Fundamental Physics I

PHYS105

Instructor Info

Prof. Karen Masters and Prof. Natalia Lewondowska

Student Hrs: Prof. Masters: https://calbird.com/karen/1136 (group meetings encouraged) — Prof. Lewondoska: M 3-4 pm, or by appointment (preferably via email).

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Course Info

Prereq: Phys Placement. MATH118 (Calculus; co-req)

Class: MWF

1: 11am-12pm OR 2: 1-2pm

1: Stokes 131 OR 2: Obs. Trailer (or online)

Lab Info

Once a month on T, W or Th

1.30-4pm

H105 "Intro Physics Lab" — pthorman@haverford.edu

TA Info

Clinic: TBD

Physics Lounge/Online

Overview - Draft Fall 2020 Version

PHYS105 is the first in the two semester introductory Physics series aimed at students interested in physical sciences.

Topics will cover (Newtonian) mechanics (including equations of motion, in one, two and three dimensions using vector algebra; work-energy, energy conservation, rotation and angular momentum, gravity and orbits and static equillibrium); an introduction to oscillations; and waves and thermodynamics. Examples will primarily be from physical sciences. Knowledge of calculus is assumed.

These topics (along with those in PHYS106) are the foundations of the physics which is used to explore the Universe from the smallest subatomic particles, to the largest known structures, as well as the physics which helps build our modern world.

Material

We will use the Open Stax *"University Physics"* textbooks (Volumes I and the first half of Volume II), which are available (free) online at `https://openstax.org/`, with their accompanying WebAssign platform (which you have to purchase access to).

It is not necessary to purchase a hard copy of the books (although they are available). Unless noted reading assignments are from Volume I.

If any student finds a significant error (not a simple typo, but something which impacts understanding – as verified by the Professor) in either of these open source books they will be rewarded with the option to drop their worst HW grade at the end of the semester.

Diversity and Inclusivity Statement

Our classroom should be a place where all members will be treated with respect. We welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability - and other visible and non-visible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class. If something was said in class (by anyone including myself) that made you feel uncomfortable, please talk to me about it (anonymous feedback is always an option). I appreciate any opportunity to continue my learning about diverse perspectives.

In an ideal world, science would be objective. However, science is done by people, and is historically built on a small subset of privileged voices. In this class, we will make an effort to notice the contributions of diverse group of scientists, but limits still exist on this diversity. I believe that integrating a diverse set of experiences is important for a more comprehensive understanding of science.

Honour Code

Collaboration is an important part of science. You are strongly encouraged to work together and/or consult one another for work in this class. You are encouraged to consult any books necessary as well as resources on the internet. You must, however, turn in your own individual homework, and this must be written on your own. Copying and pasting (even parts of sentences) is not permitted and is a violation of the Honour Code. Good collaboration involves everyone understanding what is going on in the assignments. Therefore even if the basic solution is shared you must explain it in your own words (including mathematical words). Please list any students that you collaborated with. Please pay attention to your classmates to make sure no one is being left out of collaborative work.

You may not obtain materials from students who have taken this course in previous years, nor may you distribute your current materials to students not currently enrolled in this class. Please consult me if you have any questions.

FAQs

How Should I Work on Physics Problems?

Try them first alone, but then (as long as the HW doesn't ask you to work on a problem individually) it's best to work with others. You will learn much more by talking through problems together. It is strongly suggested you find a study group.

How Can I Best Support My Learning in this Class

Make sure to attend all classes, and keep up with the schedule. Talk to the Professor as soon as you feel like you are falling behind (don't leave it too late). Attend the weekly Problem Workshop session, Physics Clinic, and student office hours. My goal is to support you to succeed in this class, so help me to help you.

What Physics is Covered in this Class?

Newtonian mechanics (including equations of motion, in 1-3D with vectors, work-energy, energy conservation, rotation and angular momentum, gravity and orbits, static equillibrium), an introduction to oscillations and waves and thermodynamics.

What's the Best Kind of Physics?

I'm obviously going to say astrophysics since this is my research area. One of the reasons I love astrophysics though, is that it uses material from all areas of physics to study the most fascinating and extreme objects in the Universe. All topics covered in this class are important in some way to the study of astrophysical objects, as well as many other areas of Physics.

