

# Physics 171 / 171H

## Introductory Physics: Mechanics and Relativity

### Fall 2016 — Professor Shawhan

The most up-to-date version of the syllabus can always be found on  
the course web site, reachable via <http://ter.ps/shawhan171>

#### **Class meetings** (same for 171 and 171H)

Lectures: Mondays/Wednesdays/Fridays 9:00-9:50 in room 1201 of the Toll Physics Building.  
Discussion and Activities: Thursdays 9:30-10:45 in the same room.

#### **Contact information**

Prof. Peter S. Shawhan, [pshawhan@umd.edu](mailto:pshawhan@umd.edu), 301-405-1580

Office: room 2120 in the Physical Sciences Complex (PSC) building

Office hours: normally 1:30-3:30 every weekday, but check course web site for exceptions

*If you have a question or issue that can't be handled during office hours, please email or call*

Grader: Yousuf Khan, [yousuf@umd.edu](mailto:yousuf@umd.edu)

#### **Course overview and prerequisites**

This is the first course in the basic physics sequence for students majoring in physics or astronomy, as well as other students who want a rigorous preparation in the physical sciences. Calculus (MATH 140 or equivalent) is a prerequisite, and I will assume that you are comfortable with basic derivatives, integrals and related calculus concepts. Also, although the official course title says it is “Introductory”, one of the normal prerequisites is a high school physics class. Please meet with me ASAP if you have not taken a physics class before. We will tend to move quickly past the topics covered in a standard high school physics class and go into more depth.

Course topics will include: Kinematics, Newton's laws, gravity, energy and work, linear momentum, special relativity, rotational kinematics, angular momentum, static equilibrium, elasticity, fluids, gases, and thermodynamics. These include many of the fundamental principles on which our understanding of the world around us is based, but we will also take many opportunities to look at applications in real life, as well as in physics and astronomy research.

This course will move quickly, and it is important for you to keep up! I will expect you to read the textbook—I'll tell you what sections, and try not to give you more than necessary—and attend the lectures and the Thursday discussion/activity sessions. Participation will be factored in when calculating your course grade. My lectures will not simply repeat things that you can read in the textbook, and will often be interactive—please come ready to think and respond, not just to take notes! Homework each week will be a combination of online work and written-on-paper problems that you'll turn in in class. To do well in the course, it is up to you to make sure you fully understand everything we cover. I will explain it as well as I can and help when you have questions, but real learning happens inside your head, not in front of your eyes.

## Required course materials

You will need four things for this course: the textbook, a subscription to the MasteringPhysics online tutorial/homework system, a subscription to the Learning Catalytics (LC) interactive response system, and a device you can bring to class to use Learning Catalytics. The first three of those can be obtained all together as a bundle, or separately. Read the information below carefully for options and advice. The offerings at the university bookstore and elsewhere can be hard to interpret without this guidance.

The required textbook for this course is “Physics for Scientists & Engineers with Modern Physics” by Douglas C. Giancoli, 4th edition, published by Pearson. The ISBN of the book *alone* is 978-013-149508-1. This book has been in print for many years and you might be able to get a used copy cheaply, but you need the two online tools too. See below for how to purchase MasteringPhysics and LC access if you are starting with a used copy of the printed book. There is also a Pearson online eText integrated with some MasteringPhysics packages. I don’t find the eText very easy to navigate through, and eText access expires after a couple of years, but I find it to be a handy supplement to the printed book that I can access when I don’t have my book with me. I personally wouldn’t be happy having *only* the eText, but it’s up to you.

If you are starting from scratch and like having a printed book, the easiest way to get all the things you need for the course is to buy the bundle which contains a new copy of the textbook and a MasteringPhysics access code; this also gives you LC as well as the online eText, both integrated with MasteringPhysics. This is the most expensive option, though. The ISBN for this bundle is 978-013-613922-5. On the UMD bookstore website, this is described as “PHYSICS F/SCI.+ENGR.W/MOD...-W/ACCESS”, the “recommended package”. I hope that the “buy used” option includes an *unused* MasteringPhysics access code along with the used book, but I’m not really sure if the bookstore is tuned in to that, so be sure to verify that if you want to buy used.

