

Chemistry Lab Report Guide

The Writing Center

Before you write:

- **Know the assignment-** make sure you know what is being asked of you. Many times your instructor will only have you write a certain section of the report, so it is important to know what they assigned.
- **Read the lab manual-** the assignment and all of the necessary components are typically written in the manual.
- **Take good notes in pre-lab lecture-** this is where your professor will go over what the overall objective of the experiment is and other background information.
 - Good notes are also important during the experiment-this will help you remember what you did later on.
- **Use your resources-** if you are confused about something while writing, you can always ask your TAs or your professor for clarification.
- **Audience-** keep in mind that your audience is *not* your professor. Instead, imagine that your audience is a group of chemistry students who have not yet performed this experiment.
- **Make an outline-** writing up a quick outline can make a huge difference. Go through each section step by step and bullet the important points for each one. This will save you time and stress.
- **Focus on the writing-** you should approach writing lab reports like you would an essay. Grammar, organization, and fluency are important.
- **Make an appointment with the writing center-** we can help you with the organization of your report and read it to make sure you are presenting your ideas clearly.

Format

- Double-spaced, 12-point font, Times New Roman, 1" margins.
- You can print on both sides.
- Include page numbers on all pages except for the title page.
- Make sure you have a firm grasp on how to write in the passive voice. Basically, you must omit all personal references:
 - No:** We weighed the compound.
 - Yes:** The compound was weighed.
- All sections should be written in the past tense, except for the Introduction (varies).
- Don't use contractions!/Do not use contractions! (See the difference?)
- All sections should be labeled in a way that differentiates them. Whether you bold or underline them, make sure they stand out. Don't make the font bigger though.

Acknowledgements

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Disclaimers:

This is a guide written by Writing Associates to focus on introductory chemistry and organic chemistry lab reports. The purpose of this guide is to help students who wish to learn or review the basics of a chemistry lab report. While we consulted chemistry professors, this guide does not reflect the views of the entire Chemistry Department and should not be regarded above your professor's instructions. Your professor's directions should be followed first and foremost and our guide should be used to supplement their instructions. We encourage you to ask your professors and TAs when you come across something you are unsure of, since every lab report is different and often times there is more than one way to write it. We hope you find this guide helpful.

Title Page**Name of Experiment**

Your name

Due Date of the Lab Report

Compound Z/ Partner X/ Measurements Y

Lab Day and Section Number

Trinity College, Hartford CT

Quick Tips:

- Takes up the whole first page of the report.
- Only page without a page number.
- For general chemistry, it is okay to use the title given by the instructor.
- For organic chemistry, much more detail is required for the title. It is important to mention the results, how you got the results, and include the names of compounds analyzed, unknown or otherwise. As a result, your title may be pretty lengthy. Only capitalize the first word of the title.

Abstract

The abstract is essentially your entire report with one or two sentences written for each section. This part of the report is single-spaced. It should address the purpose of the experiment, your hypothesis or expectations of the outcome, a brief summary of the key data collected and how it accomplished the objective, and finally, your results. Discuss only the most important data you collected to keep this section as concise as possible, referencing and citing your results. Since this is an overview of your entire report, consider saving it until the end so that it is easier to write.

Introduction

Your introduction should include the following (not necessarily in this order):

- The goal of the experiment and why it is important.

- How the experiment achieves this goal.
- Relevant background information
- Expectations

Goal

This is sometimes referred to as the “objective” or the “purpose” of the experiment. Basically, you want to tell the reader the goal of the experiment. You must also explain why this goal is important. What is the bigger picture? What is the question you are trying to answer? You must explain how your experiment was designed to reach the goal. A hypothesis is not always required by your professor, but if it is, include it after the goal.

Relevant Background Information

This information allows you to set the stage. Relevant background could include an explanation of laboratory techniques, reaction equations, relevant mechanisms, or chemical principles such as acid and base chemistry or polarity. It is important to connect this information back to the purpose and hypothesis. Make use of pre-lab lecture notes as there is useful information typically mentioned that connects to the material you are learning in lecture. **Please note:** You want to be thorough but it is also possible to be too broad. For example, do *not* start your introduction with “Chemistry is all around us” or “Chemical reactions happen every day.” Such statements are too general and your professors are never very impressed by them.

