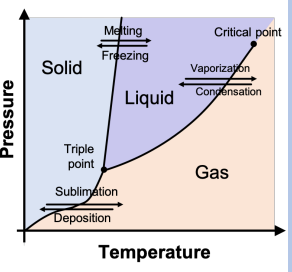


PHY 380: Thermal & Statistical Physics

Fall 2023, MWF 9:00am – 9:50am, Olin Hall Room 216

0.75 course

Dr. Chris Nolting

Office Hour (Olin 213 or Meet)
MWTF 1:30pm (subject to change)
Or email me and we'll find a time!

Contact:
nolting@gustavus.edu

meet.google.com/zmh-kkcx-gno

Statistical & Thermal Physics

Statistical mechanics studies the macroscopic behavior of large ensembles of entities. The applications of these kind of statistical models vary widely from biology, finance, neuroscience, and astrophysics. It originates in and draws heavily from classical thermodynamics. We will study these ideas and their applications to a variety of systems in this course and learn tools that we can bring to bear in many disciplines. What happens to the air in a balloon that bursts? How does a combustion engine work? Why is ice slippery? Why does a hot iron glow and how can we describe its emissions?

As we learn the answers to these questions, we'll dive into the underlying mathematical framework that makes statistical mechanics so transferable to other fields.

Course Topics

In this course, we will study: The laws and concepts of equilibrium thermodynamics and both classical and quantum statistical mechanics are developed from the microscopic dynamics of many-particle systems. Applications of the theory will be made to black body radiation, heat capacities of solids, and selected topics from the following areas: astrophysics, low temperature physics, information theory, and transport theory.

What do I need for this course?

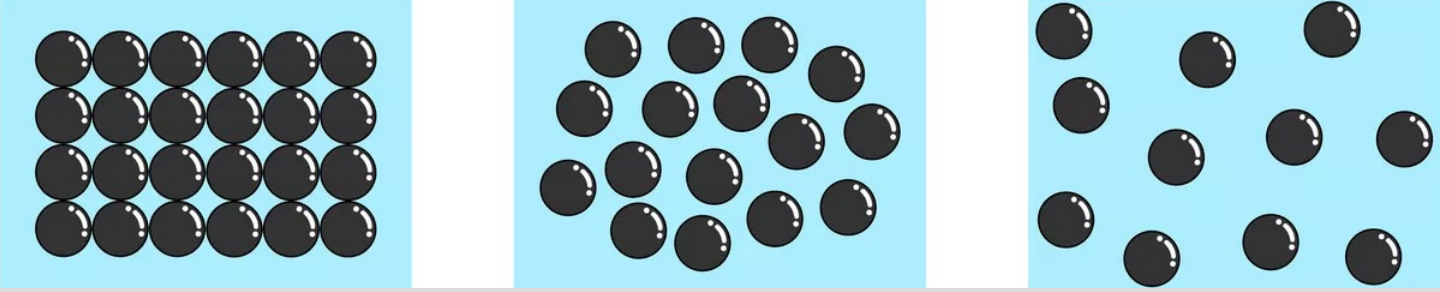
- A Book: For this course we'll be using *An Introduction to Thermal Physics* by Daniel V. Schroeder, Oxford University Press, 1st Edition
- Pen or Pencil: for notetaking and completing in class activities
- Laptop or Notebook: To take notes.

Course Structure & Moodle

The course will meet Monday, Wednesday, and Friday for 50 minutes.

Generally, Mondays and Wednesdays will be broken into lectures and physics demonstrations, group based concept exercises, and homework review. On Fridays we will alternate between quizzes and additional lecture periods.

