10. To decrease the volume of a gas by 5% at constant temperature, the pressure should be
a) decreased by 5.26% b) increased by 5.26%
c) decreased by 11% d) increased by 11%

(MHT-CET 2019)

11. The temperature of an ideal gas at atmosphere pressure is 300 K and volume 1 m^3. If temperature and volume become double, then pressure will be
a) 10^5 N/m^2 b) 2×10^5 N/m^2 c) 0.5×10^5 N/m^2 d) 4×10^5 N/m^2

12. For ideal gas, which statement is not true ?
a) it obeys Boyle's law
b) it follows PV = RT
c) internal energy depends on temperature only
d) it follows Van der Waal's equation

13. At absolute zero
a) all substances exist in solid form b) molecular motion ceases
c) water becomes ice d) none of the above

6.5 Thermal Expansion

(MHT-CET 2020)

14. A metal rod is heated to t°C. The metal rod has length, area of cross-section, Young's modulus and coefficient of linear expansion as 'L', 'A', 'Y' and 'α' respectively. When the rod is heated, the work performed is

a) $\frac{1}{2}$ YAL $\alpha^2 t^2$ b) $\frac{1}{2}$ YA$L^2 \alpha^2 t^2$ c) $\frac{1}{2}$ YAL α t d) YAL α t

15. A metal rod of Young's modulus 'Y' and coefficient of linear expansion 'α' has its temperature raised by '$\Delta\theta$'. The linear stress to prevent the expansion of rod is

a) $Y \propto \Delta\theta$ b) $Y\left(\frac{l}{L}\right)^2$ c) $Y\frac{L}{l}$ d) $\frac{Y \propto}{\Delta\theta}$

16. A metal rod of length L and cross-sectional area A is heated through T°C. What is the force required to prevent the expansion of the rod lengthwise [Y = Young's modulus of rod, α = coefficient of linear expansion] ?
a) $YA\alpha T/(1-\alpha T)$ b) $YA\alpha T/(1+\alpha T)$ c) $YA\alpha/T(1+\alpha T)$ d) $YA\alpha/(1-\alpha T)$

(MHT-CET 2021)

17. Two rods of different metals have coefficients of linear expansion 'α_1' and 'α_2' respectively. Their respective lengths are 'L_1' and 'L_2'. At all temperatures ($L_2 - L_1$) is same. The correct relation is
a) $L_1\alpha_1^2 = L_2\alpha_2^2$ b) $L_1^2\alpha_1^2 = L_2^2\alpha_2^2$ c) $L_1\alpha_2 = L_2\alpha_1$ d) $L_1\alpha_1 = L_2\alpha_2$

18. A cylindrical rod is having temperatures θ_1 and θ_2 at its ends. The rate of heat flow is 'Q' J s^{-1}. All the linear dimensions of the rod are doubled by keeping the temperatures constant. What is the new rate of flow of heat ?
a) $\frac{Q}{2}$ b) $\frac{Q}{4}$ c) 2 Q d) $\frac{3Q}{2}$

28. Calculate the amount of heat (in calories) required to convert 5 g of ice at 0°C to steam at 100°C.
a) 3100 cal b) 3200 cal c) 3600 cal d) 4200 cal

29. A piece of iron of mass 100 g is kept inside a furnace for a long time and then put on a block of ice at 0°C weighing 0.1 kg. If the block melts completely, the temperature of furnace was : Specific heat capacity of iron = 470 J kg^{-1} $°C^{-1}$, Latent heat of ice = 80 cal. g^{-1} $°C^{-1}$.
a) 715°C b) 615°C c) 815°C d) 915°C

(MHT-CET 2022)

30. A cylindrical metallic rod in thermal contact with two reservoirs of heat at its two ends conducts an amount of heat 'Q_1' in time 't'. The metallic rod is melted and the material is formed into a rod of length four times the length of original rod. The amount of heat conducted by the new rod when placed in thermal contact with the same two reservoirs in time t is 'Q_2'. Then $\frac{Q_1}{Q_2}$ is
a) $\frac{1}{4}$ b) 4 c) 16 d) $\frac{1}{16}$

