

PHYS 1425:
General Physics I
Mechanics and Thermodynamics
Section 002
Spring 2023

v2, 17 January 2023

Course Description:

This course is designed to offer students an introduction to basic physics concepts, applications and problem solving. Typically taken by science and engineering students, PHYS 1425 is part of a two-semester calculus-based sequence in introductory physics (PHYS 1425/2415); the 1425 portion of the sequence covers basic mechanics and thermodynamics, while the 2415 portion covers electromagnetism, waves, sound and optics. A third optional course (PHYS 2620) covers concepts in modern physics and is a technical elective for engineering students.

In this course we will study many introductory physics concepts, including:

- Kinematics: descriptions of the motion of objects
- Dynamics: the forces acting on objects and Newtons Laws of Motion
- Gravity and its effects
- Work and energy
- Linear and angular momentum
- Fluids and their behavior
- Oscillations, waves and sound
- The Ideal Gas Law and the Kinetic Theory of Gases
- The First and Second Laws of Thermodynamics

Yes, but why? Why take an introductory course in physics?

As scientists and engineers, it is important to have a solid foundational understanding of how the world works. This course will help establish that knowledge base.

You will also have the opportunity to learn important problem-solving skills: abstraction, idealization, approximation, and mathematical/conceptual modeling of simple phenomena, the assessment of the quality of simplifying assumptions, and more.

But, crucially, this class is much more than learning physics concepts and formulae – it is more about learning a new way to think about our world. In this class, the primary goal is to learn to think like a physicist – assessing a situation, making observations about what is known and what is not, calling upon fundamental principles to help synthesize this information, and arriving at a prediction for how some object will behave. **That problem solving approach can help disrupt our standard, accepted ways of thinking – and that new way of thinking is an asset that you can carry with you** into whatever discipline you pursue here at the University and beyond.

Pre-requisites and expectations:

This is a calculus-based physics course, but we use only a limited amount of calculus knowledge. Deep knowledge of calculus is helpful but not necessary. On the other hand, you must have a solid foundation of trigonometry.

More importantly, you must be ready for a challenging science course with 3 assignments due each week. While typical work load is 4-6 hours per week outside lecture time, some people do spend significantly more (≥ 10 hours).

Who and when and where:

My name is Prof. Chris Neu, and I will be your instructor. I have been a faculty member here at UVA for 14 years. My expertise is in experimental particle physics, and my research program is conducted at the Large Hadron Collider at CERN in Geneva, Switzerland. My work is on the Higgs boson and understanding dark matter. I prefer he/him/his pronouns.

Prof. Chris Neu chris.neu@virginia.edu

Office hours: Mon 3-4:30pm
Location TBD
or by appointment

I have multiple offices on Grounds, so catching me in person without making arrangements in advance will be challenging. Email is the best way to reach me.

Information on this course is accessible through the UVACollab system from <https://collab.itc.virginia.edu/portal> - search for 'PHYS 1425' and you will find the course web site.

We will meet for regular class sessions on MWF from 9-9:50am in room 325 of Wilson Hall. A class meeting schedule can be found posted to the UVACollab site for the class; more on class organization below.

Your presence and active participation in class meetings are important to creating the most effective and engaging learning experience. That being said, you are not required to attend

class and attendance will not be taken. However, there will be an opportunity to get credit towards your course grade if you attend class and participate (see below).

We must note that COVID-19 is still with us. Positive COVID cases will arise which will require isolation time. Further, if you feel unwell at any time this semester, you should not come to class. We must be prepared in case a few or many of us need to attend class remotely for some portion of the semester.

For these reasons, all lecture sessions will be simultaneously broadcast via Zoom. However, access to the real-time Zoom streams will be restricted to students who are in isolation due to a positive COVID test or a yet-diagnosed illness. For people in this situation, the Zoom room access must be requested well in advance of the start of each affected class meeting. We will do our best to capture the audio clearly in the Zoom broadcast.

Class sessions for this course will also be recorded. Recordings will be available to all students enrolled in the class, including those who can or cannot attend the live sessions, within 24 hours of the end of lecture. Recordings will be deleted when no longer necessary. **Recordings may not be reproduced, shared with those not enrolled in the class, or uploaded to other online environments. Individual students may not record our lectures unless expressed authorization is obtained from the instructor.** Students who are not comfortable with participating in a recorded lecture should contact the instructor during the first week of classes.

Course organization: Units

The schedule for the class is available from the UVACollab site, at the 'Syllabus' link (along with this document). You should access the schedule immediately and refer to it throughout the semester.