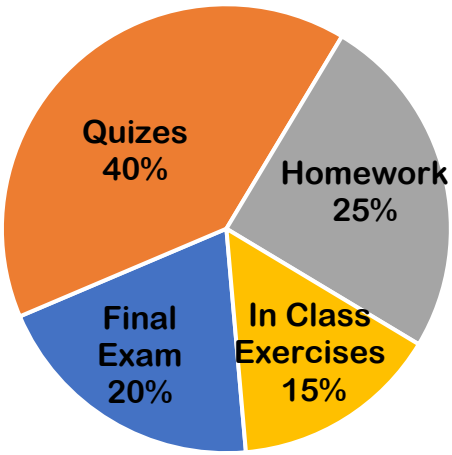
We will utilize Moodle for posting course materials as well as posting grades throughout the semester. I will post this syllabus, as well as lecture recordings, homework assignments in-class exercises, and supplementary content (videos, articles, study aids, etc.) on recent course topics.

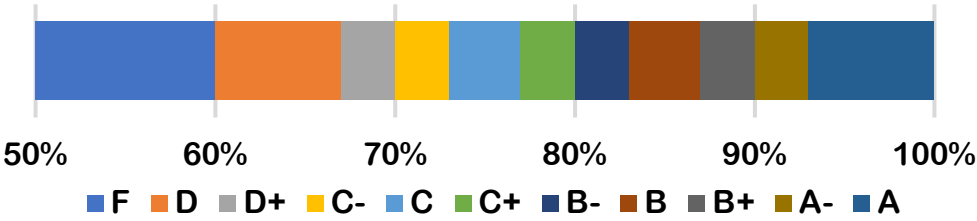


Course Schedule (subject to change)

9/4-9/8		Welcome & Ch 1.1-1.5 Ideal Gases	10/30-11/3	H4	Ch. 5.6, 6.1 Boltzmann Factor
9/11-9/15	H1	Ch. 1.5-2.2 Two State Systems	11/6-11/10	Q4	Ch. 6.2-6.4 Maxwell's Distribution
9/18-9/22	Q1	Ch. 2.3-2.5 Large Systems	11/13-11/17	H5	Ch. 6.5-7.1 Gibb's Factor
9/25-9/30	H2	Ch. 2.6-3.2 Entropy	11/20-11/21	Q5	Ch. 7.2-7.3 Degenerate Fermi Gases
10/2-10/6	Q2	Ch. 3.3-3.4 Mech. Equilibrium	11/27-12/1	H5	Ch. 7.4-7.6 Blackbody Radiation
10/9-10/13	H3	Ch. 3.5-4.1 Heat Engines	12/4-12/8	Q6	Ch 8.1-8.2 Interacting Particles
10/16-10/20	Q3	Ch. 4.2-4.4 Refrigerators	12/11-12/13		Review Days
10/25-10/27	---	Ch. 5.1-5.3 Free Energy	Mon, 12/18		Final Exam 1pm-3pm

Grading Policy





- The lowest homework score and the lowest quiz score will each be dropped
- In class exercises will be graded for participation, not correctness
- Quizzes will be completed every other Friday at the beginning of class

Homework

Problems will be assigned every other week, graded, and returned to the student. Work must be turned in on time. Extensions may be given for extenuating circumstances. Be sure to use symbolic form and provide units for your final answers. While you are encouraged to collaborate on homework, you are expected to turn in your own work. The lowest homework score will be dropped, with the remaining accounting for a total of 25% of the total grade.

