Physics 446: Thermodynamics & Statistical Mechanics Spring 2018

Course Information

- Instructor Name: Andrew Ware
- Office: CHCB 130
- Email: andrew.ware@umontana.edu
- Lectures: TR 12:30 – 2:00 pm in CHCB 231
- Text: *An Introduction to Thermal Physics*, Schroeder (required)
- Office Hours: MW 2 – 3 PM & TR 10 – 11 AM & by appointment (W over in SS 409)
- Website: umonline.umt.edu

Overview

To develop a basic framework to describe the thermal properties of a system, including an ideal gas and a system of spins, and to explore the relationship between the microscopic and macroscopic descriptions of a system through statistical physics.

Homework

I'll assign reading, which is **strongly** recommended to be read **before** you come to class. I'll assign problem sets about once a week that will be collected and graded. Feel free to ask questions about the homework. You are welcome to work together on the homework.

Exams

Two in-class exams around Th 3/13 and Th 4/26. One comprehensive final, Tu 5/8, 1:10 – 3:00 PM. Exams will be closed book, closed notes but I will provide a list of equations.

Grading

In-class exams	40 % (20 % each)
Homework	30 %
Final exam	30 %

Learning Objectives

After completing this course, you should:

Gain an understanding of the basics of thermodynamics…

- Understand what a thermodynamic system is and how systems interact
- Calculate thermal and diffusive equilibria for a system
- Be able to apply different free energies depending on what's being held constant for a system
- Understand how energy and entropy determine phase transformations

Gain an understanding of the basics of statistical mechanics…

- Understand what an ensemble represents and how to take an ensemble average
- Be able to apply statistical probabilities and the Second Law of Thermodynamics
- Understand the difference between classical, Fermi-Dirac and Bose-Einstein distributions
- Be able to apply these distributions to systems such as a photon gas & a white dwarf star

Class Topics

Topics include, but are not limited to:

Thermodynamic systems: ideal gas & spin systems (Chapter 1)
The Second Law of Thermodynamics (Chapter 2)
Exchange between systems: entropy, energy and particles (Chapter 3)
Engines & refrigerators (Chapter 4)
Free energy and constraints on systems (Chapter 5)
Phase transformations and the Clausius-Clapeyron equation (Chapter 5)
Boltzmann probability and the partition function (Chapter 6)
Bosons and fermions: Bose-Einstein and Fermi-Dirac distributions (Chapter 7)
Interacting systems: Ising model (Chapter 8, time permitting)

Course Guidelines and Policies

Student Conduct Code

The Student Conduct Code at the University of Montana embodies and promotes honesty, integrity, accountability, rights, and responsibilities associated with constructive citizenship in our academic community. This Code describes expected standards of behavior for all students, including academic conduct and general conduct, and it outlines students' rights, responsibilities, and the campus processes for adjudicating alleged violations. Full student conduct code: http://www.umt.edu/vpsa/policies/student_conduct.php

Course Withdrawal

Students may use Cyberbear to drop courses through the first 15 instructional days of the semester. Beginng the 16th instructional day of the semester through the 45th instructional day, students use paper forms to drop, add and make changes of section, grading option or credit. PHSX 101 can only be taken as credit/no-credit.

Disability Modifications

The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and Disability Services for Students. If you think you may have a disability adversely affecting your academic performance, and you have not already registered with Disability Services, please contact Disability Services in Lommasson Center 154 or call 406.243.2243. I will work with you and Disability Services to provide an appropriate modification.

[This course can be taken for a traditional letter-grade only]