RK VISION ACADEMY

PHYSICS

XI – THERMAL PROPERTIES OF MATTER

SECTION A

1. The resistance of platinum wire at 0°C is 2W and 6.8W at 80°C. The temperature coefficient of resistance of the wire is:

(1) $3 \times 10^{-1}°C^{-1}$

(2) $3 \times 10^{-4}°C^{-1}$

(3) $3 \times 10^{-3}°C^{-1}$

(4) $3 \times 10^{-2}°C^{-1}$

2. 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:

(1) 13t/5

(2) 10t/13

(3) 5t/13

(4) 13t/10

3. The quantities of heat required to raise the temperature of two solid copper sphere of radii r_1 and r_2 ($r_1 = 1.5\ r_2$) through 1 K are in the ratio

(1) 9/4

(2) 3/2

(3) 5/3

(4) 27/8

4. The difference in lengths of a copper rod of length 88 cm and an aluminium rod of unknown length is independent of increase in temperature. The length of aluminium rod is : (α_{Cu} =1.7 × 10–5 K^{-1} and $\alpha_{Al} = 2.2 \times 10^{-5}\ K^{-1}$)

(1) 6.8 cm

(2) 113.9 cm

(3) 88 cm

(4) 68 cm

5. The unit of thermal conductivity is:

(1) J m K^{-1}

(2) J m^{-1} K^{-1}

(3) W m K^{-1}

(4) W m^{-1} K^{-1}

6. The power radiated by a black body is P and it radiates maximum energy at wavelength, λ0. If the temperature of the black body is now changed so that it radiates maximum energy at wavelength $3\lambda_0/4$, the power radiated by it becomes nP. The value of n is:

(1) 256/81

(2) 4/3

(3) 3/4

(4) 81/256

7. Two rods A and B of different material but same dimensions 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:

(1) $3(K_1 + K_2)/2$

(2) $(K_1 + K_2)$

(3) $2(K_1 + K_2)$

(4) $(K_1 + K_2)/2$

8. 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:

(1) 450

(2) 1000

(3) 1800

(4) 225

9. In a certain planetary system, it is observed that one of the celestial bodies having a surface temperature of 200 K, emits radiation of maximum intensity near the wavelength 12 μm. The surface temperature of a nearby star which emits light of maximum intensity at a wavelength $\lambda = 4800$ A°, is:

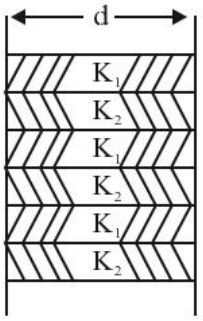
(1) 7500 K

(2) 5000 K

(3) 2500 K

(4) 10000 K

10. A wall consists of alternating blocks of length 'd' and coefficient of thermal conductivity K_1 and K_2 respectively as shown in figure. 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) $(K_1 + K_2)/2$

(2) $2K_1K_2/(K_1 + K_2)$

(3) $(K_1 + K_2)/3$

(4) $3K_1K_2/(K_1 + K_2)$

11. 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

(1) Less than 50°C but greater than 0°C

(2) 0°C

(3) 50°C

(4) More than 50°C

12. 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?

(1) $\alpha_1 l_2 = \alpha_2 l_1$

(2) $\alpha_1 l_2^2 = \alpha_2 l_1^2$

(3) $\alpha_1^2 l_2 = \alpha_2^2 l_1$

(4) $\alpha_1 l_1 = \alpha_2 l_2$

13. 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 U3. Wien's constant, b = 2.88 × 10^6 nmK. Which of the following is correct?

(1) $U_1 = 0$

(2) $U_3 = 0$

(3) $U_1 > U_2$

(4) $U_2 > U_1$

14. 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

(1) 16.8 J/s

(2) 8.0 J/s

(3) 4.0 J/s

(4) 44.0 J/s

15. 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

(1) 0.010

(2) 0.015

(3) 0.020

(4) 0.025

16. 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

(1) 45°C

(2) 20°C

(3) 42°C

(4) 10°C

17. 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}]

(1) 24 g

(2) 31.5 g

(3) 42.5 g

(4) 22.5 g

18. An aluminium meter rod of area of cross section 4 cm^2 with K = 0.5 cal /gm–°C is observed that at steady state 360 cal of heat flows per minute. The temperature gradient along the rod is

