Exercise-1

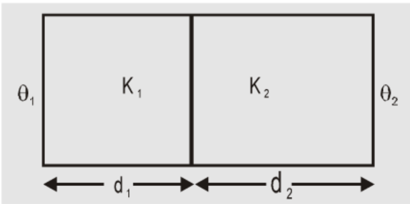
ONLY ONE OPTION CORRECT TYPE

SECTION (A) : THERMAL CONDUCTION IN LINEAR CONDUCTORS AT STEADY STATE

1. A wall has two layers A and B, each made of different material. Both the layers have the same thickness. The thermal conductivity for A is twice that of B. Under steady state, the temperature difference across the whole wall is 36°C. Then the temperature difference across the layer A is
(1) 6°C (2) 12°C (3) 18°C (4) 24°C

2. A heat flux of 4000 J/s is to be passed through a copper rod of length 10 cm and area of cross-section 100 sq. cm. The thermal conductivity of copper is 400 W/mC. The two ends of this rod must be kept at a temperature difference of–
(1) 1ºC (2) 10ºC (3) 100ºC (4) 1000ºC

3. If two conducting slabs of thickness d_1 and d_2, and thermal conductivity K_1 and K_2 are placed together face to face as shown in figure In the steady state temperatures of outer surfaces are θ_1 and θ_2. The temperature of common surface is–

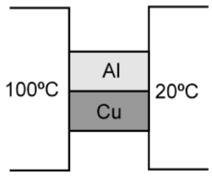


(1) $\frac{K_1\theta_1 d_1 + K_2\theta_2 d_2}{K_1 d_1 + K_2 d_2}$ (2) $\frac{K_1\theta_1 + K_2\theta_2}{K_1 + K_2}$ (3) $\frac{K_1\theta_1 + K_2\theta_2}{\theta_1 + \theta_2}$ (4) $\frac{K_1\theta_1 d_2 + K_2\theta_2 d_1}{K_1 d_2 + K_2 d_1}$

4. Which of following qualities suit for a cooking utensil?
(1) High specific heat and low thermal conductivity
(2) High specific heat and high thermal conductivity
(3) Low specific heat and low thermal conductivity
(4) Low specific heat and high thermal conductivity

5. The lengths and radii of two rods made of same material are in the ratios 1 : 2 and 2 : 3 respectively; If the temperature difference between the ends for the two rods be the same, then in the steady state, the amount of heat flowing per second through them will be in the ratio:
(1) 1 : 3 (2) 4 : 3 (3) 8 : 9 (4) 3 : 2

6. Two metal cubes with 3 cm-edges of copper and aluminium are arranged as shown in figure
(K_{CU} =385 W/m-K, K_{AL} = 209 W/m-K)
(i) The total thermal current from one reservoir to the other is :



(1) 1.42×10^3 W (2) 2.53×10^3 W (3) 1.53×10^4 W (4) 2.53×10^4 W

(ii) The ratio of the thermal current carried by the copper cube to that carried by the aluminium cube is : –
(1) 1.79 (2) 1.69 (3) 1.54 (4) 1.84

7. Two rods having thermal conductivities in the ratio of 5 : 3 and having equal length and equal cross-section are joined by face to face(series combination). If the temperature of free end of first rod is 100ºC and the free end of second rod is 20ºC, then temperature of the junction, is–

(1) 50ºC (2) 70ºC (3) 85ºC (4) 90ºC

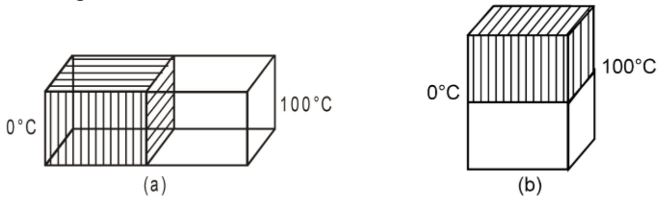
8. One end of a metal rod of length 1.0m and area of cross-section 100 cm^2 is maintained at 100ºC. If the other end of the rod is maintained at 0ºC, the quantity of heat transmitted through the rod per minute will be (coefficient of thermal conductivity of materal of rod = 100W/Kg/K)

(1) 3×10^3 J (2) 6×10^3 J (3) 9×10^3 J (4) 12×10^3 J

9. The coefficients of thermal conductivity of a metal depends on

(1) temperature difference between the two sides
(2) thickness of the metal plate
(3) area of the plate
(4) none of the above

10. Two identical square rods of metal are welded end to end as shown in figure (1). Assume that 10 cal of heat flows through the rods in 2 min. Now the rods are welded as shown in figure. (2) The time it would take for 10 cal to flow through the rods now, is



(1) 0.75 min (2) 0.5 min (3) 1.5 min (4) 1 min

11. Area of cross-section of two rods of equal lengths are A_1 and A_2 and thermal conductivities are K_1 and K_2. Specific heats are S_1 and S_2. Condition for equal heat flow is– **[CPMT- 2002]**

(1) $K_1 = K_2$ (2) $K_1S_1 = K_2S_2$ (3) $\frac{K_1}{A_1S_1} = \frac{K_2}{A_2S_2}$ (4) $K_1A_1 = K_2A_2$

12. If two metallic plates of equal thickness, equal cross section area and thermal conductivities K_1 and K_2 are put together face to face (series combination) and a common plate is constructed, then the equivalent thermal conductivity of this plate will be- **[CPMT-2002]**

(1) $\frac{K_1 \; K_2}{K_1 + K_2}$ (2) $\frac{2K_1 \; K_2}{K_1 + K_2}$ (3) $\frac{(K_1^2 + K_2^2)^{3/2}}{K_1K_2}$ (4) $\frac{(K_1^2 + K_2^2)^{3/2}}{2 \; K_1 \; K_2}$

13. Consider a compound slab consisting of two different materials having equal thicknesses, equal cross section area and thermal conductivities k and 2k respectively. If they are connected in parallel combination, the equivalent thermal conductivity of the slab is– **[CPMT-2003]**

(1) $\sqrt{2}$ (2) 3k (3) $\frac{4}{3}$ k (4) $\frac{2}{3}$ k

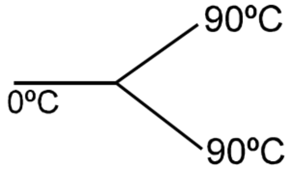
14. The two ends of a rod of length L and a uniform cross-sectional area A kept at two temperatures T_1 and T_2 ($T_1 > T_2$). The rate of heat transfer, $\frac{dQ}{dt}$, through the rod in a steady state is given by **[CPMT 2009]**

(1) $\frac{dQ}{dt} = \frac{KL(T_1 - T_2)}{A}$ (2) $\frac{dQ}{dt} = \frac{K(T_1 - T_2)}{LA}$ (3) $\frac{dQ}{dt} = KLA(T_1 - T_2)$ (4) $\frac{dQ}{dt} = \frac{KA(T_1 - T_2)}{L}$

15. A square is made of four rods of same material one of the diagonal of a square is at temperature difference 100°C, then the temperature difference of second diagonal : **[RPMT 2002]**

(1) 0°C (2) $\frac{100}{\ell}$ (3) $\frac{100}{2\ell}$ (4) 100°C

16. Three rods made of the same material and having the same cross-section are joined as shown in the fig. Each rod is of same length. The left and right ends are kept at 0°C and 90°C respectively. The temperature of the junction of the three rods will be : **[JEE (Scr.) 2001, 1/35]**



