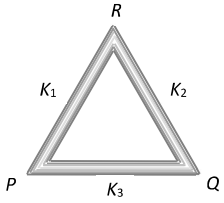
GPLUS EDUCATION

Date :
Time : **PHYSICS**
Marks :

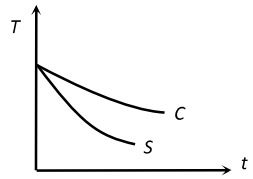
THERMAL PROPERTIES OF MATTER

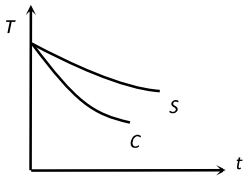
Single Correct Answer Type

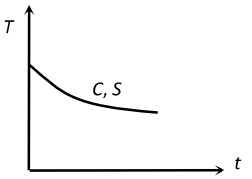
1. The luminosity of the Rigel star is 17000 times that of the sun. Assume both to be perfectly black bodies. If the surface temperature of the sun is 6000 K, then the temperature of the star is
   a) 68400 K b) 1.02×10^8K c) 12000 K d) 68400°C
2. The weight of a person is 60 kg. If he gets 10^5 calories heat through food and the efficiency of his body is 28%, then upto how much height he can climb (approximately)
   a) 100 m b) 200 m c) 400 m d) 1000 m
3. If on heating liquid through 80°C, the mass expelled is $(1/100)^{th}$ of mass still remaining, the coefficient of apparent expansion of liquid is
   a) 1.25×10^{-4}/°C b) 12.5×10^{-4}/°C c) 1.25×10^{-5}/°C d) None of these
4. The initial temperature of a body is 80°C. If its temperature falls to 64°C in 5 $minutes$ and in 10 $minutes$ to 52°C then the temperature of surrounding will be
   a) 26°C b) 49°C c) 35°C d) 42°C
5. 80 gm of water at 30°C are poured on a large block of ice at 0°C. The mass of ice that melts is
   a) 30 gm b) 80 gm c) 1600 gm d) 150 gm
6. Which one of the following processes depends on gravity?
   a) Conduction b) Convection c) Radiation d) None of these
7. Four pieces of iron heated in a furnace to different temperatures show different colours listed below. Which one has the highest temperature
   a) White b) Yellow c) Orange d) Red
8. Boiling water is changing into steam. At this stage then specific heat of water is
   a) < 1 b) ∞ c) 1 d) 0
9. Three rods of same dimensions are arranged as shown in figure. They have thermal conductivities K_1, K_2 and K_3. The points P and Q are maintained at different temperatures for the heat to flow at the same rate along PRQ and PQ then which of the following options is correct

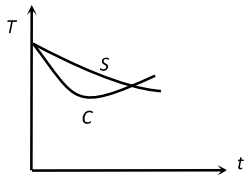


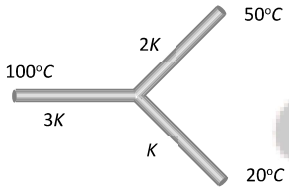
   a) $K_3 = \frac{1}{2}(K_1 + K_2)$ b) $K_3 = K_1 + K_2$ c) $K_3 = \frac{K_1 K_2}{K_1 + K_2}$ d) $K_3 = 2(K_1 + K_2)$
10. A slab consists of two parallel layers of two different materials of same thickness having thermal conductivities K_1 and K_2. The equivalent conductivity of the combination is
    a) $K_1 + K_2$ b) $\frac{K_1 + K_2}{2}$ c) $\frac{2K_1 K_2}{K_1 + K_2}$ d) $\frac{K_1 + K_2}{2K_1 K_2}$
11. At a common temperature, a block of wood and a block of metal feel equally cold or hot. The temperature of block of wood and block of metal are
    a) Equal to temperature of the body b) Less than the temperature of the body
    c) Greater than temperature of the body d) Either (b) or (c)

12. If there are no heat losses, the heat released by the condensation of $x\ g$ of steam at 100°C into water at 100°C can be used to convert $y\ gm$ of ice at 0°C into water at 100°C. Then the ratio $y : x$ is nearly
    a) $1 : 1$ b) $2.5 : 1$ c) $2 : 1$ d) $3 : 1$
13. The resistance of a resistance thermometer has values 2.71 and 3.70 ohm at 10°C and 100°C. The temperature at which the resistance is 3.26 ohm is
    a) 40°C b) 50°C c) 60°C d) 70°C
14. Ratio among linear expansion coefficient (α), areal expansion coefficient (β) and volume expansion coefficient (γ) is
    a) $1 : 2 : 3$ b) $3 : 2 : 1$ c) $4 : 3 : 2$ d) None of these
15. A hollow copper sphere S and a hollow copper cube C, both of negligible thin walls of same area, are filled with water at 90°C and allowed to cool in the same environment. The graph that correctly represents their cooling is
    a) 

    b) 

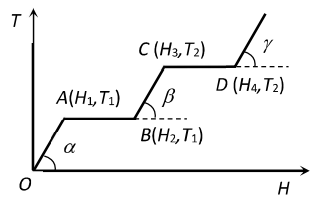
    c) 

    d) 

16. A solid copper sphere (density ρ and specific heat capacity c) of radius r at an initial temperature $200K$ is suspended inside a chamber whose walls are at almost $0K$. The time required (in $\mu\ s$) for the temperature of the sphere to drop to 100 K is
    a) $\frac{72}{2}\frac{r\rho c}{\sigma}$ b) $\frac{7}{72}\frac{r\rho c}{\sigma}$ c) $\frac{27}{7}\frac{r\rho c}{\sigma}$ d) $\frac{7}{27}\frac{r\rho c}{\sigma}$
17. Three rods of the same dimension have thermal conductivities $3K$, $2K$ and K. They are arranged as shown in fig. Given below, with their ends at 100°C, 50°C and 20°C. The temperature of their junction is
    

    a) 60°C b) 70°C c) 50°C d) 35°C
18. There are two spherical balls A and B of the same material with same surface, but the diameter of A is half that of B. If A and B are heated to the same temperature and then allowed to cool, then
    a) Rate of cooling is same in both
    b) Rate of cooling of A is four times that of B
    c) Rate of cooling of A is twice that of B
    d) Rate of cooling of A is $\frac{1}{4}$ times that of B
19. The maximum energy in thermal radiation from a source occurs at the wavelength 4000Å. The effective temperature of the source is
    a) 7325 K b) 800 K c) 10^4 K d) 10^6 K
20. An experiment takes 10 min to raise temperature of water from 0°C and 100°C and another 55 min to convert it totally into steam by a stabilized heater. The latent heat of vaporization comes out to be
    a) 530 $calg^{-1}$ b) 540 $calg^{-1}$ c) 550 $calg^{-1}$ d) 560 $calg^{-1}$
21. In a room where the temperature is 30°C, a body cools form 61°C to 59°C in 4 min. The time (in minutes) taken by the body to cool from 51°C to 49°C will be
    a) 8 b) 5 c) 6 d) 4
22. A lead bullet at 27°C just melts when stopped by an obstacle. Assuming that 25% of heat is absorbed by the obstacle, then the velocity of the bullet at the time of striking (M.P. of lead = 327°C, specific heat of lead = $0.03cal/g$°C, latent heat of fusion of lead = $6cal/g$ and $J = 4.2joule/cal$)
    a) $410m/s$ b) $1230m/s$ c) $307.5m/s$ d) None of the above

23. A block of mass 100 gm slides on a rough horizontal surface. If the speed of the block decreases from 10 m/s to 5 m/s, the thermal energy developed in the process is
    a) 3.75 J b) 37.5 J c) 0.375 J d) 0.75 J
24. Water falls from a height of 500 m. What is the rise in temperature of water at the bottom if whole energy is used up in heating water?
    a) 0.96°C b) 1.02°C c) 1.16°C d) 0.23°C
25. Two rigid boxes containing different ideal gases are placed on a table. Box A contains one mole of nitrogen at temperature T_0, while box B contains one mole of helium at temperature $(7/3)T_0$. The boxes are then put into thermal contact with each other and heat flows between them until the gases reach a common final temperature (Ignore the heat capacity of boxes). Then, the final temperature of the gases, T_f, in terms of T_0 is
    a) $T_f = \frac{7}{3}T_0$ b) $T_f = \frac{3}{2}T_0$ c) $T_f = \frac{5}{2}T_0$ d) $T_f = \frac{3}{7}T_0$
26. 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
    a) 20 J b) 40 J c) 80 J d) 160 J
27. The temperature of hot and cold end of a 20cm long rod in thermal steady state are at 100°C and 20°C respectively. Temperature at the centre of the rod is
    a) 50°C b) 60°C c) 40°C d) 30°C
28. Oxygen boils at −183°C. This temperature is approximately
    a) 215°F b) −297°F c) 329°F d) 361°F
29. A hot liquids is filled in a container and kept in a room of temperature of 25°C. The liquid emits heat at the rate of 200Js^{-1}. When its temp. is 75°C. When the temperature of the liquid becomes 40°C, the rate of heat loss in Js^{-1} is
    a) 160 b) 140 c) 80 d) 60
30. A steel wire of uniform area 2 mm^2 is heated up to 50°C and is stretched by tying its ends rigidly. The change in tension when the temperature falls from 50°C to 30°C is (Take $Y = 2 \times 10^{11}\text{Nm}^{-2}, \alpha = 1.1 \times 10^{-5}°\text{C}^{-1}$)
    a) 1.5×10^{10} N b) 5 N c) 88 N d) 2.5×10^{10} N
31. The original temperature of a black body is 727°C. The temperature at which this black body must be raised so as to double the total radiant energy, is
    a) 971 K b) 1190 K c) 2001 K d) 1458 K
32. Latent heat of 1gm of steam is 536 cal/gm, then its value in $joule/kg$ is
    a) 2.25×10^6 b) 2.25×10^3 c) 2.25 d) None
33. On a hilly region, water boils at 95°C.The temperature expressed in Fahrenheit is
    a) 100°F b) 20.3°F c) 150°F d) 203°F
34. A cylindrical rod having temperature T_1 and T_2 at its ends. The rate of flow of heat is Q_1 cal/s. If all the linear dimensions are doubled keeping temperature constant then rate of flow of heat Q_2 will be
    a) $4Q_1$ b) $2Q_1$ c) $\frac{Q_1}{4}$ d) $\frac{Q_1}{2}$
35. The gas thermometers are more sensitive than liquid thermometers because
    a) Gases expand more than liquids b) Gases are easily obtained
    c) Gases are much lighter d) Gases do not easily change their states
36. The graph shows the variation of temperature (T) of one $kilogram$ of a material with the heat (H) supplied to it. At O, the substance is in the solid state. From the graph, we can conclude that



