

Department of Physics, Brandeis University

Guide to: Physics 18a (tentative)

Introductory Laboratory, Fall - 2007

A. INTRODUCTION

Physics 18a is the first part of a two-semester introductory "college physics" laboratory course designed to illustrate basic physics principles by means of hands-on experience. The student should be currently enrolled in Physics 10a or should have taken it, or the equivalent, before. Physics 18a explores the topics of statistics, mechanics, heat, and fluids and at the same time teaches the student some general methodology of experimental/laboratory techniques. We are making extensive use of computers in this laboratory and in many experiments we will take data directly into the computer application. We will be using Microsoft Excel for the collection, organization, and analysis of data. This manual contains a tutorial that was designed to prepare the student so that he or she will be able to appreciate and enjoy the use of computers in this physics laboratory.

Many of you are proficient in Excel. Work though the tutorial at your own pace to check your level of expertise. Your TF will check your skills and there will be an "excel question" on the final. Excel help is available on September 11, 12 and 25 in the Physics Building, Rm. 116. Attend if you need help. Also see the syllabus.

B. GENERAL COURSE INFORMATION:

- Class attendance is strongly encouraged. The student is responsible for all information given out for both the laboratory and the lecture. Since there is only a lab manual but no textbook, lecture notes are very important.
- The final is "closed notes." I will list on the exam any necessary formulae or constants. A calculator and ruler will be needed.
- I am doing my best to be fair with the grading. Please feel comfortable to discuss any aspect of your grade with me. However, I will strictly enforce academic honesty in this class. I will not tolerate any cheating on the final or quizzes or copying of data files or laboratory reports.

- Physically challenged students should contact me for any assistance they may need in the class, the laboratory, or during the exams.

Physically challenged students or students with a documented disability should contact me immediately for any assistance they wish to have made in the class, the laboratory or during the exams.

C. LECTURE AND LAB SECTIONS

There will be an introductory lecture and a weekly lecture on Monday from 2:00 to 3:00 P.M. (see syllabus). In addition, students will take one two-and-one-half hour lab each week (see section times below and syllabus). Note that not all section times will be needed.

<i>Mon</i>	<i>Tue</i>	<i>Wed</i>	<i>Thu</i>	<i>Fri</i>
Lecture 2-3	1:10 - 3:40	1:10 - 3:40	1:10 - 3:40	1:10 - 3:40
4:10 - 6:40	no lab	4:10 - 6:40	4:10 - 6:40	no lab
7:00 - 9:30	7:00 - 9:30	7:00 - 9:30	7:00 - 9:30	no lab

All labs are held in Abelson room 116.

The lab section will be conducted by a teaching fellow, TF, who is, in general, a first or second year physics graduate student. He or she will be assisted by an undergraduate peer assistant, U-PA, who, in general, is a junior or senior physics major. The U-PA is not involved in any part of the evaluation or grading of your work. He or she is strictly there to give you hands-on help with the experiment or computer work. The TF is in charge of the laboratory, and any problems you might have, you should discuss with him or her. If, however, you cannot resolve your differences with your TF, come and see me. I will keep this, if you wish, confidential and try to resolve the issue, but don't wait until labs are over; there is little I can do at that point. So, let's keep the channels of communication open; we are all on your side. You should have a great learning

experience, and you should receive a grade, which fairly reflects your performance and knowledge of the subject studied.

D. OFFICE HOURS

With a class this size, it is impossible for me to be aware of every problem the student is having with the lecture or laboratory material. I encourage all students to discuss with me any problems they are having with the lecture and/or laboratory material. My office hours are:

Rm. 206, Monday from 10 to Noon, or by appointment (781-736-2850), or anytime you can find me. The best way to contact me is via email: Wellenstein@brandeis.edu

If you want to see me tell me when, give more than one choice if possible and I will set up the time.

I will always see my e-mail, so e-mail is clearly a good way to contact me.

