

Welcome to the PHYS 2260 Laboratory

Monday 14:30 - 17:30
Allen 202
Fall 2015

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Office Hours: Friday 14:30 - 15:30 (338 Allen)

SUCCESSFULLY COMPLETING THE LAB

Not only are the labs worth 20% of your grade, they are also important as a first opportunity to develop laboratory and writing skills which will be relevant throughout your academic/scientific careers. In order to perform well in the lab section of PHYS 2260 I suggest the following:

1. Read The Lab Manual

Your experiment will go much better if you are properly prepared. In addition to the lab manual, for many experiments I will prepare supplemental material with more in depth instructions than the lab manual. This extra material will be put on Desire To Learn (D2L) one week before the experiment. You are expected to be familiar with the contents of the lab manual and the supplemental material **before** starting the lab. By being prepared for the experiment you will be much more effective during the lab period. You can check your understanding before the lab by asking yourself the following questions:

- What are we doing in this week's experiment? (i.e. What is the goal?)
- How are we going to perform the experiment? (i.e. What measurements are needed to reach the goal?)
- How am I going to perform any necessary calculations?

The lab manual also contains a discussion of error analysis which you are expected to know.

2. Keep Your Report/Lab Book Organized

Hopefully it is obvious, but you must bring all necessary materials to the lab (lab manual, pen, pencil, eraser and lab book). Data should be recorded in pen and neatly stroked out if necessary. Diagrams should be drawn in pencil. Your experimental data should be recorded in some sort of bound book (not just loose paper which can be lost). Also do not just record the data, but make notes about experimental procedures and general observations, since this will help you write your report.

3. Ask Questions

Feel free to ask questions about the lab, optics, or physics in general. If you have questions about your lab reports once you have received your marks, or if you have questions when preparing for the lab, feel free to contact me, I would be happy to discuss any of your questions with you.

LAB REPORTS

The lab reports for 2260 are different from your first year physics labs, since you are now expected to write a full, detailed lab report. The method of preparation of lab reports is flexible (e.g. electronic via \LaTeX or word, handwritten etc.) and even the formatting/organization of the report is somewhat flexible, since the most important aspect of your report is always clarity and completeness. However since you are just learning how to write reports, I would suggest following the guidelines

below to ensure your reports are prepared to an adequate standard.

Lab reports will be due at 2:30 pm the Monday following each experiment and should be handed in at the beginning of the lab session. On weeks when a lab is missed due to a holiday or exam, just hand in the report at the start of the next lab period (this means when there is a holiday you get an extra week, lucky you :). Reports will be marked out of 20 and late reports will lose 2 marks per day. If your report is late you can hand it in to me in my office. If I am not there, but somebody else is, the office will be open and you can leave it on my desk. If the office is locked, please slide the report under the door. **Important:** If I am not there when you hand in your late report, please email me and tell me the date and time you handed the report in. I will not be at the university everyday, and if you do not email me the report will be considered submitted when I find it, which could be a few days after you hand it in.

Lab reports can either be handwritten or prepared electronically. If you are interested, I would encourage you to try preparing your reports in L^AT_EX. L^AT_EX is a powerful scientific typesetting program which allows you to prepare professional scientific documents and is used all the time in science to prepare journal articles, theses, course notes etc. and as such it is really necessary to learn L^AT_EX at some point in your scientific career. I encourage taking a look at it now since I am willing to help you with any problems you encounter. If you do prepare the report electronically you can draw diagrams by hand on a printed copy to save time. Even if you prepare the report electronically, please print the report and submit a paper copy for grading. **Important:** If you find electronic preparation is taking too much time, don't bother with it. The most important thing is a well written report. If electronic preparation hinders this, please just write your report by hand.

Remember that obtaining good experimental results is neither necessary nor sufficient to obtain a good mark on your report. Unless you made a clear error in performing the experiment, having results that are different from what you were expecting is okay. What is important is that you properly analyze and report your findings. Keep in mind that when you prepare your report it should be clear enough and include enough detail that a friend of yours who is not in PHYS 2260 could read the report and understand how the experiment was performed and what the results were.

As a guideline the report should include the following sections:

1. **Title Page:** The title page should have the title and number of the experiment, the date, your name and student number and your partner's name. You must indicate which name belongs to your partner. You should also include the abstract on the title page.
2. **Abstract:** The abstract is a brief summary of the whole report. The key points in the abstract are: What is the goal of the experiment, how was the experiment performed, what were the results? The abstract should be brief, around 5 - 10 sentences. The abstract should appear on the title page.
3. **Introduction:** You should give a brief introduction summarizing what you are trying to do in the experiment.
4. **Theory:** Explain the theory behind what you did in the experiment. You should derive any equations relevant to your analysis. However do not include a discussion of the error propagation in this section or derive any error formulas. This is better left for the analysis section. It is a good idea to number equations and define any variables that may be unclear.

5. **Experiment/Procedure:** So far in the report you have described what the purpose of the experiment was and the theoretical basis for the experiment. In the experiment/procedure section you should describe how the experiment was performed. Here you should include any relevant diagrams. Make sure to label all diagrams.
6. **Data and Analysis:** Here you should first present your data. Make sure any data is neatly tabulated and any necessary diagrams are neatly drawn and labelled. It is not necessary to present every detail of every calculation. For example you can expect that any reader will know how to calculate a mean or standard deviation. However if you are using a formula from the theory section to perform a calculation it should be clear what formula you are using and what values you are inputting to this formula. When performing a calculation only round at the end and make sure your final result is rounded appropriately and includes units. The analysis section is where you should derive any error propagation formulas that you will use. Graphs should be included in this section as well and make sure to label any axes and include error bars.
7. **Discussion:** State what quantities you measured and how. If necessary explain what your findings mean. If you measured a value in multiple ways compare your results to ensure they are consistent. If you know the literature value of some quantity you measured, compare with your result. Suggest possible sources of error and ways the experiment could be improved. Note that incorrect use of the equipment, calculation mistakes or recording and measuring errors are not experimental errors. Please be concise when describing errors and do not feel that you must “explain” results that may not agree. If your results seem incorrect, try to understand why and if you come up with a good explanation that is great, but it is better to acknowledge that you do not understand exactly why your result is incorrect rather than having a very weak explanation.
8. **Conclusion:** Restate what was achieved in the experiment and what conclusion/meaning you drew from your results.

The sections described above are not rigid. Your report must include a title page, abstract, and conclusion. It must also contain the information mentioned in the introduction, theory, procedure, data and analysis and discussion sessions. However how you choose to organize this information is up to you, based on your preference and how you think you can best present each experiment. Likely you will want a data/analysis and a discussion section separate, but it might be easier to combine the introduction, theory and procedure sections. That is fine. Remember that the goal is to provide a clear, concise and coherent explanation of your experiment. How you choose to do that is (to some degree) up to you.

OTHER IMPORTANT INFORMATION

- In order to understand how each measurement is performed, each lab partner should perform each type of measurement required for the experiment.
- Your lab station must be cleaned up at the end of an experiment. If you leave an excessive mess you will have marks deducted from your report.
- There is no eating/drinking allowed in the lab.