section should describe all observations and data that are relevant to the purpose of the lab.

- Provide objective observations from the lab. What was noticed throughout the course of the

experiment? Example: *As the AEV traveled along the track, it was noticed that the speed decreased on the sloped portion of the track. On trials 2 and 3, the AEV stopped forward motion near the top of the slope and began to roll backward.*

- Present the raw data from each major part of the experiment, followed by how this data was analyzed to reach the final results.
 - Provide results in the order of the experimental methodology.
 - Include any data that will be discussed later in the report. This is the only section in which results should be introduced.
 - Use a combination of text, figures, tables, and equations to present the data as clearly as possible. There should be enough descriptive text to guide the reader through the results and explain any assumptions or analysis performed in order to reach the results.
 - NOTE: Raw data can become overwhelming quickly and make it difficult to read the results. Some data, particularly large tables of values, can be placed in an appendix and referenced as needed to increase the readability of your report. If you are not discussing the

contents of a table or figure, it may belong in an appendix.

Note on using figures, tables, and equations

Figures are used to better describe something that is difficult to convey in text or in a table. Graphs are used to present data visually. Diagrams or images can be used to show results that would be difficult to describe in words. See [Using Graphics & Visuals Effectively](#) for more information.

Tables are typically used to display various data values that are not appropriate for a figure or for which a numerical value is important. A good indication that a table may be necessary is if a paragraph contains many data values.

Equations are needed whenever a calculation is part of the analysis unless it is a calculation where there is a universal

understanding of the associated equation, such as the average of a set of numbers.

Discussion

The Discussion should analyze the data presented in Results, compare it to expected values based on existing theory, and address potential error.

- Discuss what trends, or lack thereof, are present in the results that are relevant to the lab objectives. This section should answer the question, “What do the results clearly show?”
 - This section requires the most comprehension of the theory behind the experiment in order to give context to the results. Example: *The stress was greater when the knee was subjected to dynamic loads than when it was subjected to static loads.*
 - If needed, reference figures from the Results section by name; figures are not typically *introduced* in the Discussion.

- Address whether the trends you observed were expected based on theory.
 - This section should discuss whether the results “make sense.” You would expect that running a motor at a higher speed would use more energy than at a lower speed. Is that what you saw in your results?
 - The results should be compared to theory quantitatively. Do relevant equations and the existing knowledge in this area support the results of the experiment?
- Disclose the limitations and delimitations of the experiment or sources of error. Why would your data not exactly match the theory? Potential errors should be mentioned whether or not it is believed that they affected the data.
 - Both systematic and random error should be discussed. What errors could have occurred and how would they affect the data? See [“Addressing errors in lab documentation” in \(Chapter 3\)](#).
 - If it is obvious that an error did affect the data, this should be acknowledged and the estimated effects reported.
 - The suggested modifications to the

experiment that would reduce or eliminate these errors should not be presented in the discussion.

Conclusions & Recommendations

This section should summarize the findings of the experiment and offer recommendations for the scenario, including methods for decreasing the effect of error.

- Summarize the experiment and results, and highlight key points from the discussion. This 1-2 paragraph section should contain no new data that is not already part of the other sections in the report, but should pull together ideas from the entire document.
- State your conclusions. Provide quantified, high level support from data where applicable. How do these ideas compare to the lab objectives and results? How do your conclusions relate to the objective of the lab? Example: *The synthetic material's tensile strength was higher than that of the natural material, requiring 5% more stress to cause failure.*
- Discuss potential solutions for all errors mentioned in the Discussion. Example: *Timing*

error could be minimized by using multiple timers for each run or adding an automatic sensor-based timer that does not rely on human reaction time.

- Provide recommendations for the scenario posed at the beginning of the lab procedure based on your conclusions.

References

A list of references cited in the report.

- Reference any sources used in creating or following the lab procedure. Ex. lab documents or guides for data interpretation.
- Include any resources used to write the background or discussion. These might be more theoretical sources like textbooks or journal articles.

See [Citations and Citation Styles](#) for more information.

Appendices

Create a new appendix for each category of content.

- Title each appendix using the format Appendix A: Descriptive Title. For example, a report might contain the appendices:
 - Appendix A: Circuit Diagrams
 - Appendix B: Experimental Data
 - Appendix C: Equations and Sample Calculations
- Arrange appendices in the order in which they are referenced within your report—each appendix should start on a new page. Every appendix must be referenced within the document.
- Start figure and table labels at 1 in each appendix. Each numeric label will be preceded by the appendix letter and a period with no spaces (e.g., A.1, or B.3) . Labels should be formatted as described in [Using Graphics and Visuals Effectively](#).
- Organize and format each appendix neatly. Appendices should not be storage for messy or extraneous information.

- Do not repeat figures and tables between appendix and main text. Each item should appear only once in the report.

Lab Memo

Memo

Date:

To: Inst. Name & GTA Name

From: Group Letter – Team Member 1, Team Member 2, ...

Subject: Title of Lab

Introduction

The introduction should be a paragraph that

contains the goals of the lab and an overview of what the reader can expect to find within the report.

- State the objective of the lab exercise. Though this is provided in the lab documents, the purpose should be restated in your own words. Example: *In this lab, four types of beams were tested to determine which has the greatest strength-to-weight ratio (grams-pounds).*
- Provide a brief overview or “roadmap” of the report contents.

Results and Discussion

In a Lab Memo, the “results” and “discussion” are combined under a single heading, but it is helpful to distinguish between them during the writing process. Follow the guidelines for each section below as you draft the memo, but know that they will be combined under the single “Results and Discussion” heading in the final document.

[Results]

The Results section should be a concise report of all significant results—describe observations and data that were critical to the experiment’s purpose and outcomes. Ask, *what information does my reader need so they can understand the final conclusions of the memo?*

- Provide objective observations from the lab. What was noticed throughout the course of the experiment? Example: *As the AEV traveled along the track, it was noticed that the speed decreased on the sloped portion of the track. On trials 2 and 3, the AEV stopped forward motion near the top of the slope and began to roll backward.*
 - This is the only section, besides the appendix, in which results should be introduced.
 - In general, a combination of text, figures, tables, and equations is most effective to present the data as clearly as possible. Not all are necessary in a lab memo, but consider carefully what is required to convey your results most clearly.
 - Equations should be used to show how key parameters were derived from the data.
 - There should be enough descriptive text to guide the reader through the results and explain any assumptions or analysis performed in order to reach the results.
 - NOTE: Raw data can become overwhelming quickly and make it difficult to read the results. Some data,

particularly large tables of values, can be placed in an appendix and referenced as needed to increase the readability of your report. If you are *not* discussing the contents of a table or figure, it may belong in an appendix.

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Testing Log

Testing Log

When a testing log is required as part of a project, each team must track the exact amount of testing time and other relevant details about the test. Testing logs should be promptly updated and maintained in chronological order. Testing logs do not require specific formatting, but maintain a consistent format that includes all required elements.

Testing logs should include the following:

- When the test was run and how long (day/time, duration)
- Who ran the test (who conducted the test,

who observed)

- Where the test was performed (location)
- What specifically was being tested (methodology)
- Why the test was performed (purpose)
- What resulted

Additional Resources

[Writing Guidelines for Engineering and Science: Laboratory Reports](#)

[USC Research Guides: Appendices](#)