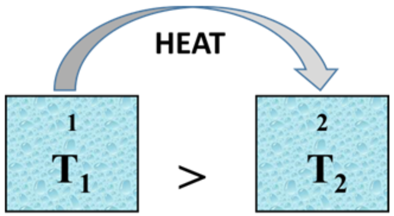
MIND MAP

Calorimetry

Heat
Transfer of energy that takes place solely due to temperature difference is called Heat flow or Heat transfer and the amount of energy transferred is called Heat.



Unit of Heat is

Joule & Calorie

1 Calorie = 4.18 J

Dimensions are ML^2T^{-2}

Calorie
1 calorie is the amount of heat required to raise the temperature of 1 gm of water from 14.5°C to 15.5°C at 1 atm pressure.

Thermal Equilibrium
Two bodies are said to be in thermal equilibrium when no heat flows between them.

If two bodies are in thermal equilibrium with each other then their temperature is same.

Zeroth Law of Thermodynamics
If bodies 'A' & 'B' are in thermal equilibrium with each other & bodies 'B' & 'C' are in thermal equilibrium with each other then bodies 'A' & 'C' must be in thermal equilibrium with each other.

If two bodies are in thermal equilibrium with each other then their temperature is same.

$\Delta Q \propto \Delta T$ $\quad$ $\Delta Q \propto m$

$\Delta Q = ms\Delta T$

$\downarrow$

Specific Heat Capacity

Specific Heat Capacity(s)
$\Delta Q = ms\Delta T$ $\quad$ $s = \frac{\Delta Q}{m\Delta T}$

Specific Heat Capacity of a substance is defined as heat required to raise a unit temperature of a unit mass of the substance.

$s = \frac{\Delta Q}{m\Delta T}$ $\quad$ SI unit : Joule/kg–K

$s = \frac{\Delta Q}{m\Delta T}$ $\quad$ CGS unit : cal/g –°C $\quad$ $\rho = \frac{M}{V}$

Specific heat capacity of water

$s_{water} = 1$ cal/g – °C

= 1 cal / g – K

= 4200 joule / kg – K

Heat Capacity
Heat capacity (C) = mass × specific heat capacity

C = ms

$\Delta Q = C\Delta T$

Molar Heat Capacity
Heat required to raise the temperature of 1 mole of substance by 1°C.

Isolated System
A system is said to be isolated if no exchange or transfer of heat can take place to and from the surrounding.

Principle of Calorimetry
According to this- In an isolated system heat lost by the part at higher temperature is equal to heat gained by the part at lower temperature.

This is based on energy conservation principle

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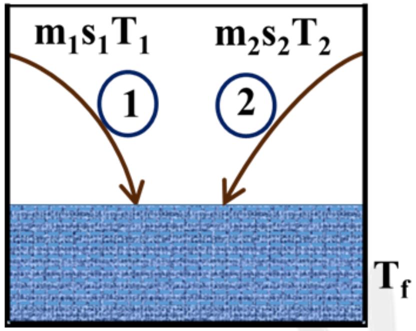
Calorimetry

