

From pebbles rolling down hills to rockets traversing space—can you describe how things move with precision and clarity? Can you predict where they’ll be in seconds, days, or millennia? Mechanics is the language every physicist uses to do just that. This semester you’ll push yourself to master the quantitative machinery behind force, momentum, and energy, learning to see these concepts everywhere around you. We’ll apply calculus in one, two, and three dimensions, pushing your mathematical limits to build physical intuition. We’ll start with Newton’s classical mechanics, building foundations for advanced courses in Hamiltonian and Lagrangian mechanics. Later, we’ll explore how classical mechanics breaks down as objects approach the speed of light—Einstein’s relativity will reshape your concepts of time and space, preparing you for Modern Physics and Electricity/Magnetism. The journey ahead is challenging but rewarding, requiring focus, strong work ethic, and most importantly, boundless curiosity. It’s your first step toward becoming a physicist. Welcome!

### People

**Professor:** Damian Sowinski  
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**Office:** 203D or 466 B&L  
**Hours:** Tu 1300-1500, F 1330-1530

**Lab Instructor:** Sheth Nyibule  
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**Recitation TA:** Hugh Randall  
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**Hours:** W 1300-1400, 1700-1800

**Lab TA:** Andrew Milne  
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**Hours:** Th, 1400-1500

**Recitation TI:** Chenfei Tang  
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**Lab TI:** Zechen (Cheryl) Liu  
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**Recitation TI:** Finley Gloor  
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**Hours:** Th 1530-1630

**Lab TI:** Ainhua Gil Uriarte  
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**Lab TI:** Edward Caine  
**Email:** ecaine3@u.rochester.edu

**Getting Help:** For homework/lab questions, contact your teaching intern (TI) first, then the teaching assistant (TA) if needed. Save non-critical questions for recitation or office hours. For administrative questions, contact me or Professor Nyibule.

**Before reaching out:** Check this syllabus first—your answer may already be here. I hold weekly office hours for homework, physics concepts, and coding questions. Feel free to drop by!

*Note: All schedules use 24-hour format. Scheduling mix-ups aren’t valid excuses.*

### Books

*An Introduction to Mechanics* by Kleppner & Kolenkow, 2<sup>nd</sup> Edition (required)  
*A Practical Guide to Data Analysis for Physical Science Students* by Louis Lyon (required)  
*Vibrations and Waves* by A.P. French (recommended)

### Time Management

**Time Investment:** This honors course requires ~10-15 hours weekly.

Lectures/labs: 2.5 – 5 hrs  
Readings: ~ 1.5 hr (go through all examples)  
Recitation/office hours: 1 – 2 hrs  
Problem sets: ~ 4 hrs (up to 10 problems, 10 – 30 min per problem)  
Lab write-ups: 2 – 3 hrs

**Success tips:** Set alarms, use your calendar, don't procrastinate. If stuck on a problem, skip it and return with fresh eyes. Use office hours and recitation. You'll be reading/studying/learning 50+ hours weekly for all your courses, taking part in our collective quest for understanding. This isn't just coursework—it's your adventure to the edge of human knowledge!

### Lectures

Tuesdays & Thursdays 940 – 1055 Hoyt Auditorium.

**Come prepared:** Read assigned sections beforehand and bring materials for handwritten notes.

**Classroom rules:** No laptops, tablets, or phones (keep in bags on silent). No meals in the auditorium—snacks, water, coffee/tea are fine. Feel free to use the bathroom without asking.

**Questions encouraged:** If something doesn't make sense, ask! Raise your hand when I'm facing the class, or just speak up when I'm not. Your classmates likely have the same question.

**Pro tip:** Sit up front if you're shy about asking questions—it's easier to forget you're not alone.

### Recitation

Tuesday	1525 – 1640	B&L 269	Finley Gloor
Tuesday	1650 – 1805	B&L 203H	Hugh Riley
Wednesday	1400 – 1515	B&L 269	Chenfei Tang
Wednesday	1815 – 1930	Hylan 202	Hugh Riley

**Attendance:** These begin on the second week of courses. 1+ section weekly (any section works, but try to stay consistent). Use recitations for questions, homework help, example problems, and exam review.

