"THERMODYNAMICS"

[Gate → 4-6 Marks]

1. Basic Concept
2. Energy Interaction.
3. Ist Law. T.D.
4. IInd Law T.D.
5. Entropy Concept.
6. A.E & VAE
7. P.S.
8. Mixture of Gases
9. T.D Relation. → [ESE BOOKLET]

"THERMODYNAMICS"

* BASIC CONCEPTS :-

It is the branch of Science which deals with the study of energy interaction and its impact on the properties of System OR.

It is a branch of science which deals with the Conversion of disorganise form of energy into Organise form. OR.

It deals with the study of 3E that is energy, equilibrium and entropy.

SYSTEM :-

Any thing under consideration OR its a control region in space over which our attention is focus.

SURROUNDING :-

Every thing external to the system.

BOUNDARY :-

It Seprates system from surrounding.

NOTE :-

1. Boundary may be real OR imaginery.
   - Real Boundary are represented by Continuous line OR Curve. whereas imaginery boundary are represented by dotted line OR Curve.

2. Boundary may be fixed [Rigid i.e change in volume (dV) = 0] OR moveable.
3. It should be considered of nearly zero thickness.

UNIVERSE :- System + Surrounding.

TYPES OF SYSTEM :-

* OPEN SYSTEM :-

It is a System in which both mass as well as energy interaction takes place.

Ex:- Boiler, turbine, Condensor, pump, Compressor, nozzle, diffuser, piston cylinder arrangment with valve.

* CLOSED SYSTEM :-

In this only energy interaction takes place between System and Surrounding.

Ex:- Piston cylinder arrangment Without Valves.

* ISOLATED SYSTEM :-

In this neither mass interaction nor energy interaction.

Ex:- Universe, Thermoflask.

* MICROSCOPIC APPROCH VS MACROSCOPIC APPROACH :-

In the Microscopic approach, single individual particle is under attention and this approach is known as statistical approach. Where as in the Case of Macroscopic appsroach the time avg behaviour of the Molecule is under attention and this approach is known as Classical approach.

NOTE :-

In the Case Rarefied Gases theory the Concept of Continuum is not Valied.

Continum APPROACH :-

In this approach we are Considering our matter as Continuous.

* THERMODYNAMIC PROPERTY :-

It Represent the Characteristic of the System.

Types of properties :-

1. Intensive Property or Intrinsic :-

These properties are independent of mass or the value of prop. remain same on its fraction.

Ex:- Pressure, temp, Conductivity, Sp. heat, Coeff. of thermal expansion, ratio of two extensive properties like density (S), $\frac{m}{V} = S$. Specific energy (e) $e = \frac{E}{m}$.

2. Extensive property or Extensic property :-

These are dependent on mass.

Ex:- Volume, heat Capacity, all forms of energy, like K.E, P.E, enthalphy, entropy, internal energy etc.

THERMODYNAMIC EQUILIBRIUM :-

A System is said be in thermodynamic Equilibrium if they are in thermal equilibrium, Mechanical equilibrium, Chemical Equilibrium.

Thermal Eq^{m} mean equality of temperature.

Mechanical Eq^{m} mean equality of mechanical forces & pr.

Chemical Eq^{m} mean equality of chemical potential

PURE SUBSTANCE :-

It is a substance of constant Chemical Composition throughout its Vol. of mixture irrespective of phase.

Ex:- ICE, Water, steam, Ice + steam, Ice + H_2O & H_2O + steam, ice + H_2O + steam.

NOTE:-

Moist Air is the impure Substance. Moist Air is the Composition of dry air and Water Vapour.

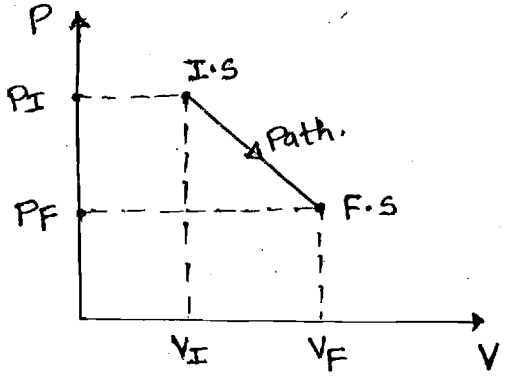
Dry Air is the pure substance but **Moist air** is the impure substance because the percentage of Water Vapour quantity Varies from place to place as we have seen that at Some places there is a high humidity and at Some places there is a Low humidity.

