

Physics 121: Fundamentals of Physics I

Fall 2024 — Professor Shawhan

The most up-to-date version of the syllabus can always be found in ELMS

Course Overview

Physics is the study of how the world works, including the essential properties of matter and how objects, fields, and energy interact. Physics can explain a wide range of things, from very basic to very complex. You can recognize physics everywhere around you, in the natural world and in our human technology, once you know how to look at things!

This course focuses on the basics: it aims to give you a deep understanding of the fundamental principles that govern physical systems, how they may be used to accurately predict the behavior of objects when they interact with their environment, and how these simple principles lead to more complex phenomena. Topics will include modeling physical systems, acceleration, force, Newton's laws of motion, drag, friction, gravity, momentum, energy, torque, elasticity, fluids, gases, and thermal physics. Besides the physics concepts themselves, this course is also designed to develop your general ability to think analytically and apply those skills to new situations.

The lectures will complement the textbook readings, not duplicate them, so it is important that you participate fully in both and don't fall behind. The course also includes a one-hour discussion session and a two-hour lab session each week, with some exceptions at the beginning of the semester and around Thanksgiving. These, too, are required elements of the course and you must attend the sessions for the section you are enrolled in.

Contact information

Prof. Peter S. Shawhan (he or they), pshawhan@umd.edu

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

Office phone: 301-405-1580

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TAs:

- Section 0401: Lukas Hakim, lhakim@terpmail.umd.edu
- Section 0402: Preston Ohanuka, pohanuka@umd.edu
- Section 0403: Preston Ohanuka, pohanuka@umd.edu
- Section 0405: Sebastian Osorio Perez, sebasop@umd.edu
- Section SEF1: Sebastian Osorio Perez, sebasop@umd.edu

Course materials

You'll need to purchase* three things for this course: the **textbook**, a subscription to the **online homework** system, and a subscription to the **lab support** system. Details are below.

* If you can borrow / share / buy-used a copy of the printed textbook, that will take care of that item. A new or used copy of either the 4th edition or 3rd edition of the textbook will be fine. But everyone will need to purchase the homework and lab support subscriptions.

The **textbook** for the course is “College Physics: A Strategic Approach” by Brian Jones, Randall D. Knight, and Stuart Field, published by Pearson. You can either get an eTextbook subscription or use a physical printed book, if you prefer that (or already have access to a copy). The 4th edition is the current edition, but the 3rd edition is very similar and thus a good substitute. The eTextbook is available through the [UMD bookstore](#) (search course materials) or directly from Pearson at <https://www.pearson.com/en-us/search.html?aq=9780137561520> . The price is the same either place: \$43.96 total for a 4-month subscription. Pearson also offers a “Study & Exam Prep Pack” if that sounds helpful and if you are willing to pay a little more, but I don’t think it is necessary. (Also, we are not using Mastering Physics in this course, so don’t buy the eText packaged with that.)

The **online homework** system is Expert TA. You will access this through ELMS (via a link in each assignment) and when you do that for the first time, it will guide you through registering for the Physics 121 homework system and paying the cost, which is \$35.

The **lab support** system (which includes online lab manuals, pre-lab questions, etc.) is also hosted by Expert TA, but this is separate from the homework system and has a separate subscription cost, \$55. You will register for the lab support system using a link specific to your course section – see below in this syllabus. Note that you must submit answers to pre-lab questions using this system BEFORE your lab session each week; we’ll say more about this in class.

Lectures

- Tuesdays and Thursdays 6:30-7:45 p.m. in room 1410 of the Toll Physics Building

Discussion and Lab Sessions

Section 0401:

- Discussion: Mondays 7:00-7:50, September 9 through December 9, *except* December 2 (yes, there will be discussion on November 25)
- Lab: Mondays 8:00-9:50, September 9 through December 2, *except* November 25
- Use this link to register for your lab section: <http://goeta.link/USH22MD-67FAF7-2RB>

Section 0402:

- Discussion: Wednesdays 7:00-7:50, September 4 through December 4, *except* November 27
- Lab: Wednesdays 8:00-9:50, September 11 through December 4, *except* November 27
- Use this link to register for your lab section: <http://goeta.link/USH22MD-769493-2RA>

