Physics 122Z Laboratory: Laboratory Structure and Requirements

General Comments and Introduction

Laboratories offer an important "extra dimension" to your study of physics. In lecture you will be presented with a number of general concepts in the form of physical laws and principles that you will be asked to apply to the solution of a variety of problems. The approach is deductive in that you are asked to proceed from the general to the specific. In the laboratory the approach is often inductive. You are asked to make various observations and draw conclusions from those observations that lead to general principles or physical models. For the Phys 122Z labs, all you need to arrive at those conclusions will be available in the lab. You are asked to base your conclusions on your observations only. Instead of looking through a text to find the solution to a problem, you are asked to make observations that can lead, with logical reasoning, to answers. Physics is ultimately an experimental science. The theories or models developed to describe physical phenomena must agree with observations or must be modified or abandoned if they do not.

The extent to which observations can be said to support a theory is determined by how well those observations are made. The lab is an ideal place in which to confront the issue of measurement accuracy and its role in describing whether measurements do or do not support a particular theory. Our belief in a theory or physical model depends on the accuracy and reliability of the measurements that support it.

The lab offers an opportunity to learn about the tools of physical measurement, from simple instruments to measure length to quite sophisticated computer-based data acquisition systems. Above all, it can provide you with an opportunity to experience the process by which physical theories are developed and tested and help you to develop a better understanding of the validity of those theories.

Laboratory Manual

The Laboratory Manual for Physics 122Z must be purchased at the UW Bookstore. Students are required to purchase the Laboratory Manual **before** their first laboratory session. It should be available by Monday, June 22.

HELPFUL HINTS:

- Your insight into the lab will be improved if you read the material in the text referenced above before coming to lab.
- For all labs, you are expected to learn from your observations. Your TA will confirm your solutions rather than supply them. At the beginning of the lab period, your TA may, at most, give a brief description of special features of the lab and lab equipment.
- Physics concepts will sometimes appear in laboratory **BEFORE** you see them in lecture. The most important of these will eventually show up in lecture, homework and exams. *Concentrate in the laboratory on observing and understanding the phenomena.* You will get practice on quantitative problem solving in your lecture homework.

Lab Reports

You are required to submit your lab report for grading at the conclusion of each lab period. **Labs may not be taken from the room**. Your TA will initial the report to verify the work done. **Reports without initials will not be accepted.**

The lab instruction sheets contain spaces in which the answers to questions posed in the lab are to be written. **In all cases these answers are to be written in complete sentences!** A simple "Yes" or "Same" or similar one-word answers are not considered to be complete sentences.

Measurements should be made carefully and recorded with attention to the appropriate number of digits. If a length of approximately 12 cm is measured to the nearest millimeter, the result should be written with a digit in the 0.1 cm place. For example, if the measurement gives a length 3 millimeters longer than 12 cm., it should be written as 12.3 cm. If it gives 12 centimeters to within 0.1 centimeter, it should be written 12.0 cm. Written in this way, the number indicates that the measurement was made to the nearest millimeter. It is said to have three *significant figures*. All your measurements must be written with the appropriate number of significant figures.

You must submit a separate lab write-up even though you will be working with another student. Partners are expected to discuss their answers with one another and should agree on the measurements. They need not agree on the answers to all questions.

Exams

Questions that are derived specifically from the labs usually appear on the exams in 122. Typically there are altogether about 5 multiple-choice questions and a free-response question, and they will appear on Midterm 2 and/or 3 and/or on the Final Exam.

Lab Maintenance

For the smooth functioning of the lab, it is **imperative** that equipment be returned to the lab bench arranged properly. A picture showing the location of the equipment and an equipment list will be at your lab station. Check the equipment at the start of the lab. If anything is missing or broken ask your TA for a replacement. Do NOT take equipment from another lab station. When you and your partner have finished a lab, call the TA to your lab station. The TA will initial your report **IF and only IF** all equipment is back in place. *Food is not allowed in the lab. Drinks are OK.*

Labs at Other Than Your Regularly Scheduled Sessions

If, for medical reasons or for unavoidable scheduling conflicts, you are unable to attend your scheduled lab section, you may request permission to attend another lab section **during the same week**. Permission must be obtained from your section TA *as well as* the TA for the section you wish to attend [**or** as a last resort, from the lab instructor.] Reports completed in other than your regular session must be turned in at the end of the session and *will be graded by the TA for your original session*. If you complete a lab in a section that is not your own, it is especially important that you provide all the information required at the top of the report, otherwise there is a real risk that the report will be lost. Check the Website if you are uncertain about who your TA is.