An alternative, if you already have gotten a used copy of the printed book alone or if you feel you’ll be happy with just the eText (no printed book), is to purchase MasteringPhysics with the eText option; this gives you integrated LC too. The ISBN for this is 978-032-155841-1, but you can simply go to [masteringphysics.com](http://masteringphysics.com), register and purchase online. Our Course ID is “SHAWHAN2016”. I think the price is \$115.95.

(The UMD bookstore is also offering a “MAST-PHYSICS W/EBK STUD. ACCESS KIT” with a different ISBN. I don’t know if that is the Pearson online eText or some other kind of E-Book.)

Finally, it is possible to buy MasteringPhysics access *without* the eText, ISBN 978-013-227357-2, online at [masteringphysics.com](http://masteringphysics.com), for \$68.95 (I think). Our Course ID is “SHAWHAN2016”. But this version does *not* include LC, so you’d also have to go to [learningcatalytics.com](http://learningcatalytics.com) and purchase a 6-month LC subscription for \$12. This *a la carte* approach would only make sense if you’ve obtained or can obtain a copy of the printed book some other way *and* don’t want the eText.

Note: Pearson is also selling some bundles with “Modified MasteringPhysics”. I asked my contact person at Pearson about this and it sounds like the registration framework is incompatible with the regular MasteringPhysics course as I’ve set it up, so you should avoid the “Modified” versions.

In any case, to use Learning Catalytics, you will need to bring a smartphone, tablet, iPod Touch or laptop to each class to use the service to participate in the questions and group activities. (If you’re not able to bring one of those devices to class, please contact me to discuss this.)

## Course grade calculation (PHYS 171)

Your scores from the different parts of Physics 171 will be combined as follows:

5%	Participation (lecture interactions, discussion attendance, end-of-semester survey)
20%	Homework (including online and written-on-paper parts)
45%	Midterm exams (15% each)
30%	Final exam

Participation scores will allow for missing up to three class sessions with no deduction, no excuse needed. However, please make sure I'm aware of any excused absences, e.g. for illness. No homework or exam scores will be dropped—all will be used to calculate your grade.

## Information specific to PHYS 171H

Students in PHYS 171H, the honors section, will have extra homework each week that will go even deeper into physics concepts and applications. Students in 171H also will be required to complete an individual project near the end of the semester and present it to their classmates.

The course grade calculation is modified as follows:

5%	Participation (lecture interactions, discussion attendance, end-of-semester survey)
20%	Homework (including online and written-on-paper parts)
39%	Midterm exams (13% each)
10%	Project and presentation
26%	Final exam

## Course policies

### **Standard university policies:**

All of the standard policies at <http://www.ugst.umd.edu/coursereLATEDpolicies.html> apply. Please take a look to familiarize yourself with these policies. My policies specific to this course are below.

### **Late or missed work:**

Assignments normally must be completed and turned in when they are due unless you have a valid excuse according to university policy, e.g. illness or family emergency, in which case an extension will be granted. Please let me know your situation as soon as possible, and I will tell you if I need documentation for the reason. However, **I am also giving each student four free one-day (25-hour) extensions to use on homework assignments**, with no excuse needed (but you can only use one per assignment). If the extended deadline is not on a class day, you can either bring your paper work to my office or else scan or photograph it and send me the file(s). In general, no credit will be given for work turned in late without either a free extension or a valid excuse, but contact me if there is some extenuating circumstance and I may make some allowance for that.

In the case of illness, we will follow the university policy posted at <http://www.president.umd.edu/policies/v100g.html>: The *first* time you miss a due date during the semester, I will accept a self-signed note from you (without a doctor's note) explaining the dates of your illness and stating that the information is true and correct. If illness causes you to miss more than one due date during the semester, or to miss an exam, I will require a doctor's note. If you do miss an exam, I will schedule a make-up time with you as soon as possible—it starts to

cause problems if it's more than a few days later. In any case, whatever the reason for your absence, it is important that you contact me as soon as you reasonably can.

**Policy on collaborating:**

Working together with other students is part of the course, e.g. in the lectures, discussions, and activities. Working together to study and figure out the homework is also encouraged, but you must do and turn in **your own work!** This simple rule applies: **Never look at someone else's written solution** (on paper, a blackboard, or a screen). That applies to your classmates as well as anything you might find on the web. Talking about how to work the problem is fine if it helps you to understand it better, but copying a solution is strictly forbidden (and will not enable you to succeed on the exams). Work that appears to have been copied will receive zero credit and may lead to an academic integrity referral (see below).