Section 0403:

- Discussion: Tuesdays 8:00-8:50, September 3 through December 3, *except* November 26
- Lab: Thursdays 8:00-9:50, September 12 through December 5, *except* November 28
- Use this link to register for your lab section: <http://goeta.link/USH22MD-BDD083-2R9>

Section 0405:

- Discussion: Thursdays 8:00-8:50, September 5 through December 5, *except* November 28
- Lab: Tuesdays 8:00-9:50, September 10 through December 3, *except* November 26
- Use this link to register for your lab section: <http://goeta.link/USH22MD-DA0131-2R8>

Section SEF1:

- Discussion: Thursdays 8:00-8:50, September 5 through December 5, *except* November 28
- Lab: Tuesdays 8:00-9:50, September 10 through December 3, *except* November 26
- Use this link to register for your lab section: <http://goeta.link/USH22MD-DA2641-2R7>

Office hours and SPS tutoring

We (Prof. Shawhan and the TAs) will have office hours on various days of the week. Prof. Shawhan is currently planning to hold office hours Wednesdays 5:15-6:15, Thursdays 1:00-2:00, and Fridays 1:00-2:00. The schedule will be posted on the ELMS course home page, including any adjustments for the current week. Some office hours will be hybrid, so you will be able to connect on Zoom, which can be useful especially if you just have a quick question or two. If you have a question or issue that can't be handled during office hours, please email, text or call.

Members of the Society of Physics Students (SPS) will offer **free tutoring** every Monday through Thursday (starting September 3) from 4:00-6:00 in room 1204 in the Toll Physics Building. No appointment needed – just walk in! This service can be very helpful, but be sure to follow our course's **Policy on collaborating**, described below.

Course grade calculation

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

20%	Homework
20%	Lab (pre-lab questions and lab reports)
3%	Participation in discussions and class activities
7%	Quizzes (some days, TBD)
30%	Midterm exams (15% each)
20%	Final Exam

No homework, lab, exam or quiz scores will be dropped; all will be used to calculate your grade.

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, including Academic Integrity and the limitations on what you can do with my course materials, which are copyrighted. My policies specific to this course are below.

Late 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 two free 24-hour extensions to use on homework assignments**, with no excuse needed (but you can only use one per assignment). You may email a pdf copy if you need to turn in written work and can't do so in person. 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.

Absences:

See the university's standard policy posted at <https://policies.umd.edu/student-affairs/university-of-maryland-policy-on-excused-absence> . Specific interpretation for our course:

- If illness causes you to miss an **exam**, I will require a note from a doctor or health service. If another compelling reason causes you to miss an exam, I may require documentation, depending on the reason. In any case, whatever the reason, it is important that you contact me as soon as you reasonably can. I will schedule a make-up time with you as soon as possible—it starts to be problematic if it's more than a few days later.
- If illness or another compelling reason causes you to miss a **homework** deadline: The *first* time this happens during the semester, I will accept a self-signed note from you (i.e., no doctor's note is needed) explaining the dates you were unable to do academic work, the reason, and signed to state that the information is true and correct. If it happens a second time, I will generally require a note from a doctor or health service, following university policy. I can give you an extension of one or more days, to be negotiated; I want you to be able to do your best work, but also don't want you to fall too far behind.
- If illness or another compelling reason causes you to miss a **discussion session and/or a lab session**: Please notify both your TA and me as soon as you reasonably can. There are two weeks set aside for make-up labs during the semester, one after the first set of 5 experiments and the other after the second set of 5 experiments. The make-up week will be your opportunity to do an experiment you missed (for a valid excused reason).
- If illness or another compelling reason causes you to miss a **class session**: I will not generally require documentation (but will take it if you have it), but let me know as soon as you reasonably can. If it is one of the days when I am recording participation to feed into the class participation component of your course grade, I will exempt you from that day.

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 to 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/whiteboard, 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, and writing notes or sketches on a piece of paper or a whiteboard is fine – that is a natural thing to do when working together – 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 standard university policies).

