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MJC (SEM-III) Unit - 1

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Topic :- MAXWELL- BOLTZMANN ENERGY DISTRIBUTION LAW:-

Suppose the particles are distributed among k energy levels $E_1, E_2, \dots E_i, \dots E_K$. Let $n_1, n_2, \dots n_i, \dots n_K$ be the number of independent quantum states associated with the energy levels. According to the statistical basic postulates.

$$N = n_1 + n_2 + \dots + n_i + n_K$$

$$\Rightarrow \boxed{N = \sum_i n_i} \quad \text{——— (I)}$$

and since the force of interaction between particles are negiligible, then we have

$$U = n_1E_1 + n_2E_2 + \dots + n_iE_i + \dots + n_KE_K \quad \text{——— (II)}$$

~~taking defferential of eqn (I) and (II)~~

$$\boxed{dN = \sum_i dn_i = 0} \quad \text{——— (III)}$$

and

$$\boxed{dU = \sum_i E_i dn_i = 0} \quad \text{——— (IV)}$$

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MB Energy distribution.

The set of occupation numbers n_1, n_2 ... is a possible mode of distribution of the particles among the energy levels, and it determines a macrostate of the system.

According to the fundamental postulate of equal a priori probabilities all the quantum states of energy of the particles in the system in equilibrium corresponding to the constant values of U, V, and N are equally probable. It means that in equilibrium state the distribution of the particles among various quantum states has the maximum probability of occurrence. This distribution can be obtained in a maximum number of statistically independent ways.