



The University of Sydney
AUSTRALIA

School of Physics

SEMESTER 1, 2006 **THERMODYNAMICS & STATISTICAL MECHANICS**

LECTURE ARRANGEMENTS

There will be 19 lectures, starting from Tues. 7 March to Fri. 28 April

Lecturer: Don Melrose

Lecture place and times: LT 5 at Tue. 1 pm, Thurs. 9 am, Fri. 1 pm

ASSIGNMENTS

There will be **two** assignments one, and together they will count 25% and the examination will count 75%.

Assignment 1 due **Tuesday 4 April**

Assignment 2 due **Tuesday 2 May**

There is no objection to students discussing the assignments with each other, but copying the solutions from another is not acceptable. You must write your answers to the assignments independently of other students. Copying may result in a reduction in marks for both students.

COURSE DEFINITION

THERMODYNAMICS

This part of the course emphasizes a different aspect of thermodynamics from earlier courses on thermal physics: the role of entropy and the chemical potential, and different choices of independent variables and of state functions. The basic concepts that you will be expected to understand are: thermodynamic variables, state functions, and changes of variables. You also will be expected to understand the First and Second Laws of Thermodynamics, and be aware of the significance of the Zeroth and Third Laws. Many of the examples in this course are from physical chemistry, and require a detailed understanding of the role of the chemical potential in thermodynamics.

STATISTICAL MECHANICS

This part of the course emphasizes the use of ensembles and relies on the different state functions and thermodynamic variables already introduced. Ensemble theory is introduced in classical statistical mechanics, and the theory of an ideal classical gas is treated using all three standard ensembles: microcanonical, canonical and grand canonical. Quantum statistical mechanics is used to treat ideal Fermi and Bose gases,

black body radiation, the Debye theory of solids, ionization equilibrium and order-disorder transitions.

As always some memorizing is required, but the main emphasis is on understanding the physical interpretation of different thermodynamic variables and how to choose them and use them in specific circumstances. Understanding implies that you should be able to discuss and explain fundamental concepts and principles including examples of their application. There are very many formulae in thermodynamics and statistical mechanics. Although you will be expected to memorize a few basic formulae (a formula sheet will be provided with the exam paper) you will be expected to be able to explain what the various formulas mean and be able to manipulate using the formulas.

Understanding a term or concept means that you should be able to:

- explain its meaning in writing and give examples,
- interpret it correctly when you read or hear it,
- use it correctly in your own writing,
- apply it correctly to examples and problems.

These skills will be tested in the examination.

ADVANCED & NORMAL COURSES

The advanced and normal courses will be in common except for the two lectures. The Advanced students will have two and the Normal students will have two lecture/tutorials on the course, emphasizing problem solving.

LECTURE NOTES

The course is defined in terms of a set of lecture notes. A hard copy of these notes will be distributed at each lecture. The full set of notes will be available on the Web.

There is no text book for the course: texts that have been used in the preparation of the course include

Reichl, *Statistical Mechanics*

Kittel and Kroemer, *Thermal Physics*.

Landau and Lifshitz, *Statistical Physics*