Especially important: **Do not submit the homework questions to Chegg, Course Hero or any other “homework help” service, and do not search for the words of our homework questions on such services. That is not permitted.**

If you would like to compose your own, distinctly different question that involves the same concepts, and study an answer to it in order to learn and figure out how to solve your actual homework question, that is OK. But keep in mind that online homework help often contains errors, from what I have seen. You should always question and check any assistance you get, in any form – and you can learn from doing that.

When getting help in office hours, tutoring, study groups, etc., 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 learn as much from that). 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. Therefore, receive help with a healthy skepticism and cross-check your understanding to make sure it really holds together.

Religious observances:

If you need to miss class, a homework deadline, a discussion and/or lab, 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, in coordination with the university's Accessibility & Disability Service. Please discuss any needs with me at the beginning of the semester so that appropriate arrangements can be made.

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 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.


Notice of Mandatory Reporting:

As a faculty member, I am designated as a "Responsible University Employee," and I must report all disclosures of sexual assault, sexual harassment, interpersonal violence, and stalking to UMD's Title IX Coordinator per University Policy on Sexual Harassment and Other Sexual Misconduct. If you wish to speak with someone **confidentially**, please contact one of UMD's confidential resources, such as [CARE to Stop Violence](#) (located on the Ground Floor of the Health Center) at 301-741-3442 or the [Counseling Center](#) (located at the Shoemaker Building) at 301-314-7651. You may also seek assistance or supportive measures from UMD's Title IX Coordinator, Angela Nastase, by calling 301-405-1142, or emailing titleIXcoordinator@umd.edu. To view further information on the above, please visit the Office of Civil Rights and Sexual Misconduct's website at ocrsm.umd.edu.

Communications:

I prefer email or phone calls for one-on-one communications. If you do not use <DirectoryID>@terpmail.umd.edu for email, please let me know your preferred address.

For information about university closures due to inclement weather, see <https://umd.edu/weather>, or call 301-405-7669 (that's 301-405-SNOW).

I will often use ELMS Announcements to notify the class of reminders, homework clarifications, schedule changes (e.g. due to inclement weather), or to follow up on discussions. It is your responsibility to be aware of them. **I strongly recommend that you adjust your notification settings (at <https://umd.instructure.com/profile/communication>) so that the Announcements and Discussions items are set to Notify immediately (indicated by the  icon).**

Physics 121 Class Schedule

(planned, subject to change)

Fall 2024 — Professor Shawhan

Deadlines for lab work depend on what section you are enrolled in:

- Pre-lab questions are due by 6:30 p.m. on the day you are going to do the experiment. They must be submitted on Expert TA.
- Lab reports are due by midnight on the sixth day after you do the experiment. For example, if you do the experiment on a Wednesday evening, your lab report must be submitted on ELMS before midnight on the following Tuesday.

Date	Topics
Tue Aug 27	Lecture: Course intro and logistics, particle model, representing motion; meet TAs for Monday and Tuesday discussion sections
Thu Aug 29	Lecture: Velocity and speed, relating motion graphs, physical dimensions and units, numerical values and precision; meet TAs for Wednesday and Thursday discussion sections
Tue Sep 3	Homework 1 due by 6:30 pm Lecture: Constant-velocity motion, problem-solving with algebra, acceleration concept and graphs <i>Section 0403: first discussion session</i> <i>Sections 0405 and SEF1: first lab session</i>
Wed Sep 4	<i>Section 0402: first discussion and lab sessions</i>
Thu Sep 5	Lecture: Motion with constant acceleration, problem-solving <i>Section 0403: first lab session</i> <i>Sections 0405 and SEF1: first discussion session</i>
Mon Sep 9	<i>Section 0401: first discussion and lab sessions</i>
Tue Sep 10	Homework 2 due by 6:30 pm Lecture: Vectors, components, velocity and acceleration vectors, projectile motion
Thu Sep 12	Lecture: Circular motion concepts, oscillating motion, relative velocity
Tue Sep 17	Homework 3 due by 6:30 pm Lecture: Forces, Newton's laws and their meaning, simple calculations
Thu Sep 19	Lecture: Applying Newton's laws in 1-D, equilibrium, tension, other types of forces