**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, and as a student you are responsible for upholding these standards for this course. I will ask you to sign the Honor Pledge on exams; I won't ask you to sign it on each homework assignment, but it should be understood that the Honor Code still applies to homework. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, or plagiarism. Violations will be taken very seriously and may result in an XF grade for the course and possible suspension. As your teacher, I have an obligation to uphold the Honor Code and have had to submit some Academic Integrity Referrals in past years, unfortunately, which led to XF grades. For more information on the Code of Academic Integrity or the Student Honor Council, please visit <http://shc.umd.edu/SHC/Default.aspx> .

**Religious observances:**

If you need to miss class, discussion, a homework deadline, or an exam due to a religious observance, please notify me in advance—preferably at the beginning of the semester—so that we can make appropriate arrangements.

**Students with disabilities:**

Accommodations will be provided to enable students with documented 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 or 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 just before an exam, then the exam will still be given according to the original schedule.

If some calamity causes the University to be closed for an extended period, I will continue the course by recording video lectures and posting them on the web, and will ask you to watch them, read, and do homework assignments on your own. In these or other exceptional circumstances, I will attempt to send out information by email.

**Course announcements by email:**

If I need to send important information to the class, or to you in particular, I will send it to your **umd.edu** email address (unless I happen to know a better address for you and remember to use it). So, if you use some other email system, please make sure that mail sent to your umd.edu address is successfully forwarded to the address you use most regularly.

**Privacy:**

You have a right to privacy of your educational records, including the fact that you are enrolled in this course, but I hope you won't mind if I may call you by name in the presence of other students, and hand back graded papers in class. If that may be an issue or if you are ever uncomfortable with the class environment, please don't hesitate to let me know.

**Help Resources**

I will have office hours most weekdays, but occasionally I will have to reschedule or cancel them. I will try to keep the day-by-day schedule up to date on the course website.

I have created a Piazza online discussion forum for our course. As you may know, Piazza is a completely free service. If you have a question that you'd like to ask, I encourage you to post it on Piazza -- that way you can get a reply at any hour of the day or night. Naturally, if you see a question posted and have a good answer or comment to contribute, please do so! Just remember that the **Policy on collaborating** applies to online communications too, so don't give answers away, but discuss in a way that aids learning! Also, I might step in if there is something I think I can clarify. You can even post anonymously if you want (though I will still know who made the post). I will also post announcements on Piazza from time to time, so it's important that you be registered.

If you are ever experiencing difficulties in keeping up with the academic demands of this course and/or your overall course load, I encourage you to contact the Learning Assistance Service, 2202 Shoemaker Building, 301-314-7693. Their educational counselors can help with time management, reading, math learning skills, note-taking and exam preparation skills. All of their services are free to UMD students.

Some other support services, including SPS Tutoring for Physics Majors, are described at <http://umdphysics.umd.edu/academics/academic-support.html> .

**Note:** Although you may get help in many forms, remember the **Policy on collaborating** described above! Please remind the people you are working with that they should explain and help you learn, not simply show you the answer to a problem, since you are not allowed to copy anyone else's written answer (and you wouldn't really learn much from it). Also, it is ultimately your responsibility to understand and arrive at (your own) correct answers. There is not much I can do if someone else gives you an ambiguous or incorrect line of reasoning, and even professionals make mistakes from time to time. Therefore, receive help with a healthy skepticism and cross-check your understanding to make sure it really holds together.

