Course Information

Course: PHYS 317 Fall 2010
Thermodynamics and Statistical Mechanics

Instructor: Katharina Vollmayr-Lee
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Classes: MWF 11 – 12 Olin 264

Office Hours: TR 1 – 3 pm, R 3 – 5 pm, and by appointment

Webpage: For updated information on our course, see the webpage
http://www.eg.bucknell.edu/~kvollmay/phys317_f2010/

Text: Daniel V. Schroeder, *An Introduction to Thermal Physics*, Addison Wesley Longman, San Fancisco 2000.

Objectives: We have an intuitive understanding of temperature and know that heat flows from hot to cold. Yet, to really understand what temperature is and why heat prefers to flow in one direction but not the other is very difficult, very interesting, and at the heart of this course.

In a more general sense, this course is about systems of very many particles in which case new "collective phenomena" occur. For example with a minimal change in density a gas might become a liquid. There are two approaches to large systems: the macroscopic approach (thermodynamics) and the microscopic approach (statistical mechanics). We will use both approaches following the modern description of D. Schroeder's textbook. On the way we will encounter many applications with examples both of daily life and Noble Prize winning topics such as the Bose-Einstein condensation.

Although the math of this course is fairly simple, the concepts are not at all. I encourage you to try hard to enter deeply into the world of thermal physics.

Course Structure: Since we will be a small class, this course will be interactive, and therefore it will be *essential that you come prepared to class*. For each reading assignment you will have to submit a **journal entry**. The purpose of these journal entries is to encourage you to do the reading and to spend class time most effectively. Your journal entry should reflect that you have done the reading and can contain any or all of the following: a summary, comments on what part of the reading was most difficult, easy, and interesting, or general comments about the course. I encourage your feedback. These journal entries will be due 9 am on the day of the class. However, it would be extremely helpful if you could get them to me earlier, to give me time to incorporate your feedback.

There will be **homework assignments** for each class both for you to be continuously involved with the class material and for me to get feedback on your understanding of the class material. Homework assignments will be due at the beginning of class. I will randomly decide (based on a tossed die!) whether to collect the homework (1/2 of the time) or have you self-grade it. I will provide guidelines for the self-grading, and solution sets for each homework set. Usually I will start the class with a brief summary of the last class. Then the course material will be discussed in lecture form, and will be practiced in the form of in-class problems for which **you** will be working on the blackboard.

Grading: Since the course structure relies on you coming to class prepared, it is important that you work steadily on the reading with journal entries and homework assignments. For this reason, journal entries are due 9 am before class and will *not* be accepted late. Scoring of the journal entries will be on a 2-point scale. You will be able to drop two of your lowest journal entry scores. Your participation is essential for the class discussions, during lecture and during work at the blackboard, and therefore counts together with the journal entries 5% towards your grade.

Homework will take a considerable amount of your time and is intended to give you plenty of practice. **No late homework will be accepted!** This is because the solution sets will already have been distributed, and because the goal is for you to be working on the problems while we are discussing the material. You will get to drop your lowest two homework grades. You are encouraged to work together on the homework, but you must write up your solutions individually. There will be three in class exams and a cumulative final. Attendance is required.

Reading Assignments & Participation	5 %
Homework Assignments	25 %
Exam 1	15 %
Exam 2	15 %
Exam 3	15 %
Final	25 %

Course Syllabus

dates	topic	text
Aug. 25/27/30 Sept. 1/3	Intro & Energy	§1.1 – 1.7
Sept. 6/8/10/13/15/17	Entropy	§2.1 – 2.6
Sept. 20	Exam 1	
Sept. 22/24/27/29 Oct.1	Temperature/Interactions	§3.1 – 3.6
Oct. 4	Engines & Refrigerator	§4.1 & 4.2
Oct. 6/8/11/13	Free Energy	§5.1, 5.2
Oct. 15/20/22	Phase Transitions	§5.3, 5.4
Oct. 25	Exam 2	
Oct. 27/29 Nov.1/3/5/8	Boltzmann Statistics	§6.1 – 6.7
Nov. 10	Ising Model	§8.2
Nov. 12/15/17/19	Quantum Statistics: Bosons & Fermions	§7.1 – 7.3
Nov. 22	Exam 3	
Nov. 29 Dec. 1	Blackbody Radiation	§7.4
Dec. 3/6	Bose-Einstein Cond.	§7.6
TBA	FINAL	