

PHYS 122L
Introductory Physics Lab
Dr. Eric C. Anderson
UMBC • Fall • 2018
Syllabus

• Getting ready •

Prerequisites • You must have completed Phys 121, and Phys 122 (or be enrolled in it this semester.)

Blackboard (BB) • Log on to myUMBC, click the *Blackboard* tab and then click *PHYS 122L Introductory Physics Lab* in the *My Courses* area for access to course materials, discussion forums, your grades, helpful advice, and announcements. Log in at least once between classes.

Required items • Two-copy lab notebook, available at UMBC Bookstore. (You keep the originals; your TA will collect the duplicates.) Ask at the bookstore if you're not sure. Access to any calculus-based intro physics text. Access to **Microsoft Word and Excel** with option to print. Make sure to back up your files properly and to have a plan B for printing. Difficulties with your computer are not an acceptable reason for a late report. Scientific calculator.

Class • T 1-1:50 PM in Physics 226 and weekly lab T or Th (check your schedule) 2 - 4:45 in Phys 110.

• Learning goals •

Prerequisite Knowledge • I will assume that you have the Physics background provided by PHYS 121 and PHYS 122. We will use concepts from these classes on a daily basis. I will assume that you have a working knowledge of calculus that includes derivatives, and formulas for algebraic and trigonometric functions.

Course goals • This may be the first serious physics lab you will have ever taken. Therefore, there will be about as much emphasis on how to carry out and report a measurement as on the physics of the lab itself. Nevertheless, keep in mind that clear understanding of the principles involved in the lab material is essential. Busy work without understanding is worthless, no matter how neatly documented. Here is a formal list of objectives, in order of importance:

- Observe physical phenomena familiar from your lecture courses. Become familiar with the intricacies of working in a lab, such as how to plan a measurement, how to set up and use equipment, and how to take and record data.
- Learn how to analyze your data and compare theory with experiment.
- Learn the proper methods of estimating and reporting errors. Although it is not the main purpose of the lab, much of your time will be spent on error evaluation. No lab report is complete without an estimated error for every measured and derived quantity. Learn how to use error propagation and fit theoretical curves (straight lines) to measured data.
- Learn to present your results in a complete, concise, and clearly written report. (In the real world, your work is usually judged by what you write about it: a report for your manager in industry, a dissertation as a graduate student, a research paper in academia. Badly written reports are dismissed, regardless of the quality of work itself.)

• Methods •

Reading• Come well prepared to the lab. Read the relevant chapter from the lab manual and polish up on your basic physics knowledge, if necessary. Summaries of the principles will be given in class and also posted on Blackboard, but they are too little too late, unless you did your share already. The summary in lecture is used only as an opportunity to ask questions. Good preparation is the key to correct and efficient work in the lab.

Homework• Homework assignments for the first two weeks will be posted in Blackboard. It is your responsibility to obtain a copy. For any solution that requires calculation in Excel, you must include a printout of the results with the main answer circled or highlighted. You should also include handwritten comments on your printout to make it easier to follow your work. For other questions, homework solutions can be handwritten, but please, write clearly and be organized. You can work together, but eventually each student must have her/his own unique solution.

Submit complete solutions, not just final results without justification. The correct answer without the work will receive NO credit. Partial credit is given for partially correct attempts with proper documentation.

Notice that the homeworks account for a substantial portion of your final grade, as much as a weekly lab report each. They are challenging, comparable to writing a lab report. Take them seriously, leaving sufficient time to complete each. It is not wasted time: all the skills developed with the homework are used later during data evaluation for reports.

Working in the lab• Arrive to the lab on time. Usually two students work together, thus being late from the lab hurts your partner and potentially gives you credit for work you were not involved in. Therefore, the following late policy will be strictly enforced:

5-15 min: your lab grade is reduced by 10%. 15-30 min: your lab grade is reduced by 30%.

If you are late by more than 30 min, you are dismissed from the lab. If you have a proven legitimate reason, you are eligible to make up the measurement; otherwise you will get no credit.

Work in the lab in an orderly manner. You will not do any particularly dangerous experiment, but accidents can happen if you are careless. Use common sense and be careful with shooting balls, pouring hot water, and high voltage.

Usually two different measurements will be set up in the lab. Half the class – Group A – will work on one measurement, Group B will work on the other. Next week you do the other measurement. Whether you are in Group A or B will be decided before the first lab. It is important to remember your group as you need to prepare for the next measurement accordingly. See the schedule at the end of this Syllabus for the order of measurements.

Lab reports• To receive full credit for a lab report, you must attend the lab, take data, submit the duplicate copy of your record (on the day that you perform the lab), and hand in a hard copy of your written report within one week after you do the experiment (normally at the beginning of the next lab.) Do NOT email your report to me or to the TA; we will delete such emails upon receipt, unless you have prior authorization due to some special circumstance. Printer problems are not acceptable as a reason.

Reports must be typed using a word processor and should conform to the format supplied at the beginning of the semester and in the sample report in the Lab Pack. It must be spell-checked and written in clear English. (Publishers return manuscript without review, if the language is full of errors.) You may talk to your classmates regarding the lab reports, but each of you **must submit your own original text, graphs, analysis, and report**. If your data evaluation required the use of a spreadsheet, attach a printout to your lab report. Incorporate only the main results and plots in the main text of the report.

