JEE MAIN : CHAPTER WISE TEST-11

SUBJECT :- PHYSICS **DATE.....**

CLASS :- 11th **NAME.....**

CHAPTER :- THERMAL PHYSICS **SECTION.....**

(SECTION A)

1. Expansion during heating–

(A) Occurs only in solids

(B) Increases the weight of a material

(C) Decreases the density of a material

(D) Occurs at the same rate for all solids and liquids

2. Two tanks A and B contains water at 30ºC and 80ºC respectively, calculate the amount of water that must be taken from each tank to prepare 40kg of water at 50ºC -

(A) 24 kg, 16 kg (B) 16 kg, 24 kg

(C) 20 kg, 20 kg (D) 30 kg, 10 kg

3. Mechanism of heat-transfer involved in freezing of lakes in colder region -

(A) Conduction only (B) Convection only

(C) Radiation only (D) None of these

4. A gas is at pressure P and temperature T. Coefficient of volume expansion of one mole of gas at constant pressure is –

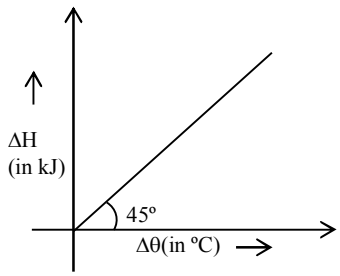
(A) $\frac{1}{T}$ (B) T (C) $\frac{1}{T^2}$ (D) T^2

5. A temperature difference of 5°C on Celsius scale corresponding to the following temperature difference in the Fahrenheit scale -

(A) 9° (B) 41°

(C) 2.8° (D) 15°

6. A solid of mass 2kg is heated and ΔH (Heat given) vs $\Delta\theta$ (change in temperature) is plotted. Specific heat of solid is –



(A) 1 J/kg/ºC (B) 0.5 J/kg/ºC

(C) 2 kJ/kg/ºC (D) 0.5 kJ/kg/ºC

7. Two vessels A and B of different materials are similar in shape and size. The same quantity of ice filled in them melts in times t_1 and t_2 respectively. The ratio of the thermal conductivities of A and B is -

(A) $t_1 : t_2$ (B) $t_2 : t_1$

(C) $t_1^2 : t_2^2$ (D) $t_2^2 ; t_1^2$

8. 300 g of water at 25°C is added to 100g of ice at 0°C. The amount of ice melts is -

(A) 6.25 g

(B) 93.75 g

(C) 100 g

(D) none of the above

9.

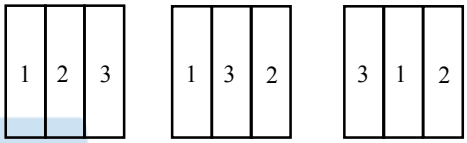


Fig.(a) Fig.(b) Fig.(c)

Figure (a), (b), (c) shows three different arrangements of materials 1, 2 and 3 to form a wall. Thermal conductivities are $K_1 > K_2 > K_3$. The left side of the wall is 20°C higher than the right side. Temperature difference ΔT across the material 1 has following relation, in three cases:

(A) $\Delta T_a > \Delta T_b > \Delta T_c$

(B) $\Delta T_a = \Delta T_b = \Delta T_c$

(C) $\Delta T_a = \Delta T_b > \Delta T_c$

(D) $\Delta T_a = \Delta T_b < \Delta T_c$

10. The diameters of steel rods A and B having the same length are 2 cm and 4 cm respectively. They are heated through 100°C. What is the ratio of increase of length of A to that of B.

(A) 1 : 2 (B) 2 : 1

(C) 1 : 1 (D) 4 : 1

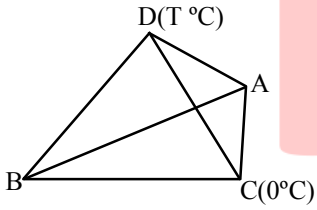
11. Two liquids are at temperature 20ºC and 40ºC. When same mass of both of them is mixed, the temperature of the mixture is 32ºC. What is the ratio of the their specific heats ?

