

University of California San Diego  
Department of Physics  
Physics 2C, Winter 2020  
Fluids, Waves, Thermodynamics, and Optics (4 units)

**Instructor:** Professor Javier Duarte, [jduarte@ucsd.edu](mailto:jduarte@ucsd.edu)  
Office hours location: Mayer Hall Addition (MHA) 5513  
Office hours: TuTh 2-3pm (i.e. right after class)

**Teaching assistants:** Jason Platt (head TA), [jplatt@ucsd.edu](mailto:jplatt@ucsd.edu), Office hours TBA  
Haochen Fu, [h4fu@ucsd.edu](mailto:h4fu@ucsd.edu), Office hours TBA  
Yiwen Huang, [yih003@ucsd.edu](mailto:yih003@ucsd.edu), Office hours TBA  
Kambalur Bharat, [bkambalu@ucsd.edu](mailto:bkambalu@ucsd.edu), Office hours TBA  
Paul Wang, [pywang@ucsd.edu](mailto:pywang@ucsd.edu), Office hours TBA

**Course webpage:** <https://jduarte.physics.ucsd.edu/phys2c>

**Course schedule:**

Lecture:	TuTh	12:30-1:50pm	York 2722
4 <sup>th</sup> hour lecture:	F (weeks 1, 2, 4, 6, 8, 10)	9-9:50am	York 2722
Discussion: (993461-993472)	W	(varies)	(varies)
Quizzes:	Th (weeks 3, 5, 7, 9)	12:30-1:50pm	York 2722
Final exam:	Tu March 17, 2020	11:30am-2:29pm	TBA

**First lecture:** Tu January 7, 2020

**Textbook:** *Physics for Scientists and Engineers: A Strategic Approach, 4<sup>th</sup> Edition* by Randall D. Knight

- Reading the textbook is an important part of the class!

**Course information:** Physics 2C is the third of a four-quarter lower-division sequence of physics intended for engineering and physical-science students. During the quarter, we'll cover 4 separate topics: fluids, waves, thermodynamics, and optics, in that order.

**Student Learning Outcomes:** Upon successful completion of Physics 2C, students will be able to:

- Realize the ubiquity of waves in their everyday lives (sound, optics, EM).
- Think about thermodynamic processes (engines, refrigerators) via PV-diagrams.
- **Take an active role in reading a lower-division physics textbook, asking questions when they don't understand something, and helping others when they do.**

**Grading Policy:** Your final course grade will be determined according to the following:

- 10% attendance (5% for lecture attendance and 5% for discussion attendance)
- 10% reading submissions (conceptual questions related to the reading, due every lecture)
- 45 or 60% quizzes (15% each, lowest quiz counted if higher than final exam grade)
- 35 or 20% final exam (20% if lowest quiz grade is higher than final exam grade)

Final grades will not be determined until the end of the quarter. Typical numbers for the cutoffs are: 85% (A-/B+ cutoff), 70% (B-/C+), 60% (C-/D), 50% (D/F). If you are taking the class P/NP, you need at least 50% to pass.

**Discussion Board:** We will use *Piazza* – an online course discussion board where you can ask and answer questions about the course material (including homework). Link to sign up for the site: <https://piazza.com/ucsd/winter2020/phys2c>

**Reading Submissions / Homework:** On the course schedule at the end of this syllabus, there are reading assignments for each lecture. **You must read these sections BEFORE the lecture.** For each lecture, there will be 1-3 questions about the material, and/or a straightforward problem on the relevant material. The point of these is to a) make sure you're keeping up with the material, and b) to give us an idea of what we need to go over in detail in lecture and discussion.

To submit your homework (and view grades in general), we will be using Gradescope: <https://www.gradescope.com/>. To sign up for the course (Physics 2C, Winter 2020), you'll need the access code: "M44KE2".

### **READING SUBMISSIONS ARE DUE BY 1 HOUR BEFORE LECTURE!**

*No late homework will be accepted – answers are posted soon after the due date/time. You can miss one assignment before it starts to affect your grade.*

In addition to the conceptual problems that you are likely to encounter on the reading submissions, there will be a collection of end-of-chapter problems for you to practice problem-solving for the quizzes. These problems are not due. Solutions to the recommended problems will be provided in a password-protected region of the course webpage.

