Heat & Temperature.

Heat :- Heat is the form of energy which simulates our sense organ, so that we fell hot or cold.

The direction of heat energy transfer always takes place form warmer body to coller body.

- Heat is caused by the charge in internal energy of matter. Internal energy → sum of.

(i) Molecular kinetic energy :- Due to random motion of molecules

(ii) Molecular potential energy :- Due to intermolecular force that acts between molecules.

(iii) Other types of molecular energy.

Unit of Joule :- Joule in SI units & Calories in CGS units

Temperature :- It is degree of hotness or coldness of body. If two systems are in thermal equilibrium, they are at same temperature.

=) Difference Between Heat & temperature.

	Heat	Temperature.
(i)	Heat is the form of energy	Temperature is the degree of hotness or coldness.
(ii)	Units :- Joulse - SI, Calories - CGS	Units :- Kelvin - SI, Celcius (C) - CGS.
(iii)	It is cause	It is effects
(iv)	It is measure of total kinetic E of all molecules	It is measure of average kinetic E of all molecules.
(v)	Two bodies can be in thermal equilibrium without having same amount of heat.	Two bodies cannot be in thermal equilibrum if they are at different temperature.

-273°C is Absolute 0°,

Thermometry:

- Science of temperature & it's measurment.
- The instrument used to measure the temperature is called therometer.

⇒ Mercury Therometer :- Mercury is used as the therometric liquid Substances, One end of thermometer is sealed with mercury inside the wide bulb & it is connected with very narrow hair-like Capilary tube.

- The principle is that when the heat is given to mercury it expands through the Capiiry tube. & when heat is released it get Contracted.

- Advantage

(i) It's boiling point is 375°c & it's freezing point is -39°c So, it can measure over wide range of temperature.

(ii) It doesn't wet the surface of glass.

(iii) It's expansion rate is uniform.

(iv) It's Specific heat is very less, so that it needs less energy

- Disadvantage

(i) It can't be used below temp° -39°c & above 357°c So, it can be used at very cold region.

⇒ Alchol Thermometer.

- Construction is same as a mercury thermometer.
- Alchol is used as the thermometric Substances.

- Advantage

(i) It's boiling pt. 78°c & freezing point -117°c. So, it is Suitable in cold place

(ii) Its Sensitivity is very high i.e 7 times more sensitivy then meraury.

- Disadvantage

(i) It sticks the surfaces of glass.
(ii) It's expansion rate isn't uniform
(iii) It is transparent
(iv) It's specific gravity is lesser than that of mercury.

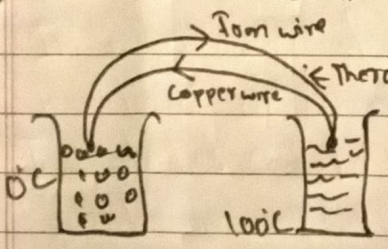
Types of thermometer.

(i) Liquid thermometer:- Liquid thermometer based on the principle of change in Vol^m with change in temperature.
eg:- mercury & Alchol thermometer.

(ii) Gas thermometer:- based on the principle of change in pressure & volume with change in thermometer.
eg - callender's constant pressure thermometer Constant volume hydrogen thermometer.
- Range :- -200°c to 1600°c.

(iii) Resistance Thermometer:- It is based on the principle of change in resistance with change in temperature
Range : -270°c to more than 700°c) ex:- platinum thermo

(iv) Thermoelectric Thermometer:- Based on principle of theromoelectric ity, ie. production of thermo emf in a thermocouple, when two Junctio are at different temp^r.
- Range: -270°c to 2300°c,

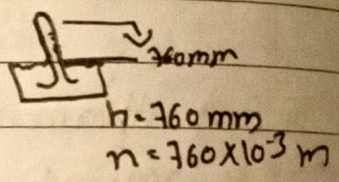


(v) Radiation Thermometer:- Based on quantity of radiation emitted by a body. These are also called pyrometer.
These thermometer measure very high temp^r.

(iv) Vapour thermometer pressure
- based on the principle of change in vapour pressure with change in temp^r
  Eg:- Helium vapour pressure thermometer (measure very low temp) Range 0.711K to 120 K

Temprature Scale:
- On the basic of two fixed pts, temp^r scale are prepared.
(i) lower fixed Point :- melting point of ice.
(ii) upper fixed point (UFP) :- boiling point of water {At NTP}

$P = h\rho g$
$= 760 \times 10^{-3} \times 13600 \times 9.8$
$= 1.01 \times 10^5$ pa.