(1) 45°C (2) 60°C (3) 30°C (4) 20°C

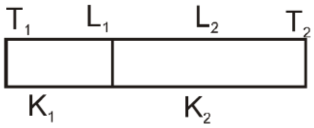
17. Two containers, one is having ice at 0°C and other containing boiling water at 100°C are connected by two identical rods. When rods are in parallel the rate of heat transfer is Q_1 and when rods are in series, the rate of heat transfer is Q_2. Then Q_2/Q_1 will be : **[JEE(Scr.) 2004' 3/84, –1]**
(1) 2 : 1 (2) 1 : 2 (3) 4 : 1 (4) 1 : 4

18. 2 litre water at 27°C is heated by a 1 kW heater in an open container. On an average heat is lost to surroundings at the rate 160 J/s. The time required for the temperature to reach 77°C is **[JEE Scr. 2005, 3/84, –1]**
(1) 8 min 20 sec (2) 10 min (3) 7 min (4) 14 min

19. If the temperature difference on the two sides of a wall increases from 100°C to 200°C, its thermal conductivity **[RPMT 2007]**
(1) remains unchanged (2) is doubled
(3) is halved (4) becomes four times

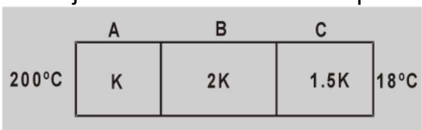
20. A cylindrical rod having temperature T_1 and T_2 at its ends. The rate of flow of heat is Q_1 cal/sec. If all the linear dimensions are doubled keeping temperature constant then rate of flow of heat Q_2 will be– **[AIPMT-2001]**
(1) $4Q_1$ (2) $2Q_1$ (3) $\frac{Q_1}{4}$ (4) $\frac{Q_1}{2}$

22. One end of a thermally insulated rod is kept at a temperature T_1 and the other at T_2. The rod is composed of two sections of lengths L_1 and L_2 and thermal conductivities k_1 and k_2 respectively. The temperature at the interface of the sections is **[AIEEE-2007; 3/120]**



(1) $\frac{(K_2 L_2 T_1 + K_1 L_1 T_2)}{(K_1 L_1 + K_2 L_2)}$ (2) $\frac{(K_2 L_1 T_1 + K_1 L_2 T_2)}{(K_2 L_1 + K_1 L_2)}$
(3) $\frac{(K_1 L_2 T_1 + K_2 L_1 T_2)}{(K_1 L_2 + K_2 L_1)}$ (4) $\frac{(K_1 L_1 T_1 + K_2 L_2 T_2)}{(K_1 L_1 + K_2 L_2)}$

23. Three rods A,B and C of same length and same cross-section area are joined as shown in the figure. Their thermal conductivities are in the ratio 1 : 2 : 1.5. If the open ends of A and C are at 200°C and 18°C respectively, the temperature at the junction of A and B in equilibrium is-



(1) 156°C (2) 116°C (3) 74°C (4) 148°C

24. In the above question, the temperature at the junction of B and C will be-
(1) 124°C (2) 124°K (3) 74°C (4) 74°K

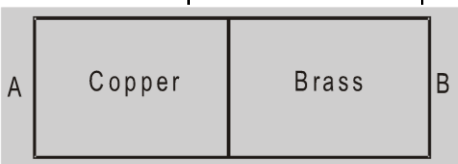
25. The ends of the two rods of different materials with their thermal conductivities, radii of cross-section and lengths in the ratio 1 : 2 are maintained at the same temperature difference. If the rate of flow of heat in the larger rod is 4 cal/sec., that in the shorter rod will be- (in cal/sec)
(1) 1 (2) 2 (3) 8 (4) 16

26. The coefficients of thermal conductivity of copper, mercury and glass are respectively K_c, K_m and K_g such that $K_c > K_m > K_g$. If the same quantity of heat is to flow per second per unit area of each and corresponding temperature gradients are X_c, X_m and X_g.
(1) $X_c = X_m = K_g$ (2) $X_c > X_m > X_g$ (3) $X_c < X_m < X_g$ (4) $X_m < X_c < X_g$

27. A compound slab is composed of two parallel layers of different material, with thicknesses 3 cm and 2 cm. The temperatures of the outer faces of the compound slab are maintained at 100°C and 0°C. If conductivities are 0.036 cal/cm-sec-°C and 0.016 cal/cm-sec-°C then the temperature of the junction is-
(1) 40°C (2) 60°C (3) 100°C (4) 50°C

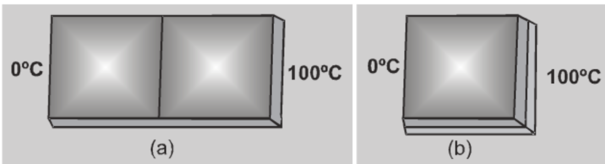
28. The intensity of heat radiation by a point source measured by a thermopile placed at a distance d is I, If the distance of thermopoile is doubled then the intensity of radiation will be-
(1) I (2) 2 I (3) $\frac{I}{4}$ (4) $\frac{I}{2}$

29. Two rods of copper and brass of same length and area of cross-section are joined as shown. One end is kept at 100°C and the other at 0°C. The temperature at the mid-point will be-



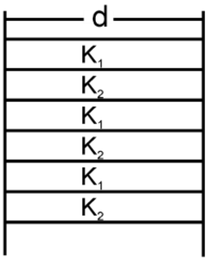
(1) more if A is at 100°C and B at 0°C
(2) more if A is at 0°C and B at 100°C
(3) will be same in both the above cases, but not 50°C
(4) 50°C in both the above cases

30. Two identical square rods of metal are welded end to end as shown in fig. (a) 20 cal. of heat flows through it in 4 min. If the rods re welded as shown in fig. (b), the same amount of heat will flow through the rods in-



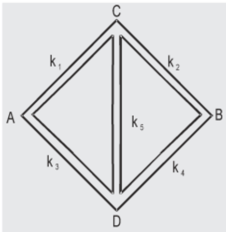
(1) 1 min. (2) 2 min. (3) 3 min. (4) 16 min.

31. A wall consists of alternating blocks with length 'd' and coefficient of thermal conductivity k_1 and k_2. The cross sectional area of the blocks are the same. The equivalent coefficient of thermal conductivity of the wall between left and right is :-



(1) $K_1 + K_2$ (2) $\frac{(K_1+K_2)}{2}$ (3) $\frac{K_1 \ K_2}{K_1+K_2}$ (4) $\frac{2 \ K_1 \ K_2}{K_1+K_2}$

32. Five rods of same dimensions are arranged as shown in the fig. They have thermal conductivities, k_1, k_2, k_5, k_4 and k_3 when points A and B are maintained at different temperatures. No heat flows through the central rod if-

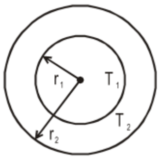


(1) $k_1k_4 = k_2k_3$ (2) $k_1 = k_4$ and $k_2 = k_3$ (3) $\frac{k_1}{k_4} = \frac{k_2}{k_3}$ (4) $k_1k_2 = k_3k_4$

33. Three metal rods made of copper, aluminium and brass, each 20 cm long and 4 cm in diameter, are placed end to end with aluminium between the other two. The free ends of copper and brass are maintained at 100 and 0°C respectively. Assume that the thermal conductivity of copper is twice that of aluminium and four times that of brass. The equilibrium temperatures of the copper-aluminium and aluminium-brass junctions are respectively.

