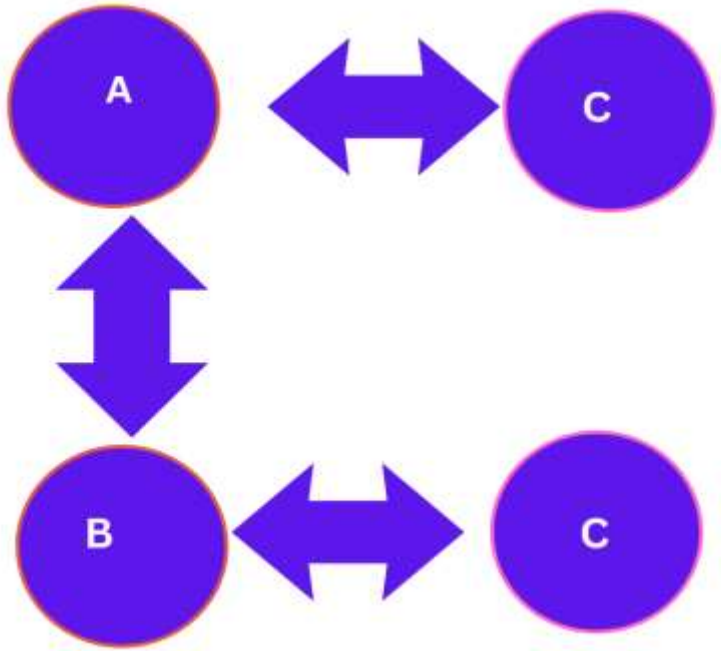
LAWS OF THERMODYNAMICS

- Zeroth Law of Thermodynamics
- First Law of Thermodynamics
- Second law of thermodynamics

Zeroth Law Thermodynamics

- STATEMENT: If two systems A and B are separately in thermal equilibrium with a third system C,then A and B must in thermal equilibrium with each other.



FIRST LAW THERMODYNAMICS

STATEMENT: It is nothing but the law of conservation of energy.it states that energy can neither be created nor destroyed but it can be converted from the one form to other.

It can be stated alternately as follows,

- Total energy of the Universe(System+Surroundings is constant.
- It is impossible to construct a perpetual motion machine, which could produce work continuously without consuming energy.
- Whenever certain quantity of one form of energy disappears, an exactly equivalent quantity of some other form of energy must appear

FIRST LAW OF THERMODYNAMICS

- MATHEMATICAL FORM:

From the above statements we may conclude that the internal energy(E of a system can be changed in following ways,

1. Allowing a system to absorb energy ,q in form of heat or release energy ,q in form of heat. According to sign convention, heat gained by system is taken as positive and heat lost by the system is taken as negative.
2. By doing work(w) on the system due to compression or work done (w) by the system due to expansion. According to sign convention work done on system positive and work done by the system is negative.

FIRST LAW OF THERMODYNAMICS

- MATHEMATICAL FORM:

Let E_1 —Initial internal energy of the system.

When heat, q is supplied ,and again some work w is done on the system, hence internal energy of the system will change.

Let E_2- Final internal energy of the system.

Hence,E_2=E_1+q+w

E_2-E_1=q+w,or

ΔE=q+w……..(i)

This is mathematical form of 1st law of thermodynamics

The above expression is applicable for the work is done on the system

FIRST LAW OF THERMODYNAMICS

MATHEMATICAL FORM:

If the heat is supplied to the system and the work is done by the system then work is taken as negative, the equation is written as

$$\Delta E = q - w \ldots\ldots\ldots\ldots\ldots\ldots\ldots (ii)$$

work done by the system, $w = P\Delta V$,(iii)

Where,P-Presure,ΔV-change in volume .The above equation can be written as

$\Delta E = q - P\,\Delta V$ …… (iv)

FIRST LAW OF THERMODYNAMICS

- MATHEMATICAL FORM:

From equation(i) different cases arises

a)If ΔE=0,q=-w

b)If w=0,ΔE=q

c)q and w are path function, but their their sum q+w=ΔE is a state function.

From equation(iv),if volume is constant, ΔV=0,q_v=ΔE ,So ΔE is the measure het absorbed or heat released at constant volume and constant temperature condition.