THERMODYNAMICS

Thermodynamics deals with energy interactions between two bodies & its effect on the properties of matter.

SCOPE OF THERMODYNAMIC

- Feasibility of a process
- Extent of a process
- Efficiency of a process

SYSTEM

The part of the universe under thermodynamical observation is called system.

SURROUNDINGS

All the part of the universe except system is called surroundings.

BOUNDARY

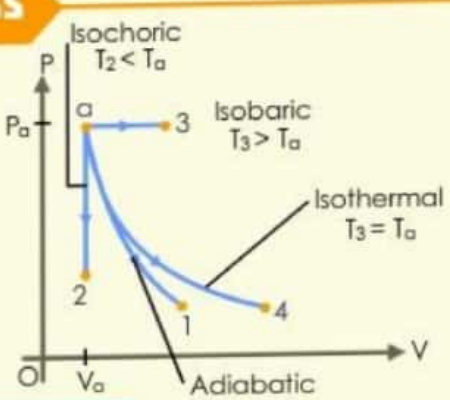
The part which separates system and surroundings is called boundary. It may be rigid or flexible.

TYPES OF THERMODYNAMIC PROCESSES

- **QUASI-STATIC PROCESS**
  Arbitrarily slow process such that the system always stays arbitrarily close to thermodynamic equillibrium.
- **REVERSIBLE PROCESS**
  Any changes induced by the process in the universe (system + environment) can be removed by retracing its path.
  Reversible processes must be quasi-static.
- **IRREVERSIBLE PROCESS**
  Any process in which a part or whole of process is not reversible.
  E.g. : any process involving friction, free expansion of gas etc.

BASIC THERMODYNAMIC PROCESS

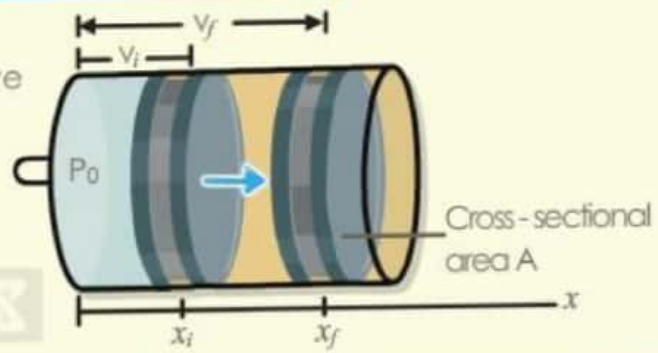
- **ISOBARIC:** Constant P
  $W = p\Delta V$
- **ISOTHERMAL:** Constant T
  $\Delta U = 0$ (for ideal gases)
- **ISOCHORIC:** Constant V
  $W = 0$
- **ADIABATIC:** No heat exchange
  $Q = 0$
- There are an infinite number of **other processes** without any special name!



WORK DONE IN THERMODYNAMIC PROCESS

Work done compressing a system is defined to be positive

$$W_{Vi-Vf} = \int_{Vi}^{Vf} PdV = P_0 \int_{Vi}^{Vf} PdV = P_0 . W_{Vi-Vf}$$

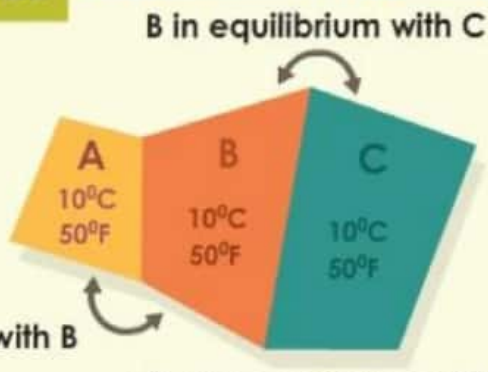


THERMODYNAMICS LAWS

The branch of physical science that deals with the relations between heat and other forms of energy (such as mechanical, electrical or chemical energy) and by extension of relationship between them.

ZEROTH LAW OF THERMODYNAMICS

If two systems are in thermal equilibrium with a third system, then they all are in thermal equilibrium with each other. This law helps define the notion of temperature.

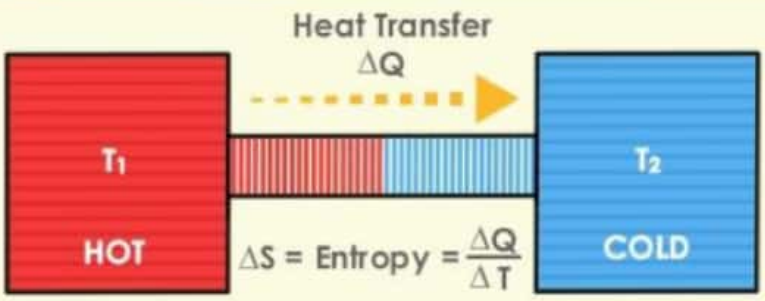


THE FIRST LAW OF THERMODYNAMICS

The first Law of thermodynamics states that overall amount of energy is Conserved. Therefore, energy cannot be created or destroyed, only lost to an outside system.

$$\Delta U = Q - W$$

THE SECOND LAW OF THERMODYNAMICS



This law states that energy naturally flows from hotter objects to cooler objects. In order for energy to flow from a cooler object to a hotter object, work must be done. When heat is converted into work, the efficiency or output of usable work will always be less than 100%.

THE THIRD LAW OF THERMODYNAMICS

The entropy of a system approaches a constant value as the temperature approaches absolute zero. With the exception of non-crystalline solids (glasses), the entropy of a system at absolute zero is typically close to zero and is equal to the logarithm of the product of the quantum ground states.