NOTE: All lab rescheduling and/or make-ups are handled via email. Use Wellenstein@brandeis.edu for this.

E. LABORATORY NOTEBOOK AND REPORTS

In this laboratory course you are required to maintain a laboratory *Notebook* which, at the end of the lab period becomes your laboratory *Report*. The books are available at the bookstore; we will all use the same kind of book. The lab book must have numbered pages, and it has to fold over to the left. Do not use lab books with alternate carbon copies! The lab book is handed in to your TF at the end of each lab with no exceptions. (No work is required after the lab session. All outside work is to be done *before* the lab meets!) The lab book with corrections and a grade is returned to you at the beginning of your next lab.

All data, observations, and calculations are entered directly into the computer or into the lab-book. No scrap paper is permitted. Most of your tables and graphs will be computer printouts. These tables or graphs you will then cut to size and Scotch tape into your lab book. There is nothing wrong if you have to cross something out and start over again. Corrections are perfectly acceptable, but

reasonable neatness is expected. A single line through is generally sufficient (rather than darkening a large area). Use a ruler if you cannot draw straight lines by hand! Never tear out a page. Pages are numbered, and we expect a complete notebook! You are doing research and documenting your work, so copying from scrap paper or tearing out pages are very bad ideas (and not just because it will lower your grade). The lab book should also have a table of contents.

NOTE: No scrap paper is permitted!

Use a ruler if you cannot draw straight lines!

Never tear out a page!

A report typically consists of the following parts:

Title:

You can simply use the title of the write-up in this manual.

Introduction/Objective:

Discuss what the experiment is about, i.e., you are verifying a law, measuring a certain quantity, etc. This should not be more than 25 words.

Method:

Describe the apparatus and the techniques used in the experiment. This should be less than 40 words. Use a diagram (block) that indicates what was measured. In general each experiment will have 1 or more diagrams.

Data/Observations:

Here you record your data. In most labs you will record data directly into Excel spread sheets. This will be done, in some labs, by means of a keyboard entry; in others, you will use a transducer, which will generate data directly into a file usually by clicking the mouse. In other labs you will set up your tables "by hand" into the lab book. Always leave ample space and have two empty lines between numbers. Further, remember that all data go directly into a spreadsheet or into your lab-book, but never onto scrap paper.

NOTE: Some labs consist of more than one experiment. They will have separate write-ups. Complete each experiment including the conclusion before starting the next one.

Calculations:

Give, but do not derive, the equation(s) you are using. Enter the numerical results with units into the equation but do not show the arithmetic, (one sample if you need to). If you are reporting your results on a spreadsheet, show all equations used by copying them into a cell, or give them in your lab book. Show your "error propagation" and state your final result(s) with consistent significant figures. In most labs you will estimate the \pm errors; if you are not sure, ask your TF.

Conclusion:

Restate your final results (one sentence). Discuss the most significant (one or two) systematic and/or random errors (20 words or less). If applicable, compare (one sentence) your result and error to the accepted result (your TF will give it to you). Finally, discuss (if appropriate) what you would do better next time (one sentence).

Save all your files on your diskette. Never copy somebody else's files. After some labs, you may be asked to hand in your diskette. At the end of the semester, your diskette will be collected with your lab book. Your diskette should not have any applications on it. Never leave files on the hard-drives of the computers in the Physics 18 laboratory.

NOTE: Team work does not mean that one partner already takes data for the next experimental part while the other one takes care of the computer analysis for the previous part.

E. RULES FOR MAKING-UP LABS:

Laboratories can be missed and made-up for the following reasons:

- Medical,
- Team sport events,
- Severe personal reasons,
- Scheduled exams in other classes.

NOTE: Missing a lab because you need to study for an exam is not a valid excuse! Plan ahead and please don't even ask me. If your lab partner has to miss a lab, that is not a reason for you to do so.

