

# PHYS1425: General Physics I - Mechanics and Thermodynamics

August 31<sup>st</sup>, 2021

([Course Calendar](#))

Lecture Sessions: Tuesdays and Thursdays 9:30-10:45am  
Lecture Location: [Wilson Hall 325](#)  
Instructor: Xiaochao Zheng ([xz5y](#))

In-Class TAs: Wenxi Huang ([wh6dzg](#)), Benjamin Johnson ([bsj7xxc](#))  
After-hour TA/graders: Ryan Mclellan ([rem9au](#)), Claire Piczak ([ctp2ep](#)),  
Caden Schuessler ([cws7dd](#))

Office Hours: see [Office Hour Matrix](#)

## Course Goals & Objectives

Why is the highest degree in physics called “Doctor of Philosophy”, not “Doctor of Physics”? Will learning physics really change how you view the world? As a researcher, teacher, and continuing learner, I truly believe learning physics will change how you view and treat the world. Physics is a science that describes everything around us at the most fundamental level: Why does the sun shine? Why is sky blue? What is heat and what causes it? Can time flow backwards? Physics provides answers to all these questions, and any others you may have about the physical universe. Knowing there is a reason behind everything will help you to face your life differently, because

Nothing in life is to be feared, it is only to be understood

– Marie Curie

This course will get you started in physics, the most difficult subject in science. We will cover mechanics and thermodynamics, that underlie many of the basic phenomena in everyday life: forces and motion, rotation, equilibrium, energy conservation, oscillations, wave and sound, heat, and entropy. You will learn how to apply concepts and physical laws to solve problems. And you will develop problem solving skills that will serve as a foundation for your science, engineering or other career direction and your place as a rational, positive, and courageous member of our world.

### By the end of the course, you will...

- Build a fundamental framework of concepts including forces and motion, energy, motion of solid and fluid, wave and sound, and heat and thermodynamics.
- Develop basic ability of solving problems by combining physical laws with math tools.
- Recognize one can use different methods to solve the same problem.
- Be able to check own solutions using estimation, “sanity” check, dimensional analysis, limit checks, and using different physical laws.

### More important, I hope you will (eventually):

- When presented with a challenge, be it a physics problem, an engineering project, or a life crisis, be able to analyze the problem objectively, apply learned knowledge, prioritize, and solve the problem or develop a path to move forward.
- Look at the world around you and realize that there are laws behind every phenomenon. Realize how grand, yet simple Nature can be. Accept as human beings we are part of this beautiful universe, and be able to draw strength from it no matter what we face.

## Course Organization

For Fall 2021 semester, this course will be offered IN PERSON, finally! To best protect everyone in the class, we will follow strictly UVA rules on masking and social distancing (when applicable). Use of masks in the classroom after (if) UVA lifts mask mandate is strongly encouraged due to the highly interactive nature of our class.

In terms of learning, we will follow a “**flipped classroom**” method. Note that because of midterm exams, fall reading days and thanksgiving recess, the Tuesday/Thursday sequence can vary from month to month or week to week, so check the [course calendar](#) and the week-by-week schedule on Collab carefully. *The following description is for weeks when Tuesday is the “first day of learning” (with in-class HW discussion) and Thursday is the “second day of learning” (HW due before class and in-class quizzes) of that week.* The “Tuesday/Thursday” will be shown in blue hereafter in this section to indicate that they will vary from week to week, while action items (assignments) and/or other important facts are shown in bold.

Each week, I will post on Collab the material to be covered in the following week in the form of lecture notes supplemented by readings from the textbook and optional short videos. You must **complete the reading** and then submit a “**Chapter Summary**” assignment on GradeScope by midnight on [Tuesday](#). In the Chapter Summary you would summarize the material of the week, that typically contain new concepts and physical laws, equations, problem solving procedure, and any important points you find worth noting. Ideally, you only need this Chapter Summary to complete the homework and the quiz of that week rather than flipping through the e-text or the bulky textbook. Keep your Chapter Summaries organized, as these will form an important part of your learning portfolio.

