

PHYS 3141 Syllabus

Thermodynamics | PHYS-3141-B | 3 credits
Fall | 2026

- Meeting time: MW 11:00 AM - 12:15 PM
- Location: Howey Physics Room S104
- Instructor: Prof. Harold Kim
- Contact: hkim438@gatech.edu
- Office: Boggs B-83
- Office hours: TBD
- Course website: <https://gatech.instructure.com/courses/559310>

Course Description

Thermodynamics provides a quantitative framework for describing the state of macroscopic systems with nearly infinite degrees of freedom using only a small number of measurable variables. Its power lies in its universality: thermodynamic principles apply to a wide range of physical systems without requiring detailed knowledge of microscopic constituents or interactions.

Despite this generality, thermodynamics can be conceptually challenging. It deals with quantities such as state functions and thermodynamic potentials that are not directly measurable and cannot always be visualized in terms of simple mechanical models. This course emphasizes careful reasoning, mathematical consistency, and physical interpretation.

“Thermodynamics is the only physical theory of universal content which I am convinced, that within the framework of applicability of its basic concepts will never be overthrown.”

— ALBERT EINSTEIN

“Thermodynamics is a funny subject. The first time you go through it, you don’t understand it at all. The second time you go through it, you think you understand it, except for one or two points. The third time you go through it, you know you don’t understand it, but by that time you are so used to the subject, it doesn’t bother you anymore.”

— ARNOLD SOMMERFELD

Course Objectives

Upon successful completion of this course, you should be able to:

- State the second law of thermodynamics in its various equivalent formulations.
- Apply the first law of thermodynamics to ideal gases, fluids, and stretchable or polarizable media.

- Derive thermodynamic identities using transformations of partial derivatives.
- Describe equilibrium conditions and phase transitions using thermodynamic potentials.

Required Course Materials

None. Lecture slides will be posted on the Canvas course website. Some helpful references are:

- *Basic Thermodynamics*, Carrington
<https://www.amazon.com/dp/0198517475>
- *Thermodynamics and an Introduction to Thermostatistics*, Callen
<https://www.amazon.com/dp/0471862568>
- *Atkins Physical Chemistry V1*, 12th ed., Atkins, Julio de Paula, James Keeler
<https://www.amazon.com/dp/0198851308>

Grading Policy and Weighting

- **Grading Policy:** Final grades will be assigned according to a standard letter-grade scale (e.g., B for 80–89%), based on five components. Two in-class tests will be administered approximately at the one-third and two-thirds points of the semester during regular lecture hours. All graded assignments and exams will be returned via the Canvas course website.
- **Weighting:**
 - Attendance (5%)
 - Weekly Assignments (35%): Problem sets will be assigned weekly and are typically due one week after assignment. Each set consists of several problems designed to practice concepts discussed in lecture.
 - Test 1 (15%): Closed-book, in-class written exam.
 - Test 2 (15%): Closed-book, in-class written exam.
 - Final Exam (30%): Closed-book, in-class written exam.

Attendance Policy

Regular attendance is strongly recommended and will count toward the final grade. Assignments and exams are based on material covered in lecture, which may not be fully reflected in the posted slides.

If you miss a lecture, you are responsible for reviewing the lecture slides and consulting with the instructor, TA, or classmates to clarify any material you do not understand.

Additional Criteria for Successful Completion of the Course

In addition to the grading policy described above, students are expected to meet the following criteria:

- Attend lectures regularly. Many examples will be worked out on the board in class and may not be fully covered in the posted slides.
- Make a habit of asking: What are the measurable quantities? How can they be measured? How are the equations useful?
- Give yourself ample time to work on assignment problems. Discussion with other students is encouraged. Questions about assignments should be emailed to the instructor or addressed during office hours. Do not postpone work until the due date.
- Carefully study problem set solutions posted after the due dates and ensure that you can solve similar problems independently.
- AI tools may be used to aid your understanding of the material. However, they should not become your first resource. Reliance on them not only prevents independent thinking but also fails to prepare you for in-class exams.

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review Georgia Tech's Honor Code (<https://catalog.gatech.edu/policies/honor-code/>) and the student Code of Conduct (<https://catalog.gatech.edu/rules/18/>). Any student suspected of cheating or plagiarism on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations (<https://catalog.gatech.edu/rules/22/>) articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (<https://disabilityservices.gatech.edu/>) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.