

Physical Sciences 2: Mechanics, Elasticity, Fluids, and Diffusion Harvard University, Fall 2020

Primary Class Time: Tu, Th Noon–1:15pm

(Interactive Lecture Viewing: Tu, Th 7:30pm–8:45pm*)

Website: <https://canvas.harvard.edu/courses/76554>

Instructors:	Dr. Greg Kestin Dr. Louis Deslauriers See course website for office hours and “help room” hours		
Head TFs:	Head Admin. & Section TF:	Justina Yang, jyang1@g.harvard.edu	
	Head Lab TF:	Tim Milbourne, tmilbourne@g.harvard.edu	
Have questions?:	Administrative/Scheduling Questions	PhysicalSciences23Harvard@gmail.com	
	Physics/Assignment Questions	Help room or office hours	
		Email your TF (emails listed on course website)	
	For other issues email: PhysicalSciences23Harvard@gmail.com kestin@fas.harvard.edu louisdeslauriers@fas.harvard.edu		
Sectioning:	After registering you will receive a survey to choose your section time. The deadline for requesting sections is 11:59pm on Saturday, Aug. 29. Any requests after that deadline will be considered on a space-available basis. For questions about sectioning, please contact Head TF, Justina at PhysicalSciences23Harvard@gmail.com.		
Course Text:	Knight, <i>Physics for Scientists and Engineers</i> , 3rd edition . ISBN: 978-0321752949. We consider this text to be recommended, not required . It is really just a reference.		
Online Homework:	We will be using Sapling Learning for homework assignments and additional tutorials this semester. Go to www.saplinglearning.com to register and purchase a subscription. One semester costs \$42; a full year of access (for Physical Sciences 2 and 3) costs\$64. If you earn 90% of the points on a sapling assignment, you will get full credit for for that assignment.		
Course Description:	An introduction to classical mechanics, with special emphasis on the motion in fluids of biological objects, from proteins to people. Topics covered include: momentum and energy conservation, kinematics, Newton's laws of motion, oscillations, elasticity, fluids, random walks, and diffusion. Labs will focus on quantitative analysis & Python. Examples in class, homework & lab will be drawn from the life sciences and medicine.		
Placement Information:	PS 2 and 3 offer a calculus-based introduction to physics, with many examples and key topics drawn from the life sciences and medicine.		
Examination Dates:	Tuesday, October 6 Tuesday, November 17	Midterm 1 Midterm 2	Noon–1:15pm EST or 7:30pm - 8:45pm EST Noon–1:15pm EST or 7:30pm - 8:45pm EST
Course Grading:	Mini-Group Exam Midterm Exam 1 Midterm Exam 2 Final Exam Problem Sets Laboratory Course Participation	3% 14% 14% 24% 15% 15% 15%	Note: There will be no makeup exams . If you miss one exam for a valid reason, your final exam score will be used in place of the missed exam. Note: Your lowest problem set will be dropped. Note: Any missed labs will receive a grade of zero.

*Only for those unable to make the primary class time

Any concerns about grading errors must be noted in writing and submitted to your TF within two days of receiving your graded exam. Any such notes will come with a regrade of the full exam.

Course participation includes in-class activities, pre-class quizzes, and other activities designed to help you learn. We will tell you the correct answers for every problem, so you can earn full credit for every activity. If you earn 90% of the participation points you will get full credit for participation; anything less will be prorated accordingly.

Prerequisites: Calculus at the level of Mathematics 1b (may be taken concurrently).

Accessible Education: Any student receiving accommodations through the Accessible Education Office should present their AEO letter to the Head TF by Friday, Sept. 15. Failure to do so may prevent us from making appropriate arrangements for the first exam.

Discussion Sections: Discussion sections (75 min) meet on Tues. and Wed. starting **Sept. 8**; you will choose your section with the online sectioning program. For questions about sectioning, contact the Head TF, at PhysicalSciences23Harvard@gmail.com.

Problem Sets: Problem sets will be posted on the Sapling website each Tuesday and will be due the following Tuesday **before** lecture (by **Noon**). The written portions of each assignment must be scanned and submitted on the corresponding canvas assignment page. Late problem sets will not be accepted, but we will drop your lowest problem set grade. Collaboration on problem sets is allowed, but you must **acknowledge your collaborators**, and you may not simply copy answers: the final write-up must be your own work. Collaboration on examinations is not allowed.

Help Room: Teaching Fellows will be available to help with problem sets. The **Physics Help Room** is open Fridays 3pm–5pm and Mondays 4pm–10pm.

Laboratory: Laboratory experiments are an integral part of the course: your understanding of lab will be tested on problem sets and on exams. You should sign up for a lab time using the online sectioning program. Attendance and participation is required. Questions about scheduling labs should be sent to the Head TF, Tim Milbourne, tmilbourne@g.harvard.edu.

Labs	Module/Class	Date	Class
Lab 1: Python Intro	1a	Thu Sep 3	Vectors and Velocity
	1b	Tue Sep 8	Momentum, Interactions and the Center of Mass
	2a	Thu Sep 10	Forces Change Momentum; HW 0 due (bonus!)
	2b	Tue Sep 15	Kinematics with Constant Acceleration; HW 1 due
	3a	Thu Sep 17	Contact Forces; Free-Body Diagrams
	3b	Tue Sep 22	Friction and Drag; HW 2 due
	4a	Thu Sep 24	Conservation of Energy
	4b	Tue Sep 29	Work and Kinetic Energy; HW 3 due
	4c	Thu Oct 1	Work and Potential Energy
	Exam 1	Tue Oct 6	Midterm Exam 1: Modules 1–3, Lab 1
Lab 2: Measurement	5a	Thu Oct 8	Introduction to Rotational Motion
	5b	Tue Oct 13	Rotational Dynamics; HW 4 due
	6a	Thu Oct 15	Static Equilibrium
Lab 3: Curve Fitting	6b	Tue Oct 20	Simple Harmonic Motion; HW 5 due
Lab 4: Sampling	7a	Thu Oct 22	Elasticity
	7b	Tue Oct 27	Fluid Statics and Buoyancy; HW 6 due
	8a	Thu Oct 29	Surface Tension
	8b	Tue Nov 3	Gases, Fluid Flow, Aneurysms; HW 7 due
Lab 5: Blood Pressure Projects	9a	Thu Nov 5	High Reynolds Number Flows
	9b	Tue Nov 10	Low Reynolds Number Flows; HW 8 due
	9c	Thu Nov 12	Kinetic Theory and Brownian Motion
	Exam 2	Tue Nov 17	Midterm Exam 2: Modules 4–8, Labs 2–4
	10a	Thu Nov 19	Boltzmann Distribution
	10b	Tue Nov 24	Random Walk, Diffusion, Friction; HW 9 due
		Thu Nov 26	Thanksgiving
	10c	Tue Dec 1	Diffusion, Fick's Laws
	10d	Thu Dec 3	Review
		Tue Dec 8	(reading period) HW 10 due Final
	Final Exam	Sat Dec 12	Final Examination (2pm-5pm EST)

Mini-Group Exam