Our [Tuesday lectures](#) will be organized typically as follows: we will spend half of the lecture time on lecturing concepts, going through examples, and Q&A, the remaining time will be for *group solving HW problems* together. Typically, the time allocated will be far from enough to complete the HW, but as a group you can discuss each problem and maximize the chance that everyone knows how to proceed on their own after lecture hours. To efficiently utilize the HW discussion time, *it is essential that you complete the reading assignment and take at least a quick look of the HW assignments prior to the lecture time.* **Bring your laptop or printed HW problems to class.**

Weekly **MasteringPhysics (MP) homework assignments** are due by 9am [Thursday](#). While this is an online platform, you are required to submit your written “**show your work**” **solution on GradeScope** for each problem (unless instructed otherwise) to demonstrate how you approach the problem/which physical law was applied, derivations, and numerical calculations when applicable. Your homework grade will consist 50% from MP automatic grading and 50% from your written work reviewed by me or the TA/grader. If you miss a problem on MP, submitting written work may allow you to receive partial credits.

Our [Thursday lectures](#) will be organized typically as follows: We will spend 15 minutes to review most-missed topics reflected in that week’s homework. We will then **spend 10+30+5 minutes on the weekly quizzes**, and the last 5-10 minutes of the lecture will be spent on “outlook for the coming week”, in which I will provide some insights on how the upcoming material connect with the current week’s (if applicable). For the quiz, the first 10 minutes is for you to read and set up the quiz problem individually – do so as fast as you can as if your life depends on it, such that you can think just as fast during an exam or other similar critical situations – then 30 minutes for discussing and *group-solving the problem*, and 5 minutes for wrapping up. The weekly quiz ideally should be submitted on GradeScope by the end of class, but the due time is set to 9pm same day in case you need more time to write the full solution. You can continue working with your group members after the lecture time, but you must write your solution independently.

**Your in-class group assignment** will be random at the start of the semester, but I'd like to keep them fixed for at least 4-6 weeks before the first "shuffling", typically and possibly after midterm1. The same group(s) can be considered as your "go to resources" when you continue studying course material and doing homework assignments. You will not grade or evaluate your group members (wouldn't that take the fun out of group activities?). I hope this means everyone will only gain, and never lose, from group discussions: either you learn how to solve a problem, learn other people's viewpoints about a concept, or offer your own insights and methods to help others and at the same time hone your skill of explaining an idea clearly and concisely.

We will have **three exams (two midterms and a non-cumulative final)**. During the week of the midterms there will be no HW due on the exam day, and the "Chapter Summary" assignment will be named "**Midterm Study Guide**", in which you will review your previous 4 chapter summaries and reorganize them as a Study Guide that is no more than about 3 pages long. You may also simply reuse your Chapter Summaries – if they are concise enough – as Study Guide submission (but keep in mind, the goal of the Study Guide assignment is such that you review the material, so please at least read before resubmitting the summaries). The exam will be open-book but not open notes, nor "open internet". The only extra material you can bring to the exam (in addition to the textbook, electronic or physical) is your own Study Guide and Chapter Summaries. The exams will be held in-class and solutions submitted on Gradescope, will be pledged work and no collaboration and/or outside help will be allowed. Those requiring extra time will be contacted for alternate arrangement (such as a different classroom and/or time).

## **Textbook and Other Study Material**

The **reference textbook** we will use is **Giancoli's Physics for Scientists and Engineers, 4<sup>th</sup> edition, with Modified MasteringPhysics** for completing homework assignments online. For Fall 2021 semester, this book will be offered through [UVA BookStore's "Inclusive Access" program](#). ALL students enrolled in the class will have immediate access to your digital course materials through UVA Collab for the first 2 weeks of class—for free – starting around August 13<sup>th</sup>. **After September 7<sup>th</sup>, your student account will be charged \$65.87.** If you choose to drop the course, there will be no charge to your account. This program is optional but if you choose to acquire your textbook elsewhere, you must opt out by the deadline (September 7<sup>th</sup>) to not be charged and you will lose online access to the material after you opt out. Due to the special pricing, no refunds can be processed. This program aims to offer all students accessibility and affordability. If you have any questions regarding the program, please email [UVAInclusiveAccess@virginia.edu](mailto:UVAInclusiveAccess@virginia.edu)

We will use **Modified Mastering Physics** to administrate the online portion of the homework assignments – more information to follow.