**Attendance (lecture):** You are required to come to the Tu Th lectures. We will be using clickers, which are helpful for me to see peoples' responses to discussion questions (so we can address confusion about the material right away). To register your iClicker, you must fill out the google form posted on the class website: <https://forms.gle/NwrqHWFhm6cwBfadA>. You can miss 3 days without it affecting your grade. The 4<sup>th</sup> hour lecture is required on Fridays during weeks when there is no quiz (weeks 1, 2, 4, 6, 8, 10).

**Attendance (discussion):** 5% of your grade is for discussion attendance. As long as you come to discussion session and participate, you will get the full 5%. However, we recognize that some of you will have work conflicts, etc. that make attending discussion session difficult. Therefore, this grade can be replaced with the final exam grade. There is no need to email requesting this – in your overall grade, we'll take the maximum of your discussion attendance and your final exam percentage.

**Physics Tutorial Center:** Aside from office hours, you can get help with your homework in the Physics Tutorial Center (Mayer Hall 2218). The center is a free, drop-in tutoring service provided by the UCSD Physics Department, and it has graduate student tutors starting week 1 of classes. More information about hours, location, etc. can be found here: <http://tutorialcenter.ucsd.edu/>

**Academic Achievement Hub:** Another resource is the Academic Achievement Hub, one of six hubs within the Teaching + Learning Commons (Geisel Library, 1<sup>st</sup> Floor West), which supports undergraduate students academically through supplemental instruction, study groups, content tutoring, and learning strategies (time management, exam preparation, note taking and reading). Content tutoring for Physics 2C is available M 4-9pm, TuTh 12-9pm, W 1-6pm, F 1-7pm. More information can be found here: <http://commons.ucsd.edu>

**Exams:** There will be four quizzes and one final; see the course schedule below for the dates and content of the exams. **If you need to miss a quiz for whatever reason (including medical), you do not need to explain why, it will automatically drop as your lowest score. However, it is vital to take the final exam during the allotted time. If you cannot attend the final exam, do not enroll.**

You are allowed one 8.5" × 11" cheat sheet (both sides) for each quiz and four sheets for the final exam, as well as scratch paper to work out problems. The cheat-sheets must be hand-written. Graphing calculators are allowed, but nothing more advanced than a TI-89 (e.g., no laptops or cell phones). If you are uncertain about your calculator, then you should check with the TA or the instructor before the first test to ensure it is allowed.

You do not need to bring blue books to the exams – you will be recording your responses directly on the exam forms, which will be scanned and uploaded to Gradescope.

You're required to have a photo ID with you for each test. Acceptable identification includes: College ID, driver license / state identification card, or passport; anything else must be approved beforehand. This is especially important for the final exam, but required for all tests.

Results to exams will be posted on Gradescope. Any questions about quizzes or quiz grades should be addressed to the head TA.

**Counseling and Psychological Services (CAPS):** The mission of CAPS is to promote the personal, social, and emotional growth of students. Many services are available to UCSD students including individual, couples, and family counseling, groups, workshops, and forums, consultations and outreach, psychiatry, and peer education. To make an appointment, call (858) 534-755 or walk in to the central office at 190 Galbraith Hall, M-F 8am-4:30pm. For more information, visit <https://wellness.ucsd.edu/caps/>.

**Academic Dishonesty:** Please read the Students' Responsibility section of the [UCSD Policy on Integrity of Scholarship](#). These rules will be enforced. For all exams, cheating includes, but is not limited to: submitting another person's work as your own, collaborating with another person during an exam, copying from any person/source, and using any unauthorized materials or aids during exams.

For homework assignments, copying from an online solution, a peer's solution, or board work is considered cheating. Collaboration is encouraged, but by the time you start writing your own solution to turn in, you should not be looking at any other source. You should know the rough outline of the solution well enough that you don't need to reference something line-by-line. Plagiarizing a solution but changing variable names is considered cheating. Also, soliciting help online via Chegg, Quora, etc. is considered cheating.

If your final exam is more than 35% away from your quiz average, a follow-up meeting is possible to help determine your final grade (this is not necessarily punitive – this might be to your benefit as well. It's mainly to help sort out the disparity in the two exam scores).

