

Lab Report Writing

Overview

Lab reports are written to show the results and importance of an experiment and allow others to replicate the experiment. They can deepen your knowledge of course material through application and analysis. In undergraduate science courses, your Professors and Teaching Assistants are looking at your lab report to see if you can:

- Apply the scientific processes involved in the experiment
- Communicate relevant theories, phenomena, and procedures
- Analyze the results
- Follow the overall style of scientific writing

The typical parts of a lab report are:

- | | | |
|-----------------|--------------------------|---------------|
| 1. Title page | 4. Materials and methods | 7. Conclusion |
| 2. Abstract | 5. Results | 8. References |
| 3. Introduction | 6. Discussion | 9. Appendices |

Use this handout to structure your lab reports. You will be able to write an organized report that communicates your results, demonstrates your understanding of course content, and follows scientific conventions. However, always refer to your assignment guidelines to ensure you meet your Professor's expectations.

1. Title Page

Typical Parts

1. Name of the experiment
2. Your name and the names of lab partner(s)
3. Date

2. Abstract

The Abstract is a summary of the important parts of the lab report.

Typical Parts

In one paragraph, summarize the:

1. Purpose of the experiment
2. Methods with which the experiment was conducted
3. Results from the experiment
4. Significance of the results

The Abstract does NOT include:

- References
- Definitions
- Information that you do not mention in the rest of the report

Example: Sample Abstract

This is a model example of how to write an abstract.

This study determined the wavelengths of light that are effective for photosynthesis for the plant *Elodea canadensis*. The rates of photosynthesis were determined at 25 °C using wavelengths of 400-700 nm in 50 nm increments and measuring the oxygen production for 30 minutes at each wavelength. Two plants were tested at each wavelength. The rate of oxygen production at 450 nm was 1.5 times greater than any of the trials which suggests that this wavelength is most easily absorbed by chlorophyll pigments. In contrast, photosynthesis was not detected at 550 nm suggesting that this light is reflected. These results have important uses in facilitating photosynthesis for plants.

Commented [RGASC1]: The first sentence clearly states the purpose of the experiment.

Commented [RGASC2]: The second and third sentences concisely explain how the experiment was conducted.

Commented [RGASC3]: Part of the fourth sentence states the results of the experiment.

Commented [RGASC4]: Part of the fourth sentence effectively presents the significance of the results.

Commented [RGASC5]: Part of the fifth sentence states the results of the experiment.

Commented [RGASC6]: Part of the fifth sentence effectively presents the significance of the experiment.

3. Introduction

The Introduction helps the readers understand the background of the experiment and what you were trying to do through the experiment.

Typical Parts

1. Background information about the experiment
Consider the relevance of the topic, relevant research, key theories, formulas, or equations
2. Purpose of the experiment and how it was achieved

Try writing the purpose of the experiment before you write the background information. When you write the purpose, make sure that you identify the end goal of the experiment rather than its learning goal.

Example: Sample Purposes

- The purpose of this experiment was to learn how to use paper chromatography.
- The purpose of this experiment was to determine the identity of the unknown plant pigment by using paper chromatography and comparing its R_f value to known pigments.

Commented [RGASC7]: This example shows a learning goal in the experiment. The students will develop their lab skills, but this is not the purpose of the experiment.

Commented [RGASC8]: This example has identified the purpose of the experiment.

Your Introduction is not complete without explaining the relevant background theories and relevance to the reader. Highlight the key terms in the purpose. You can describe these terms and explain how they were used in the experiment.

The purpose of the experiment was to determine the identity of the unknown plant pigment by using paper chromatography and comparing its R_f value to known pigments.

Commented [RGASC9]: What is the importance of plant pigments?

Commented [RGASC10]: How does it work and what is it used for?

Commented [RGASC11]: What are these values and do they mean?

4. Materials and methods

This section of the lab report should give enough information to the readers so that they can replicate your experiment. This means that you need to tell them what you used and what you did in the experiment.

Materials

1. The materials, apparatus, chemicals, or specimens that you used
2. Physical set-up of the experiment

Method

1. Experimental design
2. Procedures
3. Data analysis
4. A 3rd person past tense narrative

If your assignment instructions allow you to, you may be able to write a shortened method:

1. A reference to the lab manual and a citation
2. List of deviations from the experiment

Depending your experiment, you may need to include different types of information so that readers can replicate the experiment. For instance, if you conducted an experiment with human subjects, you could include a Participants section to describe your selection of candidates. If your experimental design was novel, you may need to include images so that readers can see how you set up your equipment.