(1) 3 °C/cm

(2) 6 °C/cm

(3) 12 °C/cm

(4) 20 °C/cm

19. In a steady state of heat conduction the temperature of the ends A and B of a rod 100 cm long are 0°C and 100°C. The temperature of the rod at a point 60 cm distant from the end A is

(1) 0°C

(2) 40°C

(3) 60°C

(4) 100°C

20. There are two identical vessels filled with equal amounts of ice. The vessels are of different metals. If the ice melts in the two vessels in 20 and 35 minutes respectively, the ratio of the coefficients of thermal conductivity of the two metals is

(1) 4 : 7

(2) 7 : 4

(3) 16 : 49

(4) 49 : 16

21. Under steady state the temperature of a body (1) increases with time

(2) decreases with time

(3) does not change with time and is same at all points of the body

(4) does not change with time but is different at different cross-sections of the body

22. Two identical slabs are welded end to end and 20 cal of heat flows through it for 4 min. If the two slabs are now welded by placing them one above the other, and the same heat is flowing through two ends under the same difference of temperatures, the time taken is

(1) 1 min

(2) 2 min

(3) 4 min

(4) 16 min

23. A perfect black body is one whose emissive power is

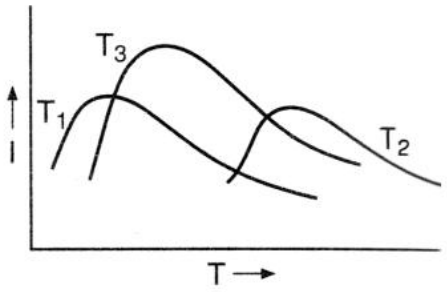
(1) maximum

(2) zero

(3) unity

(4) minimum

24. The plots of intensity versus wavelength for the three black bodies at the temperatures T_1, T & T_3 respectively are as shown. Their temperatures are such that



(1) $T_1 > T_2 > T_3$

(2) $T_1 > T_3 > T_2$

(3) $T_2 > T_3 > T_1$

(4) $T_3 > T_2 > T_1$

25. The temperature of sun is 5500 K and it emits maximum intensity radiation in the yellow region (5.5×10^{-7} m). The maximum radiation from a furnace occurs at wavelength 11×10^{-7} m. The temperature of furnace is

(1) 1125 K

(2) 2750 K

(3) 5500 K

(4) 11000 K

26. A black body has maximum wavelength λ_m at temperature 2000 K. Its corresponding wavelength at temperature

3000 K will be

(1) $3\lambda_m/2$

(2) $2\lambda_m/3$

(3) $4\lambda_m/9$

(4) $9\lambda_m/4$

27. Two spheres of same material have radii 1 m and 4m and temperatures 4000 K and 2000 K respectively. The ratio of energy radiated per second by the first sphere to that of second is

(1) 1 : 1

(2) 16 : 1

(3) 4 : 1

(4) 1 : 9

28. The amount of heat energy radiated by a metal at temperature T is E. When the temperature is increased to 3T, energy radiated is

(1) 81E

(2) 9E

(3) 3E

(4) 27E

29. A body of length 1 m having cross-sectional area 0.75 m^2 has heat flow through it at the rate of 6000 J/s. Then find the temperature difference if K = 200 $Jm^{-1}K^{-1}$.

(1) 20°C

(2) 40°C

(3) 80°C

(4) 100°C

30. How many watt of energy is required to keep a black body in the form of a cube of side 1 cm at 2000 K? (Temperature of surrounding is 27°C & $\sigma = 5.67 \times 10^{-5}$ $Wm^{-2}K^{-1}$)

(1) 444 W

(2) 544 W

(3) 644 W

(4) None of these

31. 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 should be

(1) 450

(2) 900

(3) 225

(4) 1800

32. The energy emitted per second by a black body at 27°C is 10 J. If the temperature of the black body is increased to 327°C, the energy emitted per second will be

(1) 20 J

(2) 40 J

(3) 80 J

(4) 160 J

33. A black body at 127°C emits the energy at the rate of 106 J/m^2s. The temperature of a black body at which the rate of energy emission is 16×10^6 J/m^2s is

(1) 508°C

(2) 273°C

(3) 400°C

(4) 527°C

34. If the temperature of the sun is doubled, the rate of energy received on earth will be increased by a factor of

(1) 2

(2) 4

(3) 8

(4) 16

35. A black body is at a temperature 300 K. It emits energy at a rate, which is proportional to

(1) 300

(2) $(300)^3$

(3) $(300)^2$

(4) $(300)^4$

36. A body cools from 70°C to 60°C in 8 minute. The same body cools from 60°C to 50°C in

(1) 8 minutes

(2) less than 8 minute

(3) More than 8 minute

(4) 1 or 2 or 3 depending on sp. heat of body

37. A body cools from 80°C to 64°C in 5 min and same body cools from 80°C to 52°C in 10 min. What is the temperature of the surrounding?