Grading Scheme

30%	Homeworks
25%	Labs
10%	Participation and Contributions
20%	Two midterms (10% each)
15%	Final Exam

Homework Assignments

Homework will be due almost every week on Monday. You will submit electronically via Moodle and/or WebAssign. If you create handwritten work, please use a Scanner (or Free Scanning Ap on your phone) to create a single PDF to upload to Moodle. Do not write your name on the scanned document (to enable anonymous grading).

The expectation for homework, lab reports and other written work, is that a physicist will be able to understand exactly what you're calculating and why without looking at the question you were asked. A lot of learning takes place in the process of doing science, not in simply getting a numerical answer as quickly as possible, and written work will be evaluated as such. Please show your work cleanly and neatly, and help us to give you partial or full credit! It will help your grade if you are neat and organized – we can't grade what we can't read.

You will have the opportunity to recover 50% of lost points by explaining what you did wrong. This must be due within a week after you get your graded HW back and must be done verbally to one of the Professors or TA (you may use notes). No extensions are possible on resubmissions.

Intro Lab

You will be assigned to a Lab Section to support this course. Paul Thorman runs the labs with are designed to complement the class material. There will be three labs per semester and we're planning for both in person and remote versions.

Participation

Participation is more than just attending lectures (although not attending will hurt your participation grade). Our assessment of your participation and contributions will factor in your positive efforts to engage with the material, your coming to class prepared (having read the material, and done any pre-class e-assignments), your professional and respectful interactions with other members of the class, and your willingness to share your knowledge and understanding with others.

There may be pre-class material posted to turn in online. While this will not be formally graded, missing significant amounts of this will count against your participation grade.

Attendance at Problem Solving Workshop and Student (office) Hours will be noted and count as a positive sign of participation.

Midterms and Final

There will be two midterms and a final. These will all be closed book take-home exams. You should not consult any materials except a 1 page (2 for the final) "cheat sheet" you will turn in with the exam. You will scan and upload to Moodle your exam papers. Do no write your name on your papers (to enable anonymous grading).

Midterms - These will be posted on Mon 5th Oct, and Mon 2nd Nov. You may take these in any continuous 2 hour period before the turn-in deadline on Fri 9th Oct and Fri 6th Nov respectively. There will be no HW the week of the midterms.

Final - This will be similar to the Midterms, except you will be allowed to take 3 hours. There will be an exam review session on the Monday of exam week.

Anonymous Grading

Anonymous grading has been demonstrated to reduce unconscious bias (both positive and negative) in grading.

For this reason, while we will review your HW and midterms after they are graded to check on your progress in the course, the graders (professors or student graders) will not know whose assignment they are grading.

Please do not write your name on your HW or exams before you scan it/turn it in. Scanned HW and exams will be turned in via Moodle which manages anonymous grading. .

How to Succeed

Our goal is to help everyone to succeed in this class. It will be hard work (learning always is), but I am confident you can do it.

Including lab and lecture/discussion sections, this class will have 6.5 "contact hours" between instructors and students. The problem sets & reading assignments for this course should take between 7 and 8 hours. If they take significantly more or less time, please let me know. We value student feedback, and will try to adjust the schedule accordingly, within the constraints of the essential material.

Lectures have been pre-recorded on Panopto and made available for review on the Moodle site. A selection of example problem solutions, or explanations of selected topics will be posted as short "Explain Everything Videos" (on Moodle). We will use the classtime for questions on lecture material, and to work through example problems in small groups.

The Physics clinic (staffed by upper level Physics students) will be on XX nights to support your work on the HW.

The Maths clinic is also available for support in Math. There is also extra Math support availbale in WebAssign for those who need it.

The best way to contact Prof. Masters is by email. She is very happy to help with short questions via email. She also reserves time each week to meet with students in her classes. You can see when she is free and/or reserve an appointment here: https://calbird.com/karen/1136.

Student hours with Prof. Lewondowska are Mo 3-4 pm, or by appointment (preferably via email).