Any questions on what constitutes cheating should be addressed to the instructor; any instance of cheating will result in immediate reporting to the UC San Diego Office of Academic Integrity, and can result in an automatic "F" for the course at the discretion of the instructor.

*Course Schedule, page 1 of 2* (tentative; subject to change):

Date	Topics	Sections in Knight (4 <sup>th</sup> ed.)
<b>Week 1</b>		
Tu January 7	Introduction and overview of course; Basics of Fluids and Pressure, Fluid Statics: Buoyancy, Pascal's principle	14.1-14.4
Th January 9	Fluid Dynamics: Continuity, Bernoulli's Eq., Waves: Introduction / Classification, General Waves	14.5, 16.1-16.2
F January 10	Sinusoidal Waves and Properties, Waves on Strings (Wave speed)	16.3-16.4
<b>Week 2</b>		
Tu January 14	Sound/EM Waves, Phase and Phase Difference Power, Intensity, and Decibels	16.5, 16.7-16.8
Th January 16	Doppler Effect, Superposition, Standing Waves on Strings	16.9, 17.1-17.3
F January 17	Standing Waves for Sound / Musical Instruments, Beats	17.4, 17.8
<b>Week 3</b>		
Tu January 21	Solids, Liquids, and Gases, State Variables, Temperature / Temperature Scales, Absolute Temperature, Thermal Expansion	18.1-18.4
Th January 23	<b>Quiz 1: Fluids and Waves</b>	<b>Ch. 14, 16-17</b>
<b>Week 4</b>		
Tu January 28	Phase Changes / Diagrams Ideal Gases, PV Diagrams, Processes	18.5-18.7
Th January 30	Work, Heat, and the 1 <sup>st</sup> Law of Thermodynamics	19.1-19.4
F January 31	Calorimetry: Latent Heat, Specific Heat (Liquids and Solids)	19.5-19.6
<b>Week 5</b>		
Tu February 4	Specific Heats of Gases, Adiabatic Processes, Heat Transfer Mechanisms	19.7-19.8
Th February 6	<b>Quiz 2: Thermodynamics up through the First Law &amp; Calorimetry</b>	<b>Ch. 18-19.6</b>
<b>Week 6</b>		
Tu February 11	Summary of Chapter 20: Equipartition Theorem, $v_{\text{RMS}}$ vs. $T$ , $U$ depends on $T$ alone, 2 <sup>nd</sup> Law of Thermodynamics	Skim the whole chapter, but the most important part is 20.3-20.4
Th February 13	Heat Engines and Refrigerators: Energy- Transfer Diagrams, Calculating Efficiencies and Coefficients of Performance	21.1-21.4
F February 14	The Limits of Efficiency, Carnot Engines and Refrigerators	21.5-21.6

*Course Schedule, page 2 of 2* (tentative; subject to change):

Date	Topics	Sections in Knight (4 <sup>th</sup> ed.)
<b>Week 7</b>		
Tu February 18	EM Waves, Polarization	31.6-31.7
Th February 20	<b>Quiz 3: Micro/Macro &amp; Engines and Refrigerators</b>	<b>Ch. 20-21</b>
<b>Week 8</b>		
Tu February 25	Interference of Light, Path Diff. vs. Phase Diff., Double-Slit Experiment, Diffraction Gratings, Single-Slit Diffraction	31.1-33.2, 1 <sup>st</sup> part of 33.3, 33.4
Th February 27	Ray Optics: Reflection and Refraction; Snell's Law, Total Internal Reflection	34.1-34.3
F February 28	Image Formation by Refraction	34.4
<b>Week 9</b>		
Tu March 3	Thin Lenses: Ray Tracing; Principal Rays, Real vs. Virtual Images, Lens Equation	34.5-34.6 (focus on how to use Eqs. 34.25 and 34.26)
Th March 5	<b>Quiz 4: EM Waves, Interference, Ray Optics</b>	<b>Ch. 31-34</b>
<b>Week 10</b>		
Tu March 10	Combining Lenses, Cameras, Vision / the Eye	35.1-35.3
Th March 12	Color and Dispersion, the Resolution of Optical Instruments	35.5-35.6
F March 13	<b>Final Review</b>	(all of the above)
<b>Finals Week</b>		
Tu March 17	<b>Final Exam</b>	(all of the above)