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GENERAL PHYSICS

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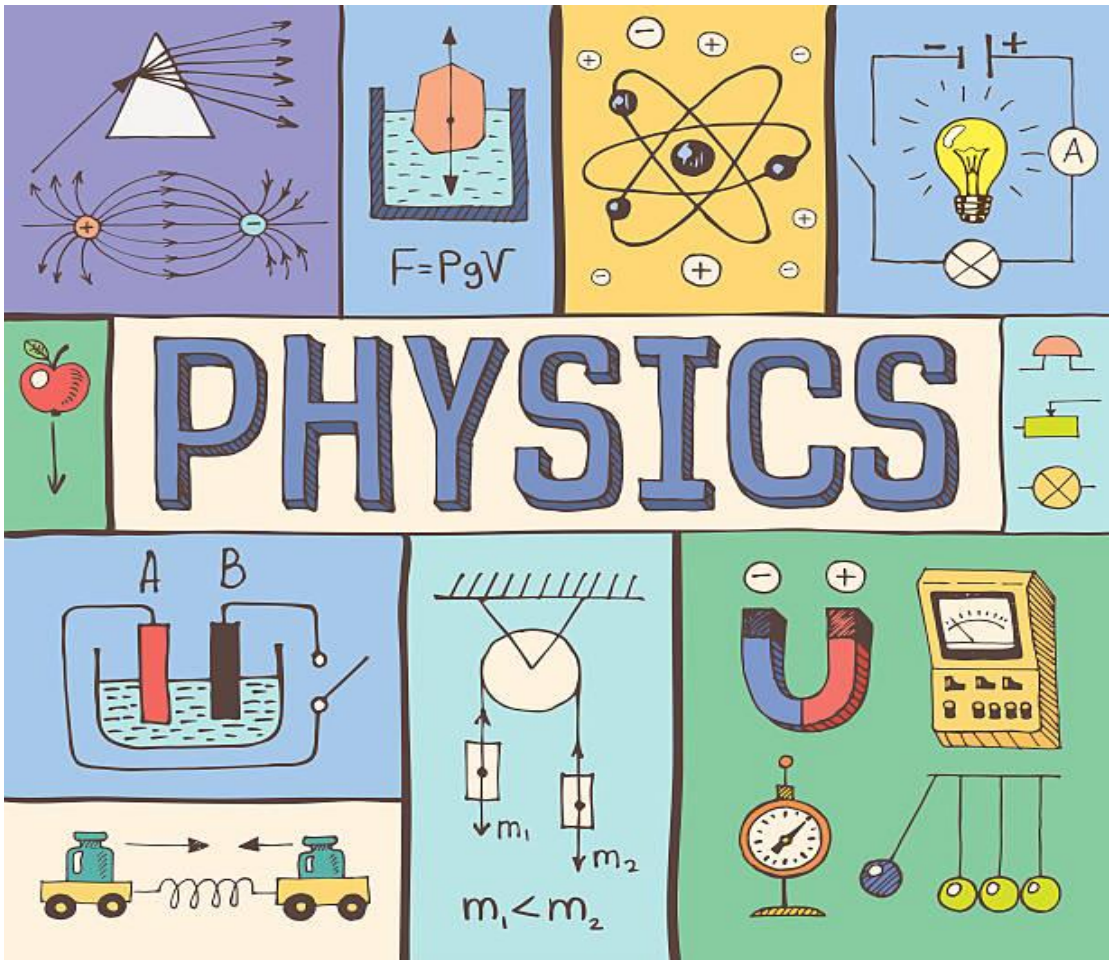
LECTURE (5) : FUNDAMENTAL CONCEPTS IN THERMODYNAMICS



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HEAT : IS ONE OF THE FORMS OF ENERGY.

In thermodynamics, heat is energy in transfer to or from a thermodynamic system, by mechanisms other than thermodynamic work or transfer of matter.