(i) Celcius (centigrade) scale.
- LFP = 0°C & UFP = 100°C
- These two points are divided into 100 equal division
- 1 smalled div = 1°C,

(ii) Fahrenheit scale
- LFP = 32°F & UFP = 212°F
- These two points are divided in 180 division
- 1 smallest div = 1°F

(iii) Reaumer scale:
- LFP = 0°R & UFP = 80°R
- These points are divided in 80 division
- 1 Smallest div = 1°R

iv Kelvin Scale : (Absolute temperature)

- LFP = 273k & UFP = 373 k
- These two points are divided in 100 division
- 1 smallest division is = 1 k

Conversion of Temperature Scale

let, C, F, R & K be the temperature reading in Celcius, Fahrenhit, Reaumer & Kelvin respectively

Here,

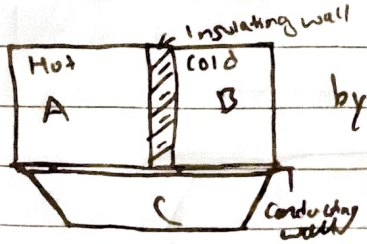
$$\frac{\text{Temp}^{\gamma} \text{ reading} - \text{L.F.P}}{\text{U.F.P} - \text{L.F.P}} = \text{Constant}$$

i.e $\frac{C-0}{100-0} = \frac{F-32}{212-32} = \frac{R-0}{80-0} = \frac{K-273}{373-273}$

⇒ The lowest possible temp$^{\gamma}$ of the matter in universe at which the K.E of the molecules of the matter is excatly equal to zero is called absolute zero temp$^{\gamma}$. At this temperature molecules of a body are completely at rest temp$^{\gamma}$ in celcius is $-273.15^{\circ}C$ which OK.

Thermal equilbrium :- when hot substances is placed in contact with cold substances, heat flows from hot body to cold body & affect after some time, the heat flow ceases & both attains common temp$^{\gamma}$ Then, the bodies are said to be in thermal equilbrium.

Zeroth law of thermodynamics



If a system A & System B are separated by the insulating wall. No heat will transfer from A to B

Again, let another system C which is connected with all the system with conducting wall. Now, A will be in thermal equilbrium with B, then, if the insulating wall is remove

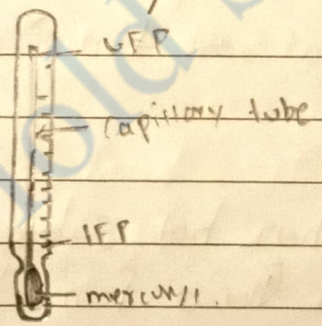
then, it is found that no further change in temp^{r} occurs bet^{n} System A & B.

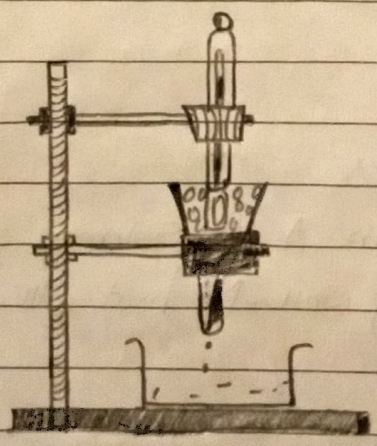
That means A & B are also in thermal equilibrium

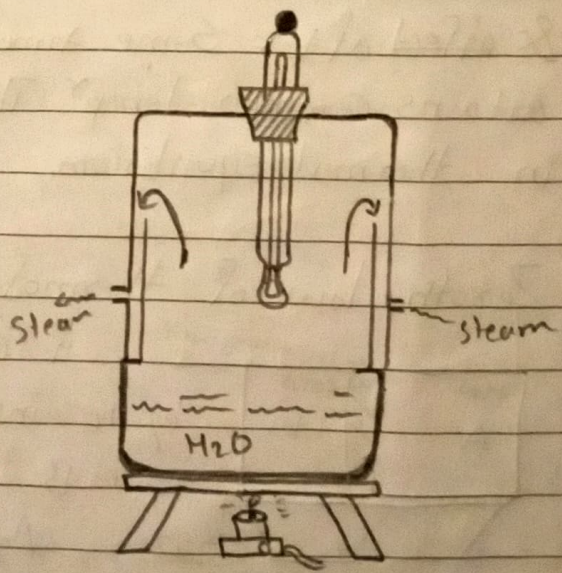
"If two System are in thermal equilibrium with third System, then that two system, must be in thermal equilibrium This is called Zeroth law of thermodynamics.

Construction & Calibration of mercury thermometer.

Construction:- The fine capillary tube of glass wide cylinder bulb is taken. Initally it is filled with mercury. It is now put in hot bath. So, that mercury expands & it push away the air out of the capillary until air particles escapes out. After that the upper end is sealed & thermometer is now cooled down Now, it Contain mercury & Vaccum only.







For calibrating the mercury thermometer. two fixed points are determined & marked.

(i) Lower fixed point :- marked as melting point of ice by placing therms. in ice.

(ii) Upper fixed point :- marked as boiling point of water by placing the thermometer in hypsometer, where water is boiled As per requirement, the interval bet^n LFP & UFP is equally divided according to the temperature scale.

For suppose, In centigrade scale LFP is taken 0°C & UFP is taken 100°C the internal bet^n them 100 equal division. each one division represents one degree.

Q. At what point the thermometric scale does kelvin scale Reading Coinside with Fahrenhit Scale reading ?

Sol^n//

where = K=F = x (let)

$$\frac{K-273}{100} = \frac{F-32}{180}$$

$$\text{or } \frac{9(x-273)}{5} = x-32$$

$$\text{or } 9x - 2457 = 5x - 160$$

$$\text{or } 4x = 2297$$

$$\therefore x = 574.75$$