

## Thermal equilibrium and Zeroth-law

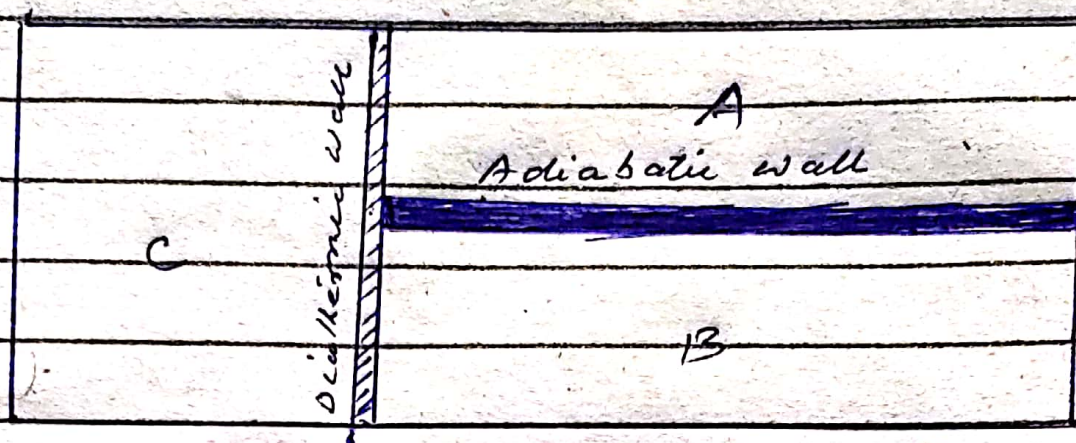
Thermal equilibrium:- It is a matter of common observation that, when two bodies at different temperature are brought in contact, then heat begins to flow from the body at higher temp to the body at lower temp till the temp of both the bodies becomes same or equal. Thus it is concluded that when two bodies have the same temp in fact stops the flow of heat between them and hence the bodies are said to be in thermal equilibrium.

Thus two bodies or systems are said to be in thermal equilibrium with each other, if they have the same temperature. So temp is a property, which determines whether the two systems are in thermal equilibrium or not.

## Zeroth Law of Thermodynamics

According to zeroth-law of thermodynamics, if two systems are in thermal equilibrium with a third system separately, then they must be in thermal equilibrium with each other.





Let two systems A & B are at different temperatures and separated by an adiabatic wall. The systems A & B are separated by a third system C which is also at different temp by a diathermic wall. Due to different temp heat exchange between A & C and also between B & C and after certain time, they will attain thermal equilibrium separately. If the adiabatic wall between A & B is removed, it will be found that there is no exchange of heat between systems A & B. Therefore, the systems A & B also acquire thermal equilibrium.

Thus on the basis of above experiment it is concluded that if two systems A & B are in thermal equilibrium with a third system C, then A & B must be in thermal equilibrium with each other.

Note: adiabatic wall, - A wall which does not allow heat flow.

Diathermic wall, - A wall which allow heat flow.