

National Training School in Theoretical Chemistry

Statistical Mechanics

David Logan (Oxford), 6 lectures, 2 tutorials

The aim of statistical mechanics is to describe the equilibrium (or near equilibrium) physical behaviour of a macroscopic system, from a knowledge of its microscopic properties – at any temperature, and whether the system be intrinsically quantum mechanical or classical. As such, statistical mechanics underpins most of theoretical chemistry.

These lectures will initially focus on developing the nuts and bolts of the subject – ensemble averaging, ensembles and fluctuations – in a general manner. Then, following consideration of some partially familiar problems (notably imperfect gases), we turn to the complex behaviour arising for systems of interacting particles, manifest notably in phase transitions and critical phenomena.

Background preparation/assumed knowledge.

By way of assumed background in advance of the School, students will require only a working knowledge of statistical thermodynamics, at the level of e.g. Atkins and de Paula's *Physical Chemistry*. This includes the elementary Boltzmannian statistical thermodynamics of non-interacting particles/ molecules, and – importantly – a knowledge of the canonical ensemble. You should also know about the method of 'undetermined multipliers' (considered briefly in the Further Information section of Atkins).

This is a 'minimum kit' by way of background, and in advance of the School you are strongly encouraged to (re)familiarise yourself with the appropriate chapters in Atkins (chapters 19, 20 in the 7th edition, or chapters 15, 16 in the 9th).