SHIKSHA CLASSES

Subject : Science -I	**Answer Paper**	Total Marks : 20
Class : X	5. Heat	

Q.1 A : Choose the correct alternative :   2

Ans. :
1) The amount of water vapour in air is determined in terms of its **humidity.**
2) During transformation of liquid phase to solid phase the latent heat is **Solidification.**

B. Solve the following questions. (Any One).   1

1) **State whether the following statement is true or false.**
   During transition of solid phase to liquid temperature of object increases.

Ans. : False

2) **Complete the analogy.**
   SI unit of heat : _____ : : CGS unit of heat : _____

Ans. : SI unit of heat : **J** : : CGS unit of heat : **Calorie.**

3) **Define one cal heat.**

Ans. : **One cal heat :**
The amount of heat necessary to raise temperature of lg of water by 1^0C from 14.5^0C to 15.5^0C is called 1 cal heat.

Q. 2 : A) Give scientific reason. (Any One)   2

1) **Aquatic plants and animals can survive even when atmospheric temperature goes below 0^0C.**

Ans. :
i) Water expands on heating and contracts on cooling. When water contracts its density increases as the volume decreases.
ii) Water behaves like normal liquid up to 4^0C. But when it s cooled from 4^0C to 0^0C it expands instead of contracting. Hence its volume increases.
iii) When temperature of lakes start getting cold water on upper side in contact with air falls to 4^0C. Thus its density increases as volume decreases and starts to move in bottom.
iv) This happens till all temperature falls till 0^0C. At 4^0C water expands instead of contracting and moves up as density is decreased. So water at top becomes 0^0C and converts into ice - But water below ice still remains at 4^0C.

Thus aquatic plants and animals can survive even when temperature goes below 0^0C due to anomalous behaviour of water.

2) **During winter season a white trail at back of flying plane is observed in a clear sky.**

Ans. :
i) When a plane flies in the air the vapour released by by the aeroplane engine condenses and forms clouds.
ii) The relative humidity i.e. vapour content in air to make it saturated gets more because of condensation.
iii) Thus air there becomes greater than the dew point temperature and thus leads to formation of clouds.

iv) If air is having more relative humidity then it takes long time for white trail to disappear.

v) If the relative humidity is less the size of white trail may be small or it may even not get formed.

Q. 2 : B) Solve the following question (Any Two) 4

1) How much heat energy is necessary to raise the temperature of 5kg of water from 20^0C to 100^0C?

Ans. : **Given :** m = 5kg, C=1 Kcal / Kg^{0}C & $\Delta T = 100 - 20 = 80^0 C$

Energy to be supplied to water = energy gained by water

= mass of water x specific heat of water x change in temperature of water

$= m \times c \times \Delta T$

$= 5 \times 1 \times 80^0 \, C$

$= 400 \, Kcal$

2) Write down the units of specific heat capacity.

Ans. : The SI unit is J/^{0}C kg. The CGS unit is cal/g^{0}C

3) What is relative humidity & % relative humidity?

Ans. : The ratio of actual mass of vapour content in the air for a given volume & temperature to that required to make the air saturated with vapour at that temperature is called the relative humidity.

$$\% \, Relative \, humidity = \frac{actual \, mass \, of \, vapour \, content \, in \, air}{Mass \, of \, vapour \, needed \, to \, make \, air \, saturated} \times 100$$

4) What is the dew point temperature?

Ans. : When unsaturated air at a certain temperature is taken and it's temperature is decreased a temperature is reached at which the air becomes saturated with vapour. This temperature is called the dew point temperature.

Q. 3 : Solve the following questions. (Any Two) 6

1) Explain Regelation.

Ans. : The phenomenon in which the ice converts to liquid due to applied pressure and then reconverts to ice once the pressure is removed is called regelation. The melting point of ice becomes lower than 0^0C due to pressure. This means that at 0^0C, the ice gets converted into water. As soon as the pressure is removed, the melting point is restored to 0^0C & water gets converted into ice again.

2) Explain the role of latent heat in change of state of a substance.

Ans. : i) The heat energy required to convert a solid into liquid or a liquid into vapour without the change of temperature is called as latent heat.

ii) When a solid is heated it gets transformed to liquid phase during this transition the object absorbs heat energy but its temperature does not increase.

iii) This heat energy absorbed at constant temperature is called as latent heat. This latent heat is given of in solids to transform in to liquid phase and is called latent heat of fusion.

iv) Similarly when liquid is heated from 0^0C to 100^0C the heat energy is absorbed at constant temperature i.e. latent heat is given of in liquid to gas state transition. This is called called as latent heat of vaporisation.

3) A Calorimeter has mass 100g and specific heat 0.1 kcal/kg 0C. It contains 250 gm of liquid at 30^0C having specific heat of 0.4 kcal/kg^{0}C. If we drop a piece of ice of mass 10g at 0^0C what will be the temperature of mixture.

Ans. : **Given :**

$M_{cal} = 100g$
$C_{cal} = 0.1 \text{ k cal/ kg }^0C$
$M_{liq} = 250 \text{ gm}$
$C_{liq} = 0.4 \text{ k cal/kg }^0C$
$M_{ice} = 10g$

To find T(mix) = ?

Suppose the liquid and the ice mixture attain final temperature T Here

Heat gained by ice = heat lost by liquid + heat lost by Calorimetor.

