Thermodynamics:- It's the science of energy interection and it's effects on the properties of system and sourounding.

* energy:- energy is the ability couse changes.

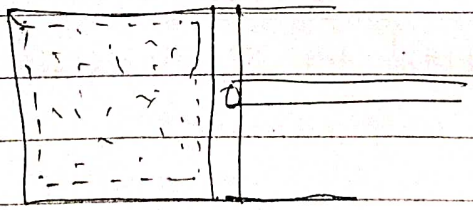
* System:- A system is define as a quality of metter or rgion in spoce. where over study is focuos.

* Sourounding:- The mass or rgion out side the system is called sorarounding.

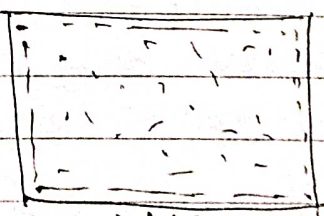
* Boundary:- (A real or imaginary surface that separates the system form e its sourounding.

* the boundary of A system can be fixed or moveble.

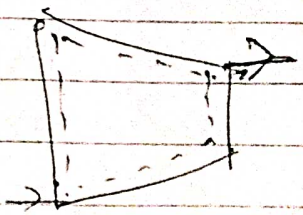
* idealy the boundary has zero thickness and does not contain any mass nor occupies any volume in space.



moveble bounebry.
System = fixed mass



boundary = fixed
System fixed
mass | fixed volume



Boundary fixed but mass move-bles

Types of system:-

S.No.	Type of system	mass transfer	Energy tran.	example..
1.	Open system	Yes	Yes	compressor, turbine, nozzle, Piston, cylinder, Arrangement with value
2.	Closed system	NO	YES	Piston cylinder without values.
3.	Isolated system	NO	NO	universe

✱ Properties of a system:-

→ Any characteristics of a system is known as property of a system.

→ Property are classified as Intensive or extensive.

* Intensive property :- [Intrinsic] :-

Independent of size or mass.

① example:- Pressure, temp., Density, thermal conductivity Co-effecient of thermal expansion.

Note:- All specific property are "Intensive property.
Ex: specific volume, specific Inernal enegy.

* Extensive or extrinsic property:-

[The properties which depends upon size or mass]

example:- volume, Total energy, total entropy total enthalpy etc.

$m/2, V/2$	
T_1, S_1	
$P_1, U/2$	

* Note:-

② (1) Properties are point function or 'state function.

③ (2) properties are independent of past-history

(3) properties are exact differentials.

Properties are macroscopic in nature

* Microscopic & macroscopic Approaches of Thermodynamics:-

[1] Macroscopic Approaches:-

→ In this approach Individual molecular behaviour is not taken, into consideration. rather the average molecular behavior is taken into consider.

→ This approch is known as classical thermodynamics. (4)

Note:-

→ In this approch we disregarded the atomic nature of a substance and view it as a continous homogeneous matter with no holes. that is continuum. (5)

(2) Microscopic Approaches:-

→ In microscopic anylsis behaviour of individual molekules is teken into considration this is known as statisticle thermodynamics.

→ (6) this approch is used when density is very low. Example - at very higher altitudes.

→ (7) In this approach rating gas flow theory is used.

* State of the system:-

Chareetnstic of the system is known as state of the system. It is specified.

by the properties of the system.

→ At a given state all the properties of the system will have fix value.
if even are property changes the state will change.

* Thermodynamics equilibrium:—
→ for a system to be in thermodynamics equilibrium all the relevent type of equilibrium must be satisfied, like.

[1] Thermal equilibrium - Equality of temp.

(2) mechanical equilibrium - Equality of forces (pressure)

(3) Chemical equilibrium - No chemical reaction is present.

(4) Phase equilibrium - This come into picture for a system involving more than one phase.

The mass of each phase should remain constant with time.

* Process:-
→ A change of state of the system is called "process".

→ The series of the state through which a system passes during a process is called the "path".

Reversible process:-

→ A process is said to be a reversible process if when reversed in direction follows the same path as that of the forword path without leaving any effect on system and surrounding.

→ Reversible process is the most efficient process

→ A work developing device will produce max. work if it follows reversible process (for same heat input)

→ A work consuming device will consume min. work for the same desired effect if it works on a reversible cycle.

* Irreversible process:-

→ The process which is not reversible is known as irreversible process.

Quasi-static or Quasi-Equilibrium process:-

→ When a process is carried out in a very slow manner that process is known as Quasi-static process.

