

# Physics 401, Fall 2006

**Instructor:** Prof. A.T. Charlie Johnson

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**Office Hours:** Tuesday 10.30-12 or by appointment.

**Textbook:** **Thermal Physics**. Kittel and Kroemer (K&K), 2<sup>ND</sup> Edition. (Freeman and Company, 1980). This is a “modern classic” that covers essential aspects of the material, while omitting many non-crucial details.

## Other Texts:

**Fundamentals of Statistical and Thermal Physics**, Reif, (McGraw-Hill, 1965). An older, classic text that covers the material in significantly more detail.

**Statistical Physics**, Mandl (Wiley & Sons 1988). This book looks promising, and I am considering it for use in the course in the future. If you take a look at it, I would be interested in your opinion.

**Molecular Driving Forces: Statistical Thermodynamics in Chemistry and Biology**, (Garland, 2002). This appears to be an interesting book with thorough explanations that do not assume much background on the part of the reader.

**Statistical Physics Part I**. Landau and Lifshitz. This classic text offers a comprehensive treatment of the material, but the presentation is terse and at a rather high level.

**Statistical Mechanics**. Pathria. A classic text at the beginning graduate level.

**It is definitely useful to consult multiple texts.** A different presentation of the same topic can be very helpful in clearing up confusion.

**Homework:** There will be homework assignments roughly every week. They will be difficult in order to help you master the material. You should get started early!! You can work together if you like but everyone must hand in their own HW solutions. You must learn how to do all the problems because the midterm and final exams will consist of problems that are related to the homework.

**Midterm Exam:** The midterm will be in-class on a day just before or shortly after Fall Break. The exam will be closed book but you will have a formula sheet.

**Final Exam:** The Final Exam will be Dec. 14, 9-11am. If you have a conflict for this exam time, you should see me *immediately*.

**Grades:** Problem Sets 30%. Midterm 30%. Final exam 40%.

**WWW:** We will have a class webpage on BlackBoard. You will find general course information, this handout, and homework assignments and solutions.

## Tentative Course Outline

We will cover Chapters 1-10 in K&K at a rate of roughly 1 chapter per week. We will then jump to Chaps. 14 and 15.

- I. Introduction
- II. Entropy and Temperature
- III. Boltzmann Distribution
- IV. Thermal Radiation
- V. Gibbs Distribution
- VI. Ideal Gas
- VII. Fermi and Bose gases
- VIII. Heat and Work
- IX. Chemical Reactions
- X. Phase Transformations
- XI. Kinetic Theory
- XII. Propagation

### HW 1: Chapter 2 Problems 1-5

Problem 6:, in class I present the Gaussian Approximation to the Binomial Distribution. The approximation is Equation 1.35 in your text, while the full Distribution is given by Eq 1.15. For the values  $N = 4, 10, \text{ and } 20$ , find the maximum value of  $g(N,s)$  given by the full distribution, the approximation, and the fractional error of the approximation. Organize your results in a short table with 4 columns:

<u>N</u>	<u><math>g_{MAX}(exact)</math></u>	<u><math>g_{MAX}(approx)</math></u>	<u><math>\Delta g_{MAX} = [g_{MAX}(approx) - g_{MAX}(exact)] / g_{MAX}(exact)</math></u>
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