

PHYSICS 125, Spring 2018
PHYSICS FOR FUTURE PRESIDENTIAL ADVISERS
aka “Widely Applied Physics”
SYLLABUS

INSTRUCTOR

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TEACHING FELLOW

Temple He (the@g.harvard.edu)

COURSE DESCRIPTION

Physics 125 is an unusual course. Most courses have a specific content-oriented goal in mind. This will not be the case here. Instead, the main goals in this course will be to develop physical intuition and to become comfortable with order-of-magnitude (“back of the envelope”) calculations. We’ll learn a little bit about a lot of things. The topics fall into three basic categories: 1) things that a presidential adviser should know, 2) things from everyday life that are good to know, 3) cool/nerdy things that every physics student should know. We’ll cover many topics in the latter two categories (which means that the official title of this course isn’t terribly accurate this time around).

Topics include, but are not limited to: dimensional analysis, scaling laws, fluids, global warming, energy production/use, nuclear power/weapons, health effects of radiation, risk analysis, cosmology, flight, spy satellites, rockets, mechanical design and failure.

Note: On one hand, you might find this course easier than a standard course because, although we will cover a very large number of topics, we won’t go so deep into any particular one. On the other hand, you might find this course more difficult because real-world physics is rarely clean. The questions are often open-ended and require you to make simplifying assumptions. (Deciding on these is half the battle.) After solving a problem, it’s hard to be confident that you did it correctly. Part of the reason for this is that “correctly” isn’t even well defined. Is the goal to get the exact answer, or to just be within an order of magnitude? Sometimes it’s one, sometimes it’s the other. Not having a definite result as a target is often unsettling for students.

LECTURES

Tuesday and Thursday, 1:00-2:30, Jefferson 256

OFFICE HOURS

We are eager to help you in any way we can in this course. David Morin’s office hours are posted on the web at www.people.fas.harvard.edu/~djmorin/office_hours.htm.

Temple He’s office hours will be determined shortly.

PREREQUISITES

Physics 15a, b, c, and math at the level of Math 21a. A few ideas from Physics 143a and 181 will be used, but they will be derived as needed.

TEXTBOOK

There isn't any one textbook that covers everything in the course, but a book that we will use for many topics (and which is therefore required) is:

The Art of Insight in Science and Engineering, by Sanjoy Mahajan, MIT Press, 2014.

It isn't available in the Coop, but it's fairly cheap online. Alternatively, the eBook is free on the MIT Press website: mitpress.mit.edu/books/art-insight-science-and-engineering. Other resources and papers will be posted on the Canvas site as the course progresses.

SECTIONS

Sections (1 hour) meet once each week and are taught by Temple He. The purpose of the sections is to work through examples relevant to the homework problems, and to discuss things in a smaller classroom setting. The meeting times and locations will be determined soon. Sections begin on Monday, January 29. The sections are extremely helpful for learning the material and for solving the homework problems. Attendance is required. But aside from being required, it is simply a good idea to attend and to get to know Temple.

PROBLEM SETS

There will be one problem set each week (except during midterm weeks), due at the beginning of Thursday's class. Solutions will be available at the end of class. New problem sets will be posted on the course webpage on Thursday evenings. To receive full credit for a problem, it must not only be correct, it must also be written up *neatly*, with clear explanations involving *words*. A good rule of thumb is to ask yourself if a classmate would be able to understand your solution. No credit will be given for a string of equations leading to the correct answer.

Except in unusual circumstances, we will not be able to accept late homeworks. But we will drop your lowest homework score when computing your final grade. Any requests for extensions should be made to David Morin.

WEBPAGE

There is a link from the online course catalog. Problem sets, solutions, announcements, readings, supplementary material, and other useful things will be posted on the webpage. It will be very helpful, so please make good use of it.

STUDY GROUPS, COLLABORATION

You are encouraged to work together on problem sets, but the work that you hand in must be your own. Be careful not to rely too much on your classmates, because you will need to fully understand the problems for the exams. The best balance between working alone and working with other people is to (1) work on the problem sets alone until you get stuck on things, then (2) work with other students or get hints in office hours, and then (3) finish things up alone where you can collect your thoughts in the peace and quiet of your own brain. If you skimp on the first and third of these, it will definitely show up on the exams.

Note: When working in study groups, please remember to be courteous to the other members. It's great if you get excited about things and shout "Eureka!" every now and then (we encourage this!), but be careful not to dominate the discussion. Remember to regularly take a step back and make sure that everyone else has the opportunity to give his/her input.

EXAMS

The exam structure will depend on the size of the class. If the enrollment is large, then there will be two midterm exams and a final exam. If the enrollment is small, then there will be one midterm, one presentation (including a short writeup), and a final. The midterm date(s) will be announced soon. The final-exam date appears to be May 4.

GRADING

Homeworks 25%, 1st Midterm 20%, 2nd Midterm (or presentation) 20%, Final exam 30%, Section participation 5%.