The mechanisms include conduction, through direct contact of immobile bodies, or through a wall or barrier that is impermeable to matter; or radiation between separated bodies; or friction due to isochoric mechanical or electrical or magnetic or gravitational work done by the surroundings on the system of interest, such as Joule heating due to an electric current driven through the system of interest by an external system, or through a magnetic stirrer.

When there is a suitable path between two systems with different temperatures, heat transfer occurs necessarily, immediately, and spontaneously from the hotter to the colder system.

- It is something which may be transferred from one body to another, according to the second law of thermodynamics.
- It is a measurable quantity, and so can be treated mathematically.
- It cannot be treated as a material substance, because it may be transformed into something that is not a material substance, e.g., mechanical work.

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Fundamental concepts in Thermodynamics

1- Heat: is energy in transfer to or from a thermodynamic system, by mechanisms other than thermodynamic work or transfer.

2- Temperature (T) is a physical property of matter that quantitatively expresses hot and cold. Temperature is measured with a thermometer.

Scales: *Celsius , Fahrenheit, Kelvin, and some scales*

We can convert from one to another as shown in the table below.

Conversion:

The following table shows the temperature conversion formulas for conversions to and from the Celsius scale.

Temperature conversions

Type of scale	from Celsius	to Celsius
Fahrenheit	$[°F] = [°C] \times \frac{9}{5} + 32$	$[°C] = ([°F] - 32) \times \frac{5}{9}$
Kelvin	$[K] = [°C] + 273.15$	$[°C] = [K] - 273.15$

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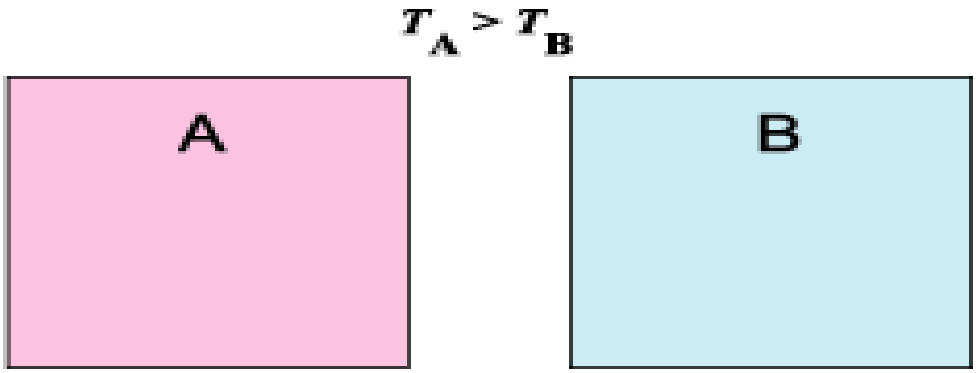
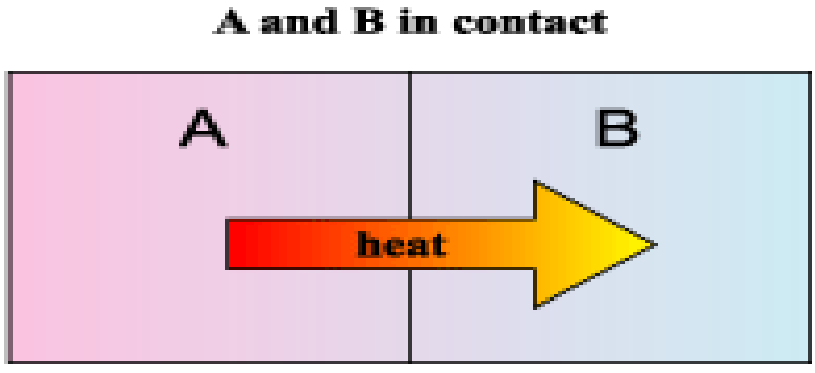
3- Thermal energy : Thermal energy refers to several distinct thermodynamic quantities, such as the internal energy of a system; heat or sensible heat, which are defined as types of energy transfer (as is work); or for the characteristic energy of a degree of freedom in a thermal system kT, where T: is temperature and k: is the Boltzmann constant.