(1) 68 °C and 75 °C (2) 75 °C and 68 °C (3) 57 °C and 86 °C (4) 86 °C and 57 °C

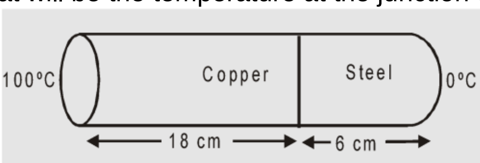
34. The figure shows a system of two concentric spheres of radii r_1 and r_2 and kept at temperature T_1 and T_2, respectively. The radial rate of flow of heat in a substance between the two concentric spheres is proportional to : **[AIEEE-2005, 4/300]**



(1) $\frac{(r_2 - r_1)}{(r_1 r_2)}$ (2) $\ln \frac{(r_2)}{(r_1)}$ (3) $\frac{r_1 r_2}{(r_2 - r_1)}$ (4) $(r_2 - r_1)$

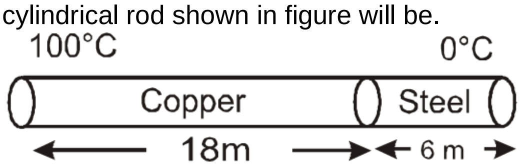
SECTION (B) : THERMAL CONDUCTION IN NONLINEAR CONDUCTORS AT STEADY STATE

1. The coefficient of thermal conductivity of copper is nine times that of steel. In the composite cylindrical bar shown in the figure, what will be the temperature at the junction of copper and steel?



(1) 75ºC (2) 67ºC (3) 33ºC (4) 25ºC

2. Heat conduction coefficient of copper is 9 times the heat conduction of coefficient of steel. Junction temperature of combined cylindrical rod shown in figure will be. **[RPMT 2010]**



(1) 75°C (2) 67°C (3) 33°C (4) 25°C

SECTION (C) : RADIATION, STEFEN'S LAW AND WEIN'S LAW

1. Water is usually heated by

(1) Conduction (2) Convection (3) Radiation (4) All the above processes

2. In natural convection a heated portion of a liquid moves because-

(1) Its molecular motion becomes aligned
(2) Of molecular collisions within it
(3) Its density is less than that of the surrounding fluid
(4) Of currents of the surrounding fluid

3. It is hotter at the same distance over the top of a fire than it is on the side of it mainly because
(1) heat is rediated upwards
(2) Air conducts heat upwards
(3) convection takes more heat upwards
(4) Conduction, convection and radiation all contribute significantly in transferring heat upwards

4. Ventilators are provided at the top of room
(1) to bring oxygen for breathing
(2) so that sunlight may enter the room
(3) to maintain convection currents to kep the air fresh in the room
(4) to provide an outlet for carbon dioxide

5. Mode of transmission of heat in which heat is carried by moving particles is:
(1) wave motion (2) convection (3) conduction (4) radiation

6. Temperature of a piece of metal is increased from 27°C to 327°C. The rate of emission of heat by radiation by a metal will become-
(1) Double (2) Four times (3) Eight times (4) Sixteen times

7. Radiation emitted by a surface is directly proportional to-
(1) Third power of its temperature (2) Fourth power of its temperature
(3) Twice power of its temperature (4) None of above

8. If temperature of surface of sun becomes half then the energy emitted by it to earth per second will reduce to -
(1) 1/2 (2) 1/4 (3) 1/16 (4) 1/64

9. If the distance between point sources and the screen is doubled then the intensity of light becomes-
(1) Four times (2) Doubled (3) Half (4) One fourth

10. At T = 200K a black body emits maximum energy at wavelength of 14 μm. Then at T = 1000K the body will emit maximum energy at wavelength of-
(1) 70 mm (2) 70 μm (3) 2.8 μm (4) 2.8 mm

11. If the temperature of a black body is raised by 50%, then the energy emitted per second will be increased by an order of-
(1) 50% (2) 100% (3) 200% (4) 400%

12. What represents the colour of star-
(1) Density (2) Distance (3) Energy (4) Temperature

13. Black body spectrum is-
(1) Continuous spectrum with black lines (2) Continuous spectrum with black bands
(3) Continuous spectrum (4) None of the above

14. There is a black spot on a body. If the body is heated and carried in dark room then it glows more. This can be explained on the basis of-
(1) Newton's law of cooling (2) Vien's law
(3) Kirchoff's law (4) Stefan's

15. A heated body emits radiation which has maximum intensity at frequency ν_m. If the temperature of the body is doubled:
(1) the maximum intensity radiation will be at frequency 2 ν_m
(2) the maximum intensity radiation will be at frequency ν_m.
(3) the total emitted energy will increase by a factor 2.
(4) None of these

16. If λ_m denotes the wavelength at which the radiative emission from a black body at a temperature T K is maximum, then- **[CPMT 2004]**

(1) $\lambda_m \propto T^4$ (2) λ_m is independent of T
(3) $\lambda_m \propto T$ (4) $\lambda_m \propto T^{-1}$

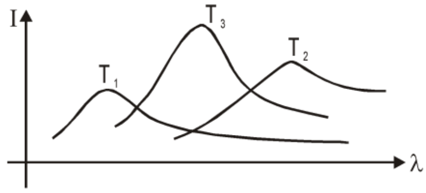
17. A black body at 1227°C emits radiations with maximum intensity at a wavelength of 5000 Å. If the temperature of the body is increased by 1000°C, the maximum intensity will be at **[CPMT 2006]**
(1) 4000 Å (2) 5000Å (3) 6000 Å (4) 3000Å

18. A black body is at 727°C. It emits energy at a rate which is proprotional to **[CPMT 2007]**
(1) $(277)^2$ (2) $(1000)^4$ (3) $(1000)^2$ (4) $(727)^4$

19. If temperature of body increases by 10%, then increase in radiated energy of the body is : **[RPMT 2001, 2002]**
(1) 10% (2) 40% (3) 46% (4) 1000%

20. Infrared radiations are detected by **[AIEEE-2002, 4/300]**
(1) spectrometer (2) pyrometer (3) nanometer (4) photometer

21. The plots of intensity vs. wavelength for three black bodies at temperatures T_1, T_2 and T_3 respectively are as shown. Their temperatures are such that- **[JEE (Scr) 2000, 3/35]**



[JEE (Scr) 2000, 3/35]
(1) $T_1 > T_2 > T_3$ (2) $T_1 > T_3 > T_2$ (3) $T_2 > T_3 > T_1$ (4) $T_3 > T_2 > T_1$

22. In which of the following phenomenon heat convection does not take place **[JEE (Scr.) 2005, 3/84, –1]**
(1) land and sea breeze
(2) boiling of water
(3) heating of glass surface due to filament of the bulb
(4) air around the furnace

23. The energy radiated by a black body is directly proportional to : **[RPMT 2003]**
(1) T^2 (2) T^{-2} (3) T^4 (4) T

24. When a substance is gradually heated, its initial colour is : **[RPMT 2003]**
(1) red (2) green (3) yellow (4) white

25. If temperature becomes double, the emitted radiation will be : **[RPMT 2004]**
(1) 16 times (2) 8 times (3) times (4) 32 times

26. If at temperature T_1 = 1000 K, the wavelength is 1.4×10^{-6} m, then at what temperature the wavelength will be 2.8×10^{-6} m ? **[RPMT 2004]**
(1) 2000 K (2) 500 K (3) 250 K (4) None of these

27. A black body is heated from 27°C to 927°C the ratio of radiations emitted will be : **[RPMT 2005]**
(1) 1 : 256 (2) 1 : 64 (3) 1 : 16 (4) 1 : 4

28. Water is used to cool the radiators of engines in cars because : **[RPMT 2005]**
(1) of its low boiling point (2) of its high specific heat
(3) of its low density (4) of its easy availability

