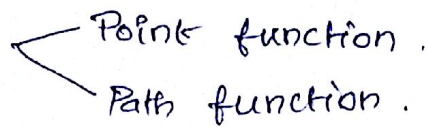


Point & Path Function :-

(3)

Thermodynamics functions are classified into two types.

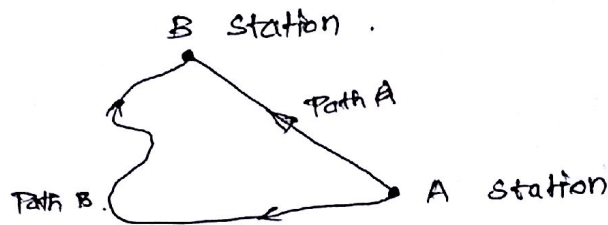


Point function :-

In which the change depends on only the end states and not on the path followed.

Path function :-

In which the change depends not only the end state but also on the path followed.



Thermodynamic System :-

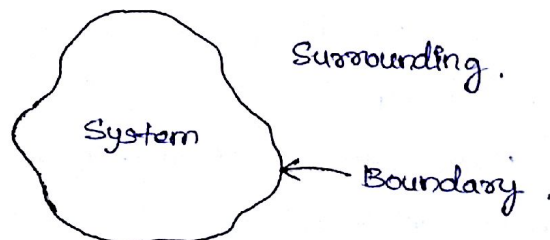
It is defined as a quantity of matter or a region in space whose behaviour is being investigated.

Surroundings :-

Everything external to the system is defined as surroundings.

Boundary :-

It is the surface which separates the system from its surroundings. It may be fixed and real or imaginary.

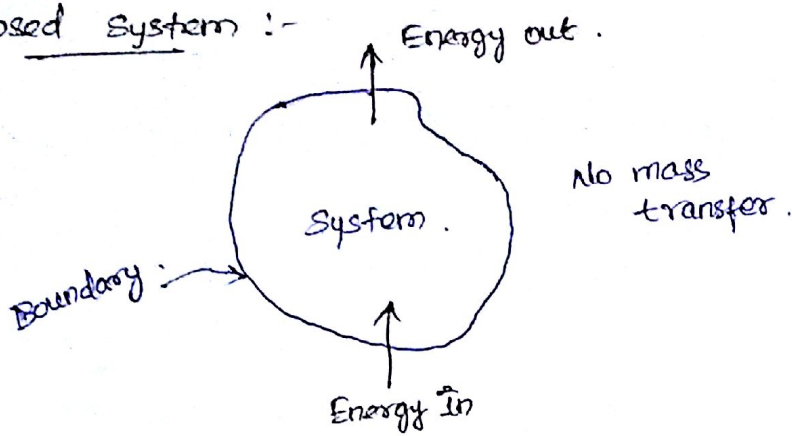


Types of system :-

3 types of thermodynamics systems.

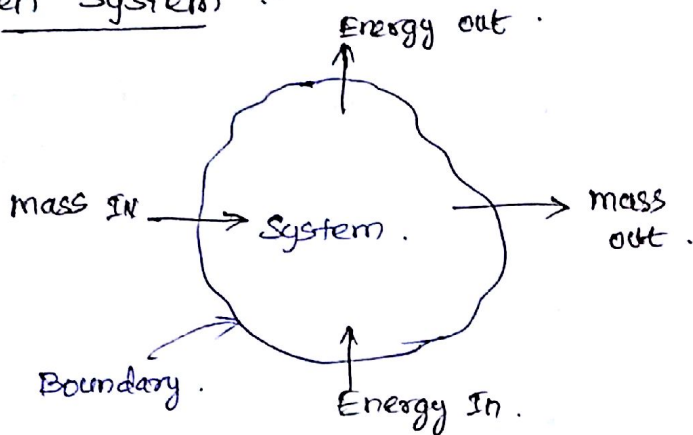
- closed system
- open system
- Isolated system.

Closed System :-



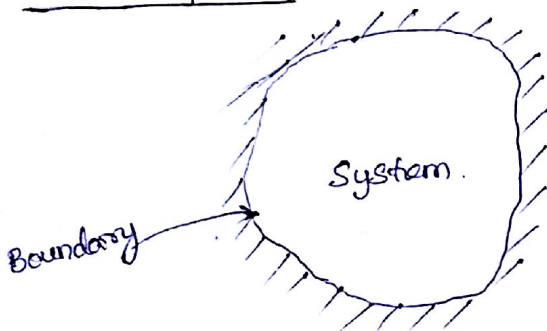
- i) No mass transfer.
- ii) Only energy transfer takes place.
- iii) control mass system.

Open System :-



- i) Mass transfer.
- ii) Energy transfer.
- iii) control volume system.