The course is organized into **12 Units**, each covering a defined set of related concepts. Each Unit is designed to be completed in 3 class meetings. The first 2 of the 3 class meetings per Unit will be a standard lecture format; the last class meeting of each Unit will be a small-group problem-solving exercise in which you will work together with peers to solve two problems related to the content we are covering.

Students are expected to do the following for each Unit:

- Read the sections in the text associated with the Unit;
- Submit a Unit Summary;
- Complete a Homework assignment associated with the content of each Unit; and
- Participate in the problem-solving exercise, which is called a Unit Quiz.

The expectations for each Unit are the same; however, due to asynchronous, one-off events, both expected (like midterm exams) and unexpected (like snow days), **the schedule will**

be irregular and subject to change. For this reason, Units will not always start on Mondays, homework will sometimes be due on Mondays, sometimes Wednesdays, etc. We will follow the class schedule, so please make sure to refer to it throughout the semester. I will communicate schedule updates to you when and if they are required.

Communication:

Communications about this class will be sent via direct email and UVACollab announcements, which are distributed via email as well. You must check your email frequently in order to not miss important messages. You are responsible for the content of emails that are sent from me or the teaching assistants regarding this class.

I encourage you to have a plan for communicating with your instructors, including myself, in case you become ill or need to isolate. In the event that I become ill, I will contact a colleague and/or my department chair to communicate with you about how our course will proceed. Please pay close attention to email communications and/or UVACollab announcements throughout this semester.

Getting Help with the material of the Course:

Success in this course is possible for every single student through being diligent, working thoughtfully and seeking help when one needs it. However the material of this class can be challenging at times. If you find yourself struggling **come see me during office hours or one of the teaching assistants during a tutorial session or contact me through some other means.** I want to help you succeed in this class; seek me out if you are in need of help.

I will hold **in-person office hours** every Monday from 3-4:30pm in the Physics Building, location TBD. Additional office hours, either over Zoom or in person, can be made by appointment - just contact me via email.

We also have a few people assisting our learning in the class this semester. These teaching assistants will hold **weekly tutorial sessions, time and format TBD (Zoom or in-person).** Tutorial sessions are designed to help you review the material we are covering in class. Please come with your conceptual questions, as well as difficulties you may be having with your homework. See the UVACollab site for the course for details on the tutorial session schedule.

The **weekly Teaching Assistant tutorial sessions** are designed to be useful for students as they prepare for their homework assignments (see more below). I recommend attending these regularly if you are in need of help. Similarly, **my office hours** are a good place to hash out deep questions on the content we are learning.

This term we will be using **Piazza** for class discussion. The system is designed to get you

help quickly and efficiently from myself, the teaching assistants and classmates. Rather than emailing questions to myself and the learning assistants, I encourage you to post your questions on Piazza. If you have any problems or feedback for the developers, email team@piazza.com.

Find our class Piazza signup link at:

<https://piazza.com/virginia/spring2023/phys1425section002spring2023>

Textbook and electronic resources:

The textbook we will use is **Giancolis Physics for Scientists and Engineers, 5th edition**. We will also use the online platform **Modified MasteringPhysics** for completing and submitting homework assignments.

As part of the UVA Inclusive Access program, all students enrolled in the class will have immediate access to the a digital copy of the textbook and access to Modified MasteringPhysics from the UVA Bookstore through UVACollab for the first 2 weeks of class for free. **After February 2nd**, your student account will be charged \$70.58.

This program is optional for students, but you must actively opt out by the **2 February deadline** to not be charged. Additionally, if you opt out, you will lose access to your materials. 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 the bookstore at UVAInclusiveAccess@virginia.edu

Note: You are not required to participate in this program, you can opt out. If you opt out by the **2 February deadline**, your student account will not be charged. However, your access to the materials through UVACollab will be removed. In that case you would need to buy the text and buy access to the Modified MasteringPhysics online portal through other means. It does not matter to me what path you choose.

Assessments and Grading:

There will be an assortment of assessments in this class through which one can demonstrate successful learning of the material. These assessments will allow you to accumulate points towards your course grade throughout the semester:

| | |
|--|---------------------|
| Unit Summaries (12 summaries) | 60 points available |
| Homework sets (12 assignments) | 240 |
| Unit Quizzes (12) | 200 |
| Lecture participation (50 opportunities) | 50 |
| Midterm exam 1 | 125 |
| Midterm exam 2 | 125 |
| Final exam | 250 |

As you can see, there are 1050 possible points.