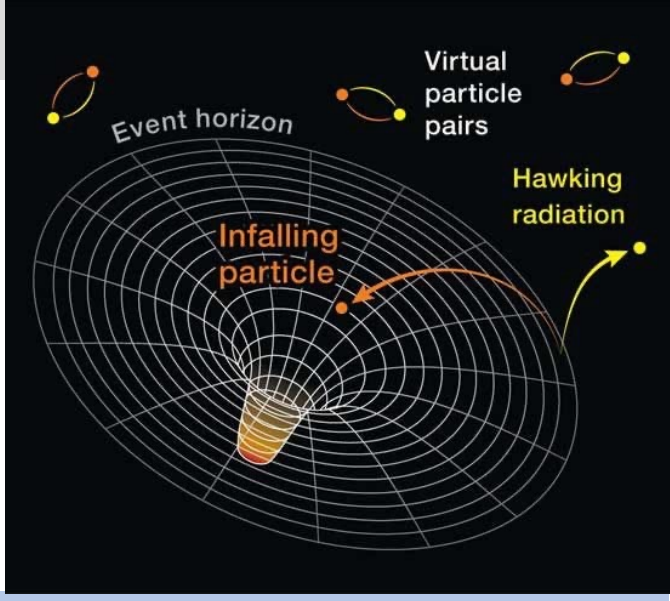
Quizzes

There will be 6 quizzes throughout the semester, encompassing the material covered in lecture since the most recent previous quiz. The lowest quiz score will be dropped, with the remaining accounting for a total of 40% of the total grade.

Should extenuating circumstances cause you to miss a quiz, please contact me (ahead of time if possible) and we may be able to find an alternative time to take the quiz.

Attendance

Attendance in person for lecture will count toward your grade via your participation in the practice exercises we will be doing during class. These will help you master the concepts you will need for your homework, quizzes, and exams. Your assignment won't be graded for its correctness, but for your effort. This is your opportunity to try your hand with a new concept while I am there to answer your questions and help you. These exercises may be at times completed in groups or individually, depending on the exercise, and will be turned in at the end of class.



How to succeed in class

- Attend & participate in every lecture. In class exercises are worth 15% of your grade, and your classmates and I will be available to help you with the concepts.
- Read the sections of the textbook we will cover before attending class. Seeing material multiple times helps reinforce it, you'll be better prepared for in-class exercises, and I will be there to answer any questions you have on the topic.
- Watch or read any supplementary materials I post to Moodle. These may be exciting physics news or applications of the ideas that we are discussing in class
- Attend office hours if you have any problems.
- Give feedback. If anything is not working for you, let me know and I will work to address the problem. We're in this together.

Mental and Physical Wellbeing

The Gustavus community is committed to and cares about all students. If you or someone you know expresses any mental health concerns or experiences a stressful event that can create barriers to learning, Gustavus services are available to assist you. You can learn more about the broad range of confidential health services available on campus at https://gustavus.edu/counseling/ and https://gustavus.edu/deanofstudents/services/.

Academic Accommodations

Gustavus Adolphus College is committed to ensuring equitable and inclusive learning environments for all students. If you have a disability and anticipate or experience barriers to equal access, please speak with the accessibility resources staff about your needs. When appropriate, staff will guide students and professors in making accommodations to ensure equal access. Accommodations cannot be made retroactively; therefore, to maximize your academic success at Gustavus, please contact them as early as possible. Accessibility resources staff are located in the Academic Support Center (https://gustavus.edu/asc/accessibility/). Accessibility Resources Coordinator, Corrie Odland (codland@gustavus.edu), can provide further information.

Academic Accommodations for Religious Observance

A student whose religious observance conflicts with a course requirement may request an academic accommodation from the instructor. Students should normally make such requests in writing by the end of the second week of classes, but there may be exceptions. Students may also request accommodations for religious traditions surrounding death and dying when the need arises. The Chaplains' Office annually publishes a multifaith holiday calendar with accommodation notations. You can find it here: https://gustavus.edu/chaplain/multifaith/. However, this list is not exhaustive and observances are not necessarily days when individuals will not attend work or school. There are also different levels of observance in different traditions. The Chaplains' Office is available for consultation on any requests for accommodation that are not included in their calendar.

Title IX: Sexual Misconduct Prevention and Resources

Gustavus Adolphus College recognizes the dignity of all individuals and promotes respect for all people. As such, we are committed to providing an environment free of all forms of discrimination including sexual and gender-based discrimination, harassment, and violence like sexual assault, domestic violence, dating violence, and stalking. If you (or someone you know) has experienced or is experiencing these types of behaviors, know that you are not alone. Resources and support are available; you can learn more online at https://gustavus.edu/titleix/.

