

# Introduction on Statistical Mechanics

Manoj Kr. Das  
Associate Professor  
Department of Physics  
J N College, Boko

## What is Microscopic & Macroscopic states?

- Micro means small scale physics such as atom, nuclei.
- Macro means properties of bulk matter such as specific heat, dielectric constant.
- Macroscopic system is not concern with individual behaviour of each individual particle.

- If the macroscopic properties do not vary with time, the system is said to be in equilibrium.
- Thermodynamics is concerned with the relationship with certain macroscopic properties or variables or functions of a system in equilibrium.
- In a thermodynamical sense the system is a collection of macroscopic bodies among which thermal, chemical or physical changes can occur.

# What is the simple definition of statistical Mechanics?

- Statistical Mechanics is one which establishes the relation between macroscopic behaviour (bulk properties) of the system in terms of microscopic behaviours (individual properties).
- Statistical Mechanics is not concern with actual motion or interaction of individual particles but it explore the most probable behaviour of assembly of particles

Statistical Mechanics is divided into two classes –

(A) Classical or Maxwell- Boltzmann Statistics

(B) Quantum or Fermi -Dirac Statistics

- Classical or Maxwell Boltzmann statistics is relating the Entropy & Probability.

- In case of Quantum Statistics, there are again two forms-

(A) Bose- Einstein Statistics.

(B) Fermi- Dirac Statistics.

- Bose-Einstein Statistics is used in case of indistinguishable particles having zero or integral spin.
- Fermi-Dirac Statistics is used for indistinguishable particles having half spin.
- Bose-Einstein Statistics holds for photon.
- Fermi-Dirac Statistics holds for elementary particle.