Copying someone else's work is cheating. If your report is too similar to someone else's work – from your class or from a previous semester – you will get zero for the report. Be prepared to provide an electronic copy of your report for electronic comparison using SafeAssign, in case of any suspicion. Of course, it is understood that the raw data of your partner equal yours. But the evaluation, graphs and the text must be clearly different.

Oral presentations• You will give a 15-minute talk based on one of the labs at the end of the semester. You and your partner will propose an addition, correction, or refinement to one of the measurements. You don't have to do the measurement you propose (though it may be beneficial if logistically possible). We'll discuss how to make such presentations during lectures. The goal is to give you experience in presenting scientific results and answering questions in front of your peers. No matter what job you do in the future, you can benefit from learning how to present a topic in a clear and concise form.

•Policies•

Grading• Each of two homework assignments, each of nine lab reports, and your presentation are equally weighted. 90% required for A, 80% for B, 70% for C, and 60% for D.

Late submissions• (both homework and lab report) can be turned in to the physics office, room 220 in the Physics Building, to the TA, or to me. They must be marked with the date and time of submission by the person receiving them. The score of a late assignment will be reduced according to the formula:

$$\text{Final Score}(t) = \text{Original Score} * 2^{-t/7},$$

where t equals the number of full or partial work days by which the assignment is late. (According to this formula, being late by one day means about a 10% reduction, thus a single printer issue is not the end of the world. Being late every time costs you a full grade. A one-week-late assignment receives 50% credit. Plan to be always on time and get full credit.

Missing a lab• If you must miss an lab due to officially sanctioned UMBC activities, illness, family emergency, detention by authorities, or another difficulty, contact me as soon as possible. At my discretion, I'll request written verification of the cause of your absence and arrange for you to make up the lab during the week of 26-30 Nov.

Academic integrity• "By enrolling in this course, each student assumes the responsibilities of an active participant in UMBC's scholarly community in which everyone's academic work and behavior are held to the highest standards of honesty. Cheating could result in disciplinary action that may include, but is not limited to, suspension or dismissal." More on the requirements of academic integrity can be found at <http://www.umbc.edu/gradschool/procedures/integrity.html>

•Getting help•

Contact me• Eric C. Anderson, Physics 320. Office hours M 12:00-12:50, W 2:00-2:50, Th 1:00-1:50 in Phys 226A through 11 Dec.. (Check BB for updates.) Phone 455-5823, email andersoe@umbc.edu. Please email me through BB or use your UMBC email and give your full name and your class. *If you seek HW help or have a general course question, please post to the appropriate discussion forum on Blackboard, so that others might benefit.*

Physics Tutorial Center• Physics 226, open 12-5 Monday through Thursday (except 3-5 Wednesday). Staffed by instructors and graduate TAs.

Student Disability Services (SDS)• UMBC is committed to eliminating discriminatory obstacles that may disadvantage students based on disability. Services for students with disabilities are provided for all students qualified under the Americans with Disabilities Act (ADA) of 1990, the ADA of 2009, and Section 504 of the Rehabilitation Act who request and are eligible for accommodations. The Office of Student Disability Services (SDS) is the UMBC department designated to coordinate accommodations that would allow for students to have equal access and inclusion in all courses, programs, and activities at the University. If you have a documented disability and would like to request academic accommodations, please refer to the SDS website at sds.umbc.edu for registration information and to begin the process, or alternatively you may visit the SDS office in person in the Math/Psychology Building, Room 212. For any questions or concerns, you may contact us through email at disAbility@umbc.edu or phone at (410) 455-2459. If you require accommodations for this class, please visit me during office hours to discuss your SDS-approved accommodations.

•Weekly guide•

Week of:	Lab	Due
3-7 Sep	Lecture: Analysis of uncertainties Continued in lab.	
10-14 Sep	Lecture: Graphing and fitting data, using Excel Continued in lab.	HW 1
17-21 Sep	Group A: 2 The Ballistic Pendulum Group B: 1 Atwood's machine	HW 2
24-28 Sep	Group A: 1 Atwood's machine Group B: 2 The Ballistic Pendulum	Lab report 1/2
1-5 Oct	Group A: 4 Angular Momentum Group B: 3 Simple Harmonic Motion	Lab report 1/2
8-12 Oct	Group A: 3 Simple Harmonic Motion Group B: 4 Angular Momentum	Lab report 3/4
15-19 Oct	Group A: 6 Heat Capacity and Latent Heat Group B: 5 Velocity of Sound	Lab report 3/4
22-26 Oct	Group A: 5 Velocity of Sound Group B: 6 Heat Capacity and Latent Heat	Lab report 5/6
29 Oct-2 Nov	Group A: 8 The Current Balance Group B: 7 DC Circuits and Ohm's law	Lab report 5/6
5-9 Nov	Group A: 7 DC Circuits and Ohm's law Group B: 8 The Current Balance	Lab report 7/8
12-16 Nov	Both Groups: 9 The Ratio of e/m for the Electron	Lab report 7/8
19-23 Nov	No meetings	
26-30 Nov	Makeups, preparing presentations	Lab report 9
3-7 Dec	Student presentations	