Thermodynamics and Statistical Mechanics
PHYSICS 317
Fall 2006

Instructor: Sally Koutsoliotas, Olin 252, 7-3105, *koutslts@bucknell.edu*

Hours: Lectures: Monday, Wednesday, Friday 11:00–12:00, Olin 264.

Web site: `http://www.eg.bucknell.edu/ koutslts/Ph317/`

Description: Many of the objects in our everyday world are collections of large numbers of particles. For example, the air in the room, a glass–and the water it contains, a rubber band, even the Sun, are composed of 10^{23} particles or more, all interacting with each other. While mechanics shows us how to understand and predict the motion of particles, attempting to do so on so large a scale is prohibitive. Instead, if we take a statistical approach, we are able to define new, more general (bulk) properties such as temperature, entropy, and pressure. This is the subject of *t*hermodynamics.

However, to truly understand the behaviour of matter, we need to combine the quantum mechanical characteristics of individual atoms and molecules, with the laws of statistics. This is the subject of *s*tatistical mechanics.

This course will cover the main topics of thermodynamics balancing the macroscopic perspective of thermal physics with the underlying microscopic principles of statistical mechanics. There will be three hour-long meetings each week. While the majority will be lectures, there will also be opportunities for problem sessions, experimental projects, and small group activities. These activities will complement the material introduced in lectures, and provide another opportunity to reinforce concepts. The mathematical tools needed to study this subject will also be developed and accompanied by a practical guide to using *Mathematica*.

Where possible, the reading associated with each lecture has been indicated in the course schedule. **It is expected that you will do the reading BEFORE coming to class.** Class lectures will focus on presenting the context for the material detailed in the text, and not on specifics relating to derivations. You are expected to work through the derivations during your reading, and come to office hours when further clarification is needed.

Required Textbook: An Introduction to Thermal Physics, by Daniel V. Schroeder.

Alternate References (On Reserve):

Thermal Physics, by Ralph Baierlein.
Thermodynamics, by E. Fermi.
Thermal Physics, by C. Kittel and H. Kroemer.
Statistical Physics, by F. Mandl.
Fundamentals of Statistical and Thermal Physics, by F. Reif.
Statistical Physics, by F. Reif.

Useful Introductory Texts:

Physics (4^{th} edition), by Resnick, Halliday and Walker.
Physics for Scientists and Engineers (5^{th} edition), by Tipler and Mosca.

Related Books of Interest:

Feynman Lectures on Physics, by Feynman, Leighton, and Sands.
Six Ideas That Shaped Physics, by Thomas A. Moore.
The Flying Circus of Physics (with Answers), by J. Walker.
Div, Grad, Curl, And All That, by H.M. Schey.

Office Hours: Tuesday 4–5 Thursday 4–5 or by arrangement.
Other times to be announced.

Problem Sets:

Problem sets will be assigned twice a week, collected, and graded. Late assignments will NOT be accepted. Solutions will be made available online. Collaboration in the analysis of problems is encouraged, but the final write–up must be your own work entirely. Collaborators' names should be noted at the top of the first page. Discussing questions arising from the problem sets during office hours is also encouraged, especially before the work is submitted.

Reading Assignments:

Reading assignments will be given at each meeting. It is expected that the reading be done BEFORE coming to the next class. An online quiz based on the reading material will accompany each assignment.

Assessment:

The overall grade will be made up of the following components:

Problem Sets	20%
Test 1	15%
Test 2	15%
Test 3	15%
Reading Assignments	10%
Final Examination	25%
TOTAL	100%

The percentage on your final exam will replace the lowest test score, if that will help your grade.