

Introduction

revised October 22, 2004

Learning Objectives

After completing the Introductory Physics Labs, you should be able to

1. determine if a given set of data supports or does not support a scientific model.
2. effectively communicate technical results in writing.
3. estimate the uncertainty of directly measured quantities.
4. determine the uncertainty of quantities calculated from uncertain quantities (error propagation.)
5. accurately record your experimental procedures and data in a laboratory notebook.

As a student in the Introductory Physics Laboratories, you are responsible for reading, understanding and following the laboratory rules and regulations described in this Introduction.

A. Attendance

1. Attend the laboratory section for which you have registered. Any permanent change of section must be completed officially through the Registrar. Permits may be required after the first day of class.
2. Attend every one of the scheduled lab meetings. Do not plan any activity that conflicts with your section schedule.
3. Arrive at the laboratory on time and remain for the full period or until you have finished the experiment **and** the analysis of your data. Students arriving late can be very disruptive to the class as a whole. If you arrive for a laboratory after your TA has finished introducing the lab, it may be necessary to assign you to a different

lab partner or have you work on your own, if a lab station is available. Depending on the difficulty of that week's lab and how late you arrive, it may also be necessary for you to reschedule for another laboratory period — if that is possible. If you arrive too late to do the lab and need to be rescheduled for another period, your tardiness will be treated as an unexcused absence. Late arrival to lab may result in your **total** lab grade (*for the entire semester*) being reduced by 5% per occurrence.

4. Before you leave the lab, you must clean up your lab station, returning it to the state in which you found it, and hand in to your Teaching Assistant (TA) a legible duplicate copy of your lab notebook pages for the period. This will serve as evidence of your attendance.
5. Submit your reports and/or worksheets on time; generally this will be one week before your next scheduled laboratory period.

B. Groups and Partners

Each laboratory section has an enrollment limit of 32 students. Since each laboratory room can only accommodate 16 people, sections will be divided in half on the first day of lab. You will be assigned to one of the two mechanics laboratory rooms and should report directly to this room for subsequent labs.

Within each room, students will work with one (*and occasionally two*) lab partners. Partners will be assigned by the TAs. You will normally keep the same partner for the duration of the semester unless special circumstances require temporary or permanent reassignments.

C. Equipment and Supplies

You will need to bring the following materials to each lab session:

1. A laboratory notebook that provides a

copy of each page. You will turn in this copy to your TA as you leave each lab session. These notebooks are available in the university bookstore. In the past few semesters, the bookstore has stocked Roaring Spring® Paper Products item #77644 for this course, but the bookstore sometimes changes the manufacturer and model without notifying the physics department;

2. this laboratory manual;
3. a scientific calculator. Be sure to record your name and/or e-mail address on the calculator. Each semester several unidentified calculators make their way to the Physics Department's lost & found.

D. Laboratory Notebook

Detailed instructions on how to keep a laboratory notebook can be found in Appendix I of this manual - **READ IT!** The notebook should be a record of all your laboratory activity — it is your *research diary*. Learning how to use your laboratory notebook correctly is an important part of the course.

D.1 Identification

Be sure to write your name, e-mail address, course and lab section number (*as in section #1A or #8B*) on the cover of your notebook.

D.2. Table of Contents

Begin with a *Table of Contents* on the first page. List all experiments in the Table of Contents with the notebook page number on which they begin. The table should take the following form.

Exp. #	Exp. Name	Pg.
1	FFA	2
2A	IP	8
...		

D.3. Notes and Data

All experiments require a header entry

in your notebook and a listing in the table of contents. The header should begin on a fresh, right-hand page and must include:

1. the title of the experiment;
2. the course and your section #
3. the date of the experiment;
4. station number (on the computer monitor);
5. your name and the names of your partner(s) and TA.

A laboratory notebook serves as a diary and workbook for all laboratory activity. Use your notebook for every experiment. Record data and notes in ballpoint pen directly in your notebook (*soft point pens may not make legible duplicates*). Record the full identification names of all computer files that you create. You should not make notes or perform any calculations on loose sheets of paper, even if you intend to transfer this information into your notebook later.