Final course letter grades may be curved according to the performance of this particular class. It is expected that roughly 40% of those who complete the course receive a grade in the A range (including A-, A, A+). In addition, historically the class average has been between B and B+ (class GPA between 3.0 and 3.3). A curve to this section's course grades could be applied if this class's overall performance does not match these expectations – but there are no guarantees.

However, for transparency, the following course letter grade minimum point cut-offs in this class are guaranteed:

| | |
|--------------------|--------------|
| ≥ 1000 points | A+ |
| ≥ 900 | A- or better |
| ≥ 800 | B- or better |
| ≥ 700 | C- or better |

These cut-offs **may be moved lower** if the class overall does not perform as well as the historical precedent, but the thresholds will never be moved higher. In other words, any curve in this class, if one is warranted and used, **will only raise your course letter grade** compared to the above thresholds and will never lower it.

The types of assessments are described in the following sections.

Unit Summaries:

At the start of each Unit, I will post on UVACollab the material to be covered in the form of reading assignments from the textbook. You must complete the reading and then submit a **Unit Summary** assignment on **Gradescope** by 2am of the day of the second lecture for that Unit. Grading of these Unit Summaries will be based on completion provided your submission has enough content. Hand-written summaries are preferred to cut/pasting from your e-book. Ideally, this Unit Summary is all you need to complete the Homework and the Unit Quiz for this material rather than flipping through the textbook. With the Unit Summary done, you will be more prepared for the Homework and Unit Quiz that follows.

Homework sets:

Weekly homework assignments will be assigned and submitted online through **Modified MasteringPhysics (MP)**. Homeworks will consist of 7-8 problems and will be due by 2am on the day of the third class meeting for each Unit. MP handles submission and grading of those submissions. We will get some practice early in the semester.

Further, you are required to submit your **written show your work (SYW) solution on Gradescope** for specific problems to demonstrate how you approach and solve the problem (for instance, which physical law is used, derivations, and numerical calculations when applicable). We will be explicit about which problems require a SYW submission in Gradescope.

Grading of SYW problems will be based mostly on completion, again, provided that your submission has enough content and makes sense. These SYW submissions are not additional homework problems - they are just MP problems that require an additional submission. This is an important part of the learning process: writing down your work requires thorough thinking of how you solve the problem, which helps to solidify concepts and problem solving skills.

Unit Quizzes:

The third meeting in each Unit will be devoted to active learning: solving 1-2 challenging problems in a small-group setting, building on what has been learned in the Unit so far. Discussion of the problem and approaches towards the solution are required. These small-group exercise are called Unit Quizzes in the schedule.

On a Unit Quiz day, typically, the first 5 minutes will be individual thinking time, followed by 35 minutes of group work, followed by volunteers presenting their solutions to the class. This allows all groups to be on the same page for submission of their Unit Quiz.

The Unit 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. Each individual must submit a solution independently. You can continue working with your group members after the lecture time, but, again, you must submit your own work.

Your group assignment will be partially based on a pre-semester survey and will be fixed within the first two weeks. We will use the same groups for the entire semester. You are encouraged to work together with your group members – both on the Unit Quiz and the Homeworks.

Lecture participation:

It is valuable to attend lecture and to participate in the discussions. I am going to work to maintain a learning environment where students are engaged and participating in each class meeting. This will include posing questions inline in lecture through a site called **LearningCatalytics** which allows us to interact via Q&A. Responses to questions posed during lecture will be worth 2 points and will be graded for correctness: half credit for submitting a response and full credit for submitting a correct response. There will be at least 25 of these opportunities throughout the semester. There is a 50-point maximum for the participation portion of your course grade.

Exams:

There will be two midterm exams and a final exam in this class:

| | | |
|----------------|------------|---|
| Midterm Exam 1 | Units 1-4 | Wednesday 22 February 2023 – in class, 325 Wilson |
| Midterm Exam 2 | Units 5-8 | Monday 3 April 2023 – in class, 325 Wilson |
| Final Exam | Units 9-12 | Monday 8 May 2023 – 2-5pm, 325 Wilson |

Exams will be held in-class and your responses will be submitted both on paper and on Gradescope. Exams will be closed book but a formula sheet will be provided. No outside resources or collaboration with others will be allowed.

The final exam will be in a similar form as the midterms. However, the final exam will be longer (both in time and length) and will focus on assessing your problem solving skills and ability to synthesize different pieces of information. Hence, the final exam will be counted more towards your final grade.

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 pencil or a black or blue colored pen is preferred. No submissions in red ink.

