

Thermodynamics

- ① Thermodynamics :- It is a branch of science which deals with the interconversion of various forms of energy. It also governs transformation of heat into work and vice-versa.

* Importance of thermodynamics

- ① To predict the feasibility of a process.
- ② To predict the yield of the product.
- ③ To deduce important generalization and their mathematical expressions like distribution law, phase rule, etc.

* Limitations of thermodynamics

- ① It deals with macroscopic quantities and not with microscopic quantities.

- ① It predicts feasibility but does not tell about the rate of reaction.
- ② It concerns only with initial and final state and does not deal with path by which the change is brought about.

System:- It is a part of the universe which is selected for thermodynamic investigation.

Surrounding:- The part of the universe other than the system is called surrounding.

→ The system and surroundings are separated by a real or imaginary boundary.

Types of system:- on the basis of the composition, the system may be:-

① Homogeneous system:- A system having uniform nature throughout and consist of

one phase only.

⑥ Heterogeneous system:- A system which is not uniform throughout and consist of more than one phase.

On the basis of exchange of mass and energy, the system may be:-

① Open system:- The system which can exchange mass as well as energy with the surroundings.

eg:- Tea in a Cup.

② closed system:- The system which can exchange energy with the surroundings but not mass.

eg:- heating of solid iodine in a sealed container

③ Isolated system:- The system which can neither exchange energy nor mass with the surroundings.

eg:- Piece of ice in a thermos flask.

Thermodynamics Properties

- (a) Extensive properties :- The properties of the system which depends upon the amount of substance in the system.
eg:- mass, volume, energy, enthalpy, work, etc.
- (b) Intensive properties :- The properties of the system which do not depend upon the amount of the substance present.
eg:- Temp_t, pressure, viscosity, density, surface tension, etc.

* Thermodynamic process

- (a) Isothermal process :- It is one in which temp_t of the system remains constant ($\Delta T = 0$).
- (b) Isobaric process :- It is one in which the pressure of the system remains constant ($\Delta P = 0$).
- (c) Isochoric process :- It is one in which the volume of system remains constt. ($\Delta V = 0$).

④ Adiabatic process:- It is one in which the system does not exchange heat with the surrounding i.e. no heat enters or leaves the system ($\Delta q = 0$).

⑤ Reversible process:- The process which is carried out infinitesimally slowly so that all the changes occurring in the forward direction can be exactly reversed and the system maintains equilibrium with the surrounding at every stage of the process.
→ It is an ideal process and cannot be observed in reality.

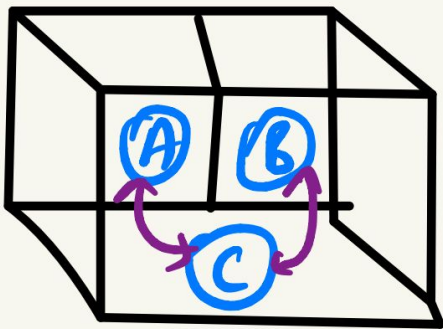
⑥ Irreversible process:- The process which is not carried out infinitesimally slowly so that all the changes occurring in the forward direction cannot be exactly reversed and the system does not maintain equilibrium with the surrounding.

→ All natural processes are irreversible in nature.

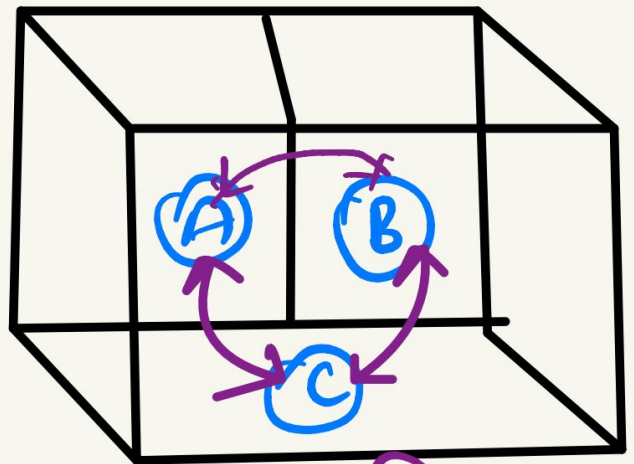
(19) Cyclic process :- It is one in which the system returns to its original state after a number of reactions. For such a process $\Delta U = 0$ and $\Delta H = 0$.

* Zeroth law of thermodynamics

If two bodies (A and B) are in thermal equilibrium with another body C, then the bodies A and B will also be in thermal equilibrium with each other.



(a)



(b)

fig:- If A and B are in thermal equilibrium with C (a), they thermal with each other (b).