SHIKSHA CLASSES

Sub. : Science **Answer Paper** **Marks : 20**

Std. : VIIIth - S.B. **14. Measurement and Effects of Heat**

Q.1(A) : Choose the correct alternative **2**

1) 32°F is equal to …….. .

Ans : c) 273.15 K

2) The boiling point of water is …… .

Ans : b) 212 °F

Q.1(B) : Solve any one of the following question 1

1) Write true or false.

Atoms of a solid are free

Ans : False

2) Find the odd one out

373.15K , 100^{0}C, 212^{0}F, 32^{0}F

Ans : 32^{0}F

3) Write the unit of Specific heat .

Ans : J/Kg.^{0}C

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

1) Mercury has been replaced by alcohol in a thermometer.

Ans : Mercury has been replaced by alcohol in a thermometer because mercury is harmful for us, it has been replaced by alcohol in a thermometer.

2) Rails have gaps at specific distances.

Ans : The rails expand in summer due to increase in the temperature of the atmosphere. Also, they expand due to rise in temperature caused by the friction between the rails and the wheels of the running train. If there is no gap between successive rails of a railway line, the rails would bend due to expansion. This bending and twisting of the rails would cause accidents. Hence, a gap is kept between successive rails of a railway line to make provision for their expansion in summer.

Q.2(B): Solve any two of the following question. 4

1) Nishigandha kept a vessel containing all the ingredients for making tea in a solar cooker. Shivani kept a similar vessel on a stove. Whose tea will be ready first and why?

Ans : Shivani's tea will be ready first because in a given time, the amount of heat received by the vessel on a stove is greater than that received by the vessel kept in a solar cooker.

2) When a substance having mass 3 kg receives 600 cal of heat, its temperature increases by 10 °C. What is the specific heat of the substance?

Ans : Data: m = 3 kg = 3000 g,

Q = 600 cal, ΔT = 10 °C, c = ?

$Q = mc\Delta T$

$$\therefore \quad c = \frac{Q}{m\Delta T} = \frac{600 \text{ cal}}{3000 \text{ g} \times 10^0 \text{C}}$$

= 0.02 cal/(g.°C)

This is the specific heat of the substance.

3) What is the difference between heat and temperature ? what are their units.

Ans : Heat is related to the total kinetic energy of the atoms in a substance while temperature is related to the average kinetic energy of the atoms in the substance. Heat flows from a body at higher temperature to a body at lower temperature. Thus, temperature is a quantity that determines the direction of flow of heat. It is a quantitative measure of the degree of hotness or coldness of a body.

Higher temperature does not mean higher heat content. Suppose a vessel A contains 2 litres of water at 90 °C and a vessel B contains 100 ml of water at 91 °C. Then the heat content of water in A is greater than that of water in B, but the temperature of water in B is higher than that of water in A.

Units of heat:

Heat is usually expressed in calorie, kilocalorie and joule. It can also be expressed in erg as heat is a form of energy.

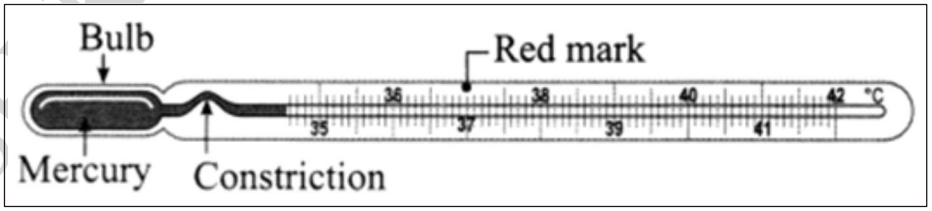
4)What is the relation between the temperature in °C and the temperature in ^{0}F?

Ans : $\frac{F-32}{9} = \frac{C}{5}$ where C denotes temperature in °C and F denotes temperature in °F.

Q.3 : Solve any two of the following question. 6

1) Describe a clinical thermometer. How does it differ from the thermometer used in a laboratory?

Ans : A clinical thermometer has a narrow stem and a long bulb filled with mercury (or alcohol). There is a small constriction in the stem above the bulb. When the bulb of the thermometer is held in the armpit or the mouth of a patient, the mercury (or alcohol) in the bulb rises in the stem.When it is taken out of the patient's body, the small constriction does not allow the mercury (or alcohol) from the stem to retreat into the bulb. Thus, this arrangement enables us to read the temperature of the patient's body at ease after the removal of the thermometer from his body.The clinical thermometer is graduated from 35 °C to 42 °C (or from 95 °F to 108 °F). At 37 °C (98.6 °F), there is a red arrow mark which indicates the temperature of a healthy person.



Clinical thermometer

The thermometer used in a laboratory has wider range and does not have constriction like a clinical thermometer.