(A) 1/3 (B) 2/3 (C) 1/5 (D) 2/5

12. A steel ball of mass m_1 = 1 kg moving with velocity 50 m/sec collides with another steel ball of mass m_2 = 200 gm lying on the ground and both come to rest. During the collision their internal energies changes equally and T_1 and T_2 are the rise in temperature of masses m_1 and m_2 respectively. If s_{steel} = 0.105 cal/gm ºC and J = 4.18, then -
(A) T_1 = 7.1ºC, T_2 = 1.47ºC
(B) T_1 = 1.42ºC, T_2 = 7.1ºC
(C) T_1 = 3.4 K, T_2 = 17.0 K
(D) None of these

13. If two rods of length L and 2L having coefficient of linear expansion α and 2α respectively are connected so that total length becomes 3L, the average coefficient of linear expansion of the composition rods equals -
(A) $\frac{3}{2}\alpha$ (B) $\frac{5}{2}\alpha$
(C) $\frac{5}{3}\alpha$ (D) None of these

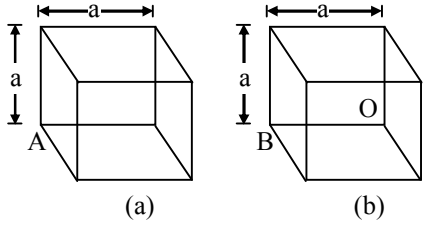
14. Six similar bars each of thermal resistance R are joined to form a regular tetrahedron as shown in the figure. Point D is maintained at a constant temperature T ºC and point C at 0ºC. Temperature of junction A is -



(A) $\frac{T}{4}$ (B) $\frac{T}{3}$ (C) $\frac{T}{2}$ (D) $\frac{T}{5}$

15. 10 g of ice at –20ºC is added to 10g of water at 50ºC. The amount of ice in the mixture at resulting temperature is (Specific heat of ice = 0.5 cal $g^{-1}ºC^{-1}$ and latent heat of ice =80 cal g^{-1})
(A) 10g (B) 5g
(C) 0 g (D) 20 g

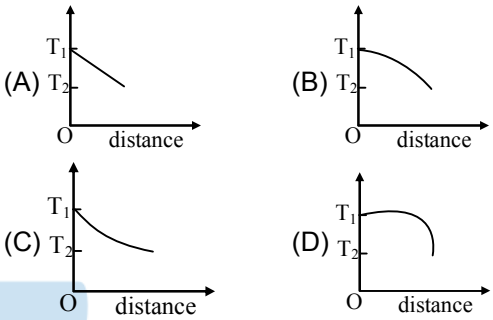
16. A and B are made up of an isotropic medium. Both A and B are of equal volume. Body B has cavity as shown in Fig.(b). Which of the following statements is true?



(a) (b)

(A) Expansion in volume of A > expansion in B
(B) Expansion in volume of B > expansion in A
(C) Expansion in A = expansion in B
(D) None of these

17. The ends of a metal bar of constant cross-sectional area are maintained at temperatures T_1 and T_2 which are both higher than the temperature of the surroundings. If the bar is unlagged, which one of the following sketches best represents the variation of temperature with distance along the bar ?



18. 10 gm of ice at 0ºC is mixed with 10 gm steam at 100ºC in a container of negligible heat capacity. Amount of steam in the mixture after some time will be (S_w = 1 cal/gmºC, L_v = 540 cal/gm, L_f = 80 cal/gm) –
(A) 0 gm (B) $\frac{20}{3}$ gm
(C) $\frac{10}{3}$ gm (D) None of these

19. Heat current is maximum in which of the following ? (rods are of identical dimension)
(A) Cu (B) Steel | Cu
(C) Cu | Steel (D) Steel

20. A cylinder of radius R, made of a material of thermal conductivity k_1, is surrounded by a cylindrical shell of inner radius R and outer radius 2R. The shell is made of a material of thermal conductivity k_2. The two ends of the combined system are maintained at two different temperatures. There is no loss of heat across the cylindrical surface and the system is in steady state. The effective thermal conductivity of the system is -
(A) $k_1 + k_2$ (B) $\frac{k_1 k_2}{k_1 + k_2}$
(C) $\frac{k_1 + 3k_2}{4}$ (D) $\frac{3k_1 + k_2}{4}$

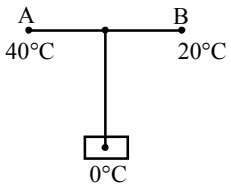
(SECTION B)

21. A thermometer of mass 50 gm and specific heat 0.4 cal/gm/ºC reads 10ºC. It is then inserted into 1 kg of water and reads 40ºC in thermal equilibrium. The temperature of water before insertion of thermometer in 10 ºC is (Neglect other heat losses).