a) T_2 is the melting point of the solid
b) BC represents the change of state from solid to liquid
c) $(H_2 - H_1)$ represents the latent heat of fusion of the substance
d) $(H_3 - H_1)$ represents the latent heat of vaporization of the liquid

37. Two rectangular blocks A and B of different metals have same length and same area of cross-section. They are kept in such a way that their cross-sectional area touch each other. The temperature at one end of A is 100°C and that of B at the other end is 0°C. If the ratio of their thermal conductivity is 1 : 3, then under steady state, the temperature of the junction in contact will be
a) 25°C b) 50°C c) 75°C d) 100°C

38. 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.
a) 2×10^{-5} b) 6×10^{-5} c) 18×10^{-5} d) 1.2×10^{-5}

39. Flash light equipped with a new set of batteries, produces bright white light. As the batteries were out
a) The light intensity gets reduced with no change in its colour
b) Light colour changes first to yellow and then red with no change in intensity
c) It stops working suddenly while giving white light
d) Colour changes to red and also intensity gets reduced

40. Water of volume 2 L in a container is heated with a coil of 1 kW at 27°C . The lid of the container is open and energy dissipates at rate of 160 Js^{-1}. In how much time temperature will rise from 27°C to 77°C [Given specific heat of water is 4.2 kJ kg^{-1}]
a) 8 min 20 s b) 6 min 2 s c) 7 min d) 14 min

41. For proper ventilation of building, windows must be open near the bottom and top of the walls so as to let pass
a) In more air
b) In cool air near the bottom and hot air out near the roof
c) In hot air near the roof and cool air out near the bottom
d) Out hot air near the roof

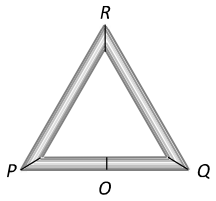
42. Two thermometers A and B are exposed in sun light. The valve of A is pointed black, but that of B is not pointed. The correct statement regarding this case is
a) Temperature of A will rise faster than B but the final temperature will be the same in both
b) Both A and B show equal rise in beginning
c) Temperature of A will remain more than B
d) Temperature of B will rise faster

43. A piece of glass is heated to a high temperature and then allowed to cool. If it cracks, a probable reason for this is the following property of glass
a) Low thermal conductivity b) High thermal conductivity
c) High specific heat d) High melting point

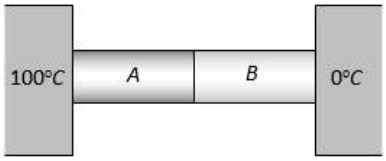
44. When two ends of a rod wrapped with cotton are maintained at different temperatures and after same time every point of the rod attains a constant temperature, then
a) Conduction of heat at different points of the rod stops because the temperature is not increasing
b) Rod is bad conductor of heat
c) Heat is being radiated from each point of the rod
d) Each point of the rod is giving heat to its neighbour at the same rate at which it is receiving heat

45. A body radiates energy $5W$ at a temperature of 127°C. If the temperature is increased to 927°C, then it radiates energy at the rate of
a) $410W$ b) $81W$ c) $405W$ d) $200W$

46. In a radiation spectrum obtained from a furnace of 2600 K has maximum intensity at 12000 Å wavelength. If the maximum intensity in spectrum of a star is at 5000 A. the temperature of the outer surface of star is
    a) 7800 K b) 6240 K c) 5240 K d) 3640 K
47. How much heat energy is gained when 5 kg of water at 20°C is brought to its boiling point (specific heat of water = 4.2 $kJ\ kg^{-1}c^{-1}$)
    a) 1680 kJ b) 1700 kJ c) 1720 kJ d) 1740 kJ
48. The point on the pressure-temperature phase diagram where all the three phases co-exist is called
    a) Sublimation point b) Fusion point
    c) Triple point d) Vaporization point
49. Distribution of energy in the spectrum of a black body can be correctly represented by
    a) Wien's law b) Stefan's law c) Planck's law d) Kirchhoff's law
50. 4200 J of work is required for
    a) Increasing the temperature of 10 gm of water through 10°C
    b) Increasing the temperature of 100 gm of water through 10°C
    c) Increasing the temperature of 1 kg of water through 10°C
    d) Increasing the temperature of 10 kg of water through 10°C
51. Three rods of equal length l are joined to form an equilateral triangle PQR. O is the mid point of PQ. Distance OR remains same for small change in temperature. Coefficient of linear expansion for PR and RQ is same, $i.e.$, α_2 but that for PQ is α_1. Then



    a) $\alpha_2 = 3\alpha_1$ b) $\alpha_2 = 4\alpha_1$ c) $\alpha_1 = 3\alpha_2$ d) $\alpha_1 = 4\alpha_2$
52. The coefficient of superficial expansion of a solid is 2×10^{-5}/°C. Its coefficient of linear expansion is
    a) 4×10^{-5}/°C b) 3×10^{-5}/°C c) 2×10^{-5}/°C d) 1×10^{-5}/°C
53. A brass rod of length 500 mm and diameter 3 mm is joined to a steel rod of same length and diameter at 50°C. If the coefficients of linear expansion of brass and steel are 2.5×10^{-5} °C^{-1} and 1.25×10^{-5} °C^{-1}, then change in length of the combined rod at 200°C is
    a) 2.4mm b) 2.8mm c) 3.2mm d) 3.6mm
54. The ratio of radiant energies radiated per unit surface area by two bodies is 16 : 1, the temperature of hotter body is 1000K, then the temperature of colder body will be
    a) 250 K b) 500 K c) 1000 K d) 62.5 K
55. It is difficult to cook rice in an open vessel by boiling it a high altitudes because of
    a) Low boiling point and high pressure b) High boiling point and low pressure
    c) Low boiling point and low pressure d) High boiling point and high pressure
56. Two metal cubes A and B of same size are arranged as shown in the figure. The extreme ends of the combination are maintained at the indicated temperatures. The arrangement is thermally insulated. The coefficients of thermal conductivity of A and B are $300W/m$°C and $200W/m$°C, respectively. After steady state is reached, the temperature of the interface will be



a) 45°C b) 90°C c) 30°C d) 60°C

57. A body, which emits radiations of all possible wavelengths, is known as
a) Good conductor b) Partial radiator c) Absorber of photons d) Perfectly black-body

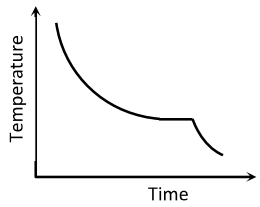
58. A solid ball of metal has a concentric spherical cavity within it. If the ball is heated, the volume of the cavity will
a) Increase b) Decrease c) Remain unaffected d) None of these

59. Steam at 100°C is passed into 1.1 kg of water contained in a calorimeter of water equivalent to 0.02 kg at 15°C till the temperature of the calorimeter and its contents rises to 80°C. The mass of the steam condensed in kg is
a) 0.130 b) 0.065 c) 0.260 d) 0.135

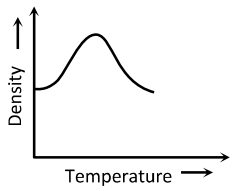
60. A hot body at temperature T losses heat to the surrounding temperature T_s by radiation. If the difference in the temperature is small then, the rate of loss of heat by the hot body is proportional to
a) $(T - T_s)$ b) $(T - T_s)^2$ c) $(T - T_s)^{1/2}$ d) $(T - T_s)^4$

61. A liquid of mass M and specific heat S is at a temperature $2t$. If another liquid of thermal capacity 1.5 times, at a temperature of $\frac{t}{3}$ is added to it, the resultant temperature will be
a) $\frac{4}{3}t$ b) t c) $\frac{t}{2}$ d) $\frac{2}{3}t$