Please know that if you choose to confide in me, I am required by the College to report to the Title IX Coordinator, because Gustavus and I want to be sure you are connected with all the support the College can offer. Although it is encouraged, you are not required to respond to outreach from the College if you do not want to. You may speak to someone confidentially by contacting the Sexual Assault Response Team (SART/CADA), Chaplains, Counseling Center, or Health Service staff; conversations with these individuals can be kept strictly confidential. SART/CADA can be reached 24 hours a day at 507-933-6868. You can also make a report yourself, including an anonymous report, through the form at https://gustavus.edu/titleix/.

Multilingual Student Support

Some Gusties may have grown up speaking a language (or languages) other than English at home. If so, we refer to you as "multilingual." Your multilingual background is an incredible resource for you, and for our campus, but it can come with some challenges. You can find support through the Center for International and Cultural Education's (https://gustavus.edu/cice/) Multilingual and Intercultural Program Coordinator (MIPC), Pam Pearson (ppearson@gustavus.edu). Pam can meet individually for tutoring in writing, consulting about specific assignments, and helping students connect with the College's support systems. If you want help with a specific task (for example, reading word problems on an exam quickly enough or revising grammar in essays), let your professor and Pam know as soon as possible. In addition, the Writing Center (https://gustavus.edu/writingcenter/) offers tutoring from peers (some of whom are themselves multilingual) who can help you do your best writing.

Academic Integrity:

Gustavus Adolphus College is proud to operate under an honor system (https://gustavus.edu/general_catalog/current/acainfo). I am required to report violations of the Academic Honesty Policy to the Provost's Office. It is your responsibility, as a student, to ask questions if you are not sure about situations such as when and how to cite a source, sharing data with lab-mates, and avoiding inadvertent cheating when working in groups. If you are unsure if you might be violating this policy, ask!

The overarching principle of the Academic Honesty Policy is that students shall submit their own work, in fairness to others and to self. I wants you, a developing scholar, to be able to take pride in your own academic work and to maintain your academic integrity. Citations must accompany any use of another's words or ideas that are not common knowledge. Quoting or paraphrasing from electronic sources without proper citation is as serious a violation as copying from a book or other printed source. Using content generated by an artificial intelligence third-party service or site (AI-generated content) without proper attribution or authorization would also be a form of plagiarism. A student may not submit work that is substantially the same in two courses without first gaining permission of both instructors. Ask me if you have questions about a particular assignment or kind of work. Unauthorized aid during any online exams and assignments is every bit as serious and inappropriate as it would be in an in-person course. In fact, in the online environment it is sometimes easier for faculty to detect violations.

The sanction in this course for a violation of the Honor Code involving plagiarism, copying another student on an exam, or other kinds of cheating on a single assignment will usually be an "F" on the plagiarized assignment or exam. For a more significant event, I, your professor, reserve the right to assign you a grade of "F" for the course. In addition, for any Honor Code violation, I will notify the Provost's Office. A letter will be generated by the Provost's Office and sent to you. The letter will remain on file. There will be no further consequence, beyond the course penalty and the letter, if you do not commit any further Honor Code violations. Repeat offenses could ultimately lead to dismissal from the College. You have the right to appeal any Honor Code violation through an Honor Board hearing process. In this course, I aims for you to learn how to cite sources properly, do your own work on all exams, and function as a scholar with integrity. Please feel welcome to ask questions about the important matter of Academic Honesty and let me know how I can best support your learning.

Honor Code & Pledge

As a community of scholars, the faculty and students of Gustavus Adolphus College have formulated an academic honesty policy and honor code system, which is printed in the Academic Bulletin and the Gustavus Guide. As a student at Gustavus Adolphus College I agree to uphold the honor code. This means that I will abide by the academic honesty policy, and abide by decisions of the joint student/faculty Honor Board.

On my honor, I pledge that I have not given, received, or tolerated others' use of unauthorized aid in completing this work.