Expectations

State what you expect the outcome of the experiment to be. This part is important, because you will later talk about whether or not the experiment met your expectations based on your results in the discussion section. In organic chemistry, if you have a proposed mechanism, it should definitely be included along with what you expect the product to be.

Note: The order you see here is not necessarily the order you should follow every time you write an introduction. It varies from experiment to experiment, so always ask yourself what order would be the most logical before you write. If you are stuck, try starting with the purpose.

Check Yourself:

- Why did you perform this experiment? Why was it important?
- What problems or questions were answered?
- What was done in the experiment to answer the question?
- What did you expect to find?

Quick tips:

- The introduction can be a mix of tenses. Facts should always be written in the present tense, but when you are referencing what you did, you can choose to either write in the future or past tense. Whichever you choose, stay consistent!
- You can consult additional resources, but remember to cite them! This includes any figures you use as well as text. In-text citations should be in the form of a

superscript number.

- Do *not* include the learning objectives from your lab manual. The learning objectives are not related to the purpose of the experiment, but are only there to guide your conceptual understanding.
- Often times, you are given a relevant reaction equation, mechanism, or structure in pre-lab or lecture that should be included in your introduction. It is advised that you use ChemDraw or hand draw the structures or mechanisms yourself. This is absolutely necessary in organic chemistry.
- Any term that can be abbreviated by an acronym should only be defined the first time you use it.

Experimental

The difference between the experimental and the procedure is that a procedure is typically written as a set of bulleted “commands”, while an experimental is written in complete sentences, describing what was *actually* done. Your biggest mistake would be to copy the lab manual word-for-word (remember, your professor wrote that procedure and would be able to recognize it). Also, chemistry does not always go as planned. You may find that you followed the lab manual’s instructions, but you did not get the desired outcome and you might have needed to improvise (with the help of your TAs and your professor). The key to this section is to take good notes while you complete the experiment. This way, when you start writing this section, you can breeze through it. Also, it ensures that another student can *reproduce* your results with your experimental.

Quick tips:

- Write this section as a narrative. Do not organize it into a bulleted or numbered list.
- Be specific, but not too specific. Remember your audience. They are familiar with basic lab techniques, but should be given enough detail to *reproduce* the experiment.
- Numbers less than or equal to ten should be written out, while numbers greater than ten should be in numerical form.
 - **Note:** Measurements and concentrations are exceptions to this rule and should *always* be written in numerical form.
- Give measured quantity values in grams and moles for reactants. For example:
 - “Salicylic acid (1.392g, 0.109mol) was obtained on weighing paper and carefully transferred to a test tube.”
- It is not necessary to state that you acquired an item such as a test tube. It is enough to state that you are using it, like in the above example.
- Don’t forget units! They must be in their abbreviated form.
- Never start a sentence with a number. It’s easier said than done, but it’s as simple as starting with a transition word like “then”.
- Don’t capitalize the names of chemicals.
- Any number that begins with a decimal should have a zero before it. For example, .1 ml should be 0.1 ml.
- If you used a major instrument or program (such as an IR spectrometer, etc.), it’s name should be included in your experimental.

Results and Discussion

Before you write these two sections, you should know that you can write them together or separately. Consider the experiment and decide which is the most logical way to present your data and discussion.

If written together: introduce your data and follow it with a thorough explanation of what it indicates.

If written separately: introduce your data in its own section and then explain it in your discussion section by referencing the tables and figures.

Results

This section is for the data you collect in your experiment. It is crucial to only present the data you will later talk about in your discussion section. When presenting your data, you should choose to use a table *or* graph based on which makes more sense. Always consider the *readability* of whichever you choose. You must also include sample calculations when appropriate. There should only be one sample for each type of calculation made and each step should be written out by first displaying the relevant equation with variables and then with your data.

Graphs

- Axes should have their own labels that include units.
- The independent variable is always on the x-axis and the dependent variable is always on the y-axis.
- Give each graph a number and title that states the dependent variable versus the independent variable with units.
- Include a caption on the *bottom* describing the graph. State the type of graph and the significance of the slope. You will elaborate on this further in your discussion.
- In organic chemistry, mention the important peaks or signals in your spectral data and explain its significance.
- Add in a line of best fit through the data.
- Include an equation for the line and the R^2 value on the graph.
- Scale the axes appropriately so you can clearly see the data points.