∴ Heat gained to convert ice at 0^0C to Water at 0^0C

$$= M_{ice} \times C_{ice} \times \text{latent heat}$$
$$= 10 \times 1 \times 80$$
$$= 10 \times 80$$

latent heat of fusion of ice = 80 cal/g

Heat gained to convert water at 0^0 to attain temprature T

$$= M_{ice} \times C \times (0 + T)$$
$$= 10 \times 1 (0 + T)$$
$$= 10 \text{ T}$$

Total heat gained by ice = $10 \times 80 + 10 \text{ T}$

Heat lost by liquid $= M_{liq} \times C_{liq} \times (30 - T)$
$$= 250 \times 0.4 \times (30 - T)$$

By principle of heat exchange

Heat gained by ice = heat lost by liquid + heat lost by calorimeter.

$$10 \times 80 + 10T = 250 \times 0.4 \times (30 - T) + 100 \times 0.1 \times (30 - T)$$
$$800 + 10T = 100 (30 - T) + 10 (30 - T)$$
$$800 + 10T = (100 + 10) (30 - T)$$
$$800 + 10T = 110 \times 30 - 110T$$
$$800 + 10T = 3300 - 110T$$
$$120T = 3300 - 800$$

$$T = \frac{2500}{120}$$

$$T = 20.8^0C.$$

4) **Which principle is used to measure specific heat capacity of a substance?**

Ans. : i) The principle of heat exchange is used to measure specific heat capacity of a substance, states that

"Energy lost by hot Object = Energy gained by cold object"

ii) The specific heat of a substance is measured using mixing method for this calorimeter is used.

iii) It hot solid object is put in water in a calorimeter heat exchange between hot object and water and calorimeter starts. This continues till the temprature of solid object water and calorimeter becomes equal.

iv) Heat lost by hot object = heat gained + heat gained by calorimeter (Q2)
   (Q)   by water (Q1)

∴ Q = Q 1 + Q 2

Of specific heat of water and calorimeter are known specific heat of solid object can be calculated.

Q. 4 : Solve the following question. (Any One) 5

    1)   Explain the following temperature v/s time graph.

Ans. : 1) Line AB represents conversion of ice into water at constant temperature i.e. latent heat of fusion.

      2) Till the transition of ice into liquid is completed temperature remains constant because during this energy is absorbed in weakening the bonds.

      3) Line BC in the graph represents rise in temperature of water 0^0C to 100^0C

      4) Thereafter it's temperature doesn't rise till the total water is transformed into gas.

      5) Here line CD is representing the constant temperature where boiling takes place. i.e. latent heat of vapourization
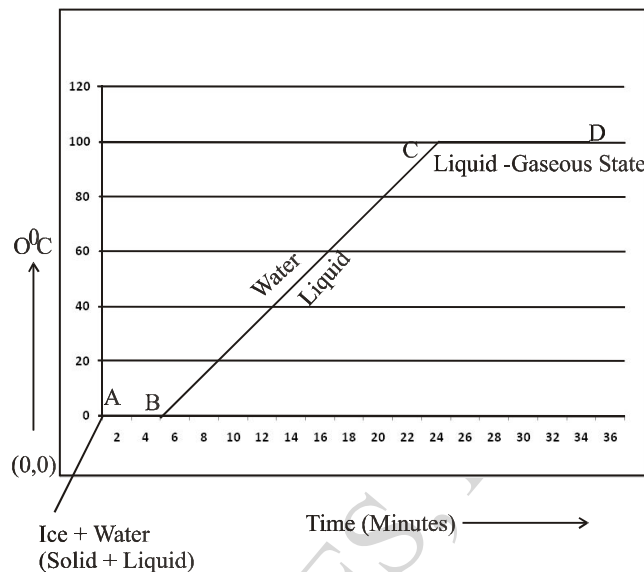

    2) What is meant by specific heat capacity? How will you prove experimentally that different substances have different specific heat capacities.

Ans. : **Specific heat capacity :** The amount of heat energy required to raise the temperature of a unit mass of an object by 1^0C is called the specific heat capacity of that object.

    We can prove that different substances have different specific heat with the help of following experiment –

    1) Take three spheres of Iron, copper & lead of equal mass.

    2) Put all of them in boiling water.

    3) Put them immediately on thick of slab of wax.

    4) Note the depth of each sphere goes into the wax
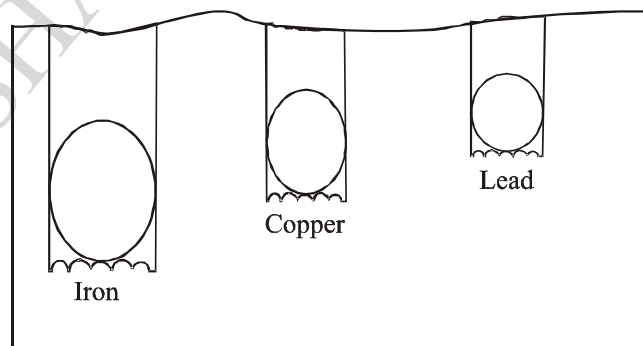
        The sphere which absorbs more heat will give more heat to wax and go deeper in the wax. Thus from the diagram ball made from iron has gone deeper so it has a high specific heat capacity in comparison to others.

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