E. Reports & Worksheets

Every lab will require that you hand in a report and/or worksheet. Worksheets generally require short answers to a page or two of questions, although you will sometimes have to attach supporting documentation such as plots you take during the lab. It is sensible to read the worksheet as you do the experiment to be certain you acquire all of the data necessary to answer each question. However, the issues that must be addressed in a worksheet or report are highlighted in the lab manual by underlining.

The writing of reports is described in Appendix II of this manual — **READ IT!** To help you learn how to write reports, you are provided with a sample report in Appendix X.

While your lab partner(s) and you will normally have identical data and perhaps very similar or the same analysis of that data, you must write your own report. We permit (and even encourage) partners to work together to analyze the data; such col-

laboration needs to be properly acknowledged or referenced. However, you need to write the words to your report yourself. **Making direct or edited copies of your partner's or someone else's text (without attribution) is considered a serious breach of ethics and will be dealt with harshly.** University regulations require that the minimum penalty for plagiarism is a zero for that report and forwarding of the evidence of plagiarism to the Office of the Dean of Undergraduate Studies.

You agree that by taking this course, all required lab reports or other assignments submitted for credit may be submitted to MyDropBox.com or similar third parties to review and evaluate for originality and intellectual integrity and that if the results of such a review support an allegation of academic dishonesty, the course work in question as well as any supporting materials may be submitted to the Office of the Dean of Undergraduate Studies for investigation and further action. A description of the services, terms and conditions of use, and privacy policy of MyDropBox.com is available on its web site, <http://www.MyDropBox.com>. Understand that all work submitted to MyDropBox.com will be added to its database of papers.

Reports are due no later than 6 PM, one week after your laboratory session. For example, if you have Lab #3 on Wednesday, February 11, you must drop off your report by 6 PM on Wednesday, October 18. If you have scheduled a make-up or make-ahead lab, your due date is the latter of the due date for your section and one week from when you actually took the lab (i.e., if you do your lab early, your due date is your regular due date; if you do your lab after your regular section, your due date is one week from when you actually did your lab. Staple together everything you hand in and drop this package into your TA's slot in the secure mailbox on the 4th floor of the Rockefeller building. Reports for labs that

meet the week before Spring Break are due the week after Spring Break. In general, the doors to the Rockefeller Building are locked at 6 PM, so plan to have your reports in by that time.

F. Grading

Your grade in the laboratory will count for 20% of your grade in the entire course.

F.1. Grade Scales

Laboratory notebooks will be graded on a scale of 10 points, reports will be graded on a scale of 60 points, and worksheets will be graded on a scale of 30 points. Different labs, with different combinations of reports and worksheets, may carry different weights in your final grade. More guidance on the point value of various aspects of your work will be provided on the grade sheets distributed in class.

The nature of experimental science is such that perfection is impossible. In particular, you may notice that the grading of your labs is not primarily based on the numerical results you obtain but rather on the process you navigate to arrive at your results as well as the quality of your description of this process.

F.2. Late Submission

Written documentation from a physician's office or Undergraduate Studies is required to avoid being penalized for late submission due to medical or personal reasons. In the absence of such documentation, late work will be penalized 10% (*of the TOTAL possible grade*) per day (*counting only weekdays*) for up to one week (*five weekdays*). Work submitted more than one week late will not be graded. Turning in even part of your work late may result in penalties being applied to the entire grade for that lab (*notebook, worksheet and report*).

F.3. Lost Notebooks or Reports

We strive to maintain the highest security in the laboratory (*even TAs may not remove your work from the laboratory for grading*), thus responsibility for lost work

will generally be placed on you. Be very careful to attach the correct cover sheet to your work and to drop it into the correct box. It is your responsibility to replace any lost work. You may wish to keep copies of all material before submitting it for grading.

F.4. Grade Posting

Your TA should return your graded work to you when you arrive to perform the next experiment. If material is not returned, ask for it.