62. The graph signifies



a) Adiabatic expansion of a gas b) Isothermal expansion of a gas
c) Change of state from liquid to solid d) Cooling of a heated solid

63. The variation of density of water with temperature is represented by the
a)


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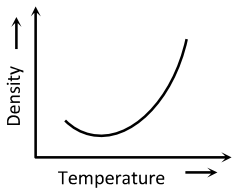

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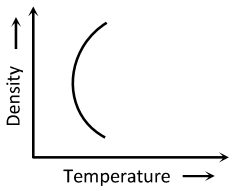
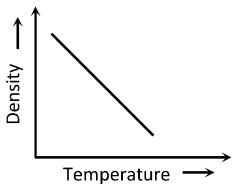


d)


64. During constant temperature, we feel colder on a day when the relative humidity will be
a) 25% b) 12.5% c) 50% d) 75%

65. "Good emitters are good absorbers" is a statement concluded from
a) Newton's law of cooling b) Stefan's law of radiation
c) Provost's theory d) Kirchhoff's law

66. Water has maximum density at
a) 0°C b) 32^oF c) -4°C d) 4°C

67. Two rods P and Q have equal lengths. Their thermal conductivities are K_1 and K_2 and cross sectional areas are A_1 and A_2. When the temperature at ends of each rod are T_1 *and* T_2 respectively, the rate of flow of heat through P *and* Q will be equal, if

a) $\frac{A_1}{A_2}=\frac{K_2}{K_1}$ b) $\frac{A_1}{A_2}=\frac{K_2}{K_1}\times\frac{T_2}{T_1}$ c) $\frac{A_1}{A_2}=\sqrt{\frac{K_1}{K_2}}$ d) $\frac{A_1}{A_2}=\left(\frac{K_2}{K_1}\right)^2$

68. Amount of heat required to raise the temperature of a body through $1K$ is called its
a) Water equivalent b) Thermal capacity c) Entropy d) Specific heat

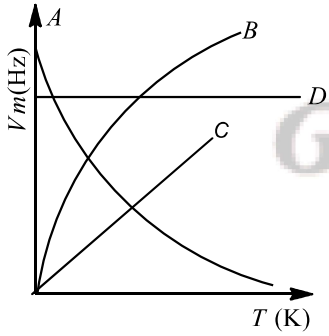
69. A lead ball moving with a velocity V strikes a wall and stops. If 50% of its energy is converted into heat, then what will be the increase in temperature (Specific heat of lead is S)
a) $\frac{2V^2}{JS}$ b) $\frac{V^2}{4JS}$ c) $\frac{V^2}{J}$ d) $\frac{V^2S}{2J}$

70. A body takes 5 *minutes* to cool from 90°C to 60°C. If the temperature of the surroundings is 20°C, the time taken by it to cool from 60°C to 30°C will be
a) 5 *min* b) 8 *min* c) 11 *min* d) 12 *min*

71. An ice box made of Styrofoam (Thermal conductivity=$0.01\text{Jm}^{-1}s^{-1}\text{K}^{-1}$) is used to keep liquids cool. It has a total wall area including lid of 0.8 m^2 and wall thickness of 0.2 cm. A bottle of water is placed in the box and filled with ice. If the outside temperature is 30°C the rate flow of heat into the box is (in Js^{-1})
a) 16 b) 14 c) 12 d) 10

72. Two rods of same length and material transfer a given amount of heat in 12 s, when they are joined end to end (*ie*, in series). But when they are joined in parallel, they will transfer same heat under same conditions in
a) 24 s b) 3 s c) 48 s d) 1.5 s

73. Which one of the following is $v_m - T$ graph for perfectly black body? v_m is the frequency of radiation with maximum intensity, T is the absolute temperature.



a) D b) C c) B d) A

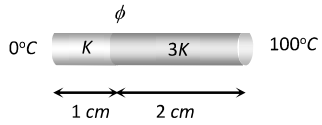
74. The wavelength of radiation emitted by a body depends upon
a) The nature of its surface b) The area of its surface
c) The temperature of its surface d) All the above factors

75. The real coefficient of volume expansion of glycerine is 0.000597 per°C and linear coefficient of expansion of glass is 0.000009 per°C. Then the apparent volume coefficient of expansion of glycerine is
a) 0.000558 per°C b) 0.00057 per°C c) 0.00027 per°C d) 0.00066 per°C

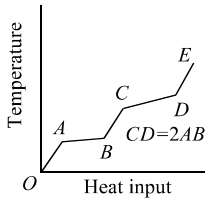
76. Temperatures of two stars are in ratio 3:2. If wavelength of maximum intensity of first body is 4000Å, what is corresponding wavelength second body?
a) 9000Å b) 6000Å c) 2000Å d) 8000Å

77. The temperature of the sun is measured with
a) Platinum thermometer b) Gas thermometer
c) Pyrometer d) Vapour pressure thermometer

78. A wall has two layers A and B, made of two different materials. The thermal conductivity of material A is twice that of B. If the two layers have same thickness and under thermal equilibrium, the temperature difference across the wall is 48°C, the temperature difference across layer B is
    a) 40°C b) 32°C c) 16°C d) 24°C
79. Two bars of thermal conductivities K and $3K$ and lengths $1cm$ and $2cm$ respectively have equal cross-sectional area, they are joined lengths wise as shown in the figure. If the temperature at the ends of this composite bar is 0°C and 100°C respectively (see figure), then the temperature ϕ of the interface is

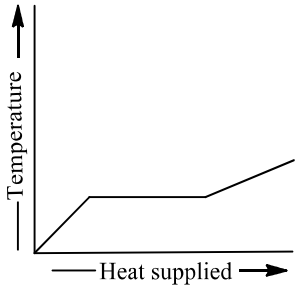


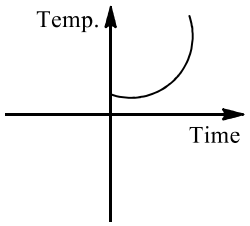
    a) 50°C b) $\frac{100}{3}$°C c) 60°C d) $\frac{200}{3}$°C
80. If the temperature of the sun becomes twice its present temperature, then
    a) Radiated energy would be predominantly in infrared
    b) Radiated energy would be predominantly in ultraviolet
    c) Radiated energy would be predominantly in X-ray region
    d) Radiated energy would become twice the present radiated energy
81. For cooking the food, which of the following type of utensil is most suitable
    a) High specific heat and low conductivity b) High specific heat and high conductivity
    c) Low specific heat and low conductivity d) Low specific heat and high conductivity
82. Two spheres P and Q, of same colour having radii 8 cm and 2 cm are maintained at temperatures 127°C and 527°C respectively. The energy radiated by P and Q is
    a) 0.054 b) 0.0034 c) 1 d) 2
83. A solid material is supplied with heat at constant rate and the temperature of the material changes as shown. From the graph, the false conclusion drawn is

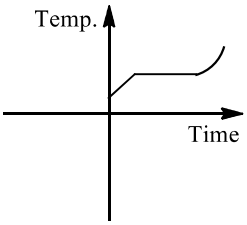


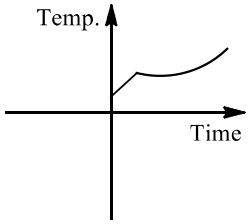
    a) AB and CD of the graph represent phase changes
    b) AB represents the change of state from solid to liquid
    c) Latent heat of fusion is twice the latent heat of vaporization
    d) CD represents change of state from liquid to vapour
84. Four identical rods of same material are joined end to end to form a square. If the temperature difference between the ends of a diagonal is 100°C, then the temperature difference between the ends of other diagonal will be
    a) 0°C b) $\frac{100}{l}$°C; where l is the length of each rod
    c) $\frac{100}{2l}$°C d) 100°C
85. Suppose the sun expands so that its radius becomes 100 times its present radius and its surface temperature becomes half of its present value. The total energy emitted by it then will increase by a factor of
    a) 10^4 b) 625 c) 256 d) 16
86. Two identical plates of different metals are joined to form a single plate whose thickness is double the thickness of each plate. If the coefficients of conductivity of each plate are 2 and 3 respectively, then the conductivity of composite plate will be
    a) 5 b) 2.4 c) 1.5 d) 1.2

87. Liquid oxygen at 50 K is heated to 300 K at constant pressure of 1 atm. The rate of heating is constant. Which of the following graphs represents the variations of temperature with time?

a) 

b) 

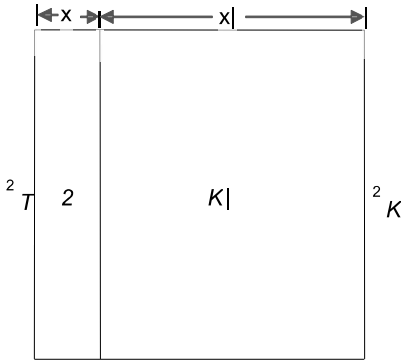
c) 

d) 

88. A faulty thermometer has its lower fixed point marked as $-10°C$ and upper fixed point marked as 110^o. If the temperature of the body shown in this scale is 62^o, the temperature shown on the Celsius scale is
a) 72°C b) 82°C c) 60°C d) 42°C