Principle of Calorimetry

In an Isolated System $T_2 > T_1$

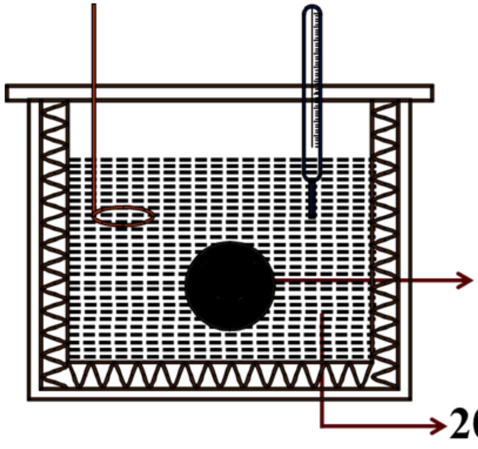
Heat gain = Heat loss

$$m_1s_1(T_f - T_1) = m_2s_2(T_2 - T_f)$$

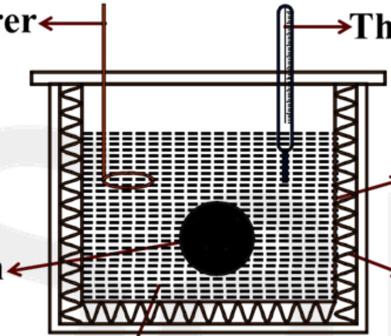


Σ Heat gain = 0

$$m_1s_1(T_f - T_1) + m_2s_2(T_f - T_2) = 0$$



Calorimeter

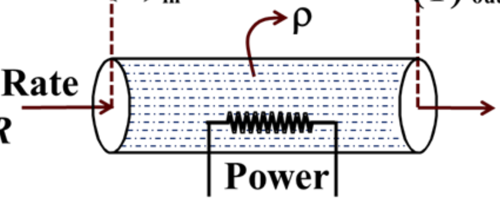


$$m_c s_c = m_{w\,eq}\, s_w$$

Water Equivalent

$$s_w\,(T_f - 20)\,(m_w + m_{w\,eq}) = m_i s_i\,(100 - T_f)$$

Flow Calorimeter



$$\Delta Q = ms_L\Delta T$$

$$\frac{\Delta Q}{\Delta t} = \frac{ms_L\Delta T}{\Delta t}$$

$$P = \rho\underbrace{\left(\frac{\text{volume}}{\Delta t}\right)}_{\text{Flow Rate}} s_L(\Delta T)$$

$$\boxed{P = \rho R s L(\Delta T)}$$

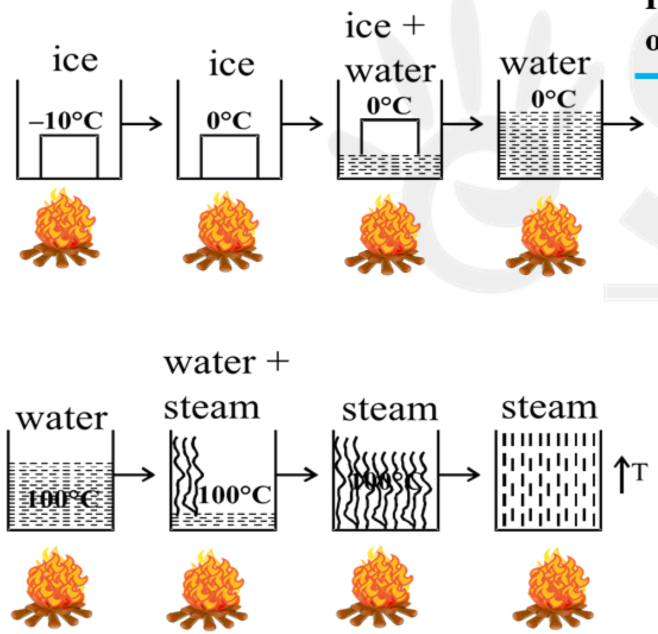
MIND MAP

Calorimetry

Change of State

During the change of state temperature of substance do not change on supplying the heat.

Both solid & liquid state (or liquid & vapor state) of the substance co-exist at thermal equilibrium during the change of state.



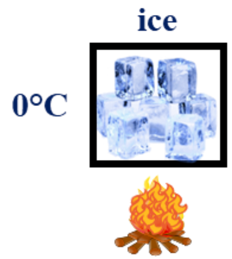
Latent Heat

$\Delta Q \propto m$

$\Delta Q = mL$ Latent Heat

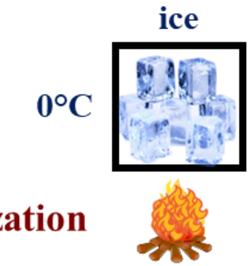
$L = \frac{\Delta Q}{m}$

It is the heat required to change the state of unit mass



Latent heat of fusion

Latent heat of fusion for ice = 80 cal/g



Latent heat of vaporization

Latent heat of vaporization for water = 540 cal/g

Graph Between T v/s Heat Supplied