

PHYSICS 6L
CLASSICAL MECHANICS

LABORATORY MANUAL

FALL QUARTER, 2014

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INTRODUCTION

Welcome to Physics 6L, the Classical Mechanics laboratory. The goal of this laboratory is to give you hands-on experience with real mechanical systems, to help you gain an intuitive grasp of the concepts introduced in the accompanying lecture course.

You may find the format and style of the physics labs quite different from your typical chemistry or biology laboratory. In chemistry and biology, you are expected to learn and retain specific techniques, such as quantitative and qualitative analysis, spectroscopy, and so forth. By contrast, the physics lab is *not* a techniques laboratory; it is a *concepts* laboratory. Although you will learn many important techniques (such as the proper use of an oscilloscope), the overwhelming stress is on understanding the deep physical principles that govern the physical world. A firm understanding of these principles should make it much easier for you to learn the technique-intensive subjects that you are also studying.

You will also find that the manual dwells at some length on the theoretical ideas behind the experiments. This is because it is often impossible to schedule the laboratory to closely follow the lecture material; sometimes the labs actually precede the lectures. Often you might miss the lecture, in any case. This is also why the laboratory instructor is asked to spend time at the beginning of each lab explaining both the theory and the techniques being used.

Course Registration

Although this course must be taken concurrently with Physics 6A, it is a separate course, for which you must register. Decide carefully which section you want to attend, because, due to space limitations, it may not be possible for you to change sections later in the course. Make sure that the section that you actually attend is the one in which you have enrolled, or your grade may be in jeopardy.

Enrollment is determined on a first-come, first-served basis. Enroll early, and be on time for the first meeting. **Students who do not show up in the first 30 minutes of the first laboratory will be dropped, and their place will be assigned to a student on a waiting list.** If you have an irreconcilable conflict, it is still important that you attend the first lab to which you have been assigned, to guarantee at least that space for you.

Laboratory Sections

Each laboratory section will meet once per week. There will be about 20 students in each section. Each section will be led by a Teaching Assistant, who is likely a graduate student in Physics.

In order to get credit for your work, you must attend the laboratory section in which you are officially enrolled. *You will only get credit for attending another section (“crashing”) if you have written permission, in advance, from both teaching assistants. In this case you must turn in your report to the TA at the end of the lab session, and ask him or her to deliver it to your regular TA.*

Notebooks

Please purchase the notebook that the bookstore has put aside for the physics introductory laboratories. It is a bound notebook with vertical and horizontal (quadrille) rulings, about 60 pages and approximately 8 inches by 10 inches. Please enter the course title, the quarter, and the TA's name on the inside of the front cover. You may use your notebook from a previous quarter, but be sure to update the course information on the inside cover. (The previous quarter's notebooks may be found on the shelves near the east stairwell in Thimann Labs).

The following records are **not** acceptable: loose-leaf binders, spiral-bound notebooks, and notebooks that have line ruling rather than graph-style quadrille ruling. *Please note that, after the first lab section, your work will be marked down if you turn it in on loose sheets of paper. The same applies to notebooks that are spiral bound or not quadrille ruled.*

Leave your notebooks with your TA at the end of each lab section, so that he or she can evaluate your work. If you don't understand or agree with your TA's comments, discuss them with him or her. For detailed guidance, please refer to **Guidelines for Laboratory Reports** in the Appendices.

Lab Partners

Work with a partner on each of the experiments. Since report preparation is an important part of the laboratory work, each of you should prepare your own notebook. Although you should feel free to refer your reader to a partner's notebook for a table of raw data, *etc.*, your calculations, descriptions, comments, and conclusions should be independently recorded.

Include your partner's name when you describe an experiment, and always enter the date. It will make it easier for your instructor. Try to choose a different partner each week. It's a chance to make new friends and to stimulate new thinking.

Pre-laboratory Questions

You will find pre-laboratory questions at the end of each chapter of this manual. These questions are intended to prepare you for the concepts and calculations that you will need for the laboratory, and are guaranteed to save you a significant amount of lab time. For this reason, it is a good idea to keep a copy of your prelab solutions with you as you do the lab. *Please submit solutions to the questions to the TA on a separate sheet of paper when you report to the laboratory class.* Late submissions will not be accepted for credit.

Grades

Your work will be appraised with a letter grade. Your grade will be based upon all of the scheduled laboratories. If you miss one lab for a documented medical or family emergency, *and you notify your TA in advance and in writing*, your grade will be averaged over the remaining laboratories. If you otherwise miss a single laboratory, your final grade will be averaged over the remaining labs, but then reduced by a full letter grade. If you miss two labs for a documented medical or family emergency, *and you notify your TA in advance and in writing*, you may, before the end of the last week of instruction,

petition in writing for an incomplete (I). If you miss two labs for any other reason, you will not pass the course.

Laboratory Etiquette

As a courtesy to your fellow students, when you are finished with the laboratory, please make sure that all of the equipment is intact and organized in an orderly way. If any equipment is missing or not working properly, please notify the instructor.

Also, please do not bring food or drink into the laboratory. You may leave such items on the shelves in the hallway to consume elsewhere. Finally, by order of the Fire Marshall, under no circumstances may bicycles be brought into the laboratory. Bike racks are available at either end of the building.

Final Comments

We hope that you enjoy this lab course, and that you will find that your discoveries will be repeated again and again in the real world. We also encourage your feedback on the curriculum, the quality and readiness of the equipment, and on the laboratory manual. Please send your comments to the laboratory manager, who can be contacted at gsbrown@ucsc.edu and who sometimes resides in 111D Thimann Laboratories.

Good luck!

George Brown
Professor of Physics