Make-up Lab

If you miss a lab and cannot attend another section the week the lab is offered, there is a universal make-up lab scheduled for the last week of the quarter. You can replace ONE missing lab by doing the universal make-up lab. There is NO provision for making up more than one lab at the end of the quarter. As for all labs, the universal make-up lab must be done completely during the make-up session.

DO NOT bring a completed or partially completed report into a regular lab or make-up session. This is cheating and will be reported as such.

It is especially important for any make-up labs (either done in the same week or the universal make-up at the end) that the TA (1) marks that you are present and (2) initials your lab report when it is completed. Lab reports that are not initialed, or from students not marked present at the session, will not receive credit.

Grading:

Graded labs will be scored on a 5, 4, 3, 2, 1, 0 point scale as follows:

5 A **superior** lab report. Answers to all questions are in complete sentences and show very good understanding. All measurements are made as accurately as the equipment allows. The measurements and their uncertainties are correctly calculated and are expressed with the correct number of significant digits. A report scored 5 is without errors.

4 A **very good** report. Nearly all questions are answered correctly in complete sentences. Measurements and measurement uncertainties are correct with the correct number of significant figures. This is the score that you can expect to receive for a lab in which nearly all answers and measurements are correct and complete.

3 A **good** lab report. A complete report with a limited number of incomplete sentences and minor inaccuracies in answers to questions. Some measurements are of lesser accuracy and some measurement uncertainties are missing or incorrectly stated. A few measurements or uncertainties are written with an inappropriate number of significant figures.

2 A **fair** lab report. Answers to several questions are not well stated or are not in complete sentences. Several measurements are inaccurate with incorrect uncertainties or have inappropriate numbers of significant figures. Parts of the lab may not be completed.

1 A **poor** lab report. Answers to questions and measurements are generally of poor quality with significant omissions or mistakes in reasoning. **Labs with a score of 1 may be replaced during makeup week for a score not to exceed 3.** The grade will remain a 1 if the lab is not replaced. Labs cannot be repeated to improve on a score other than 1.

0 The score received if no report is turned in or substantial parts of the report are missing. *Labs graded 0 will not be counted toward the required number of labs.*

The average of the scores for a lab section will be approximately 3.5.

Labs will be graded only by your section TA and will count for 15% of your Phys 122 grade. To avoid differences in grading between TAs, your lab score will be adjusted for the average grade given to all the students taught by your TA.

Your scores on all 7 LABS will determine your lab score. Missed labs will be graded 0.

If you complete fewer than 6 labs (i.e. have more than one lab with a zero score that has not been replaced by the universal make-up), your grade for the entire 5 credit Phys 122 course will be 0!!

Lab Grades on WebAssign

All grades for the Physics 122Z laboratories will be entered by your TA and will be available on the WebAssign homework system. This summer is our first use of this system, so be prepared for a few hiccups. However, you should still expect to see your grades posted in a timely fashion.

Check your scores on WebAssign regularly. This is the record by which you will be awarded credit for the course. Mistakes caught early are usually easy to correct, whereas those caught after several weeks have elapsed may not be correctable at all. TA's will have entered your scores by Friday of the week following the week in which a lab was completed. Consult your TA if you have any concerns or questions. Contact Prof. Pedigo only for problems that you cannot resolve with your TA.

Introductory Physics Courses Administrative Support

If you need assistance with registration, have questions about grades or lab or tutorial policies, consult with the Program Coordinator, Susan Hong, in PAB C136 206-543-4982

If you wish to talk with an academic counselor about becoming a physics major or minor, or have general questions about the physics program, please contact Margot Nims, margot@phys.washington.edu, PAB C139 , 543-2772.

The 12x courses are under the administration of Prof. R. Daryl Pedigo, rpd3@u.washington.edu, PAB C138. 543-4983.

Final Words

Of course, the main goal here is that each student learns some physics and develops a better understanding of the way the universe works. The big picture can sometimes be lost when blindly following a procedure you do not understand. It may help if you regularly ask yourself "What am I supposed to learn by doing this particular task?" When no answer presents itself, consult your lab partner(s) or your TA.

The curriculum for PHYS 121-2-3 is undergoing significant modification for the autumn 09 quarter and beyond. Labs in particular will change noticeably beginning in autumn. This summer we have tried to produce a curriculum that partially bridges those changes for people who are in mid-sequence and plan to continue the course sequence this autumn or later in 09-10.

Despite all the rules it is possible to enjoy your PHYS 122Z lab experience. We hope you do!