

Physics

Recipe for a Delicious Lab Report

There will be one laboratory assignment per unit of course material. Reports describing student laboratory work will be collected on the first day of the following unit, given a tentative grade, and returned. The student should then address any comments I have made before the final reports are turned in at the end of each quarter.

organize Your work Carefully

The laboratory report is a relatively challenging assignment, so plan on spending a **significant amount of time** writing it up. A word processor will not only help you incorporate my feedback into your final lab report; it will also make it easier for you to develop a complete and well-organized document (e.g., you'll be able to add things you notice are missing after you have most of the text written.) If you don't have access to a word processor, I recommend that you employ more traditional research paper organization techniques (e.g., index cards).

Tell a Story

The text of your report should **flow naturally** from your introductory paragraph to your conclusions and self-reflection. It must **stand on its own** like any scientific research paper; all of the following should make sense to a reader who has **not** read the laboratory instructions: the procedures you followed, data you collected, analysis you conducted, and (most importantly) what your results mean. **Do not simply write down answers to the questions from the instruction sheet** as you would for a homework assignment; instead, **weave** such prompts and your answers to them into the text of your report. For example, "Before beginning the lab, we considered a scenario in which... We predicted that... However, after completing the experiment, we now see that..."

Separate Data & Mathematical Analysis from Text

Embedding data and complex formulas within textual paragraphs not only makes your argument hard to follow, it also interjects weird line wrapping into your mathematical analysis. Instead, introduce each part of your analysis with explanatory text and then follow this with one or more lines of formulas, **showing all of your work carefully**. I strongly recommend that you leave space to **write your formulas out by hand**; it's very difficult to get a word processor to represent math properly (a skill I've honed over years of practice with powerful add-on tools). Label each quantity carefully, including units of measurement. For example:

... Our estimate for water's heat of fusion ($97 \frac{\text{calories}}{\text{gram}}$) was significantly higher than the accepted value ($80 \frac{\text{calories}}{\text{gram}}$):

$$\%error = \frac{\text{estimate} - \text{actual}}{\text{actual}} = \frac{97 \frac{\text{calories}}{\text{gram}} - 80 \frac{\text{calories}}{\text{gram}}}{80 \frac{\text{calories}}{\text{gram}}} = 21\%$$

However, there were several potential sources of error in the experiment...

Lab Report outline

Each report should take the following form (1-3 pages):

1. **Abstract** (3-4 sentences) – Begin your report with a **brief summary** of why you think your instructor wanted you to perform this experiment, any predictions you made beforehand, what you actually did, and what your results mean. My instruction sheet was meant to be comprehensive, so please do not regurgitate it. Instead, pretend you're explaining to a friend what the lab was all about; hit the high points.
2. **Data and Observations** – Make certain that one student has been assigned to record data and observations while the experiment is being conducted. Each group member should then copy all of this (by hand or cell phone) before class is over. The data and observations in the Laboratory Report will normally have to be copied once again, so that they can be presented in a clear and organized fashion (e.g., in one or more well-designed data tables).
3. **Data Analysis** – Describe how you analyzed your data, including formulas, calculations, graphs, columns added to tables, etc. Some of this analysis will take place during the lab, but you'll usually have to complete it for homework.
4. **Conclusions** (1-3 sentences) – Summarize what your results have to say about the key concepts being studied, especially with respect to any predictions you made. Try to distill your ideas down into a scientific model or law that might be useful for solving problems. What does it all mean?
5. **Reflection** (1-3 sentences) – No scientific experiment is perfect. Comment on how well your group performed the laboratory work, including potential sources of experimental error (e.g., “not all of the water could be poured into the graduated cylinder; some of it stuck to the container walls, which would have reduced the volume we measured...”) Describe specific areas in which you intend to improve for the next laboratory assignment.

Make Sure You Covered Everything

After you've written the text of your lab report and it flows naturally, go back and re-read the laboratory instruction sheet, searching for specific questions or analysis steps that you neglected to cover in your report, then embed each of these within your text in the place you think it fits best (again, a word processor makes doing so much easier.) Also review the Lab Report Outline above to make sure you haven't forgotten anything.