Extensions and Absences

You are expected to attend all discussion sections having done the required reading/watched the lecture videos. Unexplained absences (i.e. not caused by illness, emergency or religious observance) numbering more than two will count against your participation grade. Please email me (in advance if possible) if you know you need to miss class.

You will not be able to participate fully in class if you do not keep up with the HW schedule. It also makes scheduling the grading of your assignments harder for us. However life happens. If you contact your Professor in advance, short (e.g. 48 hours) extensions are easy to grant. But if you do this more than twice you will have to talk to your Professor in person (Zoom is fine) about how you are scheduling your time for the work in this class. After a third time, or for any homework more than a week late you will need to discuss how things are going with both your Professor and your Dean. In our experience, most students who fail this class do so because they do not keep up with the HW schedule.

There will be no extensions on the midterms except with the approval of your Dean.

Accommodation Statement

Haverford College is committed to providing equal access to students with a disability. If you have (or think you have) a learning difference or disability – including mental health, medical, or physical impairment, please contact the Office of Access and Disability Services (ADS) at hc-ads@haverford.edu. The Coordinator will confidentially discuss the process to establish reasonable accommodations.

Students who have already been approved to receive academic accommodations and want to use their accommodations in this course should share their verification letter with me and also make arrangements to meet with me as soon as possible to discuss their the specific accommodations. Please note that accommodations are not retroactive and require advance notice to implement.

It is a state law in Pennsylvania that individuals must be given advance notice if they are to be recorded. Therefore, any student who has a disability-related need to audio record this class must first be approved for this accommodation from the Coordinator of Access and Disability Services and then must speak with me. Other class members will need to be aware that this class may be recorded. It is my intention to record all classes in Panopto to make them available.

Class Schedule (Subject to Change)

Week	Topic	Reading	Lab/HW/Exam
Classical Mechanics, Motion and Gravity			
Week 1: 9-11th Sept	What is University Physics. How to read a physics book. Units and Measurement. Motion Along a Straight Line	Ch 1,3	
Week 2: 14-16th Sept	Vectors, Motion in Two and Three Dimensions	Ch2, 4	HW1 (Units and Estimation, Vectors, Calculus Review) due Mon
Fri 18th Sept:	No class (Rosh Hashana)		
Week 3: 21-25th Sept	Newton's Laws of Motion (1-2)	Ch 5,6	HW2 (Vectors, Motion in 2-3D, Newton 1) due Mon
Week 4: Mon 28th Sept	No class (Yom Kippur)		
30th Sept - 2nd Oct	Work, Energy and Power (in Physics)	Ch 7	HW3 (Applications of Newton's Laws) due Fri
Week 5: Mon 5th	Midterm 1 Review (Topics on HW 1-3)		Midterm 1 due Fri
7-9th Oct	Potential energy, conservative and other forces	Ch 8	No HW
Week 6: 12-16th Oct	Linear Momentum and Collisions	Ch 9	HW4 (Work-Energy, Conservation of Energy) due Wed
Week 7: 19-23rd Oct	Rotation and Angular Momemtum	Ch 10,11	HW5 (Linear Momentum) due Wed
Week 8: 26-30th Oct	More Rotation. Static Equillibrium	Ch12	HW6 (Rotation and angular momentum) due Fri
Week 9: 2nd-6th Nov	Gravity and Orbits	Ch13	HW7 (Gravity and Static Equillbrium) due Fri
Waves and Oscillations and Thermodynamics			
Week 10: Mon 9th Nov	Midterm 2 Review (topics on HW4-7)		Midterm 2 due Fri
11-13th Nov	Oscillations	Ch15	No HW
Week 11: 16-20th Nov	Waves	Ch16	HW8 due Fri (Oscillations)
Thanksgiving Break 23-27th Nov			
Week 12: 30th Nov-4th Dec	Sound and Acoustics (REMOTE ONLY)	Ch17	HW9 (Waves, Sound) due Fri
Week 13: 7-11th Dec	Intro to Thermodynamics (REMOTE ONLY)	Vol II Ch1,2	HW10 (Thermo) due Fri
Exam Week	Final Exam (covering everything except Thermo)		