CHAPTER 10

Thermal Properties of Matter

Thermal Expansion

1. A copper rod of 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 : *(2019)*

(α_{Cu} =1.7 × 10^{-5} K^{-1} and α_{Al} = 2.2 × 10^{-5} K^{-1})

a. 6.8 cm b. 113.9 cm

c. 88 cm d. 68 cm

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 temperatures, which one of the following relations holds good? *(2016 - I)*

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. The value of coefficient of volume expansion of glycerin is 5 × 10^{-4}/K. The fractional change in the density of glycerin for a rise of 40°C in its temperature, is: *(2015 Re)*

a. 0.010 b. 0.015

c. 0.020 d. 0.025

Specific Heat, Latent Heat and Calorimetry

4. The quantities of heat required to raise the temperature of two solid copper spheres of radii r_1 and r_2 ($r_1 = 1.5\, r_2$) through 1 K are in the ratio: *(2020)*

a. $\frac{9}{4}$ b. $\frac{3}{2}$

c. $\frac{5}{3}$ d. $\frac{27}{8}$

5. 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 [Latent heat of ice is 3.4 × 10^5 J/kg and g = 10 N/kg]: *(2016 - I)*

a. 34 km b. 544 km

c. 136 km d. 68 km

6. Two identical bodies are made of a material for which the heat capacity increases with temperature. One of these is at 100°C, while the other one is at 0°C. If the two bodies are brought into contact, then, assuming no heat loss, the final common temperature is: *(2016 - II)*

a. Less than 50°C but greater than 0°C

b. 0°C

c. 50°C

d. More than 50°C

7. Steam at 100°C is passed into 20 g of water at 10°C. When water acquires a temperature of 80°C, the mass of water present will be: [Take specific heat of water = 1 cal /g /°C and latent heat of steam = 540 cal g^{-1}]: *(2014)*

a. 24 g b. 31.5 g

c. 42.5 g d. 22.5 g

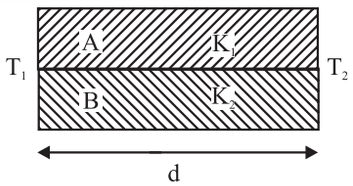
Heat Transfer and Thermal Conductivity

8. The unit of thermal conductivity is : *(2019)*

a. J m K^{-1} b. J m^{-1} K^{-1}

c. W m K^{-1} d. W m^{-1} K^{-1}

9. Two rods A and B of different material 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: *(2017-Delhi)*



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

c. $2(K_1 + K_2)$ d. $\frac{K_1 + K_2}{2}$

10. The two ends of a metal rod are maintained at temperatures 100°C and 110°C. The rate of heat flow in the rod is found to be 4.0 J/s. If the ends are maintained at temperatures 200°C and 210°C, the rate of heat flow will be: *(2015)*

a. 16.8 J/s b. 8.0 J/s

c. 4.0 J/s d. 44.0 J/s

Newton's Law of Cooling

11. A cup of coffee cools from 90°C to 80°C in t minutes, when the room temperature is 20°C. The time taken by a similar cup of coffee to cool from 80° C to 60°C at a room temperature same at 20°C is: **[RC]** *(2021)*

a. $\frac{13}{5}t$ b. $\frac{10}{13}t$

c. $\frac{5}{13}t$ d. $\frac{13}{10}t$

12. A body cools from a temperature 3T to 2T in 10 minutes. The room temperature is T. Assume that Newton's law of cooling is applicable. The temperature of the body at the end of next 10 minutes will be: **[RC]** *(2016 - II)*

a. $\frac{4}{3}T$ b. T

c. $\frac{7}{4}T$ d. $\frac{3}{2}T$

13. Certain quantity of water cools from 70°C to 60°C in the first 5 minutes and to 54°C in the next 5 minutes. The temperature of the surroundings is: **[RC]** *(2014)*

a. 45°C b. 20°C

c. 42°C d. 10°C

Stefan's Law, Wien's Displacement Law, Kirchhoff's Law and Black Body

14. 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 yellowish. Hence, **[RC]** *(2020-Covid)*

a. $T_B > T_C > T_A$

b. $T_C > T_B > T_A$

c. $T_A > T_C > T_B$

d. $T_A > T_B > T_C$

15. 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: **[RC]** *(2018)*

a. $\frac{256}{81}$ b. $\frac{4}{3}$

c. $\frac{3}{4}$ d. $\frac{81}{256}$

16. A spherical black body with a radius of 12 cm radiates 450 watt power at 500 K. If the radius were halved and the temperature doubled, the power radiated in watt would be: *(2017-Delhi)*

a. 450 b. 1000

c. 1800 d. 225

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 × 10^6 nmK. Which of the following is correct? **[RC]** *(2016 - I)*

a. $U_1 = 0$ b. $U_3 = 0$

c. $U_1 > U_2$ d. $U_2 > U_1$

18. On observing light from three different stars P, Q and R, it was found that intensity of violet color is maximum in the spectrum of P, the intensity of green color is maximum in the spectrum of R and the intensity of red color is maximum in the spectrum of Q. If T_P, T_Q and T_R are the respective absolute temperatures of P, Q and R then it can be concluded from the above observations that: **[RC]** *(2015)*

a. $T_P > T_R > T_Q$ b. $T_P < T_R < T_Q$

c. $T_P < T_Q < T_R$ d. $T_P > T_Q > T_R$

19. A piece of iron is heated in a flame. It first becomes dull red then becomes reddish yellow and finally turns to white hot. The correct explanation for the above observation is possible by using: **[RC]** *(2013)*

a. Newton's Law of cooling

b. Stefan's Law

c. Wien's displacement Law

d. Kirchoff's Law

Answer Key

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