Thermal Properties of Matter

1 A faulty thermometer shows 5°at the freezing point and shows 95°at the boiling point. This thermometer reads the temperature of a body as 59°. Then the correct temperature on Celsius scale is

(a) 48.6° (b) 58° (c) 59° (d) 60°

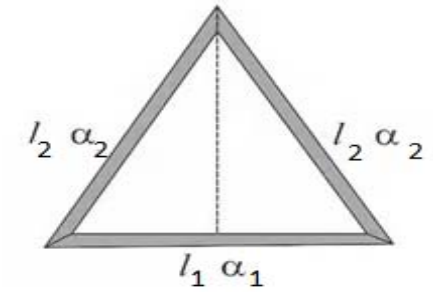
2 Coefficient of linear expansion of brass and steel rods are α_1 and α_2. Lengths of brass and steel rods are l_1 and l_2 respectively. If ($l_2 - l_1$) is maintained same at all temperature, which one of the following relations holds good?

(a) $\alpha_1 l_2 = \alpha_2 l_1$ (b) $\alpha_1 l_2^2 = \alpha_2 l_1^2$ (c) $\alpha_1^2 l_2 = \alpha_2^2 l_1$ (d) $\alpha_1 l_1 = \alpha_2 l_2$

3 Two rods, one of aluminum and the other made of steel, having initial lengths l_1 and l_2 are connected together to form a single rod of length $l_1 + l_2$. The co-efficient of linear expansion for aluminum and steel are α_a and α_s respectively. If the length of each rod increases by the same amount when their temperature is raised by t^0 c, then find the ratio $l_1 / (l_1 + l_2)$

A $\frac{\alpha_A}{\alpha_A + \alpha_S}$ B $\frac{\alpha_S}{\alpha_A}$ C $\frac{\alpha_A}{\alpha_S}$ D $\frac{\alpha_S}{\alpha_A + \alpha_S}$

4 An isosceles triangle made up of thin rods is made such that the distance between the apex and the mid-point of the base remains unchanged with temperature. Find the relation between l_1 and l_2 in terms of α_1 and α_2.



(a) $2\sqrt{(\alpha_1 / \alpha_2)}$ (b) $\sqrt{(\alpha_2 / \alpha_1)}$ (c) $2\sqrt{(\alpha_2 / \alpha_1)}$ (d) $(1/2)\sqrt{(\alpha_2 / \alpha_1)}$

5 A solid metallic cube having total surface area 24 m^2 is uniformly heated. If its temperature is increased by 10^0C, calculate the increase in volume of the cube (Given $\alpha = 5.0 \times 10^{-4} {}^0C^{-1}$).

(a) 2.4×10^6 cm^3 (b) 1.2×10^5 cm^3 (c) 6.0×10^4 cm^3 (d) 4.8×10^5 cm^3

6 Up to what temperature a gold ring of diameter 6.230 cm must be heated so that it can be fit on a wooden bangle of diameter 6.241 cm? Both the diameters have been measured at room temperature 27^0C. ($\alpha_{Gold} = 1.4 \times 10^{-5}\ K^{-1}$).

(a) 125.7^0 C (b) 91.7^0 C (c) 425.7^0 C (d) 52.7^0 C

7 A Bakelite beaker has volume capacity of 500 cc at 30°C. When it is partially filled with V_m volume (at 30^0C) of mercury, it is found that the unfilled volume of the beaker remains constant as the temperature is varied. If $\gamma_{(beaker)} = 6 \times 10^{-6}\ ^0c^{-1}$ and $\gamma_{(mercury)} = 1.5 \times 10^{-4}\ ^0c^{-1}$ where γ is the coefficient of volume expansion, then V_m (in cc) is close to:

(a) 20 (b) 25 (c) 200 (d) 250

8 A pendulum clock loses 12 s a day if the temperature is 40°C and gains 4s a day if the temperature is 20^0C. The temperature at which the clock will show the correct time is:

(a) 25 ^{0}C (b) 22.5 ^{0}C (c) 30 ^{0}C (d) 33.3 ^{0}C

9 The temperature of equal masses of three different liquids x, y and z are 10^0C, 20^0C and 30^0C respectively. The temperature of mixture when x is mixed with y is 16^0C and that when y is mixed with z is 26^0C. The temperature of mixture when x and z are mixed will be

(a) 25.62 ^{0}C (b) 20.28 ^{0}C (c) 20.32 ^{0}C (d) 23.84 ^{0}C

10 A bullet of mass 5 g, travelling with a speed of 210 m/s, strikes a fixed wooden target. One half of its kinetic energy is converted into heat in the bullet while the other half is converted into heat in the wood. The rise of temperature of the bullet if the specific heat of its material is 0.030 cal / (g $^{-10}$c) (1 cal = 4.2×10^7 ergs) close to

(a) 87.5 ^{0}C (b) 83.3 ^{0}C (c) 119.2 ^{0}C (d) 38.4 ^{0}C