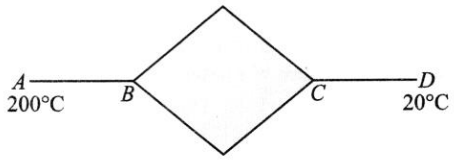
(1) 24°C

(2) 22°C

(3) 28°C

(4) 25°C

38. Six identical conducting rods are connected as shown in figure. Points A and D are maintained at temperatures 200°C and 20°C respectively. The temperature of junction B will be



(1) 80°C

(2) 100°C

(3) 120°C

(4) 140°C

39. Two rods of equal length and diameter have thermal conductivities 3 and 4 units respectively. If they are joined in series, the thermal conductivity of the combination would be

(1) 3.43

(2) 3.5

(3) 3.4

(4) 3.34

40. The surface temperature of the sun which has maximum energy emission at 500 nm is 6000 K. The temperature of a star which has maximum energy emission at 400 nm will be

(1) 8500 K

(2) 4500 K

(3) 7500 K

(4) 6500 K

41. If thermal conductivity of rod is 4, then

its thermal resistivity will be

(1) 0.25

(2) 1.0

(3) 4.0

(4) 16.0

42. On increasing the temperature of a substance gradually, its colour becomes

(1) yellow

(2) red

(3) white

(4) green

43. Heat travels through vacuum by

(1) radiation

(2) convection

(3) conduction

(4) both (1) and (2)

44. Colour of a star depends upon

(1) luminosity

(2) temperature

(3) brightness

(4) all of these

45. According to Wein's displacement law

(1) λT = constant

(2) λ / T = constant

(3) $\lambda \propto (1/T)$

(4) both (1) & (3)

46. If the temperature of a black body increases from 7°C to 287°C, then rate of energy radiation is

(1) 16 times

(2) 8 times

(3) 4 times

(4) 2 times

47. Surface temperature of star A and B are 727°C and 327°C respectively. What is the ratio H_A: H_B for the heat radiated per second by the two stars?

(1) 5 : 3

(2) 25 : 9

(3) 625 : 81

(4) 125 : 27

48. A solid sphere and a hollow sphere are heated the same temperature. Point out the true statement.

(1) hollow sphere cools more quickly

(2) both hollow & solid sphere cools equally

(3) solid sphere cools more quickly

(4) none of the statement is true

49. A body cools from 80°C to 64°C in 5 min and the same body cools from 80°C to 52°C in 10 min. What is the temperature of the surrounding?

(1) 24°C

(2) 25°C

(3) 22°C

(4) 28°C

50. A bucket full of hot water is kept in a room and it cools from 75°C to 70°C in t_1 minutes, from 70°C to 65°C in t_2 minutes and from 65°C to 60°C in t_3 minutes. Then

(1) $t_1 = t_2 = t_3$

(2) $t_1 < t_2 > t_3$

(3) $t_1 > t_2 > t_3$

(4) $t_1 < t_2 < t_3$

RK VISION ACADEMY

PHYSICS

XI – THERMAL PROPERTIES OF MATTER

SECTION A

1. 4
2. 1
3. 4
4. 4
5. 4
6. 1
7. 4
8. 3
9. 2
10. 1
11. 4
12. 4
13. 4
14. 3
15. 3
16. 1
17. 4
18. 1
19. 3
20. 2
21. 4
22. 1
23. 3
24. 2
25. 2
26. 2
27. 1
28. 1
29. 2
30. 2
31. 4
32. 4
33. 4
34. 4
35. 4

SECTION B

36. 3
37. 1
38. 4
39. 1
40. 3
41. 1
42. 3
43. 1
44. 2
45. 4
46. 1
47. 3
48. 1
49. 1
50. 4