Ludwig Boltzman, who spent much of his life studying statistical mechanics, died in 1906, by his own hand. Paul Ehrenfest, carrying on the work, died similarly in 1933. Now it is our turn to study statistical mechanics. Perhaps it will be wise to approach the subject cautiously.


Instructor: Eric Corwin <ecorwin@uoregon.edu>

Office Hours (Wil 374): Thursday, 2:30-3:45pm or by appointment

GTF Contact Information and Office Hours:
Cam Dennis <rdennis@uoregon.edu>, TBA, Wil 373
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Lectures: MW in Mackenzie 125 10-11:50am

Topics and Aims:

Physics 352 and Physics 353 cover Statistical Mechanics and Thermodynamics. Statistical Mechanics deals with the properties of many-body systems – gases in a star, electrons in a metal, molecules in a soap film – and reveals how “simple” properties such as temperature and phases of matter emerge from seemingly overwhelming complexity. Statistical mechanics is extremely useful not only within physics, but also beyond, and we'll see in the course connections to chemistry, biology, information theory, and more. Thermodynamics deals with thermal energy, and can be considered a topic in itself, but becomes much clearer and more powerful if thought of as a subset of statistical mechanics. Of all the “core” topics in physics (the others being mechanics, electromagnetism, and quantum mechanics), we and many others find statistical mechanics to be the most fascinating! In case you'd like to see how Physics 352-3 fits into the overall learning objectives of the Physics major, please see https://provost.uoregon.edu/sites/provost2.uoregon.edu/files/phys-learning-outcomes.pdf

Other goals: We will develop reasoning and problem-solving skills. The problems encountered in this course are less transparent than those in introductory courses, and tackling them helps us practice and expand our analytic abilities. An even broader aim of the entire Physics 351-3 series is to enable students to understand some of the issues and excitement of contemporary scientific research; we'll apply this directly in the “Colloquium” exercise for the course. You'll hopefully find, having explored thermodynamics and statistical mechanics, that doorways to a large fraction of current-day science are open to you.
Topics

- Temperature and Energy
- Second Law of Thermodynamics
- Entropy
- Heat Engines and Cycles
- Free Energy

Textbook

*An Introduction to Thermal Physics* by Daniel V. Schroeder.

Assignments and Grading

**Colloquium Report (5%)**: One of the goals of this course is to guide you on your journey to becoming independent scientists. To this end it is important to expose yourself to contemporary research by going to the departmental colloquia or other similar talks. For this assignment you will write a short report, around 400-800 words, about any one of this term’s Physics Colloquia. More details can be found in the specific assignment.

**Homework (25%)**: Completing and understanding homework is perhaps the most important part of the course (though not the easiest to assess). You’ll learn a lot by doing and thinking about the homework problems. There will be homework assignments every week. You are encouraged to discuss the questions with others and to work with others, but of course, the work you submit should be your own. Solutions will be posted – study these. No late homework will be accepted.

In this course we'll employ a novel grading scheme for homework, designed to encourage you to fully understand any mistakes that you may have made and to internalize the problem solving methods. Completed problem sets will be turned in at the start of class on Monday. They will be graded for completeness, which will count for 1/3 of the grade, and then returned at the end of class. Students will then self grade their own homeworks against the solution set and turn in the graded homeworks at the beginning of the next class on Wednesdays. The act of grading the homework will be worth 1/3 of the grade and the self-assigned grade will constitute the final 1/3 of the total grade for the homework.

**Quizzes (35%)**: There will be short quizzes nearly every week, at the end of the class on Wednesdays. We’ll use these to assess understanding of key points without the heavy weight of an exam. In addition to relying on all of your knowledge of physics, the
quizzes will revisit homework problems from the preceding problem set. Each student’s lowest quiz score will be dropped from the overall total. There won’t be any make-up quizzes; if you miss one, this will be the quiz dropped from your overall grade calculation.

**Final Exam (35%)**: The final is scheduled for 10:15 Monday, December 9. This will be a cumulative test of everything that you know about the physics covered in the course.

