

Writing Lab Reports¹

Writing successful lab reports is an important skill for science majors. A strong lab report summarizes an experiment cogently and thoroughly. While the desired format may vary from professor to professor, a typical lab report will include most, if not all, of the following sections:

ABSTRACT	Think of the abstract as the “TL;DR” version of your lab report. The abstract should summarize the purpose of the experiment, as well as the key findings and conclusions. It should also be brief -- roughly 100-200 words.
INTRODUCTION	Now it’s time to be more thorough. Which scientific concept/s is the experiment related to / based on? What was the goal of the experiment? What was the initial hypothesis and why? Pay attention to verb tenses, as they should vary depending on what you’re talking about. The experiment is finished, so use the past tense when discussing it. However, your report, relevant scientific theories, and permanent equipment all still exist, so make sure to use the present tense in these contexts.
METHODS	Now it’s time to describe the experiment <i>in detail</i> . To conduct the experiment, what did you do? Explain step-by-step what happened (not what was supposed to happen) when conducting the experiment. Storytellers beware! This is not a time for a narrative tone. Simply explain the facts. This section is also the place to mention all materials and equipment used in the experiment.
RESULTS	What were the measurable outcomes of the experiment? In this section, you’ll want to include all relevant calculations, tables, and graphs. As you do so, make sure to also state the results explicitly in complete sentences.

¹ PapersOwl. (2019, December 4). *How to Write a Good Lab Report For College*. <https://papersowl.com/blog/write-lab-report>
University of Toronto. *The Lab Report*. <https://advice.writing.utoronto.ca/types-of-writing/lab-report/>
Proofed. (2020, November 18). *Academic Writing: How to Structure a Lab Report*.
<https://getproofed.com/writing-tips/academic-writing-how-to-structure-a-lab-report/#:~:text=But%20most%20lab%20reports%20have,you%20obtained%20from%20your%20experiment>.

DISCUSSION	One of the most important parts of your lab report. This is your opportunity to demonstrate a thorough understanding of the experiment. Interpret your results. What is clear and what is ambiguous? Did the results meet or confound expectations? Was there experimental error? If so, what caused it and how can it be avoided in the future? How do the results connect to relevant scientific concepts or theories? Was the goal of the experiment accomplished?
CONCLUSION & REFERENCES	Can be combined with discussion section, depending on your professor or TA's preferences. If the conclusion is a separate section, give a brief recap of the main findings. Mention the implications of the results and suggest possible solutions to sources of experimental error. Lastly, don't forget to cite your sources!

Not all lab reports are the same. Not all professors are the same. Not all TAs are the same. Be sure to follow the guidelines of your professor or TA, especially regarding formatting. Below are excerpts from one well-done lab report² in a UCSB chemistry class. Notice that in this case, the abstract & introduction were essentially the same. Also note that these are only excerpts, not the full report.

ABSTRACT	<i>In this lab, the final multistep synthesis converges to form the final product: hexaphenylbenzene. The benzil synthesized in the previous lab first undergoes a bis-aldol condensation reaction to form tetraphenylcyclopentadienone. Next, this compound undergoes a Diels-Alder [4 + 2] cycloaddition to form hexaphenylbenzene.</i>
INTRODUCTION	<i>In this lab, the final multistep synthesis converges to form the final product: hexaphenylbenzene. The benzil synthesized in the previous lab first undergoes a bis-aldol condensation reaction to form tetraphenylcyclopentadienone. Next, this compound undergoes a Diels-Alder [4 + 2] cycloaddition to form hexaphenylbenzene.</i>
METHODS	<i>In the first part of the synthesis of hexaphenylbenzene from benzil, tetraphenylcyclopentadienone was prepared using a bis-aldol reaction. One equivalence (0.093 g) of benzil was added to a conical vial with one equivalence of dibenzylketone (0.094 g) and 0.44 mL triethylene glycol. After adding a spin vane and attaching an air condenser, the reaction was run at 150 °C for about 5 minutes until a homogenous green solution had formed.</i>

² Atkins, Micaiah. (2019). *Synthesis of Hexaphenylbenzene from Benzil*.

RESULTS	<i>Once the final product was collected, it had a mass of 0.128 g. When compared with the theoretical yield of 0.235 g, the percent yield was calculated to be 54.5%.</i>
DISCUSSION	<i>This is a relatively high percent yield, particularly for a multistep synthesis where errors and low yields can build on each other to produce very little pure product. One of the reasons for this is that this procedure involved a convergent instead of linear synthesis. A linear synthesis is one where the product of one reaction becomes the starting reagent for the next whereas in a convergent synthesis key fragments are synthesized separately and then brought together in the final step. Because each step does not directly build upon the last, low yield can be made up for and errors won't build upon each other.</i>
CONCLUSION & REFERENCES	<p><i>Overall this reaction was successful in the transformation of benzoin to benzil via oxidation, benzil to tetraphenylcyclopentadienone via bis-aldol, and tetraphenylcyclopentadienone to hexaphenylbenzene via Diels-Alder cycloaddition. Due to the synthesis involving multiple steps and spanning two days, there were several sources of error that could have lowered the purity and overall yield of the product.</i></p> <p>...</p> <p><i>Despite some sources of error, melting point and IR data suggest that hexaphenylbenzene was correctly synthesized and that the key concepts of oxidation, aldol, and cycloaddition reactions were understood.</i></p> <p><i>1 National Library of Medicine. National Center for Biotechnology Information: PubChem. https://pubchem.ncbi.nlm.nih.gov/compound/benzil (Accessed August 24, 2019).</i></p> <p><i>2 National Library of Medicine. National Center for Biotechnology Information: PubChem. https://pubchem.ncbi.nlm.nih.gov/compound/benzoin (Accessed August 24, 2019).</i></p>

Final Tips:

- Make sure you include every single detail/number in the methods section.
- Results and errors should be interpreted in the discussion section.
- If your discussions are short because errors are made you can actually write a lot about an error and even give your best educated guess about why it happened.