*THERMODYNAMIC STATE:-

It represent the Condition of System.

PATH:-

It is obtained by joining two equilibrium state.



$W = \int x\,dx.$

$P = \frac{f}{A}$

$F = PA.$

$W = PA\,dx.$

$\boxed{W = P.dV.}$

Pr = force per unit Area

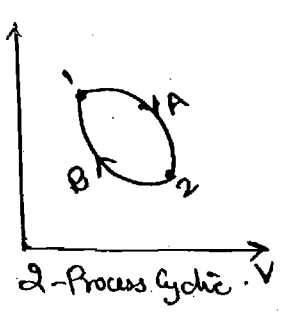
CYCLIC PROCESS:-

A process is said to be Cyclic in which initial state and final state are same.

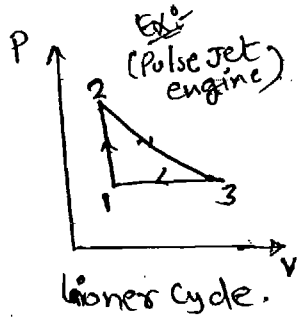
NOTE:-

Minimum No. of process required to make a cycle ~~are~~ 2.

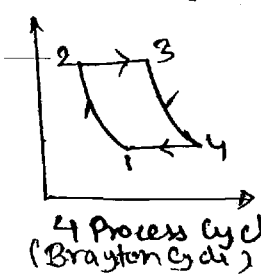
EX:-



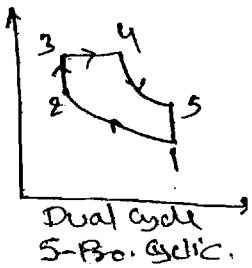
2-Process Cyclic.



Lioner Cycle.



4 Process Cyclic (Brayton Cycle)



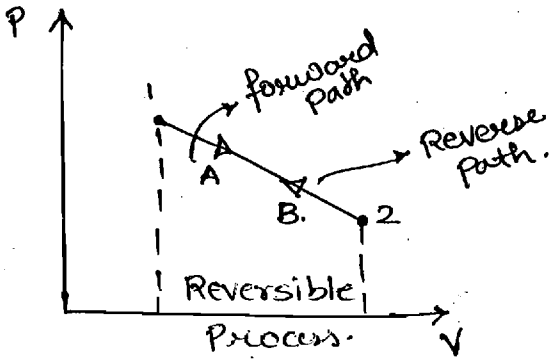
Dual Cycle 5-Pro. Cyclic.

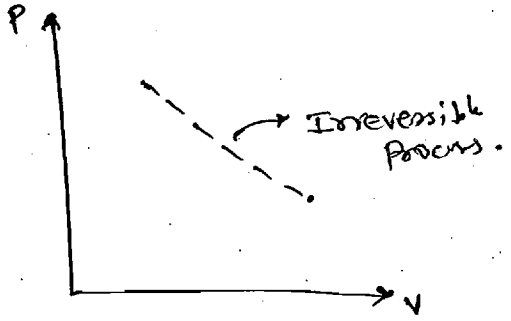
* REVERSIBLE & IRREVERSIBLE PROCESS :-

A process is said to be reversible in which system returns to it Original state without leaving any effect On surrounding.

NOTE :-

1. for the reversible process to achieve both forward and reverse path has to be same.
2. Reversible process are represented by continuous line and curve where as irreversible process are represented by dotted line or curves.
3. Example of Irreversible process,
   1. friction.
   2. free Expansion.
   3. Mixing of fluids.
   4. Heat transfer through a finite temp. difference.





Quasi- Static Process :-

It represent almost in rest condition Or infinite slowness is the characteristic of Quasi- static process. It is a imaginary process which is generated by joining a series of equilibrium states.

NOTE :-

Quasi - Static without friction is a reversible process.