

Physics 171 / 171H

Introductory Physics: Mechanics and Relativity

Fall 2009 — Professor Shawhan

Course topics:

Kinematics, Newton's laws, gravity, energy and work, linear momentum, special relativity, rotational kinematics, angular momentum, static equilibrium, elasticity, fluids, gases, and basic thermodynamics. This course is designed for physics majors and those desiring a rigorous preparation in the physical sciences. Knowledge of basic calculus will be assumed.

Prerequisites:

Math 140 (Calculus I) and a high school physics class, or permission of the department.

Lectures:

Mondays, Tuesdays, Thursdays, and Fridays from 9:00–9:50 in room 1201 of the Physics Building. Note that Physics 171 and Physics 171H (the honors section) share the lectures. Students in 171H also have a weekly discussion session: Tuesday 3:00–3:50, Wednesday 10:00–10:50, or Wed. 4:00–4:50.

Class attendance is important, and I expect you to come to class and to participate for your own benefit and enjoyment. I plan to make the class time fairly interactive, and we'll often talk about things which are not in the book. I do not attempt to keep records of class attendance.

Required textbook:

“Physics for Scientists & Engineers” by Douglas C. Giancoli, 4th edition, chapters 1-37, bundled with MasteringPhysics access kit. The ISBN number (for this book + access kit package) is 0-1361-3926-4 (ISBN-10) or 9-780-1361-3926-3 (ISBN-13). The MasteringPhysics access in this package includes both the online homework/tutorial system (required for the course) and an eBook subscription that is handy when you want to study somewhere without lugging the actual book around. Be careful to get the right package! The publisher produces other versions of this book (split into volumes; with additional chapters for modern physics topics; etc.) The ISBN number above is the simplest way (though not the only way) to get what you need for this course. The suggested retail price for this package is \$197, but I believe the University Book Center and Maryland Book Exchange are selling it for \$187.05 and \$184.50, respectively. If you're unsure about whether another version is sufficient, please check its ISBN number with me.

Note that if you buy a used copy of the book, it probably will not include an unused MasteringPhysics kit, so you will have to purchase access separately. At www.masteringphysics.com you can purchase access to the online homework/tutorial system for \$45 without the eBook or for \$121 with the eBook. Thus, the financial benefit of buying a used book—if any!—will probably be small, unfortunately.

Another option for cutting costs, at least in principle, is to purchase an eBook subscription without a physical book. Besides the MasteringPhysics option mentioned above (\$121), www.coursesmart.com offers a somewhat more readable eBook version for \$97; combined with the separate MasteringPhysics homework/tutorial system subscription, that's a total of \$142. **However, I *strongly* recommend buying a physical book instead of just an eBook subscription!** First of all, the higher-quality type in a printed book is easier to read than pixels on a screen, and a physical book is easier to flip through. Second, the eBook subscriptions expire after 18 or 24 months, and then you have nothing to show for the money you spent. As you go on in physics or another scientific or technical field, it is nice to have an introductory physics textbook to refer to from time to time.

Reading assignments will be given for nearly every class day, typically consisting of about 10 pages from the textbook. I will assume that you have done the reading before coming to class, and will not repeat everything that is in the book. Understanding all of the material in the readings, even if not covered in the lectures, is an important part of the course. For instance, you should be able to answer all of the Questions at the end of each chapter, even if not assigned as homework.

Feel free to read ahead by a few days! You could, for instance, do all of a week's reading in two sittings if you prefer. Note that if you don't have time to completely absorb a reading assignment before class, it will be best to at least read it quickly beforehand and then return to it later.

Homework:

There will usually be two homework assignments each week, each of which must be completed by the beginning of class on the specified date. Students in 171H will have extra homework problems to do. Much of the homework will use the MasteringPhysics online system, but you will also turn in handwritten problems on paper to be checked. The details of how that will work will be explained during the first class session. You can work on the homework together with a classmate as long as the end result is that you master the material and turn in your own work. Copying is cheating; on the other hand, having a friend help you figure out *how* to solve a problem can be a good learning strategy.