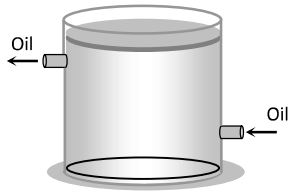
89. Two thermometers are used to record the temperature of a room. If the bulb of one is wrapped in wet hanky
a) The temperature recorded by both will be same
b) The temperature recorded by wet-bulb thermometer will be greater than that recorded by the other
c) The temperature recorded by dry-bulb thermometer will be greater than that recorded by the other
d) None of the above

90. The temperature of the two outer surfaces of a composite slab, consisting of two materials having coefficients of thermal conductivity 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 equals to



a) 1 b) 1/3 c) 2/3 d) 1/3

91. The top of insulated cylindrical container is covered by a disc having emissivity 0.6 and thickness 1 cm. The temperature is maintained by circulating oil as shown in figure. If temperature of upper surface of disc is 127°C and temperature of surrounding is 27°C, then the radiation loss to the surroundings will be (Take $\sigma = \frac{17}{3} \times 10^{-8} W/m^2K^4$)



a) $595\ J/m^2 \times s$ b) $595\ cal/m^2 \times s$ c) $991.0\ J/m^2 \times s$ d) $440\ J/m^2 \times s$

92. Two rods of equal lengths and areas of cross-section are kept parallel and hanged between temperatures 20°C and 80°C. The ratio of the effective thermal conductivity to that of the first rod is (the ratio$=\frac{K_1}{K_2}=\frac{3}{4}$)

a) 7:4 b) 7:6 c) 4:7 d) 7:8

93. The temperature of a body on Kelvin scale is found to be $x\ K$. When it is measured by Fahrenheit thermometer, it is found to be x^oF, then the value of x is

a) 40 b) 313 c) 574.25 d) 301.25

94. Which of the following cylindrical rods will conduct most heat, when their ends are maintained at the same steady temperature

a) Length 1 m; radius 1 cm b) Length 2 m; radius 1 cm
c) Length 2 m; radius 2 cm d) Length 1 m; radius 2 cm

95. Steam is passed into 22 g of water at 20°C. The mass of water that will be present when the water acquires a temperature of 90°C (Latent heat of steam is 540 cal/g) is

a) 24.8 g b) 24 g c) 36.6 g d) 30 g

96. The resistance of the wire in the platinum resistance thermometer at ice point is 5Ω and at steam point is 5.25Ω.When the thermometer is inserted in an unknown hot bath its resistance is found to be 5.5Ω.The temperature of the hot bath is

a) 100°C b) 200°C c) 300°C d) 350°C

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

a) $81E$ b) $9E$ c) $3E$ d) $27E$

98. Energy is being emitted from the surface of a black body at 127°C temperature at the rate of $1.0 \times 10^6 J/s - m^2$. Temperature of the black body at which the rate of energy emission is $16.0 \times 10^6 J/s - m^2$ will be

a) 254°C b) 508°C c) 527°C d) 727°C

99. A metal rod having linear expansion coefficient $2 \times 10^{-5}°C^{-1}$ has a length of 1 m at 20°C. The temperature at which it is shortened by 1 mm is

a) −20°C b) −15°C c) −30°C d) −25°C

100. Hot water kept in a beaker placed in a room cools from 70°C to 60°C in 4 $minutes$. The time taken by it to cool from 69°C to 59°C will be

a) The same 4 minutes b) More than 4 minutes
c) Less than 4 minutes d) We cannot say definitely

101. Of the following thermometers, the one which can be used for measuring a rapidly changing temperature is a

a) Thermocouple thermometer b) Gas thermometer
c) Maximum resistance thermometer d) Vapour pressure thermometer

102. Temperature of a black body increases from 327°C to 927°C, the initial energy possessed is $2KJ$, what is its final energy

a) 32 KJ b) 320 KJ c) 1200 KJ d) None of these

103. The amount of radiation emitted by a perfectly black body is proportional to

a) Temperature of ideal gas scale

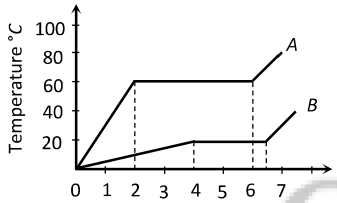
b) Fourth root of temperature on ideal gas scale
c) Fourth power of temperature on ideal gas scale
d) Source of temperature on ideal gas scale

104. A metal rod AB of length $10x$ has its one end A in ice at 0°C and the other end B in water at 100°C. If a point P on the rod is maintained at 400°C, then it is found that equal amounts of water and ice evaporate and melt per unit time. The latent heat of evaporation of water is 540 cal/g latent heat of melting of ice is 80 cal/g. If the point P is at a distance of λx from the ice end A, find the value of λ. [Neglect any heat loss to the surrounding]
a) 9 b) 2 c) 6 d) 1

105. Consider a compound slab consisting of two different materials having equal lengths, thicknesses and thermal conductivities K and $2K$ respectively. The equivalent thermal conductivity of the slab is
a) $\sqrt{2K}$ b) 3K c) $\frac{4}{3}K$ d) $\frac{2}{3}K$

106. A thin square steel plate with each side equal to 10 cm is heated by a blacksmith. The rate of radiated energy by the heated plate is 1134 W. The temperature of the hot steel plate is (Stefan's constant $\sigma = 5.67 \times 10^{-8} watt\ m^{-2}K^{-4}$, emissivity of the plate = 1)
a) 1000 K b) 1189 K c) 2000 K d) 2378 K

107. Two substances A and B of equal mass m are heated at uniform rate of 6 $cal\ s^{-1}$ under similar conditions. A graph between temperature and time is shown in figure. Ratio of heat absorbed H_A/H_B by them for complete fusion is



a) 9/4 b) 4/9 c) 8/5 d) 5/8

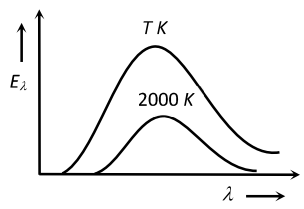
108. Two metal strips that constitute a thermostat must necessarily differ in their
a) Mass b) Length
c) Resistivity d) Coefficient of linear expansion

109. On a clear sunny day, an object at temperature T is placed on the top of a high mountain. An identical object at the same temperature is placed at the foot of mountain. If both the objects are exposed to sun-rays for two hours in an identical manner, the object at the top of the mountain will register a temperature
a) Higher than the object at the foot b) Lower than the object at the foot
c) Equal to the object at the foot d) None of the above

110. On which of the following scales of temperature, the temperature is never negative
a) Celsius b) Fahrenheit c) Reaumur d) Kelvin

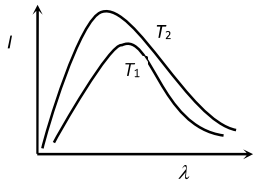
111. In a pressure cooker, cooking is faster because the increase of vapour pressure
a) Increases specific heat b) Decreases specific heat
c) Decreases the boiling point d) Increases the boiling point

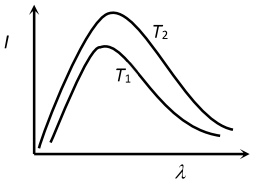
112. The adjoining diagram shows the spectral energy density distribution E_λ of a black body at two different temperatures. If the areas under the curves are in the ratio 16 : 1, the value of temperature T is

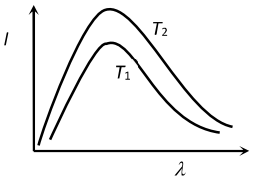


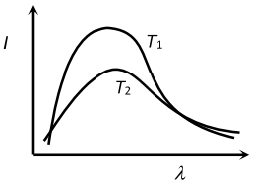
a) 32,000 K b) 16,000 K c) 8,000 K d) 4,000 K

113. Shown below are the black body radiation curves at temperatures T_1 and $T_2 (T_2 > T_1)$. Which of the following plots is correct

a) 

b) 

c) 

d) 

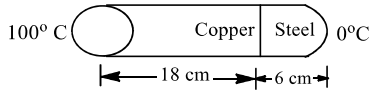
114. In supplying 400 calories of heat to a system, the work done will be

a) 400 *joules* b) 1672 *joules* c) 1672 *watts* d) 1672 *ergs*

115. Three very large plates of same area are kept parallel and close to each other. They are considered as ideal black surfaces and have very high thermal conductivity. The first and third plates are maintained at temperatures $2T$ and $3T$ respectively. The temperature of the middle (i.e. second) plate under steady state condition is

a) $\left(\frac{65}{2}\right)^{\frac{1}{4}} T$ b) $\left(\frac{97}{4}\right)^{\frac{1}{4}} T$ c) $\left(\frac{97}{2}\right)^{\frac{1}{4}} T$ d) $(97)^{\frac{1}{4}} T$

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



a) 75°C b) 67°C c) 33°C d) 25°C

117. 300 gm of water at 25°C is added to 100 g of ice at 0°C. The final temperature of the mixture is

a) $-\frac{5}{3}$°C b) $-\frac{5}{2}$°C c) -5°C d) 0°C

118. Surface of the lake is at 2°C. Find the temperature of the bottom of the lake

a) 2°C b) 3°C c) 4°C d) 1°C

119. The temperature on Celsius scale is 25°C. What is the corresponding temperature on the Fahrenheit scale

a) $40^{o}F$ b) $77^{o}F$ c) $50^{o}F$ d) $45^{o}F$

120. A beaker is completely filled with water at 4°C. It will overflow

a) When heated, but not when cooled b) When cooled, but not when heated
c) Both when heated or cooled d) Neither when heated nor when cooled

