Physics 3180 General Information

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Course web page: http://physics.weber.edu/schroeder/thermal/

Office hours: MW 2:30, TTh 10:30, F 1:30. Usually I will be in my office for the rest of the day after these times. Earlier in the day I am usually busy. My full schedule is posted next to my office door. Feel free to make an appointment if you like.

Textbook: Schroeder, An Introduction to Thermal Physics (Addison-Wesley, 2000). Everything I know about thermal physics is in this book, so we'll follow it pretty closely. Reading assignments are indicated by section number on the schedule. If this book isn't working for you for some reason, you might take a look at Mandl, Statistical Physics (Wiley, 1988). You should also review the thermodynamics chapters in your introductory physics textbook.

I apologize for the poor print quality in the most recent printings of this book. I am trying to work with the publisher to fix this problem, but obviously it has not been fixed yet. I further apologize for the serious defects in some paperback international editions of the book. Use these at your own risk.

Conflict of interest disclosure: As the author of your textbook, I receive royalty payments from all sales of new copies: approximately \$10 per copy for the hardcover U.S. edition and about \$1 per copy for paperback international editions. To eliminate any conflict of interest associated with this financial benefit, I periodically estimate the royalties received from sales to WSU students and donate that amount to the university. Furthermore, for students who do not wish to purchase the book, I have placed a copy in the Physics Majors study room (TY 360), and I have a limited number of copies to lend out.

Course Description. Please read the preface to your textbook and browse the table of contents to get a general idea of what the course is about. We'll cover most of the book but skip Section 1.7, the second half of Chapter 5, and all of Chapter 8.

Goals of the Course (a.k.a. "Learning Outcomes")

The specific goals of this course are for you to master the concepts and facts of thermal physics, as outlined in the preface and table of contents of your textbook. In brief, you will learn how collections of very large numbers of particles behave, and how to connect their large-scale behavior to the microscopic behavior of the individual particles.

But I'd rather teach you how to think than what to think. Physics is not so much a collection of facts as a way of looking at the world. My hope is that this course will not only teach you the *ideas* of thermal physics, but will also improve your *skills* in careful thinking, problem solving, and clear communication. In this course you will practice and refine your skills in mathematical problem solving using calculus; using a computer to help solve math problems; making rough numerical estimates and more accurate calculations; and communicating the ideas of physics, both qualitatively and quantitatively, through words, pictures, and equations. Whether or not you choose to become a professional physicist, these skills will serve you well for the rest of your life.

Policies and Procedures

Attendance and class participation will count for a small portion of your grade. The purpose of this policy is to encourage you to become part of a community of learners in which we all learn

from each other. You needn't worry about missing a couple of classes due to emergencies, and you needn't speak up during every single class session. But habitual absence or tardiness will lower your grade. If you're shy and used to absorbing information passively, now is a good chance for you to jump in and participate; your classmates will undoubtedly be grateful. (How much knowledge you demonstrate during class makes no difference at all.)

Problem sets will be assigned roughly once a week, and will be due at the beginning of class on the days indicated on the syllabus ("PS1" for the first problem set, and so on). If you arrive late you may still turn in your homework but you will probably miss the quiz (see below). No problem sets will be accepted after the end of class on the due date. Your homework grade will be based on only your 8 highest problem set scores (out of 9), so you may miss one problem set without penalty. This policy should give you enough flexibility to deal with most scheduled absences, illnesses, family emergencies, term papers, unexpected romances, and the like; exceptions will be granted only in the case of extended illness or other long-term exigency.

Each problem set will include one problem intended for a "formal" written solution. I will grade this problem carefully, and you should write up your solution using your best English, with correct spelling, grammar, and punctuation, organized into sentences and paragraphs, and incorporating the problem statement to produce a self-contained presentation. You may wish to type your formal solution, although typing is not required if you can write legibly by hand. Your "formal" problem solution will count for half of your total score on the problem set.

For the remainder of the problems on each set I will assign a score based only on apparent effort, without reading your solutions carefully. Instead I will provide you with official printed solutions to these problems, which you should use to check your own work. You may consult the official solutions at any time, but I strongly urge you not to look at them before you have made your best effort at solving the problems yourself. Remember, there will be a quiz (see below).

Your solution to each "formal" problem must be entirely your own. Turning in copied work from any source (including sources found online) will constitute academic dishonesty and be treated as such. Still, I encourage you to discuss these problems with your classmates, check answers with each other, and ask me for hints.

