Thermodynamics

Thermodynamics means flow of heat,
or it concerned with mechanical action produced by heat.
It deals with energy in its various forms, which include thermal, chemical, electrical and mechanical, with the restrictions on the transformation of one type of energy into other types and with the relation of energy changes to Physical and Chemical Changes.

The thermodynamics is mainly based on the principles called Themodynamic's Laws.

The first law of thermodynamics is a statement of the "Law of Conservation of energy"

The 2nd Law of thermodynamics relates to a manner in which changes in the system occur spontaneously, and

The third Law of thermodynamics relates, among other things, to the experimental approach to the absolute zero.

To understand thermodynamic the basic terms are important and it is explained as follows.

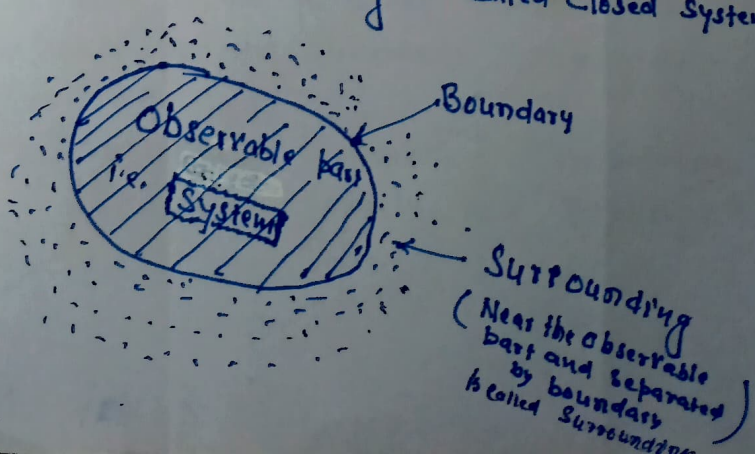
SYSTEM:- Any specified portion of the matter (Universe) which is under observation and separated from the rest of the universe with a boundary.

SURROUNDING:- The rest part of Universe which might be in a position to exchange energy and matter with the system is called Surrounding.

Isolated System:- A system which can not exchange energy as well as matter with its surrounding.

Open System:- A system which can exchange energy as well as matter with surrounding is called open system.

Closed System:- A system which can exchang energy but not matter with surrounding is called closed system.



Macroscopic Properties:-

It Consist the properties of large number of particles such as, Pressure, volume, temperature, density, Viscosity ... etc

Homogeneous System:-

This System Consist of only one phase and Completely uniform through out i.e Pure Solid, Pure Liquid, or a solution or mixture of gases.

Heterogeneous System:-

A System which is not uniform throughout or a System Consist of two or more Phases is Called Heterogeneous System.

STATE of a SYSTEM:-

The State of a System is fixed by its Macroscopic Properties when macroscopic properties of a system has definite values then the system is said to be in definite state.

STATE VARIABLES:-

Since the state of the System changes with change in any of the macroscopic properties, then these properties are Called State variables.

EXTENSIVE PROPERTIES:-

Extensive properties of a System is that properties which depends upon the amount of the substance present in the System i.e Mass, Volume, and Energy

INTENSIVE PROPERTIES:-

An Intensive properties of a System is that properties which does not depends upon the amount of the substance present in the systems.

For example:- Pressure, Temperature, Viscosity, density, and Refractive Index.... etc.

Thermodynamic Processes :—

Isothermal Process :— When the temperature of the system remains constant during each step of the process, then the process is said to be Isothermal.

Adiabatic Process :— A process is said to be adiabatic if no heat enters or leaves the system during any steps of the process. or When the heat of the system remains constant during each step of the process, then the process is said to be Adiabatic Process.

Isobaric Process :— When the pressure of the system remains Constant during each step of the process, then the process is said to be Isobaric.

Isochoric Process :— When volume of the system remains constant during each step of the process, then the process is said to be Isochoric.

Reversible and Irreversible Process :—

Reversible Process :— A process Carried out infinitesimally slow is called reversible process

Irreversible Process :— The process which does not take place infinitesimally slowly, is said to be an irreversible process.

A reversible process can not be realised in practice because it would require infinite time for its completion. So, all the process occurring in the nature or laboratory are irreversible. Therefore the concept of reversible process is imaginary and theoretical.

Reversible and irreversible Process may be understand by the following Example,

Let us consider a Cylinder Provided with an air-tight, weightless and frictionless Piston, containing a certain quantity of a gas. As shown in fig.

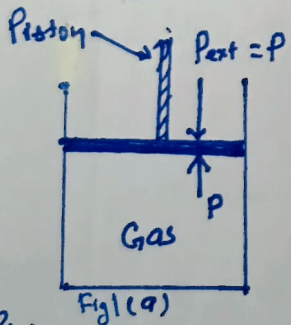


Fig 1 (a)

let the pressure P on the Piston is exactly equal to the pressure of the gas within the Cylinder. The Piston will neither move down ward nor upward and consequently there will be no change in the volume of the gas in fig 1(a).

Now suppose the pressure on the Piston is decreased by an infinitesimally small amount dP. The Pressure on the Piston is $(P - dP)$ infinitesimally smaller than the Pressure P of the gas within the cylinder (Fig. 1(b)). Hence the Piston will move up and the gas will expand infinitesimally small amount.

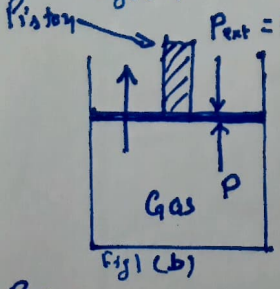


Fig 1 (b)

If the pressure on the Piston is kept infinitesimally smaller than the pressure of the gas itself so the expansion of the gas will continue infinitesimally slow i.e in thermodynamic reversible Manner.

If however the Pressure on the Piston (External Pressure) is made much smaller than the pressure of the gas within the Cylinder than the gas will expand rapidly.. On Pushing the Piston upward suddenly (Fig 1(c)) the expansion of the gas occurs irreversibly.

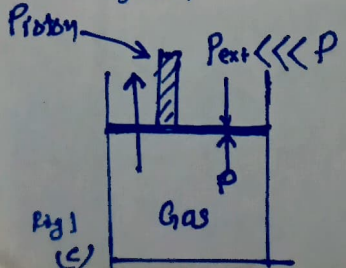


Fig 1 (c)