121. Two vessels of different materials are similar in size in every respect. The same quantity of ice filled in them gets melted in 20 minutes and 30 minutes. The ratio of their thermal conductivities will be

a) 1.5 b) 1 c) 2/3 d) 4

122. Ice formed over lakes has

a) Very high thermal conductivity and helps in further ice formation
b) Very low conductivity and retards further formation of ice
c) It permits quick convection and retards further formation of ice
d) It is very good radiator

123. On heating a liquid of coefficient of cubical expansion γ in a container having coefficient of linear expansion $\gamma/3$, the level of liquid in the container will

a) Rise b) Fall
c) Will remain almost stationary d) It is difficult to say

124. Which of the following has maximum specific heat

a) Water b) Alcohol c) Glycerine d) Oil

125. When the room temperature becomes equal to the dew point, the relative humidity of the room is

a) 100% b) zero% c) 70% d) 85%

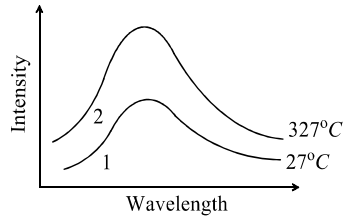
126. A body cools from 60°C to 50°C in 10 min. if the room temperature is 25°C and assuming Newton's law of cooling to hold good, the temperature of the body at the end of the next 10 min will be
a) 45°C b) 42.85°C c) 40°C d) 38.5°C

127. A metallic solid sphere is routing about its diameter as axis of rotation. If the temperature is increased by 200°C, the percentage in its moment of inertia is (Coefficient of linear expansion of the metal=10^{-5} °C^{-1})
a) 0.1% b) 0.2% c) 0.3% d) 0.4%

128. Three discs, A, B and C having radii 2 m, 4 m and 6 m respectively are coated with carbon black on their outer surfaces. The wavelengths corresponding to maximum intensitios are 300 nm, 400 nm and 500 nm respectively. The power radiated by them are Q_A, Q_B and Q_C respectively
a) Q_A is maximum b) Q_B is maximum c) Q_c is maximum d) $Q_A = Q_B = Q_C$

129. By increasing the temperature of a liquid its
a) Volume and density decrease b) Volume and density increase
c) Volume increases and density decreases d) Volume decrease s and density increases

130. The spectrum of a black body at two temperatures 27°C and 327°C is shown in the figure. Let A_1 and A_2 be the areas under the two curves respectively. The value of $\frac{A_2}{A_1}$ is



a) 1 : 16 b) 4 : 1 c) 2 : 1 d) 16 : 1

131. Pick out the statement which is not true
a) IR radiations are used for long distance photography
b) IR radiations arise due to inner electron transitions in atoms
c) IR radiations are detected by using a bolometer
d) Sun is the natural source of IR radiation

132. Dry ice is
a) Ice cube b) Sodium chloride c) Liquid nitrogen d) Solid carbon dioxide

133. The latent heat of vaporization of a substance is always
a) Greater than its latent heat of fusion b) Greater than its latent heat of sublimation
c) Equal to is latent heat of sublimation d) Less than its latent of fusion

134. According to the experiment of Ingen Hausz the relation between the thermal conductivity of a metal rod is K and the length of the rod whenever the wax melts is
a) K/l = constant b) K^2/l = constant c) K/l^2 = constant d) Kl = constant

135. A conductor of area of cross-section 100 cm^2 and length 1 cm has coefficient of thermal conductivity 0.76$cals^{-1}m^{-1}K^{-1}$. If 30 cal of heat flows through the conductor per second. Find the temperature difference across the conductor.
a) 40°C b) 20°C c) 25°C d) 35°C

136. At a certain temperature for given wave length, the ratio of emissive power of a body to emissive power of black body in same circumstances is known as
a) Relative emissivity b) Emissivity
c) Absorption coefficient d) Coefficient of reflection

137. A body cools from 62°C to 50°C in 10 min and to 42°C in the next 10 min. The temperature of the surrounding is

a) 16°C b) 26°C c) 36°C d) 21°C

138. 5 g of ice at 0°C is dropped in a beaker containing 20 g of water at 40°C. The final temperature will be

a) 32°C b) 16°C c) 8°C d) 24°C

139. A red flower kept in green light will appear

a) Red b) Yellow c) Black d) White

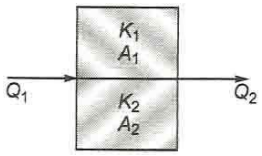
140. Which of the prism is used to see infra-red spectrum of light

a) Rock-salt b) Nicol c) Flint d) Crown

141. Two rods of equal length and area of cross-section are kept parallel and lagged between temperature 20°C and 80°C. The ratio of the effective thermal conductivity to that of the first rod is $\left[\text{the ratio } \left(\frac{K_1}{K_2}\right) = \frac{3}{4}\right]$

a) 7 : 4 b) 7 : 6 c) 4 : 7 d) 7 : 8

142. Two plates of same thickness, of coefficients of thermal conductivity K_1 and K_2 and areas of cross section A_1 *and* A_2 are connected as shown in figure. The common coefficient of thermal conductivity K will be



a) $K_1A_1 + K_2A_2$ b) $\frac{K_1A_1}{K_2A_2}$ c) $\frac{K_1A_1 + K_2A_2}{A_1 + A_2}$ d) $\frac{K_1A_2 + K_2A_1}{K_1 + K_2}$

143. Calorie is defined as the amount of heat required to raise temperature of 1 g of water by 1 °C and it is defined under which of the following conditions?

a) From 14.5°C to 15.5°C at 760 mm of Hg b) From 98.5°C to 99.5°C at 760 mm of Hg

c) From 13.5°C to 14.5°C at 76 mm of Hg d) From 3.5°C to 4.5°C at 76 mm of Hg

144. The thermal capacity of a body is 80 cal, then its water equivalent is

a) 80 cal/g b) 8 g c) 80 g d) 80 kg

145. Recently, the phenomenon of superconductivity has been observed at 95 K. This temperature is nearly equal to

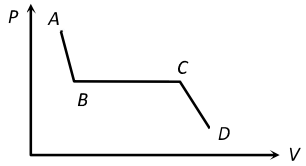
a) -288^oF b) -146^oF c) -368^oF d) $+178^oF$

146. 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

Where $r_0$is the radius of the earth and σ is stefan's constant.v

a) $4\pi r_0^2R^2\sigma T^4/r^2$ b) $\pi r_0^2R^2\sigma T^4/r^2$ c) $r_0^2R^2\sigma T^4/4\pi r^2$ d) $R^2\sigma T^4/r^2$

147. The portion AB of the indicator diagram representing the state of matter denotes



a) The liquid state of matter b) Gaseous state of matter

c) Change from liquid to gaseous state d) Change from gaseous state to liquid state

148. The ends of two rods of different materials with their thermal conductivities, radii of cross-sections and lengths all are 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/s, that in the shorter rod in cal/s will be

a) 1 b) 2 c) 8 d) 16

149. A hot body will radiate heat most rapidly if its surface is

a) White & polished b) White & rough c) Black & polished d) Black & rough

150. It is hotter for the same distance over the top of a fire than it is in the side of it, mainly because

a) Air conducts heat upwards

b) Heat is radiated upwards
c) Convection takes more heat upwards
d) Convection, conduction and radiation all contribute significantly transferring heat upwards

151. We have seen that a gamma-ray does of 3 Gy is lethal to half the people exposed to it. If the equivalent energy were absorbed as heat, what rise in body temperature would result
a) $300\mu K$ b) $700\mu K$ c) $455\mu K$ d) $390\mu K$

152. A wall is made up of two layers A and B. The thickness of the two layers is the same, but materials are different. The thermal conductivity of A is double than that of B. In thermal equilibrium the temperature difference between the two ends is 36°C. Then the difference of temperature at the two surfaces of A will be
a) 6°C b) 12°C c) 18°C d) 24°C

153. The thermal conductivity of a rod is 2. What is its thermal resistivity?
a) 0.5 b) 1 c) 0.25 d) 2

154. Newton's law of cooling is a special case of
a) Stefan's law b) Kirchhoff's law c) Wien's law d) Planck's law

155. The spectral energy distribution of a star is maximum at twice temperature as that of sun. the total energy radiated by star is
a) Twice as that of the sun
b) Same as that of the sun
c) Sixteen times as that of the sun
d) One-sixteenth of the sun

156. A particular star (assuming it as a black body) has a surface temperature of about $5 \times 10^4 K$. The wavelength in nanometers at which its radiation becomes maximum is ($b = 0.0029\ mK$)
a) 48 b) 58 c) 60 d) 70

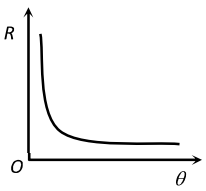
157. On a cold morning, a metal surface will feel colder to touch than a wooden surface because
a) Metal has high specific heat
b) Metal has high thermal conductivity
c) Metal has low specific heat
d) Metal has low thermal conductivity