31. A piece of ice melts completely when it falls from a height 'h'. Only 25% of the heat produced is absorbed by the ice and all energy of ice gets converted into heat during the fall. The value of 'h' is (Latent heat of ice = $3.5 \times 10^5 \frac{1}{kg}$)
a) 140 km b) 125 km c) 120 km d) 130 km

32. Which of the following is NOT a mode of heat transfer ?
a) Conduction b) Radiation c) Sublimation d) Convection

6.9 Heat Transfer

(MHT-CET 2021)

33. A wall has two layers A and B, each made of different material. Both the layers have same thickness. The thermal conductivity of the material A is thrice that of material B. If under thermal equilibrium the temperature difference across the wall is 48°C, the temperature difference across the layer 'A' is
a) 12°C b) 24°C c) 18°C d) 6°C

34. A window glass of area 10^3 cm^2 and thickness 4 mm has temperature on one side as 32°C and on the other side as –8°C. Coefficient of thermal conductivity of glass is 2.2 $\frac{cal}{sm°C}$. The rate of loss of heat through glass will be
a) 2.2 k cal s^{-1} b) 2.2×10^{-3} cal s^{-1}
c) 2.2 cal s^{-1} d) 2.2×10^3 k cal s^{-1}

35. A black rectangular surface of area 'A' emits energy 'E' per second at 27°C. If length and breadth are reduced to $(1/3)^{rd}$ of their initial values and temperature is raised to 327°C then energy emitted per second becomes
a) $\frac{20E}{9}$ b) $\frac{8E}{9}$ c) $\frac{16E}{9}$ d) $\frac{4E}{9}$

(MHT-CET 2021)

44. A body cools from 80°C to 64°C in 5 minutes and same body cools from 80 °C to 52 °C in 10 minutes. The temperature of surroundings is
a) 24°C b) 26°C c) 28°C d) 22°C

45. A metal sphere cools at the rate of 1.5°C/min when its temperature is 80°C. At what rate will it cool when its temperature falls to 50°C ? [Temperature of surrounding is 30°C]
a) 0.9°C/min b) 0.6°C/min c) 1.5°C/min d) 1.2°C/min

(MHT-CET 2022)

46. A body cools from 90°C to 70°C in 6 minutes. If the temperature of the surroundings is 30°C, the time taken by the body to cool from 70°C to 50°C is
a) 12 minutes b) 8 minutes c) 10 minutes d) 15 minutes

LEVEL - II

47. If pressure of a gas contained in a closed vessel is increased by 0.4% when heated by 1°C, the initial temperature must be
a) 250 K b) 250°C c) 2500 K d) 25°C

48. A gas at 27°C temperature and 30 atmospheric pressure is allowed to expand to the atmospheric pressure. If the volume becomes 10 times its initial volume, then the final temperature becomes
a) 100°C b) 173°C c) 273°C d) −173°C

49. What should be the lengths of a steel and a copper rod at 0°C so that the length of the steel rod is 5 cm longer than the copper rod at any temperature ?
α (Steel) = 1.1×10^{-5}/°C, α (Copper) = 1.7×10^{-5}/°C
a) 14.17 cm; 9.17 cm b) 9.17 cm; 14.17 cm
c) 28.34 cm; 18.34 cm d) 14.17 cm; 18.34 cm

50. The volume of a metal sphere increases by 0.24% when its temperature is raised by 40°C. The coefficient of linear expansion of the metal is ..... $°C^{-1}$.
a) 2×10^{-5} b) 6×10^{-5} c) 18×10^{-5} d) 1.2×10^{-5}

51. Two rods, one of aluminium and other 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 coefficients of linear expansion of aluminium and steel are α_A and α_S respectively. If the length of each rod increases by same amount when the temperature is raised by t°C, then find the relation for $\frac{l_1}{l_1+l_2}$.
a) $\frac{\alpha_A}{\alpha_A+\alpha_S}$ b) $\frac{\alpha_S}{\alpha_A}$ c) $\frac{\alpha_A}{\alpha_S}$ d) $\frac{\alpha_S}{\alpha_A+\alpha_s}$