Those students who are eligible for accommodations through SDAC should contact SDAC directly as soon as possible to arrange to take the exam at their facility.

One important note: **Make-up exams will only be considered if a valid excused absence is presented before the exam.** I will follow official university policy concerning valid excused absences (official university travel, religious holidays, personal illness, or death/illness of an immediate family member).

Additional information:

All are welcome in this class:

I recognize and value the many perspectives my students bring to the classroom. Many factors - race, gender identity, visible and invisible disabilities, family circumstances, mental health, access to resources - all influence the experiences that every individual can have in my courses this and every semester. I am committed to building an environment to support your learning in a manner that ensures equity for all.

Furthermore, this is an inclusive learning environment and all people are welcome regardless of their gender, gender identity, sexuality, race or other characteristics. Since students will be interacting with each other and addressing each other, we must have respect for others' names and pronouns, and exhibit courteous and collegial behavior throughout all class experiences.

This is an anti-racist classroom:

I acknowledge that racism and white supremacy are baked into both the history of UVA as an institution and the history of higher education as a whole. I believe that my pedagogical philosophies and practices can either reinforce inequities or work to eliminate them. I am committed and actively working to be sensitive to the needs of all my students; continuing to learn about the ways systemic injustices disadvantage my Black students and colleagues and

other students and colleagues of color in and out of the classroom; and advocating for and implementing anti-racist educational practices. I will hold myself accountable, encourage you to help me do so, and invite you to join me in this work.

Your health and well-being - this is important!

During this semester, we may face challenges as a learning community, but I am hopeful that no matter what comes we can continue to learn, connect, and grow together. I am committed to maintaining a healthy and equitable learning environment for all students.

Your health and well-being are a priority; please take care of yourself and monitor your health daily. If you are ill, please stay home, notify me, and contact the Student Health and Wellness Center (434-924-5362) so that you can receive appropriate care. I recognize the need for some time off may also arise if someone close to you becomes gravely ill. For any of these situations, we will work together and with your Association Dean to develop a plan to make sure you're looked after and can continue to make progress in the course.

To care for our community, we will follow UVA's policies in place for health and safety. Actions like observing social distancing, washing and sanitizing our hands frequently, and supporting those who choose to wear face coverings are critical for our environment to be one where you all can engage and learn. I will do my best to help establish and maintain a learning environment where health and safety are prioritized.

If you are feeling overwhelmed, stressed, or isolated, there are many resources here to help. First off, do not be afraid or reluctant to reach out to me. I care about the well-being of all my students, including you. I may not be able to provide solutions but I can at least provide guidance. Further, there are services provided by Student Health that you can take advantage of, depending on the crisis level you are experiencing.

- If you are in immediate danger of harming yourself or others, or are having a medical emergency, DIAL 911.
- Timely Care 24/7 TalkNow allows students to connect with a mental health professional any time of day, either by phone or video. Students can use TalkNow to discuss any concern, from conflicts with roommates to mental health crises. Staff are happy to assist 24 hours a day, 7 days a week. Download the TimelyCare app to get started.
- CAPS On-Call: During business hours (M-F, 8am-5pm) students in crisis can walk-in to CAPS at 550 Brandon Avenue or call 434-243-5150 to speak with an on-call counselor.
- If you prefer to speak anonymously, you can call Madison House's HELP Line at any hour of any day: 434-295-TALK
- Concerns Regarding Another Student: If you are concerned about another student, you can call 434-243-5150 24 hours a day, 7 days a week and ask to speak with the on-call counselor. Consultation regarding concerns about students is available to UVA

students, faculty, administrators, staff, parents, and other concerned community members.

Important thing to remember: Food and housing insecurity is a common issue that many UVA students face, more common than many of us realize. Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or lacks a safe, stable place to live and believes this may affect their performance in the course is urged to contact the Dean of Students for support. Furthermore, please notify me if you are comfortable in doing so.

Academic integrity:

Do not cheat on homework, quizzes, exams, your practicum or any aspect of this course. Given the allowance for take-home exams and online submission of homework, it is quite easy to cheat on certain portions of this class. Similarly it is often pretty easy for me or one of the teaching assistants to tell when you are cheating. Don't do it.

If I discover any of you are cheating I will start by giving you zero credit for the submission in question. I will then report you to the Honor Committee and I will follow through on the process. ***Students found guilty of an Honor offense are permanently dismissed from the University.*** Don't put your future here at UVA in jeopardy. Do your best and do your work in an honest, thoughtful manner.