29. The colour of star indicates its : **[RPMT 2005]**
(1) temperature (2) distance (3) velocity (4) size

30. The means of energy transfer in vacuum is : **[RPMT 2006]**
(1) irradiation (2) convection (3) radiation (4) conduction

31. the temperature of the black body increases from T to 2T. The factor by which the rate of emission will increase, is **[RPMT 2006]**

(1) 4 (2) 2 (3) 16 (4) 8

32. Let there be four articles having colours blue, red, black and white. When they are heated together and allowed to cool, which article will cool at the earliest ? **[RPMT 2007]**
(1) Blue (2) Red (3) Black (4) White

33. A piece of red glass when heated in dark to red hot states will appear to be : **[RPMT 2007]**
(1) white (2) red (3) green (4) invisible

34. What is the mode of heat transfer by which a hot cup of coffee looses most of its heat ? **[RPMT-2014]**
(1) condiction (2) convection (3) evaporation (4) radiation

35. Which one of the following processes depends on gravity : **[AIPMT2000]**
(1) Conduction (2) Convection (3) Radiation (4) None of the above

36. For a black body at temperature 727°C, its radiating power is 60 watt and temperature of surrounding is 227°C. If temperature of black body is changed to 1227°C then its radiating power will be- **[AIPMT-2002]**
(1) 304 W (2) 320 W (3) 240 W (4) 120 W

37. The Wien's displacement law express relation between- **[AIPMT-2002]**
(1) Wavelength corresponding to maximum energy and temperature.
(2) Radiation energy and wavelength
(3) Temperature and wavelength
(4) Colour of light and temperature

38. Unit of Stefan's constant is- **[AIPMT-2002]**
(1) Watt-m_2-K_4 (2) Watt-m_2/K_4 (3) Watt/m_2-K (4) Watt/m_2K_4

39. Which of the following radiations has the least wavelength ? **[AIEEE-2003, 4/300]**
(1) γ-rays (2) β-rays (3) α-rays (4) X-rays

40. If the termpreature of the sun were to increase from T to 2T and its radius from R to 2R, then the ratio of the radiant energy received on earth to what it was previously will be- **[AIEEE-2004, 4/300]**
(1) 4 (2) 16 (3) 32 (4) 64

41. Assuming the sun to be a spherical body of radius R at a temperature of T K, evaluate the total radiant power, incident on Earth, at a distance r from the Sun. (earth radius = r_0) **(AIEEE-2006; 3/180)**
(1) $\frac{R^2\sigma T^4}{r^2}$ (2) $\frac{4\pi r_0^2 \quad R^2\sigma T^4}{r^2}$ (3) $\frac{\pi r_0^2 \quad R^2\sigma T^4}{r^2}$ (4) $\frac{r_0^2 \quad R^2\sigma T^4}{4\pi r^2}$

42. The energy emitted per second by a black body at 1227ºC is E. If the temperature of the black body is increased to 2727ºC, the energy emitted per second in terms of E is -
(1) 16 E (2) E (3) 4E (4) 2E

43. Temp. of black body is 3000 k. When black body cools, then change in wavelength Δ λ = 9 micron corresponding to maximum energy density. Now temp. of black body is-
(1) 300 K (2) 2700 K (3) 270 K (4) 1800 K

44. If the radius of sun is R_S, radius of the orbit of earth about the sun is R_e and σ is Stefan's constant, then the amount of radiations falling per second on a unit area of the earth's surface is-
(1) $\left(\frac{R_s}{R_e}\right)^2 \sigma T_4$ (2) $\left(\frac{R_e}{R_s}\right)^2 \sigma T_4$ (3) $\frac{\sigma}{T^4}\left(\frac{R_s}{R_e}\right)^2$ (4) $\left(\frac{R_e}{R_s}\right)^2 \frac{T^4}{\sigma}$

45. Which of the following surfaces will absorb maximum radiant energy-
(1) Black (2) Rough (3) Smooth white (4) Rough black

46. After heating two pieces of iron, they are taken in dark room. One of them appears red and another appears blue, then-
(1) The temperature of red piece will be more. (2) The temperture of blue piece will be more.

(3) The temperture of both pieces will be same. (4) Nothing can be said about their temp.

47. If the temperature of a lamp is about 600K, then the wavelength at which maximum emission takes place will be- (wien's constant b = 3 × 10^{-3} m-K)
(1) 500 A° (2) 5000 A° (3) 50000 A° (4) 500000 A°

48. The rate of cooling of a sphere of thermal capacity 1000 cal/K is 400 J/s, its rate of fall of temperature is-
(1) 0.095 K/min (2) 0.62 K/min (3) 2.8 K/min (4) 5.7 K/min

49. If maximum spectral emissivity at temperature T_1 K is at wavelength λ_1, then the wavelength of maximum emissivity at temperature T_2 K will be-
(1) $\frac{\lambda_1 T_2}{2}$ (2) $\lambda_1\left(\frac{T_1}{T_2}\right)^4$ (3) $\lambda_1\left(\frac{T_1}{T_2}\right)^5$ (4) $\frac{\lambda_1 T_1}{T_2}$

50. The spectral emissive power of a black body at a temperature of 6000K is maximum at λ_m = 5000 A°. If the temperature is increased by 10%, then the decrease in λ_m will be-
(1) 2.5% (2) 5.0% (3) 7.5% (4) 10%

51. The rate of emission of energy by a unit area of a body is 10 watt and that of sun is 10^6 watt. The emissive power of the body is 0.1. If the temperature of the sun is 6000K, then the temperature of the body will be-
(1) 6000K (2) 600K (3) $\frac{600}{\sqrt{10}}$ K (4) $(600\sqrt{10})$ K

53. The ratio of masses of two copper spheres of identical surfaces is 8 : 1. If their temperatures are 2000K and 1000K respectively then the ratio of energies radiated per second by the two is-
(1) 128 : 1 (2) 64 : 1 (3) 16 : 1 (4) 4 : 1

54. A solid body is heated upto very high temperatures. As we go on heating, its brightness increases and it appears white at the end. The sequenc of the colour observed as the temperature of the body increases will be-
(1) Yellow, green, red, white. (2) Green, yellow, red, white.
(3) Red, green, yellow, white. (4) Red, yellow, green, white.

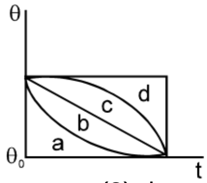
55. The effective area of a black body is 0.1 m^2 and its temperature is 100 K. The amount of radiations emitted by it per min is -
(1) 1.34 cal (2) 8.1 cal (3) 5.63 cal (4) 1.34 J

56. What is the energy of emitted radiation from Sun when the temperature is doubled-
(1) 2 (2) 4 (3) 8 (4) 16

SECTION (D) : NEWTON’S LAW OF COOLING

1. Newton’s law of cooling is a special case of
(1) Wien’s displacement law (2) Kirchoff’s law
(3) Stefan’s law (4) Planck’s law

2. A hot liquid is kept in a big room. Its temperature is plotted as a funcation of time. Which of the following curves may represent the plot ?



