

Title: Physics 4A: Physics for Scientists and Engineers Lab

Fall 2016

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Prerequisites: Concurrent enrollment in **Physics 4A**.

Course Description

This is a hands-on experimental course intended to complement Physics 4A. The purpose of the lab course is to give you an opportunity to experimentally explore some of the main concepts covered in the lecture course. You will complete at least ten laboratory experiments, which nominally meet every week. These experiments include aspects of measurement and uncertainty, force, and motion. Working in groups, you will develop experimental and collaborative skills.

Course Policies and Expectations

Students work together in groups of three when possible (two students at a minimum). All data, graphs, answers to questions, and conclusions are a collaborative effort within the group.

Actively working together is an important requirement for succeeding in the course. Each group member is assigned the same grade for the submitted work (see lab grading procedure below). Students must arrive on time for their lab; you will not be allowed to participate in your group if you are late. The student must attend each of their lab sections. If you miss a lab without an excused absence, you will receive a zero for the experiment.

Lab Handouts and Materials

All lab handouts will be posted on the course website. Students should print a copy of each handout, read it over before their section meets, and bring a copy to their lab section. Also bring pens or pencils, scratch paper, and a calculator. All other Lab materials and equipment will be supplied in your lab section.

Lab Report Submission

Before the end of the lab session, each group turns in a copy of the **lab report** (data, graphs, answers to questions, and conclusions). Specifically, each student logs into the course website and downloads a digital copy of the report to a drop box. Time permitting it is strongly recommended that you have your teacher look over the work before it is downloaded. Your teacher may be able to offer advice or suggestions to improve the report before it is submitted.

Lab Grading Procedure

Each lab experiment is graded as a group on a scale of 0-5. The grading is based on the following rubric.

10	The group clearly understands the major lab concepts. Minor mistakes and careless errors can appear insofar as they do not indicate a conceptual misunderstanding. The lab is very neat and well organized.
8	The group understands the main concepts and problem-solving techniques but has some minor yet non-trivial gaps in their reasoning. The lab lacks a little in neatness and organization.
6	The group has partially understood the problem. The group may have started out correctly, but gone on a tangent. Some aspects of the lab are incomplete. The lab is disorganized or hard to read/follow.
4	The group has a poor understanding of the lab. They may have gone in a not-entirely- wrong but unproductive direction, or attempted to solve the problem using pattern matching or by rote.
2	The group did not understand the problem. They may have written some appropriate formulas or diagrams, but nothing further. Or, they may have done something entirely wrong.
0	The group wrote nothing or almost nothing. Note: Individual students will receive a zero for a lab experiment if they do not actively participate in their group or they miss the lab without an excused absence.

Course Letter Grade

Each student starts out the semester with 100 points. Labs that achieve 8 to 10 grade will not reduce this number. Labs that receive a seven will lessen the grade by 3 points. Labs that receive a 6 lessen the grade by 4 points. Labs that receive a 5 or below reduces the grade by 5 points. This portion will constitute 15 percent of your final grade.

Missed Labs, and Cancellations

Labs can only be made up with a doctor's note or documented emergency. Your lab teacher and the course instructors must be notified as soon as the conflict arises, preferably before your lab section is scheduled to meet. You must have written (email) approval from a course instructor

with a particular time and date for a make-up before attending a lab other than your assigned section. All appeals to make up a lab are at the discretion of the course instructors. Labs may be rescheduled due to cancellations caused by inclement weather or other emergencies. We have reserved an additional lab date for each section just in case. See the lab schedules below.

Academic Integrity

In this course lab partners are expected to work together on experiments. Submitted data, calculations, answers to questions, and conclusions are a collaborative effort by lab partners. Each member of the group will sign off on the submitted work.

Tentative Lab Schedule All lab sections meet in Phys 70

Week Lab Session

- 1 Lab 1: Measurement and Uncertainty: The Simple Pendulum Lab
- 2 Lab 2: Constant Velocity Model
- 3 Lab 3: Constant Acceleration Model
- 4 Lab 4: Projectile Motion and Relative Velocity Model
- 5 Lab 5: Balanced Force Model: Free Body Diagrams and the Force Plate Lab
- 7 Lab 6: Normal Force, Tension and Friction Lab
- 8 Lab 7: Unbalanced Force Model Lab: Pulleys and Tension lab (The Atwood Machine)
- 9 Lab 8: Velocity-Dependent Forces Lab: The Coffee Filter Lab (Modeling Air Resistance)
- 10 Lab 9: Circular Motion Lab: The Flying Pig Lab (The Conical Pendulum)
- 11 Lab 10: Mechanical Energy Transfer Model Lab: The bouncing ball lab
- 12 Lab 11: Constant Momentum Transfer Model (Conservation of Momentum): The Ballistic Pendulum Lab
- 13 Lab 12: Conservation of Momentum: Collision in 1D and 2D Lab
- 14 Lab 13: Rotation Lab
- 15 Lab 14: Statics and Equilibrium Lab
- 16 Lab 15: Restoring Force Model: Mass and Spring Systems Oscillation Lab

