Locations and time (Rooms 150 and 151 of Park Science Center): 1 pm–4 pm on Thursdays.

Office hours: by Email appointment

Course description:
The lab session of Phys 214 consists of a series of modern physics experiments. Each experiment has a document folder with information on background, physics concepts, and detailed instructions on this experiment. These experiments are left fairly open ended to allow you many routes of investigation and exploration. The intention of this lab is to provide a fun environment in which to do some classic modern physics experiments, as well as to expose you to some state of the art research equipment. You will work on one assigned lab each week and write independent lab journal. Each experiment gives detailed instructions on. Follow these instructions carefully so that no one gets hurt and nothing gets broken. You are expected to arrive promptly at 1:10pm and spend the full 2 hours and 50 minutes working on each experiment.

Student learning goals:
In this lab course, you are expected
• To exercise curiosity and creativity, develop physics intuition and critical, quantitative thinking, and deepen understanding of physical concepts.
• To develop reporting skills, written and oral, by keeping a lab journal and by discussing work with instructors and fellow students.
• To develop experimental and data analysis skills, and learn to estimate statistical errors and recognize systematic errors.

Lab journal writing:
Please follow the instructions below for lab journal write up:
• Do NOT use green pen in your lab journal, because I will use green pen to grade.
• Leave the first sheet (both sides) blank. It will serve as a table of contents for your notebook. Each week you should add to the table that week’s experiment name as it appears on the lab instruction folder, date, and starting page number of your diary entry. Please number the pages of your notebook as references for the table of contents.
• Each new lab should start on a fresh right-hand page following a blank left-hand page. The name of the week’s experiment, the date, and your lab partner’s name (if any) should be clearly visible at the top of the first page of each experiment’s entry.
• Leave room at the start of each new experiment entry for a brief, one- or two-sentence "abstract" describing your understanding of what the experiment is about; i.e., what you’re trying to explore. You can write this at any point during the experiment. This is different from a research paper abstract, which summarizes results. Here, the purpose is just to get you to think about the big picture: what is/was the experiment about?
• Use both sides of pages but leave roughly a 2-inch margin on the inner side of each page for me to write comments in. We would like these notebooks to last through both semesters, so please pace your use of notebook pages.
Different formats exist for lab notebooks. In this lab, we use the journal format employed by actual working scientists. Keeping a journal means literally writing down what you are doing in as succinct a manner as possible, as you go. Full sentences and good grammar are not necessary. It also is not necessary to reproduce in detail the procedure described in the experiment write-up, but just summarize each step as you go through it. It is insufficient, however, to have a page splattered with numbers, calculations, and tables. Those numbers and calculations must be embedded in a "verbal" context so that it’s clear what each entry is. Even for directed, quantitative labs, you need to say, in English, what is happening. You also always should sketch the pieces of apparatus used. When someone reads your journal, the reader should find your lab journal to be a "stand-alone" record of the process. The reader should not need to have the write-up nearby or be sitting at the bench where the experiment is housed. Record not only what you do, but also what you discover, your analysis, and any questions that come up (as well as any answers you find).

When you tape or staple print-out graphs into your journal, make sure they are taped/stapled at all four corners and that they do not flop around when the pages are turned quickly. When a fit to data is requested, unless otherwise instructed don’t print out both a plot with just raw data and a second plot with that data plus a curve fit. Print out only the complete plot, with the curve fit. Plots should display informative titles (e.g., "Period vs. Length for a Simple Pendulum"), not just restate what’s on the axis labels (e.g., "Period vs. Length"). Axis labels should indicate units.

You need to pay extra attention to data report format and error analysis. A number without any unit means nothing. It is a wrong understanding that the more digits, the more precise the data are. Follow the rules for significant figures. Apply what you learn in the first class on error analysis to correctly estimate the uncertainty of your experiment and show the detailed steps for error analysis. Discuss errors sources, both statistical and systematic, and how to reduce errors. When possible compare your experimental result to accepted values.

In most cases, the last 15 minutes of the lab period (3:45-4:00) should be reserved to write a summary of your session. For some experiments, "summarizing as you go" may be more sensible. Use your best judgment for each experiment.

Lab evaluation:
Each week I will read your lab journals and make comments. I will focus on the correct way to report your quantitative results, especially error analysis and significant figures. Be sure to read my comments each week and answer any question I ask. I will evaluate your lab performance based on your lab skills, your lab journals and your discussion with me. I will judge how well you understand the physical concepts being investigated, your ability to solve problems and think critically about an experiment, and your reporting and analysis skills. You are not expected to have mastered all of this from the start, but rather to develop your skills as the semester proceeds.

The 214 lab is run independently, but is a required part of Phys214. You must satisfactorily perform 12 experiments (work on for 2 hours and 50 minutes) in order to pass this course. Please note that if you fail to meet this requirement, you will fail the course. There is no separate grade for this lab. However, excellent lab performance may raise your Phys214 grade in borderline cases.

Accommodations:
Students who think they may need accommodations in this course because of the impact of a learning, physical, or psychological disability are encouraged to meet with me privately early in the semester to discuss their concerns. Students should also contact Stephanie Bell, Coordinator of Access Services (610-526-7351 or sbell@brynmawr.edu), as soon as possible, to verify their eligibility for reasonable academic accommodations. Early contact will help to avoid unnecessary inconvenience and delays.
Lab Policies

- Labs run 1:10-4:00. If you finish your experiment before 3:45, you may be “checked out” by your instructor if you wish to leave. You will be asked to summarize your findings, and discuss problems and suggest possible improvements to the experiment.

- You may not miss your regular lab without an excuse (a written note or an email) from a Dean, a doctor or the Health Center. You must still make up the lab even if you have such an excuse. Please note that if any labs are not completed, you will fail your lecture course, not just the lab. We have asked the Deans to never grant an excuse because you "had too much work to do." It must be a personal or family emergency or a genuine health issue. If you know in advance that you will miss a lab, let me know well ahead of time so we can schedule a make-up. If you miss a lab without forewarning, contact me as soon as possible. It is your responsibility to ensure that all missed labs are made up.

- You may not eat in lab, but you may drink from a sealed beverage container kept on a windowsill. Do not leave a beverage container, even with a cover, on the desk; if spilled, which has happened, it can damage equipment or a computer or short out a power strip. If you do not have time to have your lunch before lab, you may eat in the hallway outside the lab, but you should get to work in the lab as quickly as possible.

- NO CELL PHONES are to be used, or even on your desk, during lab. Also, NO iPods or other music players are to be used, and you may NOT play music on your desktop computer. You also are NOT permitted to check your email on your desktop computer. This lab is a collective experience and those activities can disturb others, disconnect you from the group and diffuse your attention. You are in lab to explore, experiment and learn physics!