(1) a (2) c (3) d (4) b

3. A body takes 4 minutes to cool from 100°C to 70°C. To cool from 70°C to 40°C it will take-(room temperature is 15°C)

(1) 7 minutes (2) 6 minutes (3) 5 minutes (4) 4 minutes

4. A cup of tea cools from 80°C to 60°C in one minute. The ambient temperature is 30°C. In cooling from 60°C to 50°C it will take-

(1) 30 seconds (2) 60 seconds (3) 96 seconds (4) 48 seconds

5. A hot liquid cools from 70°C to 60°C in 5 minutes. The time needed by same liquid to cool from 60°C to 50°C will be-

(1) Less than 5 minutes (2) More than 5 minutes
(3) Equal to 5 minutes
(4) Less or more than 5 minutes that depends on the density of liquid

6. Which of the following is true statement ? **[RPMT 2001]**

(1) A good absorber is bad conductor
(2) Each body emits and absorb radiation at each temperature
(3) In a black body energy of emitted radiation is equal for all wavelength
(4) Planck's law gives the relation between maximum wavelength of black body radiation and its temperature.

7. A body takes 10 minutes to cool down from 62°C to 50°C. If the temperature of surrounding is 26°C then in the next 10 minutes temperature of the body will be : **[RPMT 2002]**

(1) 38°C (2) 40°C (3) 42°C (4) 44°C

8. A body cools from 60°C to 50°C in 10 minutes. If the room temperature is 25°C and assuming newton's law of cooling to hold good, the temperature of the body at the end of the next 10 minutes will be : **[RPMT 2005]**

(1) 45°C (2) 41.67°C (3) 40°C (4) 38.5°C

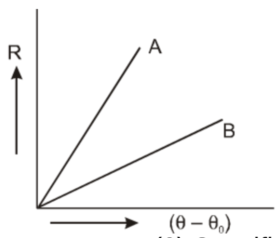
9. Two spheres of radii in the ratio 1 : 2 and densities in the ratio 2 : 1 and of same specific heat, are heated to same temperature and left in the same surrounding. Their rate of cooling will be in the ratio : **[RPMT 2005]**

(1) 2 : 1 (2) 1 : 1 (3) 1 : 2 (4) 1 : 4

10. The formation of ice is started in a lake with water at 0°C. When the atmospheric temperature is –10°C. If time taken for 1 cm of ice to be formed is 7 hours, the time taken for the thickness of ice to increase from 1cm to 2 cm is : **[RPMT 2005]**

(1) less than 7 hours (2) 7 hours
(3) more than 14 hours (4) more than 7 hours but less than 14 hours

11. Two circular discs A and B with equal radii are blackened. They are heated to same temperature and are cooled under identical conditions. What inference do you draw from their cooling curves ? **[RPMT 2007]**



(1) A and B have same specific heats (2) Specific heat of A is less
(3) Specific heat of B is less (4) Nothing can be said

12. According to Newton's law of cooling, the rate of cooling of a body is proportional to $(\Delta\theta)_n$, where $\Delta\theta$ is the difference of the temperature of the body and the surroundings, and n is equal to **[RPMT 2008]**
(1) 2 (2) 3 (3) 4 (4) 1

13. A liquid cools down from 70° C to 60°C in 5 min. The time taken to cool it from 60°C to 50°C will be
(1) 5 min
(2) lesser than 5 min
(3) greater than 5 min
(4) lesser or greater than 5 min depending upon the density of the liquid

14. The heat capacities of three liquids A, B and C of same volumes are in the ratio 3 : 2 : 1. They are allowed to cool in the same surroundings and in same conditions for the same temperature difference. Which of these will cool first?
(1) A (2) B (3) C (4) All will cool in same time

15. The temperature of a room is 30°C. A body kept in it, takes 4 minutes in cooling from 61°C to 59°C. The time taken by the body in cooling from 51°C to 49°C will be-
(1) 4 min. (2) 5 min. (3) 6 min. (4) 8 min.

Exercise-2

ONLY ONE OPTION CORRECT TYPE

1. Two cylindrical conductors A and B of same metallic material have their diameters in the raito 1 : 2 and lengths in the ratio 2 : 1. If the temperature difference between their ends is same, the ratio of heats conducted respectively by A and B per second is,
(1) 1 : 2 (2) 1 : 4 (3) 1 : 16 (4) 1 : 8

2. According to Kirchoff's law-
(1) $a_\lambda e_\lambda = E_\lambda$ (2) $E_\lambda a_\lambda = e_\lambda$ (3) $a_\lambda = e_\lambda E_\lambda$ (4) E_λ, a_λ, e_λ = const.

3. A spherical solid black body of radius 'r' radiates power 'H' and its rate of cooling is 'C'. If density is constant then which of the following is/are true.
(1) $H \propto r$ and $c \propto r_2$ (2) $H \propto r_2$ and $c \propto$ (3) $H \propto r$ and $c \propto {}_2$ (4) $H \propto r_2$ and $c \propto r_2$

4. Which of the following is nearest to blackbody- **[CPET-2002]**
(1) An enclosure with a small hole (2) Carbon black
(3) Abonite (4) None of these

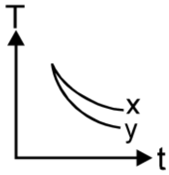
5. Which of the following processes is reversible? **[CPMT 2005]**
(1) Transfer of heat by radiation (2) Electrical heating of nichrome wire
(3) Transfer of heat by conduction (4) Isothermal compression

6. Assuming the sun to have a spherical outer surface of radius r, radiating like a black body at temperature t°C, the power received by a unit surface, (normal to the incident rays) at a distance R from the center of the sun is (considering solar constant to be uniform) **[CPMT 2007]**
(1) $\frac{4\pi r^2 t^4}{R^2}$ (2) $\frac{r^2\sigma(t+273)^4}{4\pi R^2}$ (3) $\frac{16\pi^2 r^2 \sigma t^4}{R^2}$ (4) $\frac{r^2\sigma(t+273)^2}{R^2}$

7. Which of the following is more close to a black body? **[AIEEE-2002, 4/300]**
(1) Black board paint (2) Green leaves (3) Black holes (4) Red roses

8. A black body is at a temperature of 2800 K. The energy of radiation emitted by this object with wavelength between 499 nm and 500 nm is U_1, between 999 nm and 1000 nm is U_2 and between 1499 nm and 1500 nm is U_3. The Wien constant b = 2.88 × 10_6 nm K. Then **[JEE 98, 2]**
(1) $U_1 = 0$ (2) $U_3 = 0$ (3) $U_1 > U_2$ (4) $U_2 > U_1$

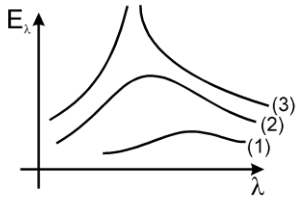
9. The temperature of bodies X and Y vary with time as shown in the figure. If emissivity of bodies X and Y are e_X & e_Y and absorptive powers are A_X and A_Y, (assume other conditions are identical for both) then: **[JEE (Scr.) 2003, 3/84, –1]**



(1) $e_Y > e_X$, $A_Y > A_X$ (2) $e_Y < e_X$, $A_Y < A_X$
(3) $e_Y > e_X$, $A_Y < A_X$ (4) $e_Y < e_X$, $A_Y > A_X$

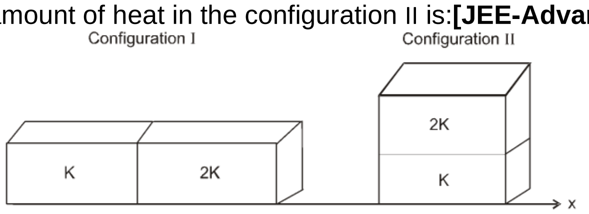
10. Three discs of same material A, B, C of radii 2 cm, 4 cm and 6 cm respectively are coated with carbon black. Their wavelengths corresponding to maximum spectral radiancy are 300, 400 and 500 nm respectively then maximum power will be emitted by **[JEE(Scr.) 2004' 3/84, –1]**
(1) A (2) B (3) C (4) same for all

