Introduction to Statistical Mechanics and Thermodynamics

based on text by Keith Stowe, 1984 ed.

Chapter 1 Introduction

Thermodynamics: the study of how changes in parameters such as T & P affect the properties of systems.

the macroscopic properties of a system (T, P, M, E, ...) are related to the microscopic properties of the individual elements - on average

→ need to study statistical nature of ensembles.

microscopic (atomic scale) ~10 Å = 10×10^{-10} m ⟷ macroscopic ("visible" scale ≥ 1 μm)

This course is all about the relationship between the two.

We have to cover statistics and introduce the concept of quantum states before we can link micro to macro.

By the end of this course you will be able to:

- "understand" how the micro & macro levels are related
- analyse systems to characterize their nature
- calculate micro & macro level behaviour

- we'll follow Stowe closely
- some additional material is given in the coursepack.

- the schedule we will follow is covered in the handout. (run through)
- the course outline gives the marking schemes and other info re how we will proceed. (run through) = labs, ~~assignments~~ tutorials, ethics content
- Learning (9) gives how to learn http://mceng.mcmaster.ca/teach/teachindex.htm

Historical Timeline

Rumford (1789-99): Heat is a form of energy

Joule (1843-49): experimental work

Carnot (1824): heat engines

Clausius
Kelvin (1850)
Gibbs (1876-78)
} thermodynamic theory

Maxwell (1859)
Boltzmann (1872)
Chapman
Enskog (1916-17)
} kinetic theory of gases

Boltzmann
Gibbs (1902)
} statistical mechanics

Today: statistical application of the laws of quantum mechanics

What strikes me is how recent the concepts of energy and thermodynamics are!