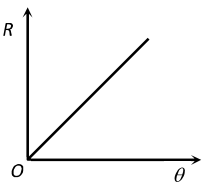
158. In Searle's method for finding conductivity of metals, the temperature gradient along the bar
a) Is greater nearer the hot end
b) Is greater nearer to the cold end
c) Is the same at all points along the bar
d) Increases as we go from hot end to cold end

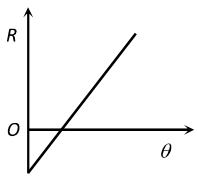
159. In which process, the rate of transfer of heat is maximum
a) Conduction
b) Convection
c) Radiation
d) In all these, heat is transferred with the same velocity

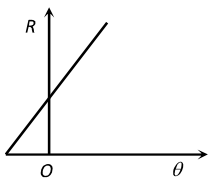
160. The temperature at which the vapour pressure of a liquid becomes equals to the external (atmospheric) pressure is its
a) Melting point b) Sublimation point c) Critical temperature d) Boiling point

161. A black body radiates at the rate of W watts at a temperature T. If the temperature of the body is reduced to $T/3$, it will radiate at the rate of (in $Watts$)
a) $\frac{W}{81}$ b) $\frac{W}{27}$ c) $\frac{W}{9}$ d) $\frac{W}{3}$

162. For a small temperature difference between the body and the surroundings the relation between the rate of loss heat R and the temperature of the body is depicted by
a) 

b) 

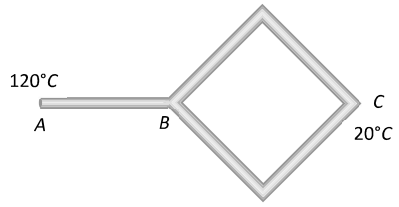
c) 

d) 

163. 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
a) 4 : 7 b) 7 : 4 c) 16 : 49 d) 49 : 16

164. The dimensions of thermal resistance are
a) $M^{-1}L^{-2}T^{3}K$ b) $ML^{2}T^{-2}K^{-1}$ c) $ML^{2}T^{-3}K$ d) $ML^{2}T^{-2}K^{-2}$

165. Five identical rods are joined as shown in figure. Point A and C are maintained at temperature 120°C and



20°C respectively. The temperature of junction B will be
a) 100°C b) 80°C c) 70°C d) 0°C

166. While measuring the thermal conductivity of a liquid, we keep the upper part hot and lower part cool, so that
a) Convection may be stopped b) Radiation may be stopped
c) Heat conduction is easier downwards d) It is easier and more convenient to do so

167. A lead bullet of 10 g travelling at 300 m/s strikes against a block of wood and comes to rest. Assuming 50% of heat is absorbed by the bullet, the increase in its temperature is
(specific heat of lead = $150J/kg,K$)
a) 100°C b) 125°C c) 150°C d) 200°C

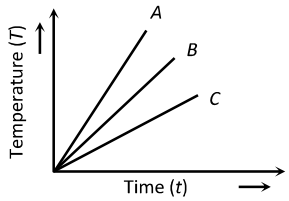
168. A liquid cools down from 70°C to 60°C in 5 *minutes*. The time taken to cool it from 60°C to 50°C will be
a) 5 *minutes*
b) Lesser than 5 *minutes*
c) Greater than 5 *minutes*
d) Lesser or greater than 5 *minutes* depending upon the density of the liquid

169. Two identical bodies have temperatures 277°C and 67°C . If the surroundings temperature is 27°C, the ratio of loss of heats of the two bodies during the same interval of time is(approximately)
a) 4:1 b) 8:1 c) 12:1 d) 19:1

170. The absolute zero is the temperature at which
a) Water freezes b) All substances exist in solid state
c) Molecular motion ceases d) None of the above

171. A copper block of mass 4 kg is heated in a furnance to a temperature 425°C and then placed on a large ice block. The mass of ice that will melt in this process will be (Specific heat of copper=500 J kg^{-1} $°C^{-1}$ and heat of fusion of ice=336 k J kg^{-1})
a) 0.5 kg b) 1 kg c) 1.5 kg d) 2.5 kg

172. Which of the substance A, B or C has the highest specific heat? The temperature vs time graph is shown



a) A b) B
c) C d) All have equal specific heat

173. A spherical black body with a radius of 12 cm radiates 440 W power at $500K$. If the radius were halved and the temperature doubled, the power radiated in watt would be

a) 225 b) 450 c) 900 d) 1800

174. How many grams of a liquid of specific heat 0.2 at a temperature 40°C must be mixed with 100 gm of a liquid of specific heat of 0.5 at a temperature 20°C, so that the final temperature of the mixture becomes 32°C

a) 175 gm b) 300 g c) 295 gm d) 375 g

175. Equal masses of two liquids are filled in two similar calorimeters. The rate of cooling will

a) Depend on the nature heats of liquids b) Depend on the specific heats of liquids

c) Be same for both the liquids d) Depend on the mass of the liquids

176. The wavelength of the radiation emitted by a body depends upon

a) The nature of the surface b) The area of the surface

c) The temperature of the surface d) All of the above factors

177. The freezer in a refrigerator is located at the top section so that

a) The entire of the refrigerator is cooled quickly due to convection

b) The motor is not heated

c) The heat gained from the environment is high

d) The heat gained from the environment is low

178. A black body of mass 34.38 g and surface area 19.2 cm^2 is at an initial temperature of 400 K. It is allowed to cool inside an evacuated enclosure kept at constant temperature 300 K. The rate of cooling is $0.04°Cs^{-1}$. The specific heat of the body in J $kg^{-1}K^{-1}$ is
(Stefan's constant $\sigma = 5.73 \times 10^{-8}$ $Wm^{-2}K^{-4}$)

a) 2800 b) 2100 c) 1400 d) 1200

179. Two slabs A and B of equal surface area are placed one over the other such that their surfaces are completely in contact. The thickness of slab A is twice that of B. The coefficient of thermal conductivity of slab A is twice that of B. The first surface of slab A is maintained at 100°C, while the second surface of slab B is maintained at 25°C. The temperature at contact of their surfaces is

a) 62.5°C b) 45°C c) 55°C d) 85°C

180. Thermoelectric thermometer is based on

a) Photoelectric effect b) Seebeck effect c) Compton effect d) Joule effect

181. An aluminium sphere of 20 cm diameter is heated from 0°C to 100°C.Its volume changes by (given that coefficient of linear expansion for aluminium $(\alpha_{Al} = 23 \times 10^{-6}/°C)$

a) 28.9 cc b) 2.89 cc c) 9.28 cc d) 49.8 cc

182. Two spherical black bodies of radii r_1 and r_2 and with surface temperature T_1 and T_2 respectively radiate the same power. Then the ratio of r_1 and r_2 will be

a) $\left(\frac{T_2}{T_1}\right)^2$ b) $\left(\frac{T_2}{T_1}\right)^4$ c) $\left(\frac{T_1}{T_2}\right)^2$ d) $\left(\frac{T_1}{T_2}\right)^4$

183. The ratio of energy of emitted radiation of a black body at 27°C and 927°C is

a) 1 : 4 b) 1 : 16 c) 1 : 64 d) 1 : 256

184. If the temperature difference on the two sides of a wall increases from 100°C to 200°C, its thermal conductivity

a) Remains unchanged b) Is doubled c) Is halved d) Becomes four times

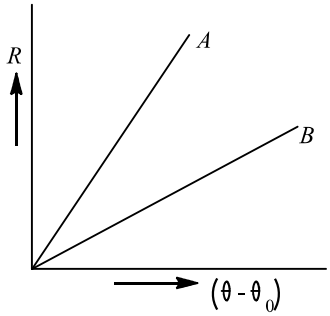
185. When the temperature of a rod increases from t to $t + \Delta t$, its moment of inertia increases from I to $I + \Delta I$. If α be the coefficient of linear expansion of the rod, then the value of $\frac{\Delta I}{I}$ is

a) $2\alpha\Delta t$ b) $\alpha\Delta t$ c) $\frac{\alpha\Delta t}{2}$ d) $\frac{\Delta t}{\alpha}$

186. A solid sphere and a hollow sphere of the same material and size are heated to the same temperature and allowed to cool in the same surroundings. If the temperature difference between each sphere and its surroundings is T, then

a) The hollow sphere will cool at a faster rate for all values of T
b) The solid sphere will cool at a faster rate for all values of T
c) Both spheres will cool at the same rate for all values of T
d) Both spheres will cool at the same rate only for small values of T

187. Two circular discs A and B with equal radii are blackened. They are heated to some temperature and are cooled under identical conditions. What inference do you draw from their cooling curves?



a) A and B have same specific heats
b) Specific heat of A is less
c) Specific heat of B is less
d) Nothing can be said

188. A quantity of heat required to change the unit mass of a solid substance, from solid state to liquid state, while the temperature remains constant, is known as
a) Latent heat
b) Sublimation
c) Hoar frost
d) Latent heat of fusion