11. Three graphs marked as 1, 2, 3 representing the variation of maximum emissive power and wavelength of radiation of the sun, a welding arc and a tungsten filament. Which of the following combination is correct **[JEE(Scr.)-2005, 3/84, –1]**



(1) 1- tungsten filament, 2 → welding arc, 3 → sun
(2) 2- tungsten filament, 3 → welding arc, 1 → sun
(3) 3- tungsten filament, 1 → welding arc, 2 → sun
(4) 2- tungsten filament, 1 → welding arc, 3 → sun

12. Two rectangular blocks, having indentical dimensions, can be arranged either in configuration I or in configuration II as shown in the figure, On of the blocks has thermal conductivity k and the other 2k. The temperature difference between the ends along the x-axis is the same in both the configurations. It takes 9s to transport a certain amount of heat from the hot end to the cold end in the configuration I. The time to transport the same amount of heat in the configuration II is:**[JEE-Advanced 2013 4/360,-1]**



(1) 2.0 s (2) 3.0 s (3) 4.5 s (4) 6.0 s

13. Parallel rays of light of intensity I = 912 Wm^{-2} are incident on a spherical balck body kept in surroundings of temperature 300 K. Take Stefan-Biltzmann constant $\sigma = 5.7 \times 10^{-8}\ Wm^{-2}\ K^{-4}$ and assume that the energy exchange with the surroundings is only through radiation. Th final steady state temperature of the black body is close to: **[JEE(Advanced)-2014,3/60, –1]**
(1) 330 K (2) 660 K (3) 990 K (4) 1550 K

14. Two spherical stars A and B emit blackbody radiation. The radius of A is 400 times that of B and A emits 10^4 times the power emitted from B. The ratio $\left(\frac{\lambda_A}{\lambda_B}\right)$ fo their wavelengths λ_A and λ_B at which the peaks occur in their respective radiation curves is : **[JEE(Advanced) 2015 ; 4/88]**
(1) 1 (2) 2 (3) 3 (4) 4

15. The earth radiates in the infra-red region of the specturm. The spectrum is correctly given by : **[RPMT 2008]**

(1) Rayleigh Jeans law (2) Planck's law of radiation
(3) Stefan's law of radiation (4) Wien's law

16. Two spheres of different materials one having radius double of other and wall thickness 1/4 of other are filled with ice.If time required to completely melt the ice is 25 min. for larger radius sphere and 16 min.for smaller radius sphere, then ratio of thermal conduction coefficient for material of larger radius to that of thermal conduction coefficient for material of smaller radius sphere will be. **[RPMT 2010]**
(1) 4 : 5 (2) 5 : 4 (3) 8 : 25 (4) 1 : 25

17. A black body is at room tempreture. It is placed in a furnace, and it is observed that **[RPMT 2010]**
(1) In begining it is seen most black and later on it is seen most brightest.
(2) It is always seen black.
(3) It can't be resolved at any times
(4) In begining it is seen most black and later on it can't be resolved.

18. If a liquid takes 30 sec. in cooling of 95°C to 90°C and 70 sec. in cooling of 55°C to 50°C then temp. of room is-
(1) 16.5 °C (2) 22.5 °C (3) 28.5 °C (4) 32.5 °C

19. A body takes 2 minutes in cooling from 365K to 361K. If the room temperature is 293K, then the time taken in cooling from 344K to 342K will be-
(1) 1 min. (2) 1.2 min. (3) 1.4 min. (4) 1.8 min.

20. Reflection and absorption coefficients of a given surface at 0°C for a fixed wavelength are 0.5 (each). At the same temperature and wavelength the transmission (coefficient) of surface will be-
(1) 0.5 (2) 1.0 (3) zero (4) in between zero and one

21. The earth receives radiation from the sun at the rate of 1400 watt/m^2. The distance from the centre of the sun to the surface of the earth is 1.5 × 10_{11} m and the radius of the sun is 7.0 × 10_8 m. Treating the sun as a black body the temperature of the sun will be-
(1) 6000K (2) 5500K (3) 5800K (4) 6200K

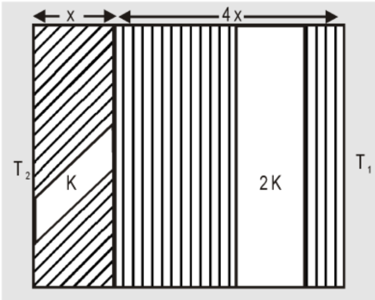
22. The rate of a cooling of a heated solid sphere is R cal/min. If it is divided into two hemispheres the rate of cooling at the same temperature will become-
(1) 1.25R cal/min. (2) 1.5R cal/min. (3) 1.75R cal/min. (4) 2.5R cal/min.

23. Equal volumes of a liquid of relative density 1.02 and water are allowed to cool from 80°C to 60°C in the same surroundings. The times taken are 8 mts and 15 mts respectively. The specific heat of the liquid in cal/gm-°C is-
(1) 0.52 (2) 0.81 (3) 1.02 (4) 1.23

24. Two identical calorimeters of negligible heat capacities are filled with two liquids A & B whose densities are in the ratio 4 : 3. The ratio of times taken in cooling from 80°C to 75°C is 5 : 6. The ratio of their specific heats is-
(1) 1 : 2 (2) 5 : 6 (3) 4 : 3 (4) 5 : 8

25. Blackened metal foil receives heat from a heated sphere placed at a distance r from it. It is found that foil receives power P. If the temperature and the distance of the sphere are doubled, then the power received by the foil will be-
(1) P (2) 2P (3) 8P (4) 4P

21. The temperature of the two outer surfaces of a composite slab, consisting of two materials K and 2K and thickness x and 4x, respectively, are T_2 and T_1($T_2 > T_1$). The rate of heat transfer through the slab, in a steady state is $\left(\frac{A(T_2 - T_1)K}{x}\right) f$ with f equal to– **[AIEEE-2004, 4/300]**



(1) 1 (2) 1/2 (3) 2/3 (4) 1/3

Exercise-3

PART - I : NEET / AIPMT QUESTION (PREVIOUS YEARS)

1. If the radius of a star is R and it acts as a black body, what would be the temperature of the star, in which the rate of energy production is Q ? [**AIPMT-Pre-2012]**
(1) $Q/4\pi R^2\sigma$ (2) $(Q/4\pi R^2\sigma)^{-1/2}$ (3) $(4\pi R^2Q/\sigma)^{1/4}$ (4) $(Q/4\pi R^2\sigma)^{1/4}$

2. A slab of stone of area 0.36 m^2 and thickness 0.1 m is exposed on the lower surface to steam at 100°C. A block of ice at 0°C rests on the upper surface of the slab. In one hour 4.8 kg of ice is melted. The thermal conductivity of slab is : **[AIPMT 2012 (Mains)]**
(Given latent heat of fusion of ice = 3.36 × 10^5 J kg^{-1}) :
(1) 1.24 J/m/s/°C (2) 1.29 J/m/s/°C (3) 2.05 J/m/s/°C (4) 1.02 J/m/s/°C

3. 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 :**[NEET_2013]**
(1) Wien's displacement Law (2) Kirchoff's Law
(3) Newton's Law of cooling (4) Stefan's Law

4. Certain quantity of water cools from 70^0C to 60^0C in the first 5 minutes and to 54^0C in the next 5 minutes. The temperature of the surroundings is; **[AIPMT-2014]**
(1) 45^0C (2) 20^0C (3) 42^0C (4) 10^0C

