Physics paper VI
Group A : statistical physics

Phase space

Let a macrostate of the system is described by N, V and E.

N is Large numbers of identical particles.

V is volume occupied by particles

E is total energy.

For a given macrostate of a system, there are a large number of microstates as the position and momentum coordinates of the constituent particles are changing continuously with time.

A microstates of a system comprising N particles is defined by 3N position coordinates and 3N momentum coordinates.

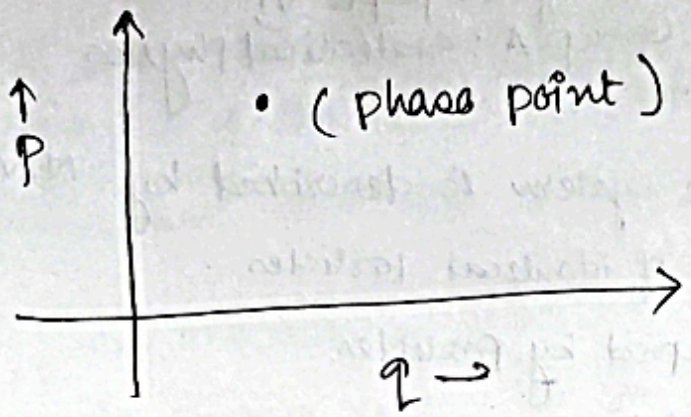
This 6N - dimensional space is known as the "phase space" of the system.

* If the system is in the gaseous condition, the phase space is also known as the Γ- space.

* A point (q, p) in the phase space called a phase point represents a microstate.

* With the passage of time, position and momentum coordinates of the constituent particles changes continuously therefore, the phase ~~point~~ point moves in the phase space, generating a phase line called as phase trajectory.

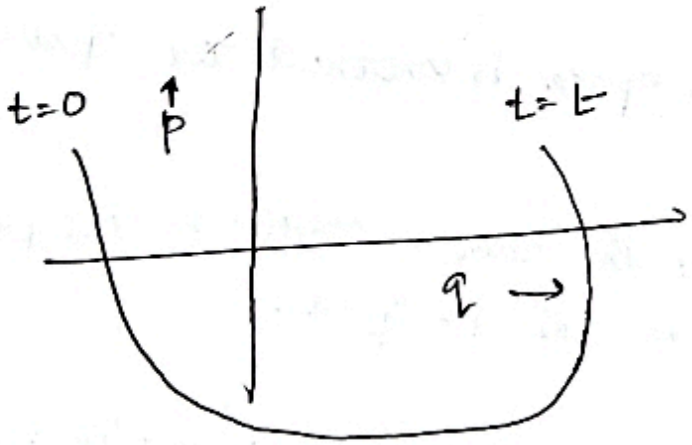
(A)



In Above figure phase point is represented in the phase space of the system. It represents one microstate of the system.

~~Microstate of the sy~~

(B)

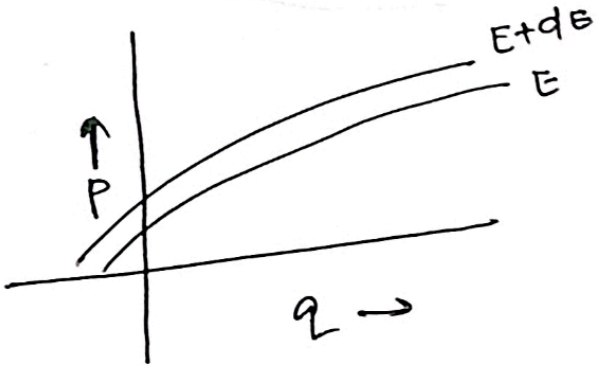


Above figure presents phase trajectory.
Microstate of the system changes with time and therefore position of phase point varies with time.

A locus of phase points in the phase space such that the total energy E of the system remains constant defines a surface, called the energy surface of energy E.

For a given macrostate, trajectory of the phase point always lies on the energy surface as the energy of the system is constant.

If the total energy of the system lies in the range from E to E+dE, the trajectory of the space points would lie within the shell described by the range of the energy as shown below



Two energy surfaces corresponding to the energies E and E+dE in the phase space are shown.