Grades and grade summaries will be posted regularly on the class Web site. It is your responsibility to check these grades for accuracy and to assure that all material has been graded and properly recorded. Problems must be reported in a timely fashion by e-mail to your TA with a cc: to the laboratory director. Delays of more than two weeks may make it difficult or impossible to post your credit properly. The first reading day before final exams is the absolute deadline for clearing up any problems with your laboratory grade.

G. Missed Experiments

You are expected to attend all of your laboratory sessions and complete satisfactorily all required work. Formal makeups will be given in the two reading days at the end of the semester. The number of available makeups is limited so you must have a valid, documented excuse and written permission to be assured a spot. Students must request permission for an end-of-semester makeup from the Laboratory Director no later than two weeks after the missed lab (*or, for Lab #7, by the last day of classes*).

If you have a valid reason for missing your regular section and if another section of the same lab fits your schedule, you should request permission from the laboratory director (*not a TA*) to attend it, rather than an end-of-semester makeup. Students who could have come to a different section but did not do so may be denied permission for an end-of-semester makeup. If you have to

make a choice between missing a course or a laboratory session, you should note that there are about 40 meetings of each course during a semester but only 7 laboratory meetings.

Some acceptable reasons for being permitted to make up a missed lab might be illness or family emergencies. Preparing homework assignments, studying for an exam and oversleeping are **not** acceptable excuses. However, always ask for special permission when problems arise; it's possible you will be granted a reprieve, although some penalty may still be assessed.

Faculty members are not permitted to give exams that conflict with your regular course schedule unless they provide suitable alternate times. Please report any such problems as soon as possible. In general we cannot provide lab section changes or make-ups which arise from such problems. However, a phone call from the Dean of Undergraduate Studies may convince these faculty to change their schedules.

H. Laboratory Website

The laboratory website is at

<http://physicslabs.phys.cwru.edu/>

There is a lot of useful information on the website:

1. Announcements: You *must* check the web announcements before each lab. The announcements have pictures of the laboratory equipment, supplemental instructions, changes to the laboratory, corrections of typographical errors, and other laboratory-specific useful information.
2. Schedule: If you forget the exact date and time of your laboratory meeting, you can find it on the website.
3. Open Lab Times: Times when the laboratories are not in use and you can use the computers are listed on the website and posted on the doors of the laboratories. **You may not use the laboratory equipment during open lab times without the permission of the laboratory director.**

4. **Make-Up Labs:** Policies for requesting make-ups/make-aheads for missed labs as well as possible times are listed here.

5. **Policies:** A reminder of the policies listed on the next page is here.

6. **Contact Your Instructor:** Quick e-mail links, as well as office room numbers and phone numbers for the lecturer, all the TAs, and the lab director are listed here.

7. **Lab Manual:** Electronic versions of the lab manual are available here.

8. **Check Your Grade:** The laboratory director will regularly update this page with students' grades; if you find a discrepancy between this page and the grade written on your cover page, contact your TA first.

IMPORTANT SCHEDULES and POLICIES

SCHEDULES

Paper copies of reports/worksheets due: at 6 pm 1 week after you do the lab

Deadline for reporting grade errors: 2 weeks from posting date

Deadline for requesting an end-of-semester makeup: 2 weeks from the date of the missed experiment

Deadline for resolution of all problems: First Reading Day before Finals

POLICIES

You may lose points for each instance of the following infractions:
wrong mailbox, missing report cover sheet, incomplete ID.

Forgetting your notebook: Lose 5 points.

Missing lab without valid reason: a 0 for that lab.

Late arrival or attending wrong lab section without valid reason: 5% points from your total lab grade, for the entire semester per occurrence.

Late work: 10% (of total credit) per weekday until 1 week after due date, 0 credit afterwards. Penalty applies to ALL parts of the lab, even if some parts were submitted on time.

Not submitting report to MyDropBox: 0 for report.

Correctly Attributed Copying: 50-100% of value of copied work (depending on amount copied) with minimum loss of 6 points.

Plagiarism: 100% of your grade for the report and forwarding of evidence to the Office of the Dean.