**Learning portfolio:** Your own weekly chapter summarizes should form the foundation of your learning portfolio. After completing the homework and the quiz, go back to your chapter summaries and see if you can add a few more details. Before each exam, put all 4-5 summaries together and form/write your own study guide. By the end of the semester, you should have condensed all 20 chapters into a comprehensive yet concise study guide that should be sufficient for preparing for the final exam.

**Course material:** All lecture notes and solutions (homework, quiz, exams) will be posted on Collab under Resources.

## Assessments and Grading

The **final grade** for this course will be determined from: 40% Weekly homework assignments (that include the Chapter Summaries and the MP problem set with written submission), 15% Weekly quizzes, and 15% each from the three exams.

**On the Chapter-Summary Assignments:** These will be posted as assignments on GradeScope on Collab and are due by midnight on the first learning day of the week. I would assume most people will do this in writing to save time, but typed summaries are also fine. These chapter summaries will be graded based on content and the best submissions may be showcased in lecture or distributed as study guides to the whole class.

**On Weekly HW Assignments:** These are assignments administered on MasteringPhysics. In addition to submitting your answers on MP (and receive automatic grades), you must show your work by submitting your written work for each problem through GradeScope.

**On Weekly Quizzes:** These are 1 or 2 written problem quizzes that are based on the material you have learned in the previous and the current week, and have practiced on by doing the homework assignments on MasteringPhysics. The quiz problems will likely be challenging, and working in groups will likely help. The quiz will be given through GradeScope and will be graded “by hand” by me or the grader.

**On the two Midterm Exams:** These will be open-book and open-study-guide, but not “open internet” and will be pledged. All exams will be held in-class. Printed exam will be handed out, and solutions should be submitted through GradeScope by the end of the exam time. You must pledge that you have not received or given aid on these exams.

**On the Final Exam:** This will again be an open-book, open-note and “close internet” exam that will be held in person. The final exam is not cumulative, i.e., the final exam will not test on material that appeared on the two midterms unless if the midterm exams show a substantial percentage of students missing a specific topic. In the latter case, additional problems will be given in the final exam to test those most-missed topics. One caveat: please bear in mind that knowledge itself is cumulative, and thus implicit use of earlier material in a later exam may not be avoidable.

Because your written work will be graded by human beings (myself, TAs and graders), neat handwriting will be greatly appreciated. Label your problems clearly as “Problem 1”, “Problem 2”, etc, and box around your final answers. Use of a black or blue colored pen (or use a pencil) is preferred. Please avoid red color except for Chapter Summaries.

## Course Policy

### Attendance Policy

There is no strict attendance policy, though missing in-person classes may cause loss of learning (and possibly some fun).

By the end of the semester, those of you who fill out the course evaluation will have the lowest HW grade exempt from the final grade. Additionally, each of you will receive a “free pass” on quizzes which means one of the weekly quizzes is exempt. This should take care of occasional illness or other unexpected “bad week” reasons for missing the HW or quiz.

### Late Work Policy

This course has a packed schedule. Keeping up your course work – completing your reading, HW and quizzes, for example – on time is really important. For this reason, late work will be graded with a penalty unless if an extension has been granted by the instructor PRIOR to the due date. Please email your instructor (me) in advance if you anticipate difficulties or delays due to official travel, unexpected illness, and family emergencies. Such extension requests are typically granted, all you need is to ask in advance. On the other hand, extension requests based on arguments such as “having too many projects due this week” will be reviewed more carefully on an individual basis, as such challenges are considered typical for college learning (and life in general).

