PH4211 Statistical Mechanics

Revision 2022 - Summary of discussion in session Tuesday 22 March 2022

Foundations
Statistical Mechanics — Thermodynamics
Macrostates/microstates
Fundamental Postulate
Boltzmann entropy
Conditions for equilibrium - Temperature, pressure, chemical potential
Boltzmann factor / canonical distribution function
Gibbs entropy
Partition function, Helmholtz free energy
Ideal gas -> temperature
Thermal de Broglie wavelength
Boltzmann H theorem
Third Law
BEC - briefly

Interactions
Classical approach
Cluster expn
Vitial expansion
2nd virial coefficient
universality/corresponding states
van der Waals eqn of state
Quantum effects (briefly)

Phase transitions
Partition function?
1st and 2nd order transitions
Order parameter
Critical exponents
Individual models: Weiss magnet, van der Waals gas, binary alloy
Landau theory — all in the shape of the Landau free energy curve
You *must* truncate the Landau expansion
1st order vs. 2nd order
Quantum ps - briefly

Fluctuations and dynamics
Onsager hypothesis
correlation functions
Brownian motion
Langevin eqn
Fluctuation-dissipation