## Physics 171 / 171H Class Schedule Fall 2016 — Professor Shawhan

Date	HW due	Lecture topic / • Discussion+activities theme	Book sections
Mon Aug 29		Introduction to the course	
Wed Aug 31		Mechanics survey	
Thu Sep 1		• Kinematics concepts and relationships	2-{intro, 1 to 5, 9}
Fri Sep 2	MP intro	Calculating motion with acceleration; Precision	2-{6,7,8}; 1-3
Mon Sep 5		** <i>Labor Day — No class</i> **	
Wed Sep 7	HW 1	Vectors and coordinate systems	3-{1 to 5}
Thu Sep 8		• Force, mass and Newton's Laws	4-{intro, 1 to 6}
Fri Sep 9	HW 2	Force and motion in two or three dimensions	3-{6 to 9}, pp. 95-96
Mon Sep 12	HW 3	Dynamics and statics with various forces	4-{7,8}
Wed Sep 14		Friction	5-1
Thu Sep 15	HW 4	• Going in circles	5-{2 to 5}
Fri Sep 16		Drag forces	5-6
Mon Sep 19	HW 5	Work and kinetic energy	7-{intro, 1 to 4}
Wed Sep 21		Power; Potential energy	8-8; 8-{1,2,3,9}
Thu Sep 22	HW 6	• Conversion and conservation of energy	8-{4,5,6}
Fri Sep 23		Quantization of energy	37-{1,2}
Mon Sep 26	HW 7	Review	
Wed Sep 28		Exam 1	
Thu Sep 29		• The physics of collisions	9-{3 to 6}
Fri Sep 30		Linear momentum	9-{intro,1,2,7}
Mon Oct 3	HW 8	Center of mass; reference frames	9-{8,9}
Wed Oct 5		Foundations of relativity	36-{1,2,3}
Thu Oct 6	HW 9	• The relativity of simultaneity	36-4
Fri Oct 7		Implications of relativity	36-{5,6}
Mon Oct 10	HW 10	Spacetime diagrams; Invariant spacetime interval	36-7
Wed Oct 12		Relativistic momentum and energy	36-{9,10,11}
Thu Oct 13		• General relativity and relativistic astrophysics	6-8, 36-12
Fri Oct 14		Lorentz transformation; Addition of velocities	36-8
Mon Oct 17	HW 11	Rotational motion	10-{intro,1,2,3}
Wed Oct 19		Torque and rotational inertia	10-{4 to 7}
Thu Oct 20	HW 12	• More analogues: $K_{\text{rot}}$ and angular momentum	10-8, 11-{intro, 1 to 4}
Fri Oct 21		Calculating with angular momentum and torque	11-{5,6,7}

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Date	HW due	Lecture topic / • Discussion+activities theme	Book sections
Mon Oct 24	HW 13	Newton's law of gravitation	6-{intro,1,2,3}, 8-7
Wed Oct 26		Gravitational fields and tides; Circular orbits	6-{4,5,6}
Thu Oct 27		• General orbits and planetary dynamics	6-5
Fri Oct 28	HW 14	Review	
Mon Oct 31		Exam 2	
Wed Nov 2		Static equilibrium	12-{intro,1,2,3}
Thu Nov 3		• Everything is a spring (until it breaks)	12-{4 to 7}
Fri Nov 4		Apparent forces in rotating reference frames	11-{8,9}
Mon Nov 7	HW 15	Density and pressure in fluids	13-{1 to 4}
Wed Nov 9		Pressure and buoyancy	13-{5,6,7}
Thu Nov 10	HW 16	• Fluids in motion; Correct and incorrect (!) applications of Bernoulli's Principle	13-{8,9,10}
Fri Nov 11		Viscosity and surface tension	13-{11,12,13}
Mon Nov 14	HW 17	Temperature, thermal expansion, thermometers	17-{intro, 1 to 4}
Wed Nov 16		The ideal gas law	17-{6 to 10}
Thu Nov 17	HW 18	• Gases and liquids: the microscopic reality	18-{intro,1,2,6}
Fri Nov 18		Phase changes	18-{3,4,5}
Mon Nov 21	HW 19	Heat and heat capacity	19-{intro, 1 to 5}
Wed Nov 23		** <i>Thanksgiving Holiday</i> — <i>No class</i> **	
Thu Nov 24		** <i>Thanksgiving Holiday</i> — <i>No class</i> **	
Fri Nov 25		** <i>Thanksgiving Holiday</i> — <i>No class</i> **	
Mon Nov 28		First Law of Thermodynamics; Heat transfer	19-6; 19-10
Wed Nov 30	HW 20	Review	
Thu Dec 1		Exam 3	
Fri Dec 2		Equipartition of energy	19-8
Mon Dec 5		Adiabatic expansion of a gas	19-9
Wed Dec 7	HW 21	Heat engines	19-7, 20-{2,3,4}
Thu Dec 8		• Entropy & the Second Law of Thermodynamics	20-{1,5,6,7,9}
Fri Dec 9		Course review – part 1	
Mon Dec 12	HW 22	Course review – part 2	
Sat Dec 17, 8-10 a.m.		Final exam (confirmed, in our regular room)	