**Section rules:** Laptops and tablets OK; step outside for phone calls. Bring water, but avoid disruptive snacks.

### Laboratory

Monday	1400 – 1640	B&L 407	A,C
Monday	1650 – 1930	B&L 407	A,E
Monday	1940 – 2220	B&L 407	E,C

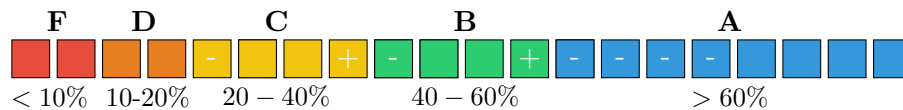
There are five labs total, starting week three, then every two weeks. They are led by Ainhoa, Edward, and Cheryll, two of whom will be present at each one, and overseen by Andrew. Download/print out the lab manuals for each week's lab prior to attending. You can work in groups of up to three people. Write-ups must be in TeX (using the template provided on blackboard), and submitted as PDFs on blackboard two weeks later. *Labs can be run the following Monday in case more time is needed for data collection, but this is strongly discouraged. Please try to finish in one sitting.*

**Lab rules:** computers/tablets OK, no phones, no disruptive food.

**Off-week Mondays:** Optional TI-led recitations for write-up help – highly encouraged.

### Grading Policy

*Grades* will reflect performance on weekly **problem sets**, **labs**, and four **exams**. The lowest performance in these six assessments is dropped. The remaining five contribute equally (20%) to your course percentage. Your course grade corresponds to the percentage bracket below:



**Problem sets** hone your ability to identify and apply physical concepts. Up to 10 questions weekly—read them ahead of lectures so they're stewing in your mind; you never know when a lecture might unlock one for you. Try solving extra chapter problems too, as exams feature similar questions. Collaborate at the Society of Physics Students, but ensure write-ups are in your own voice (see Academic Honesty). Be thorough, use full sentences, keep math legible and pictures intelligible. Pencil or black/blue pen only. Plots and pictures can use other colors, just no red/pink - use colors with contrast. Each weekly set is due the Tuesday of the following week at lecture start handed in to me. *No late submissions.* Graded by Hugh, Chenfei, and Finley.

**Labs** test your experimental skills in a hands-on setting. The write-ups hone your ability to communicate the experimental and theoretical features of a scientific experiment in a concise and informative way. Each consists of an introduction, methods, results/discussion, and conclusion section. The template explains more on how each of these should be written. Graded by Andrew.

**Exams** test your theoretical skills under time pressure. The first three use **Common Exam Time**: September 16<sup>th</sup>, October 9<sup>th</sup>, and November 11<sup>th</sup> from 800-930 in the rooms listed in the syllabus. The final exam is December 15<sup>th</sup> at 1600 during **Final's Week**, on December 15<sup>th</sup> at 1600. *No make-up exams—set those alarms!* Each exam focuses on recent material, but since physics concepts build on each other, earlier topics will reappear. You probably won't finish everything—skim the entire exam first, then tackle problems that jump out at you. Expect multi-part word problems that demand solid algebra, trigonometric and geometric formulas, and some calculus. Show your work—I grade both your final answer and your problem-solving approach. No electronic devices or graphing calculators; there's minimal plug-and-chug computation. Graded by Sowinski.

### Syllabus

*Note: The PHYS 140s faculty are in the process of reorganizing and streamlining the series. The syllabus and other parts of this documents may change; I will discuss important changes with you.*

Date	Topic (K&K Chapter.sections)	Chapter.Homework Problems
Week 1: Vectors & Kinematics		
8/26	<i>Course Information &amp; Vector Algebra</i> (1.1-1.6)	1.1-6
8/28	<i>Approximations, V. Calculus, Dimensional Analysis</i> (1.n1-n5,2.8,5.n2)	1.11,14,15
Week 2: Vectors & Kinematics, Newton's Laws		
9/2	<i>Coordinates, Kinematics</i> (1.7-1.11)	1.18,19,23,25,26+2.16
9/4	<i>Newton's Laws of Motion &amp; Force Diagrams</i> (2.1-2.6,2.9-2.10)	2.2,8,10,15
Week 3: Forces and Equations of Motion		
9/8	<b>Lab I</b> (Lyons, Chapter 1 before lab)	
9/9	<i>Universal Gravitation and Coulomb's Law</i> (3.1-3.3,n3.1)	3.4,5,9,14
9/11	<i>Phenomenological Forces &amp; Equations of Motion</i> (3.4-3.7)	3.19,21,22,25
Week 4: Momentum		
9/16	<b>Exam I</b> (Hoyt Auditorium) 800-920 <i>Center of Mass &amp; Conservation of Momentum</i> (4.1-4.5, n4.1)	4.1-3,6
9/18	Exam Discussion	No Problems
Week 5: Momentum & Energy (No homework due this week)		
9/22	<b>Lab II</b>	
9/23	<i>Impulse, Rocketry, &amp; Momentum Flux</i> (4.6-4.10)	4.11,16,24
9/25	<i>Kinetic Energy &amp; Work-Energy Theorem</i> (5.1-5.3)	5.2
Week 6: Energy		
9/30	<i>Potential Energy &amp; Conservation of Energy</i> (5.4-5.6,n5.1)	5.3,7,12
10/2	<i>Vector Calculus &amp; Conservative Forces</i> (5.3,7-5.11)	5.6,8,9,13
Week 7: Topics in Dynamics		
10/6	<b>Lab III</b>	
10/7	<i>Divergence &amp; Curl, Ideal Gas Law, Review</i> (Ch. 4-5)	No Problems
10/9	<b>Exam II</b> (109 B&L) 800-920 <i>Small Oscillations and Stability</i> (6.1-6.3)	6.1,2
Week 8: Topics in Dynamics		
10/14	<i>Fall Break</i>	Catch up on reading!
10/16	<i>Normal Modes</i> (6.4)	6.3,1.21,2.17,3.24
Week 9: Topics in Dynamics, Angular Momentum and Fixed Axis Rotation		
10/21	<i>Collisions</i> (6.5)	6.4,8,10
10/23	<i>Angular Momentum, Moment of Inertia, P.A.T., Torque</i> (7.1-7.4)	7.1,2,3
Week 10: Angular Momentum and Fixed Axis Rotation, Rigid Body Motion		
10/27	<b>Lab IV</b>	
10/28	<i>Pendula, Rotational Dynamics, Chasles Theorem</i> (7.5-7.9, n7.1)	7.7,8,13
10/30	<i>Physical Pendula, Bohr Atom</i> (7.10,8.1,2)	7.18,19, 8.1
Week 11: Fixed Axis Rotation		
11/4	<i>Vector Nature of Angular Velocity, Gyroscopes</i> (8.3-8.6.1)	8.2,3,4