For some courses, the assignment requirements may allow you to make reference to the lab manual. If this is the case, you can do this but you will likely have to state all of the changes you made from the lab manual.

Example: Sample Methods

- The methods were as described in the lab manual.
- The experiment was performed according to pages 48-52 of the BIO206 lab manual¹. There were no deviations from the manual.
- The experiment was performed according to pages 35-37 of the CHM231 lab manual³. There was one deviation from the instructions:
 1. In step 7, 25 mL of ethanol was used instead of 15 mL.

5. Results

The Results section describes your key findings and observations from the experiment. Do not provide an analysis of the information in the Results. Your analysis will be in the Discussion section of the lab report.

Typical Parts

1. Key findings and observations
2. Organized with tables, figures, and graphs
3. Calculations

Commented [RGASC12]: This is not descriptive enough for the readers. Did you make any changes to the procedure during the lab? If so, you need to state them.

Commented [RGASC13]: The first sentences **help the readers replicate the experiment**. They can refer to the citation.

Commented [RGASC14]: The second sentence tells the reader that you did everything exactly as the manual stated.

Commented [RGASC15]: The second sentence **highlights the change from the standard procedure**. You need to describe everything you did differently from the lab manual's instructions.

You can summarize your key findings in data tables, figures, or graphs depending on the nature of your information. Data tables typically summarize data points using headings, columns, and rows. Figures show pictures or images from the experiment. Graphs show a relationship between variables. Regardless of how you summarize your key findings, you also need to include a brief description to explain the importance to the reader.

Write captions above tables:

Table 1: Summary of flame colours for metal samples

Sample	Colour
Copper	Green-blue
Potassium	Purple
Sodium	Yellow
Unknown	Green

Write captions below figures/graphs:



Figure 2: Samples after 2 hr incubation at 50°C

6. Discussion

Analyze and interpret your results. This is the section of the lab report where you make connections between the course content and your results. The overarching question you are answering is, “What do these results mean?”.

Analysis

1. State what the results show

Interpretation

1. Explain any problems in the data – possible sources of error
2. Connect your results to theory
3. Relate your results back to the purpose of the experiment
4. Compare your results to literature values or other experimental work

Example: Sample Discussion

The following examples show how to effectively write a discussion.

Analysis

Since the colour of the flame produced by the unknown sample most closely resembled the colour of the flame made by the copper sample, it was determined that the unknown also contained copper.

Interpretation

The colours of the flames produced by the unknown and the copper sample were not exactly the same. It is possible that the identity of the unknown was another metal that was not tested in the experiment. For example, barium produces a green flame and it is possible that this would be a better match for the unknown sample⁴.

Commented [RGASC16]: The first part of the sentence makes a direct reference to the observations. This helps the reader identify where the rest of the analysis will come from.

Commented [RGASC17]: The second part of the sentence clearly states what can be concluded from the results.

Commented [RGASC18]: The first two sentences state a limitation based on what was observed in the experiment.

Commented [RGASC19]: The third sentence suggests another item that could be explored based on the limitations. The ideas are supported by a citation.

7. Conclusion

State your key findings and mention any limitations or suggestions to improve the experiment.

Typical Parts

1. Connect your key findings back to the purpose
2. State any limitations
3. Make suggestions for future research

Example: Sample Conclusion

This example highlights how to write a good conclusion.

The identity of the unknown metal sample was determined to be copper. The qualitative flame tests showed that the unknown results best matched the control copper sample. However, a flame test comparison with barium is recommended since the flame colour for the unknown was green rather than green-blue.

Commented [RGASC20]: The first sentence answers the purpose of the experiment.

Commented [RGASC21]: The second sentence explains how the purpose of the experiment was achieved.

Commented [RGASC22]: The third sentence suggests an idea for future research based on the results.

8. References

Include proper citations for all the sources you used in your report. Refer to your assignment guidelines for the citation style you should use.

9. Appendices

The appendices contain other information that is not included in the report. For example, your raw data can be put in an appendix. Make sure that you refer to your appendices at least once in your report.

Typical items

1. Raw data
2. Full calculations
3. Extra graphs, pictures, or data tables

More resources for lab report writing

Get feedback on your lab report writing! Book an appointment with an Instructor:
<http://www.utm.utoronto.ca/asc/appointments-undergraduate>.

Check out these resources to get more help and information on lab report writing:
Writing tips for first year biology lab – Queen's University
<http://sass.queensu.ca/topics/tips-for-writing-first-year-biology-labs/>

Lab Report module – University of Waterloo
<http://writeonline.ca/labreport.php?content=intro>

Looking for more learning strategies? Visit us at: <http://www.utm.utoronto.ca/asc/>.