### **Equity and Inclusiveness Policy**

This course provides an inclusive space and all people are welcome regardless of their race, age, nationality, gender, and gender identity. Since we will be interacting with each other in class, we must show respect and exhibit courteous and collegial behavior throughout all class experiences. For more information, the Code of Conduct of the Physics Department can be found at <http://www.phys.virginia.edu/DEI/CodeOfConduct/>

### **Honor/Academic Integrity Policy**

I trust every student in this course to fully comply with all of the provisions of UVA’s Honor Code. By enrolling in this course, you have agreed to abide by and uphold the Honor System of the University of Virginia, as well as the following policies specific to this course:

- You may collaborate on the weekly homework assignments, but each one of you must submit your solution independently. Copying solutions from online “study helper (=cheater)” websites or posting assignment problems from this course to such websites are both violation of the honor policy.
- You will work in groups on the weekly quizzes, but each of you must write and submit your solution independently. Copying others’ solutions is a violation of the honor policy.
- You must complete your Chapter Summaries independently.
- You must not give or receive any help on the midterm and the final exams.

Here is I think about academic integrity: I do not think I need to remind everyone how difficult it is to take courses and pursue your education under the current pandemic situation. Everyone of us has endured 18 months of pandemic life at home or dorm rooms and learning online, and some of us experienced personal difficulties big time. So why are we still here, taking courses with our masks on, working hard on the assignments pass midnight, spending weekend hours on reading, and what do we get in return? The answer is simple: knowledge, and a sense of achievement, that can be gained only by hard and honest work. If we can manage to get through this course, we will emerge as a stronger class than those who didn’t work as hard and we will be able to pat our back and say: “That was hard but we did it, and we are proud of it!”

### **Our Team**

My experience as an experimental physicist tells me that being good as an individual is important, but it only gets you to 80% of your potential. The rest comes from team work, and sometimes, a bit of luck. Our class will be diverse, some of you have not taken any physics class, while some may have taken both Physics 1 and 2 classes but still have to be here. I believe everyone has their own place. If you are comfortable with physics and problem solving, please volunteer to be a discussion leader and help answering questions on Piazza

after-hours. This course will be challenging for sure, but should not be boring nor tormenting (well, I hope not, at least).

You may not realize, but we will not have graduate student TAs this term. I have recruited several students from last year's class who will be on your side every week. They will help to explain your homework problems, guide your quiz discussion, answer your questions during office hours, and help monitoring online Piazza chat room after-hours.

## **Accessibility**

There are plenty of opportunities should you wish to discuss course material or other matters with me: Office hours are offered in-person or on Zoom (exact time will be announced later). The Piazza function is available on Collab and was somewhat helpful in the past. Finally, email inquires are always replied within 24 hours on weekdays and often more promptly (within reasonable hours) if it's about an assignment that is due soon. In summary, I wish I can be there whenever you need me, and please let me know how I can help.

## **Special Accommodations**

There is no doubt the ongoing pandemic (even if it might be waning) is posing great difficulty to everyone's life, and perhaps more so for some than others. Please do not hesitate to contact me (email or in person) if you need special accommodations and we can explore potential options without lowering quality of teaching and learning.

Students with disabilities may wish to work with the Student Disability Access Center (SDAC) to discuss a range of options to remove barriers of learning, including official accommodations. Please visit their website for information on this process and to apply for services online: [sdac.studenthealth.virginia.edu](http://sdac.studenthealth.virginia.edu). If you have already been approved for accommodations through SDAC, you will be contacted by email (from me) and we will develop an implementation plan together. If you are in the process of evaluation, please let me know as well.

## **Other Thoughts**

In the past, introductory physics courses at UVA are known to be difficult to teach, and awfully more difficult to take. For years we have adhered to the traditional lecturing method that is known to not work for a majority of modern day students. In Fall 2020, I tried applying, for the first time, some of the active learning technique that I used in physics major core and elective courses to PHYS1425, and it seems to have worked well, at least partially, despite the fully online format. I am sure that applying the same technique to in-person setting will require some fine tuning, and I will be conducting midterm evaluations such that I can continue improving this course throughout the semester. So stay tuned, as I can't make this course a success without your help and support!