11/6	<i>Precession and Gyrocompass</i> (8.6.2-8.7, n8.1,2).....	8.6,9,10
Week 12: Non-Inertial Systems and Fictitious Forces		
11/10	<b>Lab V</b>	
11/11	<b>Exam III</b> (Hoyt Auditorium) 800-920	
	<i>Galilean Transformation &amp; The Equivalence Principle</i> (9.1-9.4) .....	9.1,4,7
11/13	<i>Physics in a Rotating Coordinate System</i> (9.5,n9.1) .....	9.2,10,12
Week 13: Central Force Motion		
11/18	[106 B&L] <i>Central Force Motion &amp; its Universal Properties</i> (10.1-10.2) .....	10.1,4,5
11/20	<i>Planetary Motion</i> (10.3-10.4) .....	10.6,10,13
Week 14: Central Force Motion		
11/25	<i>Planetary Motion</i> (10.5-10.6).....	10.2,3,9,12,14
Week 15: The Harmonic Oscillator		
12/2	<i>Damped Harmonic Motion</i> (11.1-11.3).....	11.1,2,3,7
12/4	<i>Driven Harmonic Motion</i> (11.4-5) .....	11.10,13
Week 16:		
12/15	<b>Exam IV</b> (Hoyt Auditorium) 1600	

### LaTeX and Overleaf

There are two methods for TeXing up your reports. The first is to do it online using [Overleaf](#), which is required for the course. Head over to the site and make yourself an account using your UofR email to get started. The second is TeXing locally on your computer; you should download a distribution ([MacTeX](#), [LaTeX Project](#), [TeX Live](#)) if you plan on being away from internet access for long periods of time. Please read through the info page on LaTeX [here](#).

### Academic Honesty

Please acquaint yourself with the [UR Academic Honesty Policy](#). Cheating includes the submission of homework or exam solutions that are not your own work or under someone else's name. Any detected act of cheating will be handed over to the Board on Academic Honesty for investigation.

### Statement of Inclusion

The University of Rochester, this course, and its teaching staff are committed to inclusion and welcome students of all backgrounds and abilities. Services and reasonable accommodations are available to students with temporary and permanent disabilities, to students with DACA or undocumented status, to students facing mental health issues, other personal situations, and to students with other kinds of learning needs. Please feel free to let any of us know if there are circumstances affecting your ability to participate in class or your full participation in this course. Some resources that might be of use include:

- [International Student Academic Affairs](#)
- [University of Rochester's CARE network](#)

### Disability Resources

The University of Rochester respects and welcomes students of all backgrounds and abilities. In the event that you encounter any barrier(s) to full participation in this course due to the impact of a disability, please contact the Office of Disability Resources. The access coordinators in the Office of Disability Resources can meet with you to discuss the barriers that you are experiencing and explain the eligibility process for establishing academic accommodations. You can reach the Office of Disability Resources at [disability@rochester.edu](mailto:disability@rochester.edu); (585) 276-5075; Taylor Hall; [Website](#).

### Mental Health Services

Managing your mental and physical health while keeping up with all your academic responsibilities may be especially challenging. The University offers support services in a variety of areas and has adapted to supporting students both in-person and online. We encourage you to review the services offered and reach out should you find yourself struggling. You can find a list of services, with descriptions, at this [page](#).