In all cases you will need to obtain my (not the TF's) prior permission to miss a lab! All requests have to be by e-mail. Explain why you want (have) to miss a lab and include your phone number and when you can make it up (read the rest of the paragraph). You can also come and see me or phone me, but I still require an e-mail message. This e-mail request will be kept on record and will be forwarded to your TF. If you are, for some reason, unable to contact me in advance (you did not wake up from your nap, were caught in a snow storm, etc.), then do so as soon as possible.

The labs should be taken in sequence. Hence it is important that you make up the lab, if at all possible, during the same week. Most TF's teach two sections; therefore my first preference is that you attend your TF's other section (since your TF has to evaluate your work). If this is not possible, then I will assign you to another TF's section during the same week. Only if that does not work, then will the lab be made up during one of the assigned make-up periods. If this make-up period is after the final exam, you are responsible for the material. Setting up a lab again is a lot of work. Further, I have to weigh the TF's additional hours in the lab against the student's "right" to a make-up. However, as long as you are making an effort to get your labs done, you will find me very supportive and understanding.

REMEMBER: You will need my permission to attend other lab sections. The TF will not let you attend without it. The make-up lab period is not a walk-in affair. Because we must set up the equipment beforehand, you will only be able to attend with an appointment.

F. GRADING:

The course will be graded on a point system with the class average set to about a B⁺. A student who participates in and completes all labs will receive at least a C minus even if he/she "collects" few points. For each lab you missed and did not make up, the grade will be lowered by one step, i.e., a C⁺ to a C. The list below explains the different categories:

Lab Reports 100

This grade is given by the TF for the Excel-homework and the nine labs. TFs tend to give high grades, so even if you get lots of 8/10 or 9/10, keep

in mind that the rest of your class is probably getting high grades as well. What matters is your performance relative to the rest of your class. At the end of the semester, the total grade is normalized to 80 points per student for each TF.

Quizzes **100**

Each TF will give a weekly quiz. Their purpose is to test whether or not you are prepared for the lab. Attend lectures and read both the lab manual and the relevant sections in your textbook. The total of the quiz grades will be averaged to 70 points per student for each section. No quiz grades will be dropped!

Performance **100**

Your TF will evaluate your performance during the lab period. An excellent student is one who arrives on time and is well prepared, i.e. knows the topic of the lab, has done all the derivations etc. that the write-up asks for ("before coming to lab" ...), participates in (takes charge of) the experiment, **is proficient in excel**, shows, through questions and otherwise, that he/she is enjoying the lab, (if you don't enjoy it, fake it!), and does not leave early unless he or she has done the best job possible and does not ask "do we have to do this part, why don't we skip this?" - Ask your TF how you are doing. - This grade is normalized to 75 points per student for each TF.

IMPORTANT: Quiz and performance grades are very important. Discuss with your TF how you are doing compared to the rest of your class.

Lab-Book **50**

The lab-books are collected at the end of the semester and are all evaluated by one grader. Here we are looking for overall organization of (especially) diagrams, graphs and tables. We expect that at the end of the semester you will understand significant figures. We will also pick one lab and evaluate it more closely.

If you are not sure how you are doing, come see me with your lab-book. If you run out of pages in your lab book, you may use some other old book, or ask me for a "recycled" book. Then when you hand in your book, tape

the other part closed and hand them both in with rubber bands around them.

Final **150**

There will be a 90-minute final exam (see syllabus). 90 minutes will be the time an average student should need to complete the exam, but an extra 45 minutes will be allowed to accommodate the more thorough workers. This exam will test whether you learned some basic statistics, understood the physics and method of the experiments, whether you have mastered the use of Excel, learned how to handle data and state your result with correct "error bars" and significant figures.

It is expected that you make an effort to understand each lab when you are doing it, or if you have problems during the lab, to make sure that you understand it immediately afterward. Talk to your TF! Come and see me! "Cramming" for the final is a bad idea; by that time your performance and quiz grade will already have suffered.

The final will be scaled to a class average of 100 points.

Total **500**