CALORIMETRY

HEAT - Heat is the internal energy of molecules constituting the body. It flows from a hot body to a cold body when they are kept in contact.

It is represented by Q.

S.I. unit ⇒ joule (J)

Other units - 1 calorie = 4.2 J

$1 kcal = 10^3 cal = 4.2 \times 10^3 J$

NOTE - The measurement of the quantity of heat is called calorimetry.

TEMPERATURE - It is the measure of hotness or coldness of any body.

S.I. unit ⇒ kelvin (K)

Other units ⇒ celcius (°C), fahrenheit (°F)

$$T(K) = T(°C) + 273.15$$
$$\Delta T(°C) = \Delta t(K)$$

Factors affecting the quantity of heat absorbed to increase the temperature of a body -

1) mass of body (m)
2) increase in temperature of body Δt
3) material of the body.

$Q \propto m$ $Q \propto \Delta t$

$$Q = cm\Delta t$$

c = specific heat capacity

THERMAL CAPACITY OR HEAT CAPACITY - (C)

Amount of heat energy required to raise the temperature of a body by 1°C (or 1K).

It is denoted by C.

$$\text{Heat capacity } (C) = \frac{\text{Heat supplied } (Q)}{\text{rise in temperature } (\Delta t)}$$

S.I. unit ⇒ $J K^{-1}$ or $J °C^{-1}$

SPECIFIC HEAT CAPACITY - (c)

Amount of heat energy required to raise the temperature of unit mass of the substance through 1°C (or 1K).

$$c = \frac{\text{Amount of heat energy supplied}}{\text{Mass} \times \text{rise in temperature}}$$

$$c = \frac{Q}{m\Delta t}$$

S.I. unit ⇒ $J kg^{-1} K^{-1}$ or $J kg^{-1} °C^{-1}$

Relationship between C and c -

$$C = m \times c$$

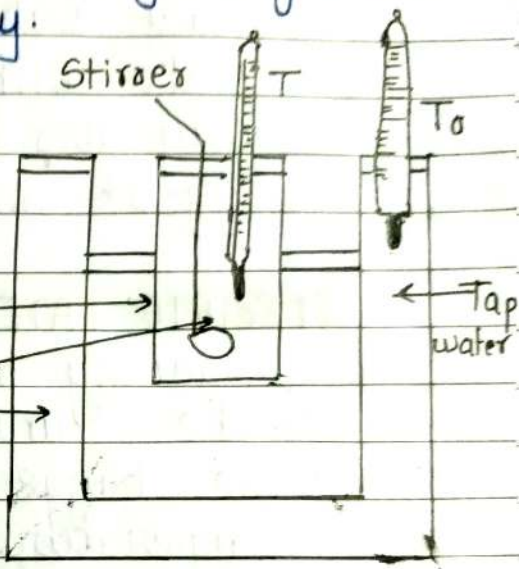
Specific heat capacity (c) → Low ⇒ Conductor

Specific heat capacity (c) → High ⇒ Poor conductor

Water has an unusually high specific heat capacity ($= 4200 J kg^{-1} K^{-1}$)

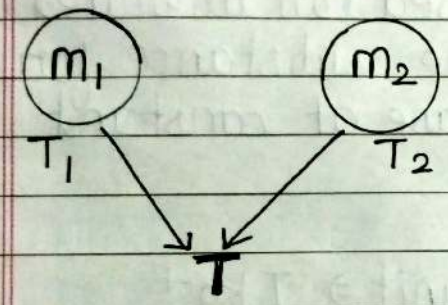
CALORIMETER -

It is a cylindrical vessel which is used to measure the amount of heat gained (or lost) by body when it is mixed with the other body.



Principle -

Heat lost by hotter body = Heat gained by colder body

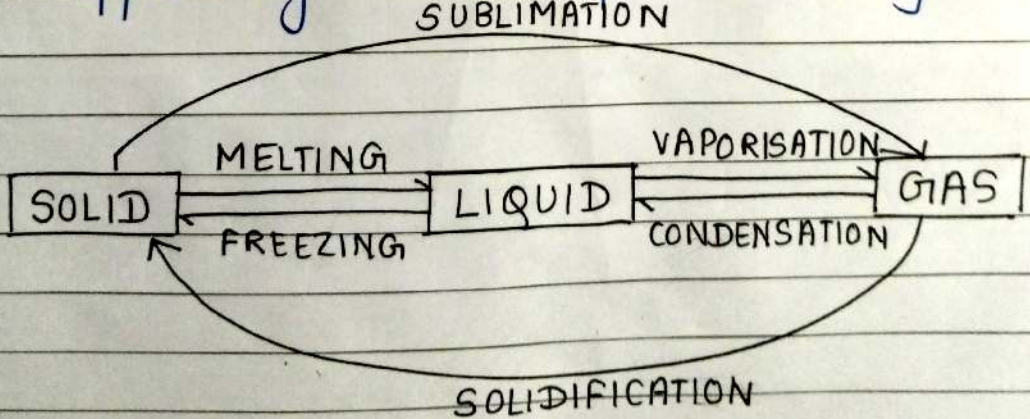


Heat lost (Q_1) = Heat gained (Q_2)

$$m_1 c_1 (T_1 - T) = m_2 c_2 (T - T_2)$$

CHANGE OF PHASE (STATE) -

The process of converting one state of substance into another state is known as change of state of substance. It happens by heat absorption or rejection.