52. The coefficient of apparent expansion of a liquid when heated in a copper vessel is C and when heated in a silver vessel is S. If A is coefficient of linear expansion of copper, then the coefficient of linear expansion of silver is
a) $\frac{C+S+3A}{3}$ b) $\frac{C+3A-S}{3}$ c) $\frac{C+S-3A}{3}$ d) $\frac{S+3A-C}{3}$

53. An electric kettle takes 4 A current at 220 V. How much time will it take to boil 1 kg of water from temperature 20°C ? The temperature of boiling water is 100°C.
a) 12.6 min b) 4.2 min c) 6.3 min d) 8.4 min

36. A conducting rod of length 1 m has area of cross-section 10^{-3} m^2. One end is immersed in boiling water (100°C) and the other end in ice (0°C). If coefficient of thermal conductivity of rod is 96 cal/sm °C and latent heat for ice is 8×10^{-4} cal/kg then the amount of ice which will melt in one minute is

a) 5.4×10^{-3} kg b) 7.2×10^{-3} kg c) 1.8×10^{-3} kg d) 3.6×10^{-3} kg

(MHT-CET 2022)

37. The ratio of thermal conductivity of two rods A and B having same area of cross-section is 3 : 2. If the thermal resistance of the two rods is same, then the ratio of length of rod A to length of rod B is

a) 5 : 1 b) 2 : 3 c) 3 : 2 d) 1 : 5

38. Rate of flow of heat through a cylindrical rod is H_1. The temperatures of the ends of the rod are T_1 and T_2. If all the dimensions of the rod become double and the temperature difference remains the same, the rate of flow of heat becomes H_2. Then the relation between H_1 and H_2 is

a) $H_2 = 4H_1$ b) $H_2 = \frac{H_1}{2}$ c) $H_2 = 2H_1$ d) $H_2 = \frac{H_1}{4}$

39. Two metal slabs of same cross-sectional area have thicknesses 'd_1' and 'd_2' and thermal conductivities 'K_1' and 'K_2' respectively, connected in series. The free ends of the two slabs are kept at temperatures 'T_1' and 'T_2'. ($T_1 > T_2$). The temperature 'T' of their common junction is

a) $\frac{K_1T_1 + K_2T_2}{K_1 + K_2}$ b) $\frac{K_1T_1 + K_2T_2}{T_1 + T_2}$ c) $\frac{K_1T_1d_1 + K_2T_2d_2}{K_1d_2 + K_2d_1}$ d) $\frac{K_1T_1d_2 + K_2T_2d_1}{K_1d_2 + K_2d_1}$

40. Two rods of same material, same length and same radius transfer a given amount of heat in 't' seconds when they are joined end to end. When the rods are joined one above the other then, they will transfer same heat in same conditions in time

a) 2 t seconds b) $\frac{t}{2}$ seconds c) t seconds d) $\frac{t}{4}$ seconds

6.10 Newton's Law of Cooling

(MHT-CET 2005)

41. A body cools from 100°C to 70°C in 8 s. If the room temperature is 15°C and assuming Newton's law of cooling holds good, then time required for the body to cool from 70°C to 40°C is

a) 14 s b) 8 s c) 10 s d) 5 s

(MHT-CET 2006)

42. Newton's law of cooling holds good only if the temperature difference between the body and the surroundings is

a) less than 10°C b) more than 10°C c) less than 100°C d) more than 100°C

(MHT-CET 2019)

43. A hot body at a temperature 'T' is kept in a surrounding of temperature 'T_0'. It takes time 't_1' to cool from 'T_1' to 'T_2', time t_2 to cool from 'T_2' to 'T_3' and time 't_3' to cool from 'T_3' to 'T_4'. If $(T_1 - T_2) = (T_2 - T_3) = (T_3 - T_4)$, then

a) $t_1 > t_2 > t_3$ b) $t_1 = t_2 = t_3$ c) $t_3 > t_2 > t_1$ d) $t_1 > t_2 = t_3$