Physics 3180 General Information

Instructor: Dr. Daniel Schroeder
Office: SL208
Email: dschroeder@weber.edu
Phone: 801-626-6048 (please note that I check email much more often than voicemail)
Office hours: MWF 11:30–noon and Mondays 1:30–2:30. I'll usually be available later on MWF afternoons as well, and I can come in earlier in the morning if you make an appointment. I will not be on campus most Tuesdays and Thursdays.

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

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.

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; you 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 due by 4:00 p.m. on the days indicated on the syllabus ("PS1" for the first problem set, and so on). Late problem sets will not be accepted. 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.

There is a fine line, while working physics problem sets, between depending too heavily on help from others and trying to be too independent. The purpose of the homework is to help you learn (it's not a test!). But you won't learn anything if you merely transcribe somebody else's solution, and you won't learn anything from hours of wheel-spinning and frustration either. Please think carefully (and regularly) about whether you are inclined more toward one or the other of these hazards, and act accordingly. In any case, here are some ground rules:

- Spend at least ten minutes on each problem (or part thereof), making a good-faith effort to solve it yourself, before you seek help on it from anyone else.
- *Do* ask me or a classmate for a hint if you are still stuck on a problem after ten minutes. You may also ask for hints from other WSU faculty members and from students here who have taken the class in previous years. When asking for a hint, it's usually helpful if you first explain what you do already understand.
- When you obtain assistance from someone, acknowledge that person by name in your writeup of the problem. Be specific about exactly how that person helped: "Special thanks to D. Bernoulli for pointing out that I was confusing force with pressure." Please don't feel embarrassed for having obtained help. This is absolutely routine in academia, but we always acknowledge the assistance we receive.
- Whether or not you obtain assistance in solving a problem, be sure to check your answers with classmates or with me. If this check results in a revision to your solution, include an acknowledgment as described above.
- Never look at anyone else's written solution before turning in your own. This includes any and all solutions written by me or by other instructors or students or anyone else. Do not tempt your classmates by showing them your own written solutions. Comparing *answers* (including intermediate results) is encouraged but comparing entire *solutions* is not allowed.
- Never seek help from internet sites, or from anyone not affiliated with WSU, without advance permission.
- Naturally, you may consult any source you like *after* you have turned in your own solutions.
- If you are ever in doubt about the interpretation of these policies, ask.

Tests (three of them) will be closed-book, given in the Science Testing Center (SL 228) 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)	24%
Tests (3 weighted equally)	50%
Project	18%
Attendance and participation	8%

In the event of a **snow day or other campus shutdown**, please check your email as soon as you can for specific instructions regarding this course. Obviously I will not require you to turn in a problem set or take a test on a day when the campus is closed, but otherwise you should assume that all deadlines are still in effect unless I explicitly modify them. It is your responsibility to make sure I have your correct email address.

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.

Academic dishonesty, though rare, occasionally does occur in physics classes, so the following policies are necessary. Inappropriate collaboration or consultation of unauthorized sources on homework will result in a zero grade for that problem set on the first occurrence and failure in the course thereafter. Dishonesty of any sort on a test, if clearly documented, will result in automatic failure in the course. In serious cases, evidence of dishonesty may also be presented to the appropriate hearing committee for possible further sanctions.

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!