22. A bar measured with a Vernier Caliper is found to be 1800 mm long. The temperature during the measurement is 10ºC.
The measurement error if the scale of the Vernier Caliper has been graduated at a temperature of 20ºC is found to x × 10^{-2} mm. Find x.

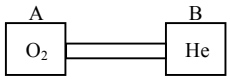
23. A calorimeter of negligible heat capacity contains 100 gm water at 40°C. The water cools to 35°C in 5 min.. If water is now replaced by a liquid of same volume as that of water at same initial temperature it cools to 35°C in 2 min. Given sp. heats of water and liquid are 4200 J/kg-°C and 2100 J/kg-°C respectively. Find the density of liquid give answer in….× 100 kg/m^3. [Assume Newton law of cooling is applicable]

24. In the figure shown AB is a rod of length L and thermal resistance R_H = 10 SI unit and end A and B are maintained by 20°C and 40°C. At mid point of rod another rod of thermal resistance $R'_H = R_H/4$ SI unit connected and other end of rod is inserted into ice.
After steady state reach, we start counting of time, and find the amount of ice (in kg) melt in 5.6 × 10^4 s. (L_f = 3.36 × 10^5 J/kg)



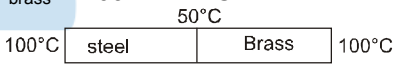
25. Two rods of same dimensions, but made of different materials are joined end to end with their free ends being maintained at 100ºC and 0ºC respectively. The temperature of the junction is 70ºC. Then the temperature of the junction if the rods are interchanged will be equal to T °C Find T :

26. Two containers A and B are connected by a conducting solid cylindrical rod of length $\frac{242}{7}$ cm and radius $\sqrt{8.3}$ cm. Thermal conductivity of the rod is 693 watt/mole-K. The container A contains two mole of oxygen gas and the container B contains four mole of helium gas. At time t = 0 temperature difference of the containers is 50ºC, after what time (in seconds) temperature difference between them will be 25ºC. Transfer of heat takes place through the rod only. Neglect radiation loss. Take R = 8.3 J/mole-K and $\pi = \frac{22}{7}$.

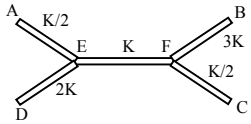


27. 1 gm of steam at 100°C is kept in a vessel of negligible heat capacity. Amount of ice required at 0ºC so that at equilibrium only water is remaining at 0°C is m gm. Find m.

28. Figure shows a steel rod joined to a brass rod. Each of the rods has length of 31 cm and area of cross-section 0.20 cm^2. The junction is maintained at a constant temperature 50°C and the two ends are maintained at 100°C. The amount of heat taken out from the cold junction in 10 minutes after the steady state is reached in n × 10^2 J. Find 'n'. The thermal conductivities are K_{steel} = 46 W/m–°C and K_{brass} = 109 W/m–°C.



29. Five rods with identical geometries are arranged as shown. Their thermal conductivity are shown. Only A and C are maintained at 100°C and 0°C respectively. If temperature difference between ends B and C can be writted as 10x °C where x is an integer. Then find x .



30. One end of copper rod of uniform cross-section and of length 1.45 m is in contact with ice at 0ºC and the other end with water at 100°C. The position of point along its length where a temperature of 200°C should be maintained so that in steady state the mass of ice melting is equal to that of steam produced in the same interval of time is x cm from hotter end of rod. Find x [Assume that the whole system is insulated from surroundings]. (take L_v = 540 cal/g L_f = 80 cal/g)