**Overall Grade**: A=[88,100); B=[76,88); C=[64,76); D=[55,64); F=[0,55]. *Note that these are minimum guarantees, which I may (likely) choose to loosen.*

**Absences**: Students with a serious and well-documented reason for missing an assignment or exam should contact me. If you contact me in advance of the missed work then it will be much more likely that we can work out a favorable agreement. Please see the descriptions of quizzes and reading quizzes for policies on missing any of those.

**How to Do Well in the Course**

**Plan ahead and start early!** This applies to everything in the course - homework, reading assignments, and general studying. It will be crucial to keep up with the course and not fall behind; later topics build on earlier ones. Homework assignments, especially, will require considerable time spent thinking – the majority of your learning will come from this.

**Make use of resources!** If you have questions about lectures, assignments, readings, or other matters, come to office hours with questions! Also, we encourage communication by email or canvas (but won't promise to answer outside of normal work hours).

**Sleep!** Many studies show that sleeping helps memory and understanding.

**Student Conduct and Academic Integrity:**

Mutual respect in class is paramount. Academic Misconduct, as defined in the Student Conduct Code <https://studentlife.uoregon.edu/conduct>, including cheating, fabrication, facilitating academic dishonesty, and plagiarism, devalues the reputation of our institution, its faculty, its students, and the degrees we offer. Moreover, academic misconduct is particularly unfair for the students who do their work with integrity and honor. Violations of the student conduct code result in the incident being included on your student conduct record and can result in a failing grade on any course work related to the violation or a failing grade in the course. Every effort will be made in this class to
deter dishonesty through classroom procedures. Suspected academic dishonesty will be reported.

**No Laptops/cell phones/tablets in Class**

The use of laptops and phones in class is in general not allowed. Why? Several studies, plus past experience, show that students using laptops in class spend a great deal of time on non-class-related activities and that these distractions negatively impact both learning and grades. This alone isn’t a reason to ban laptops – you’re responsible for your own performance in class. In addition, however, studies have shown that non-class-related laptop use distracts and impacts the learning of other students nearby. (E.g. Fried, C. B. Computers &amp; Education 50, 906-914 (2008).) Plus, students have complained to me about the environment created by their classmates laptop use. Taking notes by hand, by the way, is more effective in cementing concepts in your mind. The only exceptions will be for people with documented medical needs; please see me if this is the case.

**Campus Resources to Support Learning**

**Tutoring and Academic Engagement Center** [<https://engage.uoregon.edu/services/>](https://engage.uoregon.edu/services/) Drop-in math and writing support in addition to tutoring, study skills support, and Class Encore. Located in the 4th Floor Knight Library (541) 346-3226, engage@uoregon.edu.

**Counseling Center** Call anytime to speak with a therapist who can provide support and connect you with resources. Located on the 2nd Floor of the Health Center (541)346-3227.

**Accessible Education Center** The University of Oregon is working to create inclusive learning environments. The instructor believes strongly in creating inclusive learning environments. If there are aspects of the instruction or design of this course that result in barriers to your participation, please notify us as soon as possible. You are also encouraged to contact the Accessible Education Center. If you are not a student with a documented disability, but you would like for us to know about class issues that will impact your ability to learn, we encourage you to come visit during office hours so that we can strategize how you can get the most out of this course. Located on the 1st Floor of Oregon Hall (541) 346-1155, uoaec@uoregon.edu.

**Center for Multicultural Academic Excellence (CMAE)** Their mission is to promote student retention and persistence for historically underrepresented and underserved populations. We develop and implement programs and services that support retention, academic excellence, and success at the UO and beyond. We reaffirm our commitment
to all students, including undocumented and tuition equity students. Located on the 1st Floor of Oregon Hall (541) 346-3479, cmae@uoregon.edu.

**The UO Access Shuttle** An on-campus ride service provided at no cost to students with conditions that limit mobility. More information and a sign-up form can be found on the parking & transportation department website: [https://parking.uoregon.edu/content/access-shuttle](https://parking.uoregon.edu/content/access-shuttle).