

Thermodynamics & Statistical Mechanics**Physics 4750****Fall 2008**

3–3:50 pm MTWF room PHYS1140

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office hours: 11am-12pm MTW, 1–2pm W, or by appointment (or call or email me or stop by any time). I am usually out of town on Thursdays.

Books: Thermal Physics by Kittel & Kroemer (2ed, 1980) & Thermodynamics, Kinetic Theory, & Statistical Thermodynamics by Sears & Salinger (3ed, 1975).

Course content: All the material will come from Kittel, with Sears as a backup. We will cover Chapters 1–10 of Kittel. All the concepts of classical thermodynamics which you learned in Physics 1361 (1st & 2nd Laws of Thermodynamics, heat, work, entropy) will be developed from a fundamental thermal physics perspective. For example, the fundamental assumption of thermal physics, that "a closed system is equally likely to be in any of the quantum states accessible to it", leads immediately to a definition of entropy in terms of probability. The concept of a distribution function will be developed as the average occupation of a quantum state, & the Planck distribution for thermal radiation will be derived. For systems which can exchange particles with the environment, the chemical potential μ is defined to be the partial derivative of the Helmholtz free energy F with respect to the number of particles; particles flow from higher to lower chemical potential, just as heat flows from higher to lower temperature. The Fermi-Dirac distribution (for fermions) & the Bose-Einstein distribution (for bosons) are derived, & examples are examined. It is shown that in the low-density limit both give rise to an ideal gas, & properties of the ideal gas are examined. In the opposite limit, conduction electrons in a metal are a Fermi gas, & high-density bosons can lead to Bose-Einstein condensation. Heat engines, refrigerators, & work are examined in Ch. 8, Gibbs Free Energy & Chemical Reactions in Ch. 9, & Phase Transformations in Ch. 10.

I have left the last 5 class days open. Depending on the interests of the students, and on my judgement of what material may need more study, we may do Kittel Ch. 13 ("Semiconductor Statistics", energy band theory & semiconductors), topics from Sears & Salinger, or the thermodynamics section of the Graduate Record Examination (GRE).

This is a very important & thought-provoking class with applications in many areas of science & engineering. I hope you will enjoy it as I do.

Grading:

homework.....	15%
4 hour exams....	60%
final exam.....	25%
	100%

Normally the grading scale is 90% – A, 80% – B, 70% – C, 60% – D, below 60% – F, & these boundaries will be shifted down by no more than about 1 percentage point at the end of the semester, depending on factors such as improvement & consistency.

Exams: In general, for reasons of simplicity & consistency in grading, make-up exams will not be given. If you miss one exam for a very good reason, please let me know as soon as possible and bring some documentation to back up your excuse. You will not be penalized if your reason for missing the exam is acceptable to me. Otherwise, you get a zero. If you miss two exams for very good reasons, then you have to arrange with me to make up the second exam. On the tentative schedule on the last page of this syllabus you will see that the exams are scheduled for Sept. 24, Oct. 8, Oct. 28, & Nov. 19. We will probably have 2-hour exams near those dates.

The final exam (2:45pm Thurs. Dec.18) will be comprehensive. If you miss the final exam without an adequate excuse, if you contact me immediately you can take a makeup exam, but 20% will be subtracted from the exam score.

An equation sheet will be supplied for each exam.

Homework: There will be about 11 homework assignments, due in class on the due date. I will take off 20% for lateness after I have started grading that assignment, & 50% after I have finished. Homework will not be accepted after I have returned it to the class or posted the solutions. You must always show your work. At the end of the semester, I will drop your lowest homework grade.

You can get hints from classmates, from me, or from the physics tutors, but the work must ultimately be yours. In any case, if you can't do the homework, you won't be successful on the exams.

How to get a good grade: Read the material & think about the concepts before coming to class. I do not grade on attendance, but it's always a good idea to come to class. If you don't understand something, either ask me or work on it till you understand. To study for exams, review the chapters, & work out as many problems as possible, always starting "from scratch" without looking at the solution. Remember, I am available to help you, either inside or outside of class.

Disabilities & Safety: If you have a documented disability and wish to receive academic accommodations or services, please contact Julie or Kathy in the Office of Disability Services at 581-6583. If you need to know where the areas of rescue assistance are located in case the building must be evacuated, please notify me.

tentative schedule - Physics 4750 Fall 2008

	Monday	Tuesday	Wednesday	Friday
August	1 intro, syllabus p4 25	2 p10 26	3 p15 27	4 p20 29
	Labor Day 1	5 p26 2	6 p33 3	7 p40 5
	8 p47 8	9 p54 9	10 H1 (ch.1-2) p60 10	11 p65 12
September	12 p71 15	13 p76 16	14 H2 (§3.1-3) p81 17	15 p92 19
	16 p98 22	17 p104 23	18 Exam 1 ch.1,2,§3.1-3 24	19 H3 (§3.4-4.2) p110 26
	20 H4 (§4.3-4) p121 29	21 p125 30	22 p130 1	23 p135 3
	24 p139 6	25 p144 7	26 Exam 2: §3.4, ch.4 8	Fall Break 10
	27 H5 (ch.5) p155 13	28 p160 14	29 p166 15	30 p171 17
	31 p176 20	32 H6 (ch.6) p186 21	33 p193 22	34 p199 24
October	35 p205 27	36 Exam 3: ch.5-6 28	37 p212 29	38 p218 31
	39 H7 (ch.7) p229 3	40 p.235 4	41 p241 5	42 p246 7
	43 p252 10	44 p257 11	45 H8 (ch.8) p265 12	46 p272 14
	47 p280 17	48 p286 18	49 Exam 4: ch.7-8 19	50 H9 (ch.9) p291 21
	24	25	26	28
	Thanksgiving			
December	51 p297 1	52 p301 2	53 p305 3	54 H10 (ch.10) 5
	55 TBA 8	56 TBA 9	57 TBA 10	58 H11 evaluations 12

Final exam: 2:45pm Thurs. Dec. 18