189. A black body emits radiations of maximum intensity for the wavelength of 5000Å when the temperature of the body is 1227°C. If the temperature of the body is increased by 1000°C, the maximum intensity would be observed at
a) 1000Å
b) 2000Å
c) 5000Å
d) 3000Å

190. The maximum wavelength of radiation emitted at $2000K$ is $4\mu m$. What will be the maximum wavelength of radiation emitted at 2400 K
a) $3.33\mu m$
b) $0.66\mu m$
c) $1\mu m$
d) $1m$

191. 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 liquids and solids

192. A hot metallic sphere of radius r radiates heat. It's rate of cooling is
a) Independent of r
b) Proportional to r
c) Proportional to r^2
d) Proportional to $1/r$

193. A black body of surface area $10cm^2$ is heated to 127°C and is suspended in a room at temperature 27°C. The initial rate of loss of heat from the body at the room temperature will be
a) 2.99 W
b) 1.89 W
c) 1.18 W
d) 0.99 W

194. The temperature of a metal block is increased from 27°C to 84°C. The rate of the radiated energy from the block will increase approximately
a) 2 times
b) 4 times
c) 8 times
d) 16 times

195. 'Stem Correction' in platinum resistance thermometers are eliminated by the use of
a) Cells
b) Electrodes
c) Compensating leads
d) None of the above

196. Liquid is filled in a vessel which is kept in a room with temperature 20°C. When the temperature of the liquid is 80°C, then it loses heat at the rate of 60 cal/s. What will be the rate of loss of heat when the temperature of the liquid is 40°C
a) 180 cal/s
b) 40 cal/s
c) 30 cal/s
d) 20 cal/s

197. In which of the following process convection does not take place primarily
a) Sea and land breeze
b) Boiling of water
c) Warming of glass of bulb due to filament
d) Heating air around a furnace

198. A body takes 5 minutes for cooling from 50°C to 40°C. Its temperature comes down to 33.33°C in next 5 minutes. Temperature of surroundings is
a) 15°C b) 20°C c) 25°C d) 10°C

199. A rod of silver at 0°C is heated to 100°C. It's length is increased by 0.19 cm. Coefficient of cubical expansion of the silver rod is
a) 5.7×10^{-5}/°C b) 0.63×10^{-5}/°C c) 1.9×10^{-5}/°C d) 16.1×10^{-5}/°C

200. A black body radiates energy at the rate of E Wm^{-2} at a high temperature T K. When the temperature is reduced to $\left(\frac{T}{2}\right)$ K, the radiant energy is
a) $\frac{E}{2}$ b) $2E$ c) $\frac{E}{4}$ d) $\frac{E}{16}$

201. What should be the lengths of a steel and 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) $= 1.1 \times 10^{-5}°C^{-1}$
α (Copper)$= 1.7 \times 10^{-5}°C^{-1}$
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

202. If a liquid is heated in weightlessness, the heat is transmitted through
a) Conduction
b) Convection
c) Radiation
d) Neither, because the liquid cannot be heated in weightlessness

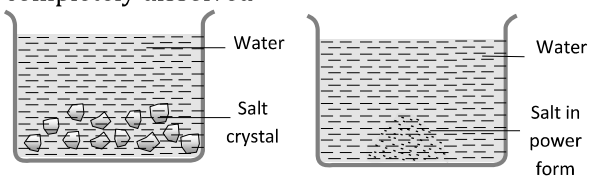
203. A black body at a temperature of 1640 K has the wavelength corresponding to maximum emission equal to 1.75μ. Assuming the moon to be a perfectly black body, the temperature of the moon, if the wavelength corresponding to maximum emission is 14.35μ is
a) 100 K b) 150 K c) 200 K d) 250 K

204. 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 $2R$ made of 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) $\frac{3K_1 + K_2}{4}$

205. Water is used to cool radiators of engines, because
a) Of its lower density b) It is easily available
c) It is cheap d) It has high specific heat

206. A metal rod of Young's modulus γ and coefficient of thermal expansion α is held at its two ends such that its length remains invariant. If its temperature is raised by t°C, the linear stress developed in it is
a) $\frac{\alpha t}{\gamma}$ b) $\frac{\gamma}{\alpha E}$ c) $\gamma \alpha t$ d) $\frac{I}{\gamma \alpha t}$

207. Out of the following, in which vessel will the temperature of the solution be higher after the salt is completely dissolved



a) A b) B
c) Equal in both d) Information is not sufficient

208. If black wire of platinum is heated, then its colour first appear red, then yellow and finally white. It can be understood on the basis of
   a) Wien's displacement law
   b) Prevost theory of heat exchange
   c) Newton's law of cooling
   d) None of the above

209. The freezing point of the liquid decreases when pressure is increased, if the liquid
   a) Expands while freezing
   b) Contracts while freezing
   c) Does not change in volume while freezing
   d) None of these

210. The end A of a rod AB of length 1 m is maintained at 100°C and the end B at 10°C. The temperature at a distance of 60 cm from the end B is
   a) 64°C
   b) 36°C
   c) 46°C
   d) 72°C

211. At temperature T, the power radiated by a body is Q $watts$. At the temperature $3T$ the power radiated by it will be
   a) 3 Q
   b) 9 Q
   c) 27 Q
   d) 81 Q

212. Ice starts forming 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 h, the time taken for the thickness of ice to increase from 1 cm to 2 cm is
   a) 7 h
   b) Less than 7 h
   c) More than 7 h but less than 14 h
   d) More than 14 h

213. Woolen clothes are used in winter season because woolen clothes
   a) Are good sources for producing heat
   b) Absorb heat from surroundings
   c) Are bad conductors of heat
   d) Provide heat to body continuously

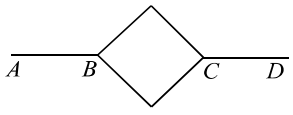
214. Let there be four articles having colours blue, red, black and white. When they are heated together and allowed to cool, which article cool at the earliest
   a) Blue
   b) Red
   c) Black
   d) White

215. Which of the following law states that "good absorbers of heat are good emitters"
   a) Stefan's law
   b) Kirchhoff's law
   c) Planck's law
   d) Wien's law

216. Which of the following statements is true/correct
   a) During clear nights, the temperature rises steadily upward near the ground level
   b) Newton's law of cooling, an appropriate form of Stefan's law, is valid only for natural convection
   c) The total energy emitted by a black body per unit time per unit area is proportional to the square of its temperature in the Kelvin scale
   d) Two spheres of the same material have radii $1m$ and $4m$ and temperatures $4000K$ and $2000K$ respectively. The energy radiated per second by the first sphere is greater than that radiated per second by the second sphere

217. For a perfectly black body, its absorptive power is
   a) 1
   b) 0.5
   c) 0
   d) Infinity

218. Six identical metallic rods are joined together in a pattern as shown in the figure. Points A and D are maintained at temperature 60°C and 240°C. The temperature of the junction B will be

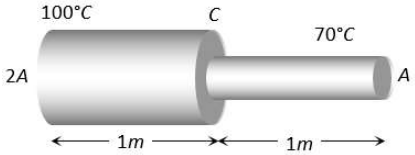


   a) 120°C
   b) 150°C
   c) 60°C
   d) 80°C

219. The relative humidity on a day when partial pressure of water vapour is 0.012×10^5 Pa at 12°C is (Take vapour pressure of water at this temperature as 0.016×10^5 Pa)
   a) 70%
   b) 40%
   c) 75%
   d) 25%

220. The radiant energy from the sun incident normally at the surface of earth is 20 $kcal/m^2 min$. What would have been the radiant energy incident normally on the earth, if the sun had a temperature twice of the present one
   a) 160 $kcal/m^2\ min$
   b) 40 $kcal/m^2\ min$
   c) 320 $kcal/m^2\ min$
   d) 80 $kcal/m^2\ min$

221. A metal rod of length $2m$ has cross sectional areas $2A$ and A as shown in figure. The ends are maintained at temperatures 100°C and 70°C. The temperature at middle point C is



a) 80°C b) 85°C c) 90°C d) 95°C

222. Which of the following is the unit of specific heat

a) $J\ kg°C^{-1}$ b) $J/kg°C$ c) $kg°C/J$ d) $J/kg°C^{-2}$

223. A body of area $1cm^2$ is heated to a temperature $1000K$. The amount of energy radiated by the body in $1\ s$ is (Stefan's constant $\sigma = 5.67 \times 10^{-8} Wm^{-2}K^{-4}$)

a) 5.67 joule b) 0.567 joule c) 56.7 joule d) 567 joule

224. The cause of Fraunhoffer lines is

a) Reflection of radiations by chromosphere b) Absorption of radiations by chromosphere
c) Emission of radiations by chromosphere d) Transmission of radiations by chromosphere

225. A bucket full of hot water is kept in a room. 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,

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

226. The quantity of heat which crosses per unit area of a metal plate during conduction depends upon

a) The density of the metal b) The temperature gradient perpendicular to the area
c) The temperature to which the metal is heated d) The area of the metal plate