Don't wait until the last minute to start a homework assignment! In fact, try to start it early so that you can ask for help if you need it. Please do all of the homework and turn it in on time, unless you have a valid excuse (i.e. illness, a religious observance, or some other compelling reason). I know that things sometimes come up (e.g., exams and important deadlines in other courses), so I will give you four free extension days to use during the semester with no excuse necessary. Beyond that, if you do not have a valid excuse, you can still turn in the homework up to 24 hours late for half credit; after 24 hours, no credit will be given.

Exams:

There will be four exams during the semester plus a final exam. Note that the date and time of the final exam have not yet been decided by the University; we should find out the schedule in early November. The exams will be given in class, on paper, and will be closed-book. Any physical constants or data that you may need will be provided. You will need a calculator with standard trigonometry functions. Exams must be taken on the scheduled days unless you have a valid excuse. If you know in advance that you will have to miss an exam, please inform me as soon as possible so that we can arrange a make-up. Note that the make-up exam will be identical to the regular exam; I will trust you and your classmates to not allow the contents of the exam to leak out to someone who still has to take it.

Course grade:

| | |
|-----|---|
| 40% | Homework |
| 40% | Exams during the semester (i.e. 10% each) |
| 20% | Final exam |

How to do well in this course:

Come to the lectures. Participate in class discussions. Keep up with the reading—try to read some at least three or four times per week. Start the homework early enough so that you can finish it all. Ask for help (your teacher, TA, or a classmate) whenever there is something you don't understand. Also ask about anything you are curious about. Review your notes and past homeworks before each exam.

Contact Information:

Prof. Peter S. Shawhan, room 4205B in the Physics Building, 301-405-1580, pshawhan@umd.edu

Office hours: Monday through Friday, 1:30–3:00, in room 4205B

TA: Prabal Adhikari, room 4223, 301-405-6192, prabal@umd.edu

Office hours: Tuesdays 10:00–12:00 and Fridays 1:00–3:00, in room 4223

*** NOTE: Office hours are subject to change – watch for announcements

If you are unable to come during regular office hours, please contact me by email or phone to ask a question and/or arrange a time to meet.

Course Evaluations:

As you probably know, the University of Maryland has a system called CourseEvalUM which collects information from students about the quality of courses and the effectiveness of instructors, and provides online summaries at Testudo for students to view when they are preparing to register for future semesters. This can be a valuable resource for you and for other students, but it depends on your participation! Your feedback is confidential and important to the improvement of teaching and learning at the University as well as to the faculty tenure and promotion process. The CourseEvalUM web site, www.courseevalum.umd.edu, will be open for you to complete your evaluations for fall semester courses between Tuesday, December 1 and Sunday, December 13 (i.e. it closes **before** final exams begin). It is important to complete all of your evaluations each semester to provide a complete picture of each class and also because if you don't, you will lose the privilege of accessing the summary reports in the following semester.

Honor Code:

The University of Maryland has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit <http://www.studenthonorcouncil.umd.edu/whatis.html>.

Religious observances:

If you need to miss class, a homework deadline, or an exam due to a religious observance, please notify me in advance—preferably at the beginning of the semester.

Students with disabilities:

Accommodations will be provided to enable students with disabilities to participate fully in the course. Please discuss any needs with me at the beginning of the semester so that appropriate arrangements can be made.

Weather and emergency closures:

If the University is closed due to weather or some emergency situation on a day when homework is due, then that homework must be turned in at the beginning of the next class when the University is open. If the University is closed on the scheduled date of an exam, then the exam will be given during the next class period when the University is open. If the University is closed on any non-exam day, including a review session (the class immediately before an exam), then the exam will still be given according to the original schedule. In these or other exceptional circumstances, I will attempt to send out information by email.

