fundamental postulates of statistical mechanics:

→ Any gas under consideration may be considered to be composed of large no. of molecule which are constantly in motion. And Behave like very small elastic sphere

→ The configuration of the particle is completely described by six co-ordinate (x, y, z, p_x, p_y, p_z). This six dim space is klas phase-space. This phase is divided into large no. of elementary cell called phase cell, each having equal size h^3.

→ The most fundamental postulate of S.M. is "principal of equal a priori prob." ie all accessible to possible macrostate are equally probable.

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→ The equilibrium state of gas corresponds to macrostate of max^m prob

→ The total no. of molecule

$$N = \sum_i n_i = \text{constt}$$

drived from (conservation of mass)

→ Total energy of the system remains constt.

$$E = n_1\epsilon_1 + n_2\epsilon_2 + \cdots = \sum_i n_i\epsilon_i = \text{constt}$$

(energy conservation)

constraints on system:

Prob: 10 particle are distributed in 3 given cells, with with energy per particle $0, \epsilon, 3\epsilon$

such that $n_1 = 3,\ n_2 = 5,\ n_3 = 5$

If total En of the system remains same. Then find δn_1 & δn_2 when $\delta n_3 = -1$

Also find the thermodynamical prob. for old & new distribution.

Sol^n:

$$n_1 + n_2 + n_3 = 13 = \text{constt}$$

$$\delta n_1 + \delta n_2 + \delta n_3 = 0$$

$$\delta n_1 + \delta n_2 = 1$$

$$E = n_1 \epsilon_1 + n_2 \epsilon_2 + n_3 \epsilon_3 = \text{constt}$$

$$\Rightarrow E = n_2 \epsilon + 3 n_2 \epsilon$$

$$0 = \epsilon \delta n_2 + 3 \epsilon \underbrace{\delta n_3}_{-1}$$

$$\delta n_2 = 3$$

new distribution $(1, 8, 4)$

No. of accessible μ-state / thermodynamic prob. —

$$\Omega = \frac{\lfloor N}{\lfloor N_1 \lfloor N_2 \lfloor N_3} = \frac{\lfloor 13}{\lfloor 1 \lfloor 8 \lfloor 4}$$

$$\Omega_{old} = \frac{\lfloor 13}{\lfloor 3 \lfloor 5 \lfloor 5}$$ most prob. distri. (equillibrium state max^m entropy state)