CHAPTER-1
HEAT

A) Concept of Hotness and Coldness

Fig -1

Fig -2

When heat energy enters your body you get a feeling of hotness

When heat energy flows out of your body you get a feeling of coldness.

B) Temperature: The degree of hotness or coldness of the object is known as "Temperature"

It is denoted by **T**

Unit of Temperature: The S.I unit is **Kelvin(K)**

Also expressed in **Celsius(^{0}C)**

Relation between Kelvin and Celsius: K = C + 273 (OR) C = K - 273

Q: Convert 20^{0}C into Kelvin scale.

Given C= 20^{0}C K= ?

We know that K= C+273

= 20+273

= 293K

Q: Convert 300K into Celsius scale.

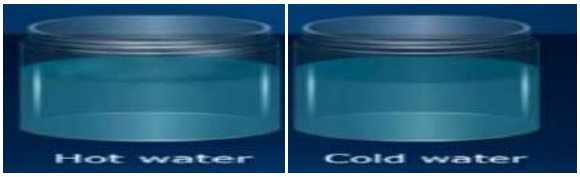
Given K=300K C=?

We know that C= K-273

=300-273

=27^{0}C

C) Thermal equilibrium



When two bodies are placed in thermal contact , heat energy will be transferred from the hotter body to the cold body. This transfer of heat energy continues till both bodies attain the same degree of hotness or coldness. At this stage, we say that the bodies have achieved "thermal equilibrium". The state of thermal equilibrium denotes a state of a body where it neither receives nor gives out of heat energy.

D) Heat: " Heat is a form of energy in transit, that flows from a body at higher temperature to a body at lower temperature" (OR)

"Heat is the energy that flows from a hotter body to a colder body"

It is denoted by **Q**

Unit of Heat: The S.I unit is **Joule(J)**

The C.G.S unit is **Calorie(cal)**

Relation between Joule and Calorie: **1 cal = 4.186 Joules**

E) Difference between Heat and Temperature

Heat	Temperature
1.Heat is the energy that flows from a hotter body to a colder body	1.The degree of hotness or coldness of the object is known as temperature
2.It is denoted by 'Q'	2.It is denoted by 'T'
3.S.I unit is Joule	4. Scalar Quantity

F) Heat depends upon

i) When change in temperature(ΔT) is constant the amount of heat(Q) absorbed by a substance is directly proportional to its mass(m)

$$Q \alpha m \quad \text{------(1)}$$

ii) When mass(m) is constant the amount of heat(Q) absorbed by a substance is directly proportional to its change in temperature(ΔT)

$$Q \alpha \Delta T \quad \text{------(2)}$$

From (1) and (2)

$$Q \alpha m \Delta T$$

$$Q = mS\Delta T$$

Where **'S'** is called **Specific heat** of the substance

G) Specific heat: The amount of heat required to raise the temperature of unit mass of the substance by 1^0C.

Formula: S= Q/mΔT

Unit of Specific heat(S): The S.I unit is **J/kg-K**

The C.G.S unit is **cal/g-^{0}C**

Relation between J/kg-K and cal/g-^{0}C **: 1 cal/g-^{0}C = 4.186x10^3 J/kg-K**

Substance	Specific heat	
	In cal/g-°C	In J/kg-K
Lead	0.031	130
Mercury	0.033	139
Brass	0.092	380
Zinc	0.093	391
Copper	0.095	399
Iron	0.115	483
Glass(flint)	0.12	504
Aluminum	0.21	882
Kerosene oil	0.50	2100
Ice	0.50	2100
Water	1	4180
Sea water	0.95	3900

From the above table, we observe that the rise in temperature depends on the nature of the substance(Specific heat of a substance depends on its nature). If specific heat is high, the rate(or fall) in temperature is low for same quantity of heat supplied.

Applications of Specific heat capacity

1. The oceans behave like heat "store houses" for the earth. They can absorb large amounts of heat at the equator without appreciable rise in temperature, maintaining a relatively constant temperature and stabilizing atmosphere temperature during winter and summer seasons.
2. Water melon brought out from the refrigerator retains its coolness for a longer time than any other fruit because it contains a large percentage of water.
3. A samosa appears to be cool outside but it is hot when we eat it because the curry inside the samosa contains ingredients with higher specific heat.

H) Method of mixtures

$$T = \frac{m1T1 + m2T2}{m1 + m2}$$

I) Principle of method of mixtures:- Net heat lost = Net heat gain

J) LAB ACTIVITY: Determination of Specific heat of a solid

Aim: To find the specific heat of given solid

Material required: calorimeter, thermometer, stirrer, water, steam water, wooden box and lead shots (or) iron bolt

Procedure:

Step-1:

Mass of the calorimeter(m_1)=….

Temperature of the calorimeter(T_1)=..

Let specific heat of calorimeter = S_c

Step-2:

Now fill 1/3rd of the volume of calorimeter with water.

Mass of the calorimeter + water = m_2

Mass of the water= $m_2 - m_1$

Temperature of the water(T_1)=…..

Let specific heat of water= S_w

Step-3:

Take a few lead shots and place them in hot water or steam water.

Temperature of the lead shots(T_2)=..

Let specific heat of lead shots = S_l

Step-4:

Transfer the hot lead shots quickly into the calorimeter.

Mass of the calorimeter + water + lead shots = m_3

Mass of lead shots = m_3-m_2

After some time

Temperature of calorimeter+ water+ lead shots = T_3

According to **Principle of method of mixtures**

Heat lost by the solid (lead shots) = Heat gain by the calorimeter + Heat gain by the water

$$(m_3 - m_2)\, S_l (T_2 - T_3) = m_1 S_c (T_3 - T_1) + (m_2 - m_1) S_w (T_3 - T_1)$$

$$S_l = \frac{[m_1 S_c + (m_2 - m_1) S_w]\,(T_3 - T_1)}{(m_3 - m_2)(T_2 - T_3)}$$

Note: 1. This chapter content prepared based on Academic Calendar 2020-2021

2. Class room activities of teacher: Explain about hotness and coldness, Difference between heat and temperature&Thermal Equilibrium, Dependable factors of heat (mass, change in temperature) Activity-6, Specific heat & Applications, Method of mixture, Find the specific heat of solids (Lab Activity)
3. Questions are from Class room activities and Self learning activities
4. Need not give importance to Optional activities (i.e. Deleted syllabus from the chapter)

M.SRINIVASA RAO, SA (PS) AGKMH SCHOOL GUDIVADA PH: 9848143855

srini science mind