THERMODYNAMICS OF EQUILIBRIUM STATE

THERMODYNAMIC EQUILIBRIUM

Thermodynamics predominantly addresses the state of equilibrium within a system, wherein the state variables remain consistent and uniform throughout the entire system. For a system to be in thermodynamic equilibrium, it must encompass the coexistence of all three forms of equilibrium.

(i) Mechanical Equilibrium

A state of mechanical equilibrium is attained within a system when there is an absence of noticeable macroscopic motion occurring either within the system or concerning the system in relation to its surroundings. In this condition, the system remains entirely stationary and does not exhibit any observable movements, ensuring that it remains in a state of balance and stability, free from significant displacement or motion at the macroscopic level.

(ii) Chemical Equilibrium

Chemical equilibrium occurs when a system comprises multiple substances, and the composition of the system remains constant over time. In a chemically equilibrated state, the system's chemical composition must remain uniform and unchanging. Importantly, there should be no net chemical reactions occurring within the system at this point. This implies that while individual molecules or particles may still undergo chemical transformations, the overall balance between reactants and products remains constant, resulting in no net changes in the system's chemical makeup.

(iii) Thermal Equilibrium

Thermal equilibrium is established within a system when the temperature throughout the entirety of the system is identical to that of the surrounding environment. This means that there is a consistent and uniform temperature distribution within the system, matching the temperature of the surroundings. In such a state, no heat transfer occurs within the system or between the system and its environment, resulting in an overall balance of thermal conditions and ensuring that the system is in a state of thermal equilibrium.

Ex. Which is the intensive property: -

(A) temperature **(B)** viscosity

(C) density **(D)** all

Ans. **(D)**

Ex. A thermodynamic state function is: -

(A) one which obeys all the law of thermodynamics

(B) a quantity which is used in measuring thermal changes

(C) one which is used in thermos chemistry

(D) a quantity whose value depends only on the state of system

Ans. **(D)**

Ex. A system is changed from state A to state B by one path and from B to A by another path. If DE_1 and DE_2 are the corresponding changes in internal energy, then:

(A) $DE_2 + E_2 = +ve$ **(B)** $DE_1 + DE_2 = -ve$

(C) $DE_1 + DE_2 = 0$ **(D)** none of the above

Ans. **(C)**