5. On observing light from three different stars P,Q and R, it was found that intensity of violet colour is maximum in the spectrum of P, the intensity of green colour is maximum in the spectrum of R and the intensity of red colour is maximum in the spectrum in the spectrum of Q. If T_p, T_Q and T_R are the respective absolute temperature of P, Q and R, then it can be concluded from the above obdervations that :
[AIPMT-2015]
(1) $T_P > T_R > T_Q$ (2) $T_P < T_R < T_Q$ (3) $T_P < T_Q < T_R$ (4) $T_P > T_Q T_R$

6. The two ends of a metal rod are maintained at temperatures 100ºC and 110ºC. The rate of heat flow in the rod is found to be 4.0 J/s. If the ends are maintained at temperatures 200ºC and 210ºC, the rate of heat flow will be : **[AIPMT-2015]**
(1) 16.8 J/s (2) 8.0 J/s (3) 4.0 J/s (4) 44.0 J/s

7. 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 $(\ell_2 - \ell_1)$ is maintained same at all temperatures, which one of the following relations holds good ? **[AIPMT-2016]**
(1) $\alpha_1\ell_1 = \alpha_2 \ell_2$ (2) $\alpha_1\ell_2 = \alpha_2 \ell_1$ (3) $\alpha_1\ell_2^2 = \alpha_2 \ell_1^2$ (4) $\alpha_1^2\ell_2 = \alpha_2^2 \ell_1$

8. A refrigerator works between 4°C and 30°C. it is required to remove 600 calories of heat every second in order to keep the temperature of the refrigerated space constant. The power required is :
(Take 1 cal = 4.2 Joules) **[AIPMT-2016]**
(1) 2365 W (2) 2.365 W (3) 23.65 W (4) 236.5 W

9. 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 in to 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] **[AIPMT-2016]**

(1) 68 km (2) 34 km (3) 544 km (4) 136 km

10. A block 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 ? **[AIPMT-2016]**

(1) $U_2 > U_1$ (2) $U_1 = 0$ (3) $U_3 = 0$ (4) $U_1 > U_2$

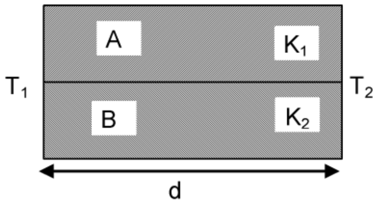
11. Two identical bodies are made of a material for which the heat capacity increases with temperature. One of these is at 100ºC, while the other one is at 0ºC. If the two bodies are brought into contact, then assuming no heat loss, the final common temperature is **[NEET 2016]**

(1) 0º C (2) 50º C
(3) more then 50º C (4) less than 50º C but greater than 0º C

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 **[NEET 2016]**

(1) T (2) $\frac{7}{4}$T (3) $\frac{3}{2}$T (4) $\frac{4}{3}$T

13. 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 **[NEET 2017]**



(1) $\frac{K_1+K_2}{2}$ (2) $\frac{3(K_1+K_2)}{2}$ (3) $K_1 + K_2$ (4) $2(K_1 + K_2)$

14. 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 : **[NEET 2017]**

(1) 225 (2) 450 (3) 1000 (4) 1800

15. The power radiated by a black body in P and it radiated maximum energy at wavelength, λ_0. If the temperature of the black body is now changes 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 : **[NEET 2018]**

(1) $\frac{3}{4}$ (2) $\frac{81}{256}$ (3) $\frac{256}{81}$ (4) $\frac{4}{3}$

16. 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 (α_{Cu} = 1.7 × 10^{-5} K^{-1} and α_{Al} = 2.2 × 10^{-5} K^{-1}) **[NEET_2019-I]**

(1) 68 cm (2) 6.8 cm (3) 113.9 cm (4) 88 cm

17. The unit of thermal conductivity is : **[NEET_2019-I]**

(1) W m^{-1} K^{-1} (2) J m K^{-1} (3) J m^{-1} K^{-1} (4) W m K^{-1}

18. An object kept in a large room having air temperature of 25ºC takes 12 minutes to cool from 80ºC to 70ºC. The time taken to cool for the same object from 70º to 60ºC would be nearly **[NEET_2019-II]**

(1) 10 min (2) 12 min (3) 20 min (4) 15 min

19. A deep rectangular pond of surface area A, containing water (density = ρ, specific heat capacity = s), is located in a region where the outside air temperature is at a steady value of –26ºC. The thickness of the frozen ice layer in this pond, at a certain instant is x. Taking the thermal conductivity of ice as K, and its specific latent heat of fusion as L, the rate of increase of the thickness of ice layer, at this instant, would be given by **[NEET_2019 - II]**

(1) 26K/ρx(L-4s) (2) 26K/(ρx^2L) (3) 26K/(ρxL) (4) 26K/ρx(L+4s)

PART - II : AIIMS QUESTION (PREVIOUS YEARS)

1. A flask containing air at 27ºC is corked up at atmospheric pressure. The cork can be forced out by a pressure of 2.5 atmosphere. To what temperature the flask should be heated to do that?
(1) 150 K (2) 300 K (3) 600 K (4) 750 K

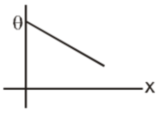
2. 1 kcal of heat flowing through a rod of iron per second. When the rod is cut down to 4 pieces then what will be the heat flowing through each piece per second having same differential temperature (temperature gradient)?
(1) (1/2) kcal (2) (1/4) kcal (3) 1 kcal (4) (1/15) kcal

3. Black holes in orbit around a normal star are detected from the earth due to the frictional heating of infalling gas into the black hole, which can reach temperatures greater than 10^6K. Assuming that the infalling gas can be modelled as a blackbody radiator then the wavelength of maximum power lies
(1) in the visible region
(2) in the X-ray region
(3) in the the microwave region
(4) in the gamma-ray regin of electromagnetic spectrum.

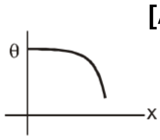
4. Two conductors having same width and length, thickness d_1 and d_2 thermal conductivity K_1 and K_2 are placed one above the another. Find the equivalent thermal conductivity.
(1) $\frac{(d_1+d_2)(K_1d_2+K_2d_1)}{2(K_1+K_2)}$ (2) $\frac{(d_1-d_2)(K_1d_2+K_2d_1)}{2(K_1+K_2)}$
(3) $\frac{K_1d_1+K_2d_2}{d_1+d_2}$ (4) $\frac{K_1+K_2}{d_1+d_2}$

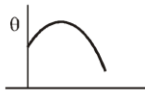
PART - III : JEE (MAIN) / AIEEE PROBLEMS (PREVIOUS YEARS)

1. A long metallic bar is carrying heat from one of its ends to the other end under steady-state. The variation of temperature θ along the length x of the bar from its hot end is best described by which of the following figures **[AIEEE-2009, 4/144]**

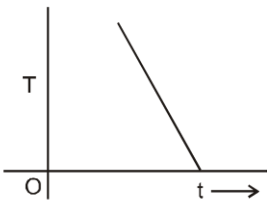
(1) 

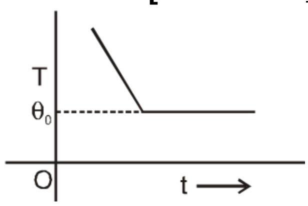
(2) 

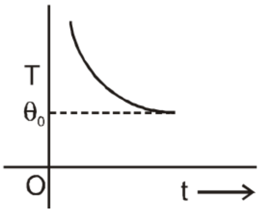
(3) 

