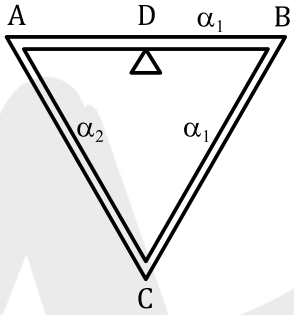
DPP 03

Q.1 Two metal rods of the same length and area of cross-section are fixed end to end between rigid supports. The materials of the rods have Young moduli Y_1 and Y_2, and coefficients of linear expansion α_1 and α_2. The junction between the rods does not shift if the rods are cooled. Then:

(A) $Y_1\alpha_1 = Y_2\alpha_2$ (B) $Y_1\alpha_2 = Y_2\alpha_1$ (C) $Y_1\alpha_1^2 = Y_2\alpha_2^2$ (D) $Y_1^2\alpha_1 = Y_2^2\alpha_2$

Q.2 Three rods of equal length are joined to form an equilateral triangle ABC. D is the midpoint of AB. The coefficient of linear expansion is α_1 for AB, and α_2 for AC and BC. If the distance DC remains constant for small changes in temperature,



(A) $\alpha_1 = \alpha_2$ (B) $\alpha_1 = 2\alpha_2$ (C) $\alpha_1 = 4\alpha_2$ (D) $\alpha_1 = \frac{1}{2}\alpha_2$

Q.3 If I is the moment of inertia of a solid body having α-coefficient of linear expansion then the change in I corresponding to a small change in temperature ΔT is

(A) α I ΔT (B) $\frac{1}{2}$αIΔT (C) 2αIΔT (D) 3αIΔT

Q.4 When a copper ball is heated, the largest percentage increase will occur in its

(A) diameter (B) area (C) volume (D) density

Q.5 A metal rod of Young's modulus Y and coefficient of thermal expansion α is held at its two ends such that its length remains invariant. If its temperature is raised by t°C, the linear strees developed in it is-

(A) $\frac{\alpha t}{Y}$ (B) Yat (C) $\frac{Y}{\alpha t}$ (D) $\frac{1}{Y\alpha t}$

Q.6 An aluminum sphere of 20 cm diameter is heated from 0°C to 100°C. Its volume changes by (given that coefficient of linear expansion for aluminium $\alpha_{Al} = 23 \times 10^{-6}/\,^\circ C$)

(A) 28.9cc (B) 2.89cc (C) 9.28cc (D) 49.8cc

Q.7 A pendulum clock loses 12 s a day if the temperature is 40°C and gains 4 s a day if the temperature is 20°C. The temperature at which the clock will show correct time, and the co-efficient of linear expansion (α) of the metal of the pendulum shaft are respectively:

(A) $60^\circ C; \alpha = 1.85 \times 10^{-4}/\,^\circ C$ (B) $30^\circ C; \alpha = 1.85 \times 10^{-3}/\,^\circ C$

(C) $55^\circ C; \alpha = 1.85 \times 10^{-2}/\,^\circ C$ (D) $25^\circ C; \alpha = 1.85 \times 10^{-5}/\,^\circ C$

Q.8 Two rods one of aluminium of length l_1 having coefficient of linear expansion α_a, and other steel of length l_2 having coefficient of linear expansion α_s are joined end to end. The expansion in both the rods is same on variation of temperature. Then the value of $\frac{l_1}{l_1+l_2}$ is

(A) $\frac{\alpha_s}{\alpha_a+\alpha_s}$ (B) $\frac{\alpha_s}{\alpha_a-\alpha_s}$ (C) $\frac{\alpha_a+\alpha_s}{\alpha_s}$ (D) None of these

Q.9 A cube of coefficient of linear expansion α_s is floating in a bath containing a liquid of coefficient of volume expansion γ_l. When the temperature is raised by ΔT, the depth upto which the cube is submerged in the liquid remains the same. Find the relation between α_s and γ_1, showing all the steps.

ANSWER KEY

1. (A) **2.** (C) **3.** (C) **4.** (C) **5.** (C) **6.** (A) **7.** (D)
8. (A) **9.** $\Upsilon_1 = 2\alpha_s$

Home Work

Ex. 1	Q. 8, 10, 12,
Ex. 2	Q. 10
Ex.3	Q. 5, 6, 7,
Ex.4	Q. 6
Ex.5	Q.