

Physics 421: STATISTICAL MECHANICS

Spring 2017

The course nominally meets:

Mondays and Thursdays at 8:30 - 10:00 am in Elliott 161.

I didn't choose that horribly-early class time! – and I'm hopeful that there might possibly be a time later in the day that would work for every one (~12) of you students (as well as me). We'll determine that on the first day of class, and if there is a time later in the day that works for everyone (it of course needs to be everyone!), then we'll find an available room at that new time, and just move the class time to a more civilized time of day! ☺ ☺

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Description: Statistical Physics is a vast subject. It includes the study of both equilibrium and non-equilibrium properties of gases, solids, liquids, phase transitions, random processes etc, using probability distributions, kinetic theory, Monte Carlo simulations, and first-principle methods of classical and quantum mechanics. Because of the vastness of the subject and the variety of mathematical methods used, it is not uncommon that two textbooks on statistical physics will have virtually no overlapping content! Physics 421 is meant as an introduction to equilibrium statistical physics and its connection with thermodynamics. We'll go through basic statistical methods, equilibrium ensembles, microscopic description of thermodynamic quantities, and applications. We'll also go through the Bose-Einstein and Fermi-Dirac distributions relevant to quantum gases, and (time permitting) touch on superfluidity and superconductivity.

Office hours: Come by anytime! I will stay in my office for an hour after each class, but please send e-mail or call if you want to be absolutely sure I will be in my office/available at any given time. If I'm in my office but busy I'll let you know a time to come back. Feel free to always try my office though, or phone, or e-mail. Cell phone is (250) 661-7066, feel free to call! My lab space is in Elliott 022, so you can often find me there too.

Course homepage: <http://coursespaces.uvic.ca/course/view.php?id=26772>

Text (required): The course will be based around chapters 12 – 20 of Ashley H. Carter, *Classical and Statistical Thermodynamics*, 4th edition, Cambridge Univ. Press, 2000 (these are the later chapters of the same textbook you used for P214 [Thermodynamics], which saves you money in that you don't need to buy a new overpriced textbook [just that one overpriced textbook]). Please read the textbook sections provided in CourseSpaces near the beginning of the week that they are covered!

Some other sources that I sometimes consult:

Reif, *Statistical and Thermal Physics*, McGraw-Hill, 1965.

Landau + Lifshitz, *Statistical Physics* (Part 1: Course of Theoretical Physics Vol. 5), Pergamon Press, 3rd Edition, 1980.

Kittel + Kroemer, *Thermal Physics*, Freeman, 2nd Edition, 1980.

Prerequisites: Phys 217 (or Phys 317); Phys 321B; Phys 323; one of: Math 301, Math 330B, or Math 438; and one of: Math 326 or Math 346.

Midterm Date: **Thursday, Feb. 9** (in class) -- we'll have a review session (optional but useful) at **TBD** in Ell 161 (the usual classroom).

Final date: **TBD in TBD** -- we'll have a review session at **TBD** in Ell 161 (the regular classroom).

Grade will be based 35% on the weekly problem sets above, 25% on a 1-hour midterm exam, and 40% on the final exam. Your lowest problem set score will be dropped.

Please note UVic's correspondence between percentage points and letter grades: A+: 90 or more; A: 85-89; A-: 80-84; B+: 77-79; B: 73-76; B-: 70-72; C+: 65-69; C: 60-64; D: 50-59; F: below 50.

Problem sets: Problem sets are due at the beginning of class on Thursday (first one due on Thurs., Jan. 18th). Answers will be posted the following Thursday. You are allowed *one late homework* without penalty, up to a week late (along with the one lowest problem set score that is dropped). **All** other late homeworks count 50% if completed before the answer key is handed out the following week. Afterwards, it counts 10% (there is still a little bit of value in copying over the answers to better understand them). No exceptions (other than death in the immediate family, signed doctor's note). Note that the lowest homework score is dropped, and another homework can be a week late, so that covers cold/flu issues.

Collaboration on the homework is at your discretion. Each person is responsible for doing his/her share of the work, **writing up her/his own**

solutions and for listing his/her collaborators on each set.

Exams are closed book, closed notebook. You will be allowed to bring an 8.5" x 11" formula sheet of your own making (double-sided) to each exam.

Calculator: The only acceptable calculator for student use on exams (as per the department policy) is the Sharp EL-510RB. It is available at the UVic Bookstore for approximately \$8.95.

The midterm exam will be held in class. No makeups will be given (other than the above death in the immediate family, signed doctor's note).

Please just let [me](#) know anytime if you have any questions!!!