Physics 110
Practical Physics
Laboratory Manual

Spring 2014

Physics Department
William and Mary

http://physics.wm.edu/~labs/110

Laboratory Manual: Practical Physics 110

Contents

Physics 110 Laboratory Schedule for Spring 2014

Lab Name	**Week**
No Lab Partial Week	January 15-17
No Lab Martin Luther King Day	January 20-24
Introduction	January 27-31
Vectors, Forces, and Equilibrium	February 3-7
Motion and Newton's 2nd Law	February 10-14
Oscillations: Mass on a Spring and Pendulums	February 17-21
Energy and Momentum - Ballistic Pendulum	February 25-28
No Lab Spring Break	March 3-7
Uniform Circular Motion and Centripetal Force	March 10-14
Temperature Scales and Thermometers	March 17-21
Internal Combustion Engines	March 24-28
Standing Waves and the Velocity of Sound	March 31 - April 4
Ohm's Law - Series and Parallel Circuits	April 7-11
Magnetic Fields and Induction	April 14-18
No Lab Last week of Class	April 21-25

Introduction

Without exception, all fields of science rely on experimental data to test theoretical models of the world around us. To fully understand the concepts of physics and other sciences, it is not sufficient to learn from a textbook alone. By performing hands-on experiments, you are able to explore and confirm the concepts which scientists have put forth to describe the processes that govern our universe.

To earn a successful grade for your lab each week you must successfully complete all steps of the experiment, write a lab report that presents the experiment, data, analysis, and error analysis in a clear and concise manner, and correctly answer all of the questions in the lab manual, and any additional ones posed by your TA. Poorly executed experiments, poorly written reports (this includes the scientific quality as well as grammar and neatness), failure to clearly analyze experimental errors, incorrect answers to questions, unlabeled graphs, and unit-less numbers will result in a poor grade. A successful experimentalist is one who understands the scientific goals and principles behind the experiment, pays clear attention to the details and potential errors, and presents the results in a clear and accurate report.

General Policy

In order to provide for consistency in policy and grading practices across the various sections of the introductory physics labs, the Department of Physics has adopted the following guidelines. Questions concerning these policies should be directed to your teaching assistant (TA) or the lab director .

Eating, drinking, or smoking, in the lab class is not allowed. Even the most careful and considerate students run the risk of damaging equipment if a liquid should accidentally be spilled. There is also the possibility of injury from such accidents with the electronic equipment used in some labs.

Students must bring their laboratory manual or a copy of the current experiment to class. In addition, each student should bring paper, pencils and a scientific calculator. A protractor, a ruler with centimeter scale are often useful.

Attendance

In general, the only acceptable excuse for missing a lab is an emergency or serious illness, and whenever possible, you need to contact the TA prior to missing the lab. A note from the office of the Dean of Students may be required to excuse the absence. Because each experiment requires specialized equipment which is only set up for one week, it is often difficult to make-up missed labs. Also, because there are not enough experimental set-ups to accommodate an overfilled class, it is not possible for students to attend a lab section for which they are not registered unless approved by the lab director and your teaching assistant. Even with the approval of the lab director or your teaching assistant, a make-up lab can only be done during the week the lab is scheduled. For these reasons, it is important that you make sure you are registered for a lab section that you will be able to attend for the entire semester.

Students must attend the lab section for which they registered. Requests to change lab sections after the beginning of the term will only be allowed under exceptional circumstances.

An unexcused absence from a scheduled laboratory will result in a student receiving a grade of zero (0) for that lab.

A student who presents documentation indicating that their absence from a lab should be excused will be considered on a case by case bases. Normally, a maximum of two (2) excused absences will be considered. The definition of an excused absence shall be an absence for which the Dean of Students is willing to offer a written excuse. Excused absences are limited to (1) illness with a written doctor's statement, (2) a major illness, death or other emergency in the immediate family or (3) official William and Mary business.

Grading

The lowest lab grade for the semester will be dropped from the student's final lab average.

To insure fairness and uniformity across lab sections, labs reports will be graded on an absolute scale from zero to twenty (20) points.

Lab Reports

- Lab reports are to be turned in at the end of the lab period. You are not allowed to leave before your lab is finished. Your partner cannot complete the work for you.
- The lab report must include your name, the date, the title of the experiment and the name(s) of your lab partner(s).
- The introduction to your lab report (see below) should be prepared before lab. It should not exceed two or three paragraphs. The introduction should include the basic 'theoretical' ideas and formulas for the lab.
- Raw data and calculations must be included with the report. Calculations should be neat and clearly explained. It is not necessary to show all arithmetic calculations but the reader should be able to clearly understand the manipulation of the raw data to determine the final results.
- Graphs and tables should be clearly labeled and referenced in your lab report. Tables and graphs should be neatly organized.
- Reports should be written in complete sentences. The report must be legible with proper spelling and grammar.
- You should list sources of uncertainty on measured quantities.
- All questions in the manual should be answered in the report. Any additional questions ask by your lab teaching assistant should also be included in the report.
- The lab report must include a conclusion.

- The format of your report should be:
  - Introduction (relevant theory and expectations)
  - Data (including calculation)
  - Analysis (Answer all questions)
  - Conclusion (state final results and explain errors).
- At the first 'introductory' meeting of the lab your teaching assistant will explain more details of what he or she expect to see in lab reports.

Preparation for Labs

You must prepare for the lab by reading the lab before coming to your lab section. Without reading and understanding the lab before coming to lab class, you can not hope to complete the lab in the required time and make sense of the data. Putting the required time into reading the lab manual before class will make your lab experience a more enjoyable learning experience. Your lab TA will present a brief introduction to the lab at the beginning of each lab. If you have read over the material before coming to lab, you will be prepared to ask questions on anything you might not understand before preforming the lab. If a teaching assistant determines that students are not coming to class prepared to do the lab, a quiz may be given at the beginning of class.