Second Law of Thermodynamics :-

First Law of Thermodynamics Successfully Explains the Conversion of heat energy into mechanical energy and vice versa. But this Law fails to Explain (i) the direction of heat-flow (ii) the Conditions, under which heat can be transformed into work (iii) why the whole of the heat energy can not be converted into mechanical work continuously.

The answer of these questions are Explained by Second Law of Thermodynamics, which is stated in a number of ways. The following two statements are given below.

Kelvin's Statement :- "It is impossible to derive a Continuous supply of work by Cooling a body to a temperature lower than that of the coldest of its surrounding."

Clausius Statement :- "It is impossible for a Self-acting machine, unaided by any external agency, to transfer heat from a body at lower temperature to another at higher temperature."

These two statement are different

in words but both them are equivalent in meaning in all respects.

Reversible process:- A process which can be made to proceed to proceed in reverse direction with equal ease by variations in its conditions, so that all changes occuring in the direct process are exactly reversed in the reverse process, is called a reversible process.

To achieve this process, following conditions must be satisfied:

(i) The process should be take place very slowly so that the system is always in mechanical, thermal and chemical equilibrium.

(ii) The System should be free from dissipative forces like friction, viscosity inelasticity etc.

The examples of this process are,

(i) The working substance taken along the complete carnot's cycle.

(ii) An ideal gas allowed to expand slowly and then Compressed slowly so as to return to its initial State.

(iii) All thermal proces taking place at infinitely slow rate.

(iv) All mechanical processes taking place under the action of conservative forces.

Irreversible process :- Any process which can not be made to proceed in reverse direction is called irreversible process.

Examples :- (i) Diffusion of gases.

(ii) Rusting of Iron

(iii) Adiabatic expansion or compresion of a gas

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