STRUCTURED MULTIMEDIA ENTRANCE PROGRAMME

Module - P | **THERMAL PROPERTIES OF MATTER** | **Class Test**

1. A copper rod of length 88 cm and an aluminium rod of unknown length have their increase in length independent of increase in temperature. The length of aluminium rod is
(a) 113.9 cm (b) 88 cm
(c) 68 cm (d) 6.8 cm

2. The coefficient of volume expansion of glycerine is $49 \times 10^{-5} {}^\circ C^{-1}$. What is the fractional change in density for a $30^\circ C$ rise in temperature?
(a) 0.0155 (b) 0.0145
(c) 0.0255 (d) 0.0355

3. 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 temperatures, which one of the following relations holds good ?
(a) $\alpha_1 l_2^2 = \alpha_2 l_1^2$ (b) $\alpha_1^2 l_2 = \alpha_2^2 l_1$ (c) $\alpha_1 l_1 = \alpha_2 l_2$ (d) $\alpha_1 l_2 = \alpha_2 l_1$

4. Two metal rods of lengths L_1 and L_2 and coefficients of linear expansion α_1 and α_2 respectively are welded together to make a composite rod of length $(L_1 + L_2)$ at 0°C. Find the effective coefficient of linear expansion of the composite rod.
(a) $\frac{L_1\alpha_1^2 - L_2\alpha_2^2}{L_1^2 + L_2^2}$ (b) $\frac{L_1^2\alpha_1 - L_2^2\alpha_2}{L_1^2 + L_2^2}$
(c) $\frac{L_1\alpha_1 + L_2\alpha_2}{L_1 - L_2}$ (d) $\frac{L_1\alpha_1 + L_2\alpha_2}{L_1 + L_2}$

5. Water is heated from 0° C to 10° C, then its volume
(a) does not change
(b) decreases
(c) first decreases and then increases
(d) increases

6. In anomalous expansion of water, at what temperature, the density of water is maximum?
(a) 4°C (b) < 4° C (c) > 4° C (d) 10° C

7. A metal rod is fixed rigidly at two ends so as to prevent its thermal expansion. If L, α and Y respectively denote the length of the rod, coefficient of linear thermal expansion and Young's modulus of its material, then for an increase in temperature of the rod by ΔT, the longitudinal stress developed in the rod is
(a) inversely proportional to α
(b) inversely proportional to Y
(c) directly proportional to $\Delta T / Y$
(d) independent of L

8. A horizontal uniform tube, open at both ends, is containing a liquid of certain length at some temperature. When the temperature is changed, the length of the liquid in the tube is not changed. If α is the coefficient of linear expansion of the material of the tube and γ is the coefficient of volume expansion of the liquid, then
(a) $\gamma = 2\alpha$ (b) $\gamma = 3\alpha$ (c) $\gamma = 4\alpha$ (d) $\gamma = \alpha$

9. When a liquid is heated in a glass vessel, its coefficient of apparent expansion is $1.03 \times 10^{-3} /^\circ C$. When the same liquid is heated in a copper vessel, its coefficient of apparent expansion is $1.006 \times 10^{-3} /^\circ C$. If the coefficient of linear expansion of copper is $17 \times 10^{-6} /^\circ C$, then the coefficient of linear expansion of glass is
(a) $8.5 \times 10^{-4} /^\circ C$ (b) $9 \times 10^{-6} /^\circ C$
(c) $27 \times 10^{-6} /^\circ C$ (d) $10 \times 10^{-4} /^\circ C$

10. Two temperature scales A and B are related by $\frac{A - 42}{110} = \frac{B - 72}{220}$. At which temperature, two scales have the same readings?
(a) – 42° (b) – 72° (c) + 12° (d) – 40°

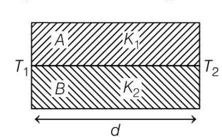
11. Three stars A, B, C have surface temperatures T_A, T_B, T_C, respectively. Star A appears bluish, star B appears reddish and star C, appears yellowish. We can conclude that
(a) $T_A > T_B > T_C$ (b) $T_B > T_C > T_A$
(c) $T_C > T_B > T_A$ (d) $T_A > T_C > T_B$

12. The unit of thermal conductivity is
(a) $J\ m^{-1}\ K^{-1}$ (b) $W\ m\ K^{-1}$
(c) $W\ m^{-1}\ K^{-1}$ (d) $J\ m\ K^{-1}$

13. Calculate radiation power for sphere whose temperature is 227°C, radius 2 m and emissivity 0.8.
(a) 142.5 kW (b) 1500 W
(c) 1255 W (d) 1575 W

14. The power radiated by a black body is P and it radiates maximum energy at wavelength λ_0. If the temperature of the black body is now changed, so that it radiates maximum energy at wavelength $\frac{3}{4}\lambda_0$, the power radiated by it becomes nP. The value of n is
(a) $\frac{256}{81}$ (b) $\frac{4}{3}$ (c) $\frac{3}{4}$ (d) $\frac{81}{256}$

15. Two rods A and B of different materials are welded together as shown in figure. Their thermal conductivities are K_1 and K_2. The thermal conductivity of the composite rod will be



(a) $\frac{K_1 + K_2}{2}$ (b) $\frac{3(K_1 + K_2)}{2}$
(c) $K_1 + K_2$ (d) $2(K_1 + K_2)$

16. A spherical black body with a radius of 12 cm radiates 450 W power at 500 K. If the radius were halved and the temperature doubled, the power radiated (in watt) would be
(a) 225 (b) 450 (c) 1000 (d) 1800

17. A black body is at a temperature of 5760 K. The energy of radiation emitted by the body at wavelength 250 nm is U_1, at wavelength 500 nm is U_2 and that at 1000 nm is U_3. Wien's constant, $b = 2.88 \times 10^6$ nmK. Which of the following is correct?

(a) $U_3 = 0$ (b) $U_1 > U_2$ (c) $U_2 > U_1$ (d) $U_1 = 0$

18. A piece of ice falls from a height h, so that it melts completely. Only one-quarter of the heat produced is absorbed by the ice and all energy of ice gets converted into heat during its fall. The value of h is (Take, latent heat of ice is 3.4×10^5 J/kg and $g = 10$ N/kg)

(a) 544 km (b) 136 km (c) 68 km (d) 34 km

19. Two plates of same area are placed in contact. Their thickness as well as thermal conductivities are in the ratio 2:3. The outer surface of one plate is maintained at 10 °C and that of the other at 0 °C. What is the temperature at the common surface?

(a) 0 °C (b) 2.5 °C (c) 5 °C (d) 6.5 °C

20. For maximum radiant energy from the moon, the corresponding wavelength is 14 micron. If Wien's constant is $b = 2892 \times 10^{-6}$ mK, then temperature of the moon is

(a) 207 K (b) 270 K (c) 207 °C (d) 270 °C

Thermal Properties of Matter

1.c	2.b	3.c	4.d	5.c
6.a	7.c	8.b	9.b	10.c
11.d	12.c	13.a	14.a	15.a
16.d	17.c	18.d	19.c	20.a