LATENT HEAT -

It is the hidden amount of heat that is given out or taken by the unit mass of any substance to change its state without change in temperature.

- It may also be called as change in potential energy of molecules.

SPECIFIC LATENT HEAT -

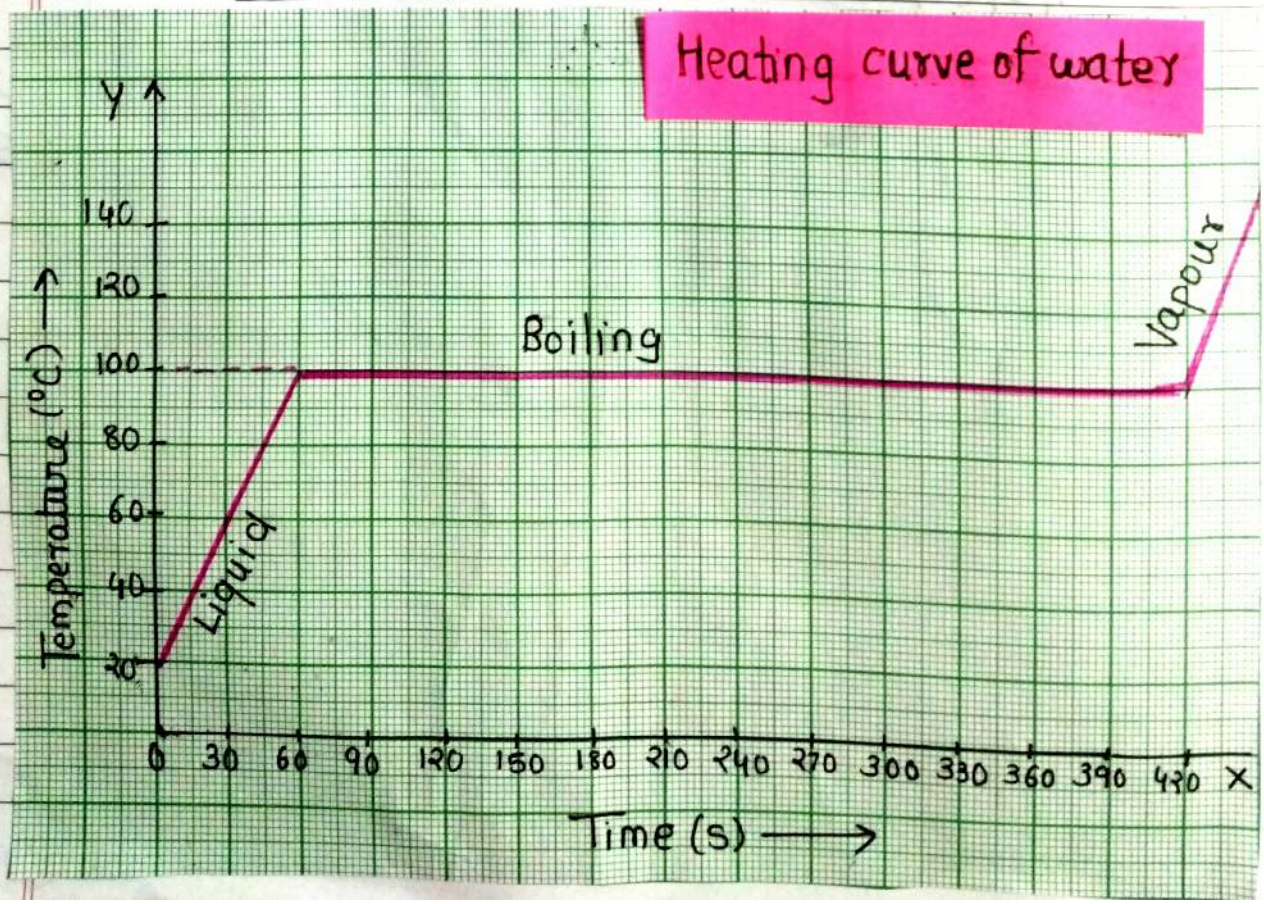
Quantity of heat absorbed (or liberated) by the unit mass of the substance for the change in its phase at constant temperature.

It is denoted by L.

S.I. unit ⇒ $J\,kg^{-1}$

Other unit ⇒ $cal\,g^{-1}$, kcal/kg

$$L = \frac{Q}{m}$$



FORMULA SHEET

1) $T(K) = T(^{\circ}C) + 273.15$

2) $Q = mc\Delta t$ [Heat energy]

3) $C = \frac{Q}{\Delta t}$ [Heat capacity]

4) $c = \frac{Q}{m\Delta t}$ [Specific Heat Capacity]

5) $C = m \times c$ [Relation b/w C and c]

6) $m_1 c_1 (T_1 - T) = m_2 c_2 (T - T_2)$ [Principle of calorimetry]

7) $L = \frac{Q}{m}$ (Specific Heat capacity)