Tables

- Number all tables and include a title.
- The title should be a very specific description of the table. You can even summarize the headings of your columns if that is the best way to communicate the table's data.
- Columns should be properly labeled with the correct units. The rest of the rows in this column should *not* include the units.

- Captions should be included on the *top* of the table to summarize the table in more detail than the title.
- Construct your table so data that is similar reads down a column, not across a row.

Calculations

In general chemistry, sample calculations are very common after tables to show how you came up with certain values in your table. Make sure the sample calculations are labeled with the type of calculation you made. If you know how to use Microsoft Word to write out math equations, more power to you. You can always look up a video on YouTube on how to do this. If you aren't so tech savvy, you can leave space after the table and neatly write in the calculations by hand once you've printed your lab report. There is no specific rule for when sample calculations should or should not be included, but your professor will usually explicitly state what they would like to see. If you aren't sure, ask!

In organic chemistry, you typically need to include a calculation for degrees of unsaturation, molecular formula or percent yield. Your professors will specifically state when calculations are necessary for your report, either in lab or in the lab manual.

Check Yourself:

- Is this the most logical way I can present my findings?
- Does it make the most sense to present my findings as table or a graph? Which will make my results the most comprehensible?
- Do I discuss all of this data?

Quick tips:

- Include a table or a graph, but not both. Usually your professor will tell you what you should include, but if they don't make sure you don't put a graph and table with the same information in it.
- Significant figures should always be taken into account.
- Don't forget your units.
- Use scientific notation. Avoid writing powers as "E-3" or "10^3". Instead write them as "10³".
- Number your tables and figures so that you can refer to them easily in your discussion.
- Give each table and figure a descriptive title or caption. It should accurately describe the data presented in the table or figure.
- Be aware of how you use your space. Make sure your results are easy to follow and are presented in a way that is pleasing to the eye.

Discussion

The discussion section should include the following, though once again the order will vary depending on the report. This section demonstrates your understanding of the lab and relates your data to your original objectives. Consult all of the resources available to you to

ensure that you have a full grasp on the material.

Objective

- Reiterate the goal of the experiment.
- State the type of data that was collected to achieve the goal of the experiment and explain how *your* data was used to answer the question.

Results

- State what your results indicate.
- Discuss how the data collected proves your conclusion.
- You must cite specific values or evidence from the data collected (not just graph and table numbers) and fully discuss *all* data that was presented in the results section.
- This part will most likely make up the bulk of your discussion.
- Connect your results back to the purpose of the experiment. What do your results indicate about the topic you were discussing in your introduction? Why are your results significant?

Expectations

- Discuss whether or not the findings agree with your expectations discussed in the introduction.
- If you had a hypothesis, explain whether or not it was proven or disproven and explain why. It is not enough to say it was proven or was not proven.
- It is absolutely crucial that you refer to the figures and graphs of your results section to explain whether or not your data supports or refutes your expectations. You must prove this by referencing the results and making an argument for it.

Sources of Error

- If the findings do not agree well with expected values, you must explain why this is: either because your expectations were made with the incorrect information or there was error in your experiment. Again, it is not enough to say you made bad predictions or that there was error in your experiment. You must be specific.
- If you can't come up with any reasons as to why your results go against accepted values, consult your professor or TA's.

Quick tips:

- Make sure you are aware of what your professor is asking of you for this section. Often times they explicitly state what they would like to see in the discussion or they will specify something they want you to include in addition to the information mentioned here.
- Biggest mistake you could make? Not referencing your data. Include the names of the figures or table and talk about it.
- Never apologize for your data. Just because your results did not come out perfectly, does not mean they are not good enough to discuss.

Conclusion

Note: A separate conclusion section is typically only necessary when you are assigned a full, formal lab report. When you are only assigned a results and discussion section, this is included as a paragraph in the discussion that sums everything up. Again, this is typically acceptable, but you should run this by your professor if you are unsure.

The conclusion section is a summary of the findings and the *key* data that led to this conclusion. It is a good idea to cite your data specifically. Stay concise and it's okay if this section seems repetitive at this point in your report. Make sure you connect your findings back to the original objective. Whereas the abstract includes how the objective was achieved, the conclusion simply summarizes the findings again.