

# Statistical Mechanics

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## 1 Classical Statistical Mechanics

Statistical mechanics links the microscopic properties of atoms and molecules to the macroscopic observable properties of materials, such as temperature and pressure.

## 2 Thermodynamic Potentials

Thermodynamic potentials like the Helmholtz free energy and Gibbs free energy provide insights into system behavior under different constraints.

$$F = U - TS \tag{1}$$

## 3 Phase Transitions

Phase transitions, such as the transition from liquid to gas, are described by changes in the free energy as a function of temperature or other external parameters.

## 4 Fluctuation-Dissipation Theorem

The fluctuation-dissipation theorem relates the response of a system to small external forces to the fluctuations occurring in the system at equilibrium.