Isolated System :-



- i) No mass transfer.
- ii) No Energy transfer.

Eg :- Flask (tea)

Thermodynamics Equilibrium and State

When a system does not undergo any change, all the ^{macroscopic} properties have fixed values. This condition is known as a thermodynamic state.

Equilibrium means balance.

An equilibrium state of a thermodynamic system is a state that can ~~be~~ not be changed without any interaction with its surroundings.

- i) Thermal equilibrium - No temperature difference.
- ii) Mechanical equilibrium - No mechanical / pressure difference.
- iii) chemical equilibrium - No chemical difference.

State :- When a system does not undergo any change, all the properties have fixed values.

It is the continuous of the system at any particular moment.

At given state, all the property of the system have fixed values.

If the value of one property changes, there will be a change in state called change of state.

Path :-

The succession of state crossed through the control volume during the change of state is called path.

the change of state is called path.

Process: When a system is taken from one equilibrium state to another, the change is known as process.

Quasi-Static Process:-

A system passes through an infinite number of continuous equilibrium states and attains the original state when the process is reversed.

It is reversible & slow process.

Reversible Process:-

A system passes through an infinite number of continuous equilibrium states and if it traces the same path when this process is reversed.

Irreversible Process:-

A system passes through an infinite number of continuous non-equilibrium states and it does not trace the same path when the process is reversed.

Work Transfer (W)

Work is an energy interaction between system and surrounding. The energy can cross the boundary of any system in the form of either heat or work. But, the energy crossed through the boundary in a closed system is definitely in the form of work.

$$\text{Work} = \text{force} \times \text{distance}$$

$$= F \times x \quad \text{Nm}$$

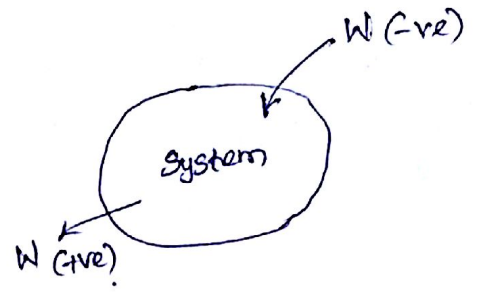
Work done per unit time is called power.

(Work done by the system)
Positive Work - Work output from any system is called positive work.
 Eg: Heat engine, turbines etc.

Negative Work - Work supplied to the system is taken as negative work.
 Eg: Compressor, fans, heat pump etc.
 (Work done to the system)

Mode of Work Transfer :-

- 1) Mechanical
- 2) Non-mechanical.



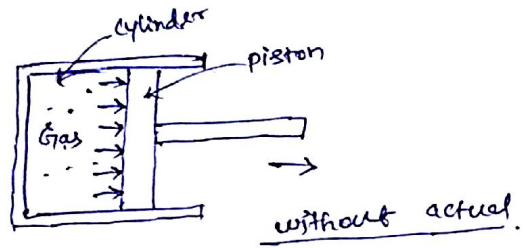
Mechanical

- Moving boundary work.
- Gravitational work
- Acceleration work.
- Spring work.

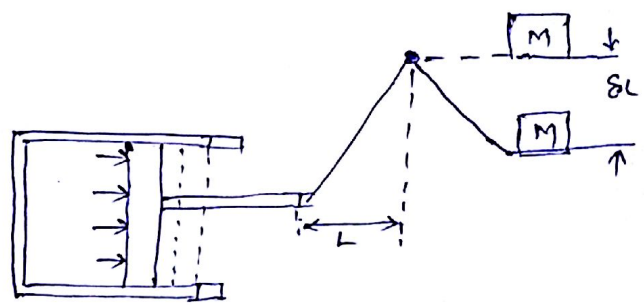
Non-Mechanical

- Electrical work.
- magnetic work.

Thermodynamic Work :-



- no mass is actually lifted against gravity.



Expansion with actual lifting of mass.
 - work is said to be done by the system.

unit : Nm / Joule (KJ)

Sign Convention of Work :-

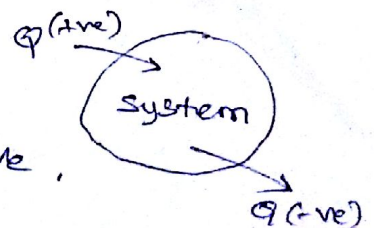
- work done by the system on the surrounding (+ve work)
- work done on the system by the surrounding (-ve work)

Heat :-

Heat is the interaction between systems which occurs by virtue of their temperature difference when they communicate.

Sign Convention of Heat :-

- Heat given into a system, is positive.
- Heat coming out of the system is negative.



Comparison between Work and Heat.

- Both heat and work are boundary phenomena, i.e. they occur only at the boundary.
- Both work and heat are path functions.
- The interaction due to the temperature difference is heat and all other interactions are to be taken as work.