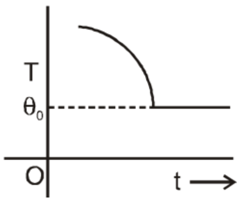
(4) 

2. If a piece of metal is heated to temperature θ and then allowed to cool in a room which is at temperature θ_0, the graph between the temperature T of the metal and time t will be closest to : **[JEE-Mains_2013, 4/360,-1]**

(1) 

(2) 

(3) 

(4) 

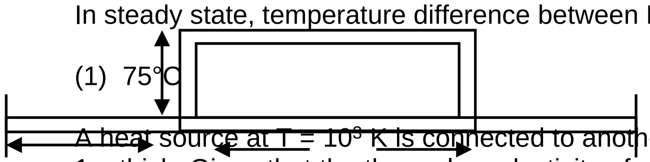
3. Three rods of Copper, brass and steel are welded together to form a Y-shaped structure. Area of cross-section of each rod = 4 cm^2. End of copper rod is maintained at 100°C where as ends of brass and steel are kept at 0°C. Lengths of the copper, brass and steel rods are 46, 13 and 12 cms respectively. The rods are thermally insulated from surroundings except at ends. Thermal conductivities of copper, brass and steel are 0.92, 0.26 and 0.12 CGS units respectively. Rate of heat flow through copper rod is: **[JEE-Mains 2014]**

(1) 1.2 cal/s (2) 2.4 cal/s (3) 4.8 cal/s (4) 6.0 cal/s

4. An ideal gas undergoes a quasi static, reversible process in which its molar heat capacity C remains constant. If during this process the relation of pressure P and volume V is given by PV^n = constant, then n is given by (Here C_p and C_V are molar specific heat at constant pressure and constant volume, respectively) : **[JEE Main 2016]**

(1) $n = \frac{C - C_p}{C - C_V}$ (2) $n = \frac{C_p - C}{C - C_V}$ (3) $n = \frac{C - C_V}{C - Cp}$ (4) $n = \frac{C_p}{C_V}$

5. Temperature difference of 120°C is maintained between two ends of a uniform rod AB of length 2L. Another bent rod PQ, of same cross-section as AB and length $\frac{3L}{2}$, is connected across AB (see figure). In steady state, temperature difference between P and Q will be close to : **[JEE Main 2019]**



(1) 75°C (3) 60°C (4) 35°C

6. A heat source at T = 10^3 K is connected to another heat reservoir at T = 10^2 K by a copper slab which is 1m thick. Given that the thermal conductivity of copper is 0.1 $WK^{-1} m^{-1}$, the energy flux through it in the steady state is : **[JEE Main 2019]**

(1) 200 Wm^{-2} (2) 90 Wm^{-2} (3) 65 Wm^{-2} (4) 120 Wm^{-2}

7. A thermometer graduated according to a linear scale reads a value x_0 when in contact with ice. What is the temperature of an object in °C, if this thermometer in the contact with the object reads $x_0/2$? **[JEE Main 2019]**

(1) 35 (2) 60 (3) 25 (4) 40

8. A cylinder of radius R is surrounded by a cylindrical of inner radius R and outer radius 2R. The thermal conductivity of the material of the inner cylinder is K_1 and that of the outer cylinder is K_2. Assuming no loss of heat, the effective thermal conductivity of the system for heart flowing along the length of the cylinder is: **[JEE Main 2019]**

(1) $K_1 + K_2$ (2) $\frac{2K_1 + 3K_2}{2}$ (3) $\frac{K_1 + K_2}{2}$ (4) $\frac{K_1 + 3K_2}{4}$

9. Two rods A and B of identical dimensions are at temperature 30°C. If A is heated upto 180°C and B upto T°C, then the new lengths are the same. If the ratio of the coefficients of linear expansion of A and B is 4 : 3, then the value of T is : **[JEE Main 2019]**

(1) 270°C (2) 200°C (3) 230°C (4) 250°C

Answers

EXERCISE - 1

SECTION (A) :

1.	(2)	**2.**	(3)	**3.**	(4)	**4.**	(4)	**5.**	(3)	**6.**	(i) (1)	(ii) (4)	
7.	(2)	**8.**	(2)	**9.**	(4)	**10.**	(2)	**11.**	(4)	**12.**	(2)	**13.**	(3)
14.	(4)	**15.**	(1)	**16.**	(2)	**17.**	(4)	**18.**	(1)	**19.**	(1)	**20.**	(2)
21.	(3)	**22.**	(2)	**23.**	(3)	**24.**	(2)	**25.**	(3)	**26.**	(2)	**27.**	(3)
28.	(1)	**29.**	(1)	**30.**	(2)	**31.**	(1)	**32.**	(4)	**33.**	(3)		

SECTION (B) :

1.	(1)	**2.**	(1)

SECTION (C) :

1.	(2)	**2.**	(3)	**3.**	(3)	**4.**	(3)	**5.**	(2)	**6.**	(4)	**7.**	(2)
8.	(3)	**9.**	(4)	**10.**	(3)	**11.**	(4)	**12.**	(4)	**13.**	(3)	**14.**	(3)
15.	(1)	**16.**	(4)	**17.**	(4)	**18.**	(2)	**19.**	(3)	**20.**	(2)	**21.**	(2)
22.	(3)	**23.**	(3)	**24.**	(1)	**25.**	(1)	**26.**	(2)	**27.**	(1)	**28.**	(2)
29.	(1)	**30.**	(3)	**31.**	(3)	**32.**	(2)	**33.**	(3)	**34.**	(4)	**35.**	(2)
36.	(2)	**37.**	(1)	**38.**	(4)	**39.**	(1)	**40.**	(4)	**41.**	(3)	**42.**	(1)
43.	(1)	**44.**	(1)	**45.**	(4)	**46.**	(2)	**47.**	(3)	**48.**	(4)	**49.**	(4)
50.	(4)	**51.**	(2)	**53.**	(2)	**54.**	(4)	**55.**	(2)	**56.**	(4)		

SECTION (D) :

1.	(3)	**2.**	(1)	**3.**	(1)	**4.**	(4)	**5.**	(2)	**6.**	(2)	**7.**	(3)
8.	(2)	**9.**	(2)	**10.**	(3)	**11.**	(2)	**12.**	(4)	**13.**	(3)	**14.**	(3)
15.	(3)												

EXERCISE - 2

1.	(4)	**2.**	(2)	**3.**	(2)	**4.**	(1)	**5.**	(4)	**6.**	(4)	**7.**	(1)
8.	(4)	**9.**	(1)	**10.**	(2)	**11.**	(1)	**12.**	(1)	**13.**	(1)	**14.**	(2)
15.	(1)	**16.**	(3)	**17.**	(1)	**18.**	(2)	**19.**	(3)	**20.**	(3)	**21.**	(3)
22.	(2)	**23.**	(1)	**24.**	(4)	**25.**	(4)	**26.**	(4)				

EXERCISE - 3

PART-I

1.	(4)	**2.**	(1)	**3.**	(1)	**4.**	(1)	**5.**	(1)	**6.**	(3)	**7.**	(1)
8.	(4)	**9.**	(4)	**10.**	(1)	**11.**	(3)	**12.**	(3)	**13.**	(1)	**14.**	(4)
15.	(3)	**16.**	(1)	**17.**	(1)	**18.**	(4)	**19.**	(3)				

PART-II

1.	(4)	**2.**	(3)	**3.**	(2)	**4.**	(3)

PART-III

1.	(1)	**2.**	(3)	**3.**	(3)	**4.**	(1)	**5.**	(2)	**6.**	(2)	**7.**	(3)
8.	(4)	**9.**	(3)										