2) At 15^0C **the height of Eifel tower is 324 m. If it is made of iron, what will be the increase in length in cm, at 30^0C?**

Ans :

$\Delta T = 30\ °C - 15\ °C = 15\ °C,$

$l_1 = 324$ m,

λ for iron $= 11.5 \times 10^{-6}$ / °C

$l_2 - l_1 = \lambda l_1 \Delta T$

$= 11.5 \times 10^{-6}$ / °C $\times$ 324 m $\times$ 15 °C

$= 55890 \times 10^{-6}$ m

$= 55890 \times 10^{-6} \times 10^2$ cm

$= 55890 \times 10^{-4}$ cm $= 5.589$ cm (nearly 5.6 cm)

This is the increase in the length, i.e., the increase in the height of Eiffel Tower

3) Explain with the help of formulae the expansion coefficients of liquid .

Ans : A liquid is held in a container. When it is heated, both the container and the liquid expand. The expansion of the container is usually very small compared to that of the liquid in it. Often, it can be ignored.

Suppose a liquid is heated so that its temperature rises by ΔT (very small) and its volume increases from V1 to V2. Experimentally, it is found that the increase in volume, V2 – V1, is proportional to V1 and ΔT Hence, $(V_2 - V_1) \alpha V_1 \Delta T$

$\therefore V_2 - V_1 = \beta V_1 \Delta T$, where β is a constant of proportionality called the volumetric expansion coefficient of the liquid.

$\beta = \dfrac{V2 - V1}{V1 \Delta T}$ .It is expressed in per °C.

We have $V_2 = V_1 + \beta V_1 \Delta T = V_1 (1 + \beta \Delta T)$.$\beta$ is the increase in the volume of a liquid per unit original volume per unit rise in its temperature.

4) Define coefficient of linear expansion of a solid .Write the formula for it and its unit.

Ans : Coefficient of linear expansion of a solid is defined as the increase in the length of a rod of the solid per unit initial length per unit rise in its temperature.

Coefficient of linear expansion of a solid,

$\lambda = \dfrac{l_2 - l_1}{l_1 \Delta T}$, where l1 and l2 are respectively the initial and final length of the rod of the solid and ΔT is the rise in its temperature.

$$\text{Unit of } \lambda = \frac{\text{unit of length}}{\text{unit of length} \times \text{unit of temperature}}$$

Q.4 : Solve any One of the following question. 5

1) Explain the construction of a calorimeter. Draw the necessary figure.

Ans : Calorimeter

A device used for heat measurement is called a calorimeter.

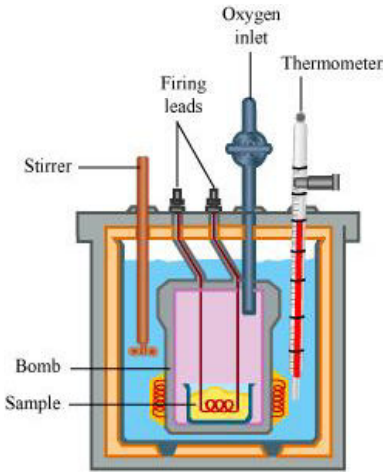
Construction of a Calorimeter

It consists of a metallic vessel and stirrers. They are made of copper or aluminium.

The vessel is then kept inside a wooden jacket which contains heat-insulating materials.

The outer wooden jacket acts as a heat shield, and reduces the heat loss from the inner vessel.

The outer jacket has an opening through which a mercury thermometer is inserted into the calorimeter.



2) How will you determine the specific heat of a metal using a calorimeter.

Ans : 1. Find the mass (m_i) of the iron ball.

2. Find the total mass (m_c) of the calorimeter (metal container) and the stirrer.

3. Fill the calorimeter to two-thirds of its capacity with water and find its mass (m'c) along with the stirrer. Hence, find the mass (mw) of the water in the calorimeter ($mw = m'_c - m_c$).

4. Keep the calorimeter in the wooden box and note the temperature (T_1) of the water in the calorimeter with the thermometer.

5. Suspend the iron ball in water in a beaker. Heat the beaker so that the water starts boiling. Note the temperature (T_2) of the boiling water.

6. Transfer the iron ball quickly to the calorimeter and cover the calorimeter with the lid immediately.

7. Stir the water in the calorimeter gently and continuously for uniformity of temperature and note the maximum temperature (T_3) attained by the mixture.

8. Find the specific heat capacity of iron using the following formula:

heat lost by the iron ball = heat gained by the calorimeter, stirrer and water

$$\therefore m_i c_i (T_2 - T_3) = (m_c c_c + m_w c_w)(T_3 - T_1)$$

$$\therefore c_i = \frac{(m_c c_c + m_w c_w)(T_3 - T_1)}{m_i (T_2 - T_3)}$$

Where c_c = specific heat of the material of the calorimeter and stirrer and c_w = specific heat of water.

Hence, the specific heat of iron (c_i) can be determined when other quantities are known.

* * *