(11)

→ Quasi-static process is carry with negligible gradient, frictionless quasi-static process is a reversible process.

* Cycles:-

A system is said to have under on a cycle when initial and final state of the system is same.

* Pure substance:-

→ A substance is said to be a pure substance if is of same homogenous chemical comporition throughout.

(12) ex- gaseous air, water + water vapour mixture, water.

(13) → A mixture of liquid air and gaseous air is not a pure substance.

Note:-

→ A mixture of refrigrent that behaves as pure substance is called "Azeotrope".

Gibbs-phase Rule:-

$P+F=C+2$

P = No. of phase (Liq, solid, vapour)

F = min. no. of independent, intensive variable

C = No. of component.

Ex:-

(1) O_2 and N_2 mixture

$1+F=2+2$

$F=3$

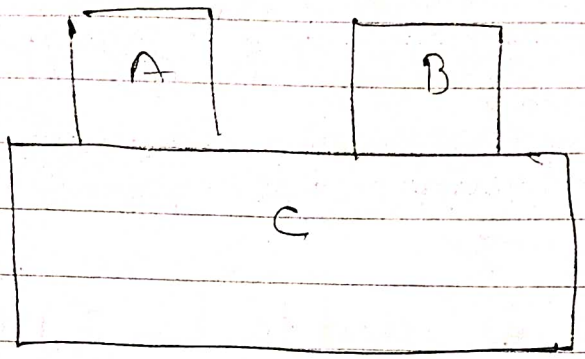
Which are the following are intensive properties:-

(1) K.E. (2) Sp. internal energy

(3) thermal conductivity (4) viscosity (5) pressure

(6) volume (7) temp.

* Zeroth law of Thermodynamics:-



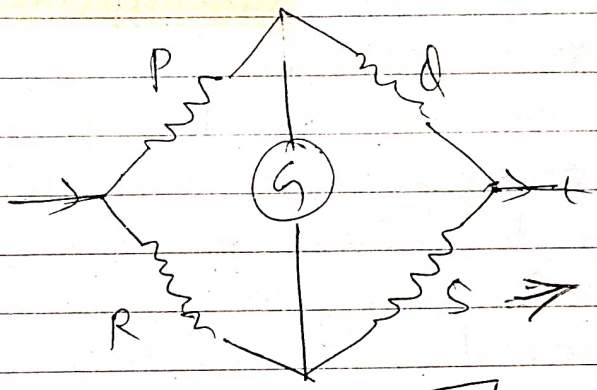
→ It states that if two (2) bodies (here A & B) are in thermal equilibrium with a third body (C) seperately then they are also a thermal equilibrium with each other.

→ In zeroth law of thermodynamics one body acts as thermometer.

Types of Thermometer:-

The principle of thermometer are based on finding the thermometenc properties.
Thermometric property is which help in finding the temp.

① Resistance termometers:-



Here S is unknown resistance made of platinum.

$$\left[\frac{P}{R} = \frac{Q}{S}\right]$$

(1) its works on whicht stone brige

(2) Resistance plays the role of Thermometric property.

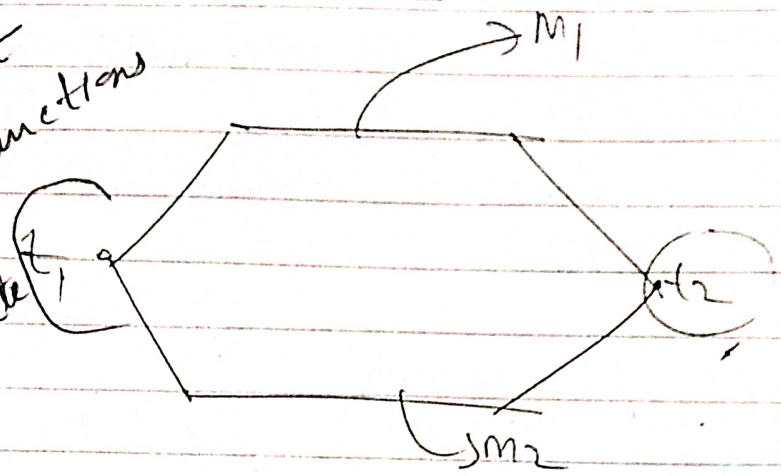
$$\Rightarrow S = S_0(1 + \alpha t + \beta t^2)$$

(3) Generally platinum wire is used as the unknown Resistance. (Here S)

→ Ir eff

① Thermocouple:-

works on seebeck effect
dif. temp. at junctions
emf generate



This is based on seebeck effect according to this principle if two diffrent metals are joints to form two diffrent junction and if this junctions are maintain ~~are~~ at diffrent temp. and emf is generated.
emf generated is directely perposanal to the temp. diff.
one jenction (Here ②) is dipped in fluid whose temp is be found., and the other junction is kept at some known temp. hense by finding out the emf generated we can find the unknown temp.
in this emf ~~is~~ plays the role of ~~thermodynamic~~ thermometric property.