- Tue Sep 24 **Homework 4 due** by 6:30 pm
 Lecture: Problem-solving with Newton's laws, friction, drag, elevators
- Thu Sep 26 **Lecture:** Review and discussion; free-body diagrams in 2-D, friction on a ramp
- Sat Sep 28 **Homework 5 (short) due** by midnight
- Tue Oct 1 **Midterm Exam 1**
 (Note: Tuesday discussion and lab sections do meet after the exam)
- Thu Oct 2 **Lecture:** Circular motion calculations, various examples
- Tue Oct 8 **Homework 6 (short) due** by 6:30 pm
 Lecture: Kinetic energy, gravitational potential energy, problem-solving
- Thu Oct 10 **Lecture:** Newton's law of universal gravitation, consequence for orbits
- Tue Oct 15 **Homework 7 due** by 6:30 pm
 Lecture: Rotational motion, torque
- Thu Oct 17 **Lecture:** Rotational dynamics, rotational inertia and how to calculate it, combined translational and rotational motion
- Tue Oct 22 **Homework 8 due** by 6:30 pm
 Lecture: Elasticity, springs, series and parallel combinations
- Thu Oct 24 **Lecture:** Statics problem-solving
- Tue Oct 29 **Homework 9 due** by 6:30 pm
 Lecture: Impulse, momentum, conservation of total momentum, collisions
- Thu Oct 31 **Lecture:** Review and discussion; protective padding; conservation of total momentum in 2-D
- Sat Nov 2 **Homework 10 (short) due** by midnight
- Tue Nov 5 **Midterm Exam 2**
 (Reminder: Tuesday discussion and lab sections do meet after the exam)
- Thu Nov 7 **Lecture:** Different types of energy, the work-KE theorem, examples
- Tue Nov 12 **Homework 11 (short) due** by 6:30 pm
 Lecture: Net work, conservative and non-conservative forces
- Thu Nov 14 **Lecture:** Problem-solving with energy conservation, partially inelastic collisions

- Tue Nov 19 **Homework 12 due** by 6:30 pm
Lecture: Thermal energy, kinetic theory of gases, ideal gas law, absolute temperature
- Thu Nov 21 **Lecture:** Gas processes, sound, chemical energy and combustion
- Mon Nov 25 *Section 0401 has discussion but not lab*
- Tue Nov 26 **Homework 13 due** by 6:30 pm
Lecture: Evaporation and condensation, steam, heat engines, efficiency limits
Section 0403: No discussion today
Sections 0405 and SEF1: No lab today
- Nov 27-29 *No discussions, labs or lecture – Thanksgiving Break!*
- Mon Dec 2 *Section 0401: No discussion today*
- Tue Dec 3 **Lecture:** Fluids, pressure, buoyancy
- Thu Dec 5 **Lecture (last one):** Fluids in motion, lift of an airplane wing, viscosity
- Mon Dec 9 *Section 0401 does have discussion*
Homework 14 due by midnight
- Date TBD **Final Exam**

Physics 121 Labs, Fall 2024

Monday - Thursday

Instructors: Dr. Heidarian & Dr. Shawhan

Wk	Week of	Expt #	Experiment
1	Aug 26	--	No Labs
2	Sep 2	--	No Labs
3	Sep 9	1	Introduction to Data Analysis Using Excel
4	Sep 16	2	Measurement and Uncertainty
5	Sep 23	3	Motion with Constant Velocity
6	Sep 30	4	Motion with Constant Acceleration
7	Oct 7	5	Projectile Motion
8	Oct 14	1 - 5	Make-Up Labs
9	Oct 21	6	Forces and Equilibrium
10	Oct 28	7	Centripetal Acceleration
11	Nov 4	8	Conservation of Linear Momentum
12	Nov 11	9	Conservation of Energy
13	Nov 18	10	Ideal Gas Law and Absolute Zero
14	Nov 25	--	No Labs – Thanksgiving Break
15	Dec 2	6 - 10	Make-Up Labs