4- Thermal equilibrium: Two physical systems are in thermal equilibrium if there is no net flow of thermal energy between them when they are connected by a path permeable to heat.

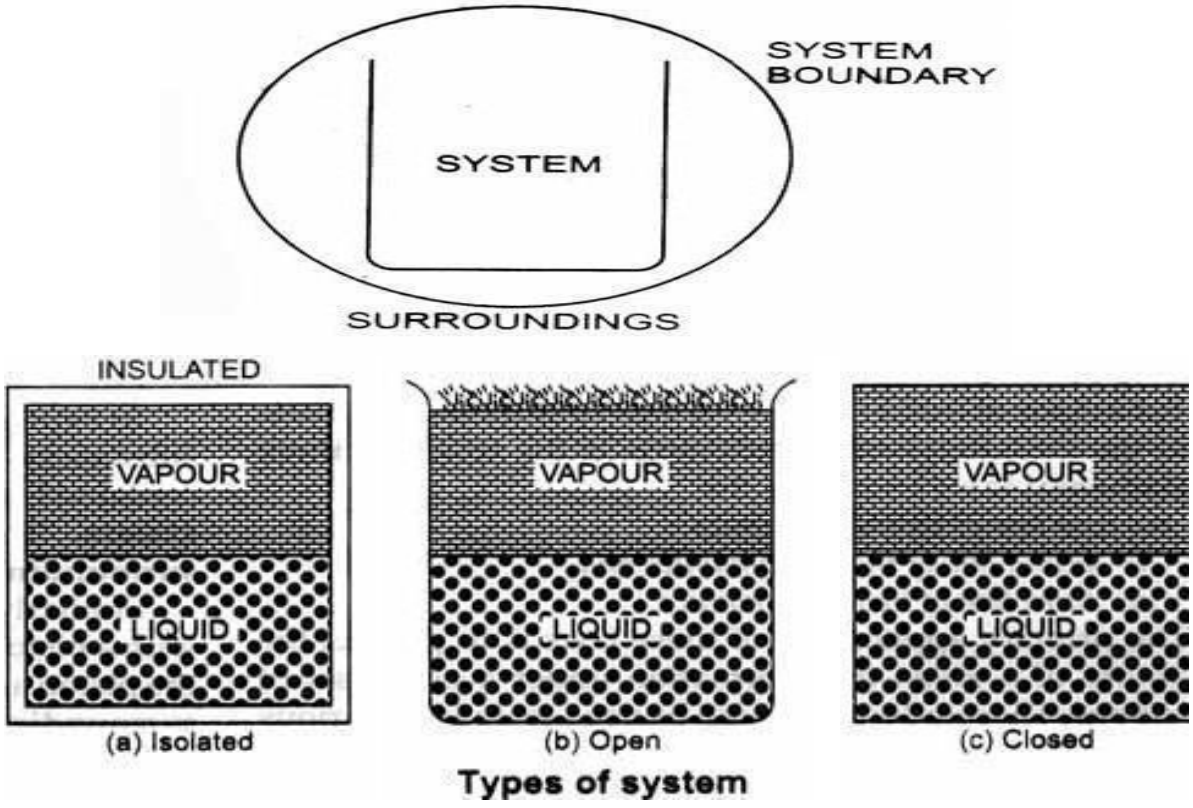




5- Internal energy of a system : is the energy contained within the system.

6- System : is a body of matter and/or radiation, confined in space by walls, with defined permeability's, which separate it from its surroundings.

7- Surrounding : The system is the part of the universe being studied, while the surroundings is the remainder of the universe that lies outside the boundaries of the system.



Types of system

8- Thermal contact: Two object are in thermal contact with each other if the energy exchange can occur between them in the absence of work done by one in the other.