Physics 171 / 171H Course Schedule
 Fall 2009 — Professor Shawhan
 (Revised October 19)

| Date | HW due | Pre-lecture reading | Lecture topic(s) |
|------------|--------|-----------------------------|--|
| Mon Aug 31 | | — | What you need to know about the course |
| Tue Sep 1 | | 1-intro through 1-7 | Measurement and units |
| Thu Sep 3 | HW 0 | 2-intro through 2-5 | Motion in one dimension |
| Fri Sep 4 | HW 1 | 2-6 through 2-8 | Solving problems with acceleration |
| Mon Sep 7 | | <i>Labor Day — No class</i> | |
| Tue Sep 8 | | 3-intro through 3-5 | Vectors and coordinate systems |
| Thu Sep 10 | HW 2 | 3-6 through 3-9 | Motion in two and three dimensions |
| Fri Sep 11 | | 4-intro through 4-5 | Newton's laws of motion |
| Mon Sep 14 | HW 3 | 4-6 through p. 98 | Various forces |
| Tue Sep 15 | | p. 99 through 4-8 | Solving problems with forces |
| Thu Sep 17 | HW 4 | 5-intro, 5-1, 5-6 | Friction and drag |
| Fri Sep 18 | | 5-2 through 5-5 | Circular motion |
| Mon Sep 21 | HW 5 | — | Review and discussion |
| Tue Sep 22 | | — | Exam 1 |
| Thu Sep 24 | | 6-intro through 6-3 | Gravitational force |
| Fri Sep 25 | | 6-4 through p. 152 | Orbits |
| Mon Sep 28 | HW 6 | p. 153 through 6-8 | Gravitational fields and tides |
| Tue Sep 29 | | 7-intro through 7-3 | Work |
| Thu Oct 1 | HW 7 | 7-4, 8-8 | Kinetic energy; Power |
| Fri Oct 2 | | 8-intro through 8-3, 8-9 | Potential energy |
| Mon Oct 5 | HW 8 | 8-4 through 8-7 | Conservation of energy |
| Tue Oct 6 | | 37-1, 37-2 | Quantization of energy |
| Thu Oct 8 | HW 9 | 9-intro through 9-3 | Linear momentum |
| Fri Oct 9 | | — | Synthesis: work, energy, and momentum |
| Mon Oct 12 | HW 10 | 9-4 through 9-7 | Collisions |
| Tue Oct 13 | | 9-8, 9-9 | Center of mass; Reference frames |
| Thu Oct 15 | HW 11 | — | Review and discussion |
| Fri Oct 16 | | — | Exam 2 |

(continued on next page)

| Date | HW due | Pre-lecture reading | Lecture topic(s) |
|------------|--------|------------------------------|---|
| Mon Oct 19 | | — | Exam 2 post-mortem |
| Tue Oct 20 | | 36-1 through 36-3 | Relativity |
| Thu Oct 22 | HW 12 | 36-4 | Relativity of Simultaneity tutorial |
| Fri Oct 23 | | 36-5, 36-6 | Implications of relativity |
| Mon Oct 26 | HW 13 | 36-7, 36-8 | Spacetime diagrams and Lorentz transformation |
| Tue Oct 27 | | 36-9 through 36-11 | Relativistic momentum and energy |
| Thu Oct 29 | HW 14 | 10-intro through 10-3 | Rotational motion |
| Fri Oct 30 | | 10-4 through 10-7 | Torque and moment of inertia |
| Mon Nov 2 | HW 15 | 10-8 through 10-10 | Rotational kinetic energy and rolling |
| Tue Nov 3 | | 11-intro through 11-3 | Angular momentum |
| Thu Nov 5 | HW 16 | 11-4 through 11-6 | Angular momentum and torque |
| Fri Nov 6 | | 11-7 through 11-9 | Gyroscopes, etc. |
| Mon Nov 9 | HW 17 | — | Review and discussion |
| Tue Nov 10 | | — | Exam 3 |
| Thu Nov 12 | | 12-intro through 12-3 | Static equilibrium |
| Fri Nov 13 | | 12-4, 12-5 | Elasticity |
| Mon Nov 16 | HW 18 | 13-intro through 13-5 | Density and pressure in fluids |
| Tue Nov 17 | | 13-6, 13-7 | Pressure gauges; Buoyancy |
| Thu Nov 19 | HW 19 | 13-8 through 13-11 | Fluids in motion |
| Fri Nov 20 | | 17-intro through 17-5 | Temperature, thermal expansion, thermometers |
| Mon Nov 23 | HW 20 | 17-6 through 17-10 | The ideal gas law |
| Tue Nov 24 | | 18-intro through 18-2, 18-6 | Kinetic theory of gases |
| Thu Nov 26 | | <i>Thanksgiving</i> — | <i>No class</i> |
| Fri Nov 27 | | <i>Thanksgiving</i> — | <i>No class</i> |
| Mon Nov 30 | | 18-3 through 18-5 | Phase changes and phase diagrams |
| Tue Dec 1 | HW 21 | — | Review and discussion |
| Thu Dec 3 | | — | Exam 4 |
| Fri Dec 4 | | 19-intro through 19-4, 19-10 | Heat |
| Mon Dec 7 | HW 22 | 19-5 through 19-9 | First Law of Thermodynamics; Equipartition |
| Tue Dec 8 | | 20-intro through 20-4 | Second Law of Thermodynamics; Heat engines |
| Thu Dec 10 | HW 23 | — | Course review and discussion – part 1 |
| Fri Dec 11 | | — | Course review and discussion – part 2 |