Quizzes will be given at the beginning of class on each day a problem set is due. The purpose of the quizzes is to test your understanding of the problems you have just worked. The quizzes will be very short (no more than 10 minutes), so you will need to arrive on time. No make-up quizzes will be given, but your final grade will be based on only your 8 highest quiz scores, so again you may miss one without penalty.

Tests (three of them) will be closed-book, given in the Tracy Hall Testing Center (TY 101C) with a 90-minute time limit. You will have a 47-hour window within which to take each test: starting after class on the date indicated on the course schedule and continuing until the start of class two days later. You may use a calculator on tests to do arithmetic, but not to store information. There will be no comprehensive final exam.

No make-up tests will be given without *advance* permission.

Projects. At the end of the semester you will work on a capstone project for this course, giving you a chance to investigate a thermal physics problem in more depth and present your results in a formal paper and short slide presentation to your classmates. Detailed guidelines and dates are given in a separate document.

Grades will be computed according to the following weights:

Problem sets (highest 8)	20%
Quizzes (highest 8)	10%
Tests (3 weighted equally)	50%
Project	15%
Attendance and participation	5%

Although it is rare for a student who completes all the assignments to fail this course, I am occasionally forced to give non-passing grades for various reasons. You should be aware that WSU has two different non-passing grades: E and UW. When a student stops attending but does not officially withdraw from the course, the appropriate grade is UW. I normally give a UW to any student who does not pass the course and who has not completed the final project.

Miscellaneous Rules

You are responsible for reading, understanding, and following the **WSU Student Code**, including its prohibition on all forms of cheating. Cheating on a homework assignment or quiz will result in a zero grade for that item on the first occurrence and failure in the course thereafter. Cheating in any way on a test or on the final project will result in automatic failure in the course. Evidence of Student Code violations may also be presented to the appropriate hearing committee or the Dean of Students for possible further sanctions.

The Student Code also contains multiple provisions that essentially require you to treat your fellow students with respect, both in and out of the classroom. Inappropriate behavior toward other students will not be tolerated and will be reported to the appropriate authorities for possible sanctions.

All written materials for this course, including problem solutions, quizzes, and tests, are covered by copyright law and may not be reproduced, in printed or electronic form, without written permission. WSU policy prohibits the making of audio or video recordings during class without the instructor's permission.

In the event of a **campus emergency** (e.g., a power outage or unsafe weather conditions) that interrupts the schedule of this class, please check your WSU email promptly for any special instructions.

Any student requiring accommodations or services due to a disability must contact Services for Students with Disabilities (SSD) in room 181 of the Student Service Center. SSD can also arrange to provide course materials (including this syllabus) in alternative formats if necessary.

Hints and Suggestions

Thermal physics differs somewhat from other branches of theoretical physics not only in its subject matter (very large systems), but also in its logical structure. There are no grand differential equations (like Newton's second law or Maxwell's equations or the Schrödinger equation) that encompass the entire subject. Instead, there are only a few small equations, most of them definitions, together with a bag of tricks for solving a huge variety of problems. Once the basic concepts are defined, almost everything follows from pure logic.

Because the logic of thermal physics is more important than any particular equations, you should concentrate on the logic, more than the equations, as you study. You'll need to understand, and be able to reproduce, most of the "derivations"; otherwise you will find it difficult to apply the ideas to new systems that are different from those we discuss in class. (The number of possible applications is so enormous that we'll have time for only a small fraction of them.)

The textbook for this course is very different in style from books used in introductory physics courses. Instead of presenting the material in isolated fragments, it attempts to give a continuous narrative that incorporates theory, interpretation, and examples. Several students in past years have told me that they got more out of the course once they started setting aside time to read the book carefully.

Since the ideas of thermal physics are closely linked to each other, the material of this course will be highly sequential. It is therefore crucial that you not fall behind. If you don't understand something I say in class, ask immediately—don't just write it down and hope that you'll figure it out later. Most important of all, start each homework assignment early and budget plenty of time to work on it, on multiple days; don't put it off until the last minute (or later).

Extensive research has shown that the students who do best in physics (and other subjects) are those who involve themselves *actively* in the learning process. This involvement can take many forms: writing lots of questions in the margins of the book; asking questions in class or during my office hours or by email; discussing physics with classmates; inventing your own examples; writing careful English explanations in homework assignments. Try to do things like these as often as possible!