→ the apposite of seebeck effect is known as peltier effect. it is used in Refrigration.

↓
peltier effect

in constant volume and constant pressure in ⇒ ideal gas is used as Therm. properties

③ Constant volume gas thermometer

⇒ in this ideal gas is used as material of construction.

there $PV = mRT$

$\boxed{P \propto T}$

⇒ By finding out the pressure we can find the temp. hence pressure plays the role of thermometric propetie.

④ ~~Const.~~ gas → H_2, He

⑤ Constant pressure & gas thermometer

⇒ idea gas is used as metrial of constr.

⇒ in this volume plays the role of thermometric properties.

$\boxed{V \propto T}$

Note:- ideal gas thermometer is independ of the material of construction.

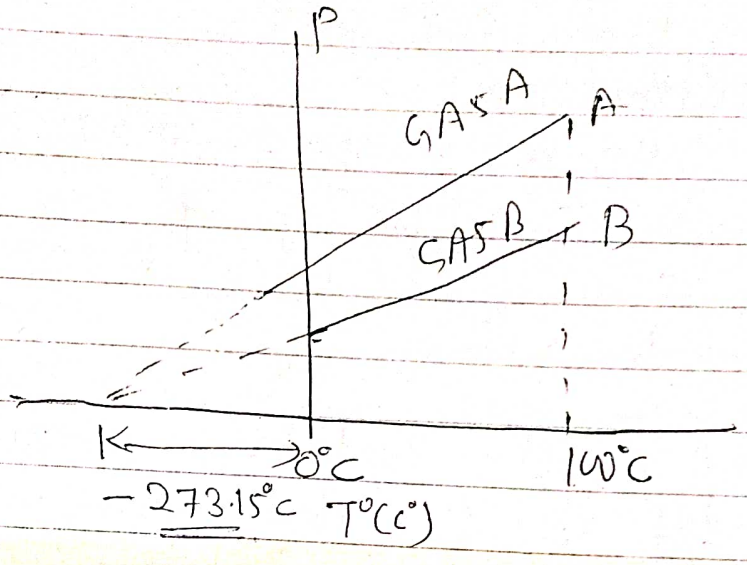
⇒ generally hydrogen or hellim is use

⇒ in mercry and alcohal thermometer (liquid) volume or length place the roll of thermometric propetis.

↳ l, V → in mercury & alcohol therm.

100 180 20

Temprature scale :—



$$K = °C + 273.15$$

$$°F = 1.8[(°C) + 32]$$

freezing pt	steam pt.
0°C	100°C
32°F	212°F
273.15°K	373.15K

$\frac{\wedge}{t_5 - t_i}$

⇒ Temp. measurment :-

① Temp method use before 1954 :-

The temp. measurment was based on two refrance points namely ice point (0°c) and steam point (100°c).

$$t = ap + b \quad \text{—①}$$

$$t_i = ap_i + b \quad \text{—②}$$

$$t_s = ap_s + b \quad \text{—③}$$

① - ②

$$t - t_i = a(p - p_i) \quad \text{and}$$

divided both

③ - ②

$$t_s - t_i = a(p_s - p_i)$$

$$\left\{ \frac{t - t_i}{t_s - t_i} = \frac{p - p_i}{p_s - p_i} \right\}$$

If in quastion sulpher point is given then take temp 445°c

✓ by knowing the termometric property p, the unknown temp (t) is found.

Method use After 1954:-

$$P + F = C + 2$$

$$3 + F = 1 + 2 \Rightarrow F = 0$$

at triple point $t = 273.16K$

$p = 0.61 KPa$.

and $\frac{t}{t_t} = \frac{p}{p_t}$

{ where t in Kelvin. }

$$\begin{cases} t = ap & \text{(1)} \\ t_t = ap_t & \text{(2)} \end{cases}$$

Q. match the following

List I (Thermometer)	List II (Thermometric prop.)
(a) mercy in glass	(1) EMF
(b) Thermo couple	(2) Resistance
(c) Thermistor	(3) Vol.
(d) const. vol. gas	(4) pressure

(a) → (3), (b) → (1), (c) → (2), (d) → (4)