Date and time to be determined

Final exam

Notes about MasteringPhysics

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Registering

Assuming that you bought the specified version of the textbook, it should have been packaged with a slim cardboard “Student Access Kit” for MasteringPhysics. Inside it are an access code and instructions for registering. (If you bought a version of the book that didn’t come with an Access Kit, you can purchase access on the MasteringPhysics web site.) Go to www.masteringphysics.com and follow the directions in the Access Kit. The first step is to register: you’ll choose a username and password, and enter your name, email address, and school (choose United States, zip code 20742, and then select “UNIV MARYLAND COLLEGE PARK”). Once you have registered, you can log in and “join” our specific course. Enter your Student ID (the 9-digit number on the front of your University ID card, beginning with either “10” or “11”) and the Course ID: SHAWHAN2009PHYS171 if you are in the regular section, or SHAWHAN2009PHYS171H if you are in the honors section.

Using MasteringPhysics

When you log in, you will see a screen with “Assignments” and some other tabs along the left edge, and “Home” and a few other links at top right. One of the links at top right is “Help”, which will give you information about navigating the web interface, etc. The first homework assignment (“HW 0”, which you’ll see when you click on “Assignments”) is a tutorial which teaches you how to use MasteringPhysics. Each assignment contains a number of “items”, and a given item can contain multiple parts. When you have done all of the parts for an item, be sure to click on the “submit item” button at the bottom of the page. When you do that, you will see your score for the item, which is calculated from the average score from the individual parts. There is also an “Item Survey” which gives you an opportunity to provide feedback to me on the item; you don’t normally have to do that, but it’s there if you want to.

How assignments will be graded

MasteringPhysics automatically calculates grades based on your answers, but the rules for giving partial credit can be confusing. Here is how I plan to set up the grading:

- You get a maximum of six attempts to answer each part. For symbolic or numeric questions, each wrong answer before the correct one reduces your score on that part by 10%. For multiple-choice questions, each wrong answer before the correct one reduces your score by the fraction $1/(n-1)$, where n is the number of answer choices.
- There is no penalty for opening a hint. However, if you answer the part correctly *without* opening a hint, you get a *bonus* of 3% per unopened hint. (You can even look at the list of hint topics without actually opening any of them.)
- If you open a hint that contains a question, and you answer that question incorrectly, then your score is reduced by 10%. There is no penalty for leaving a hint question unanswered.

You can click on “Grading Policy” link at the top of an assignment to check the settings that apply to the assignment. If you think you have lost points unfairly for some technical reason, let me know what happened and I will look at your answers and make an adjustment if appropriate. Note that my provisions for extension days (four free) and unexcused late homework (half credit if turned in up to 24 hours late) won’t be handled by MasteringPhysics, but will have to be adjusted manually.