227. Two cylinders P and Q have the same length and diameter and are made of different materials having thermal conductivities in the ratio 2:3. These two cylinders are combined to make a cylinder. One end of P is kept of 100°C and another end of Q at 0°C. The temperature at the interface of P and Q is

a) 30°C b) 40°C c) 50°C d) 60°C

228. A metal sphere of radius r and specific heat c is rotated about an axis passing through its centre at a speed of n rotations per second. It is suddenly stopped and 50% of its energy is used in increasing its temperature. Then the rise in temperature of the sphere is

a) $\frac{2}{5}\frac{\pi^2 n^2 r^2}{c}$ b) $\frac{1}{10}\frac{\pi^2 n^2}{r^2 c}$ c) $\frac{7}{8}\pi r^2 n^2 c$ d) $5\left[\frac{\pi r n}{14c}\right]^{-2}$

229. Temperature of water at the surface of lake is -20°C. Then temperature of water just below the lower surface of ice layer is

a) -4°C b) 0°C c) 4°C d) -20°C

230. A black body at 227°C radiates heat at the rate of 7 $Cal/cm^2 s$. At a temperature of 727°C, the rate of heat radiated in the same units will be

a) 60 b) 50 c) 112 d) 80

231. The spectrum from a black body radiation is a

a) Line spectrum b) Band spectrum
c) Continuous spectrum d) Line and band spectrum both

232. The densities of a liquid at 0°C and 100°C are respectively 1.0127 and 1. A specific gravity bottle is filled with 300 g of the liquid at 0°C upto the brim and it is heated to 100°C. Then the mass of the liquid expelled in grams is (Coefficient of linear expansion of glass$=9 \times 10^{-6}$ °C^{-1})

a) $\frac{3}{10.1}$ b) $\frac{3}{1.01}$ c) $\frac{3.81}{1.0127}$ d) $\frac{3.81}{0.0127}$

233. One gram of ice is mixed with one gram of steam. At thermal equilibrium the temperature of mixture is

a) 0°C b) 100°C c) 55°C d) 80°C

234. A rod of length 20 cm is made of metal. It expands by $0.075cm$ when its temperature is raised from 0°C to 100°C. Another rod of a different metal B having the same length expands by 0.045 cm for the same change in temperature. A third rod of the same length is composed of two parts, one of metal A and the other of metal B. This rod expands by 0.060 cm for the same change in temperature. The portion made of metal A has the length
a) 20 cm b) 10 cm c) 15 cm d) 18 cm

235. Two solid spheres A and B made of the same material have radii r_A and r_B respectively. Both the spheres are cooled from the same temperature under the conditions valid for Newton's law of cooling. The ratio of the rate of change of temperature of A and B is
a) $\frac{r_A}{r_B}$ b) $\frac{r_B}{r_A}$ c) $\frac{r_A^2}{r_B^2}$ d) $\frac{r_B^2}{r_A^2}$

236. The volume of a gas at 20°C is 100 cm^3 at normal pressure. If it is heated to 100°C, its volume becomes 125 cm^3 at the same pressure, then volume coefficient of the gas at normal pressure is
a) 0.0015/°C b) 0.0045/°C c) 0.0025/°C d) 0.0033/°C

237. The readings of a constant volume gas thermometer at 0°C and 100°C are 40cm of mercury and 60 cm of mercury. If its reading at an unknown temperature is 100cm of mercury column, then the temperature is
a) 100°C b) 50°C c) 25°C d) 300°C

238. At what temperature the centigrade (Celsius) and Fahrenheit, readings are the same
a) -40^o b) $+40^o$ c) 36.6^o d) -37^o

239. An ideal black body at room temperature is thrown into a furnance. It is observed that
a) It is the darkest body at all times
b) It cannot be distinguished at all times
c) Initially it is the darkest body and later it becomes brightest
d) Initially it is the darkest body and later it cannot be distinguished

240. Two beakers A and B are filled to the brim with water at 4°C. When A is heated and B is cooled, the water
a) Level in B decreases b) Will overflow in A only
c) Will overflow in B only d) Will overflow in both A and B

241. The sprinkling of water reduces slightly the temperature of a closed room because
a) Temperature of water is less than that of the room
b) Specific heat if water is high
c) Water has large latent heat of vaporisation
d) Water is a bad conductor of heat

242. The value of Stefan's constant is
a) $5.67 \times 10^{-8} W/m^2\text{-}K^4$ b) $5.67 \times 10^{-5} W/m^2\text{-}K^4$
c) $5.67 \times 10^{-11} W/m^2\text{-}K^4$ d) None of these

243. In MKS system, Stefan's constant is denoted by σ. In CGS system multiplying factor of σ will be
a) 1 b) 10^3 c) 10^5 d) 10^2

244. A slab consists of two parallel layers of copper and brass of the same thickness and having thermal conductivities in the ratio 1:4. If the free face of brass is at 100°C and that of copper at 0°C, the temperature of interface is
a) 80°C b) 20°C c) 60°C d) 40°C

245. A gas in an airtight container is heated from 25°C to 90°C. The density of the gas will
a) Increase slightly b) Increase considerably
c) Remain the same d) Decrease slightly

246. The maximum energy in the thermal radiation from a hot source occurs at a wavelength of $11 \times 10^{-5} cm$. According to Wien's law, the temperature of the source (on Kelvin scale) will be n times the temperature

of another source (on Kelvin scale) for which the wavelength at maximum energy is $5.5 \times 10^{-5} cm$. The value n is

a) 2 b) 4 c) $\frac{1}{2}$ d) 1

247. Work done in converting one gram of ice at -10°C into steam at 100°C is

a) 3045 J b) 6056 J c) 721 J d) 616 J

248. Two rods of same length and cross section are joined along the length. Thermal conductivities of first and second rod are K_1 and K_2. The temperature of the free ends of the first and second rods are maintained at θ_1 and θ_2 respectively. The temperature of the common junction is

a) $\frac{\theta_1 + \theta_2}{2}$ b) $\frac{K_2 K_1}{K_1 + K_2}(\theta_1 + \theta_2)$ c) $\frac{K_1\theta_1 + K_2\theta_2}{K_1 + K_2}$ d) $\frac{K_2\theta_1 + K_1\theta_2}{K_1 + K_2}$

249. One end of a copper rod of length 1.0 m and area of cross-section $10^{-3} m^2$ is immersed in boiling water and the other end in ice. If the coefficient of thermal conductivity of copper is 92 $cal/m\text{-}s\text{-}$°C and the latent heat of ice is $8 \times 10^4 cal/kg$, then the amount of ice which will melt in one minute is

a) $9.2 \times 10^{-3} kg$ b) $8 \times 10^{-3} kg$ c) $6.9 \times 10^{-3} kg$ d) $5.4 \times 10^{-3} kg$

250. The temperature gradient in a rod of 0.5 m long is 80°C/m. If the temperature of hotter end of the rod is 30°C, then the temperature of the cooler end is

a) 40°C b) -10°C c) 10°C d) 0°C

251. If between wavelength λ and $\lambda + d\lambda$, e_λ and a_λ be the emissive and absorptive powers of a body and E_λ be the emissive power of a perfectly black body, then according to Kirchoff's law, which is true

a) $e_\lambda = a_\lambda = E_\lambda$ b) $e_\lambda E_\lambda = a_\lambda$ c) $e_\lambda = a_\lambda E_\lambda$ d) $e_\lambda a_\lambda E_\lambda =$ constant

252. Good absorbers of heat are

a) Poor emitters b) Non-emitters c) Good emitters d) Highly polished

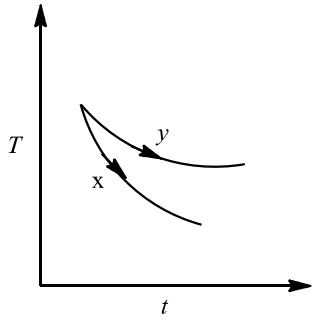
253. Infrared radiations are detected by

a) Spectrometer b) Pyrometer c) Nanometer d) Photometer

254. Two temperature scales A and B are related by $\frac{A-42}{110} = \frac{B-72}{220}$. At which temperature two scales have the same reading?

a) -42°C b) -72°C c) 12°C d) 40°C

255. The graph, shown in the adjacent diagram, represents the variation of temperature (T) of two bodies, x and y having same surface area, with time (t) due to the emission of radiation. Find the correct relation between the emissivity and absorptivity power of the two bodies.



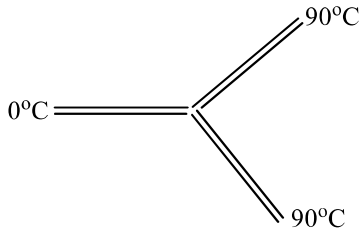
a) $E_x > E_y$ and $a_x < a_y$ b) $E_x < E_x$ and $a_x > a_y$

c) $E_x > E_x$ and $a_x > a_y$ d) $E_x < E_x$ and $a_x < a_y$

256. In heat transfer, which method is based on gravitation

a) Natural convection b) Conduction c) Radiation d) Stirring of liquids

257. Three rods made of same material and having same cross-section are joined as shown in the figure. Each rod is of same length. The temperature at the junction of the three rods is

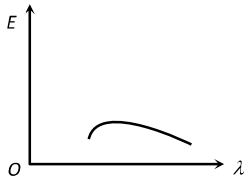


a) 45°C b) 90°C c) 30°C d) 60°C

258. There is a rough black spot on a polished metallic plate. It is heated upto 1400 K approximately and then at once taken in a dark room. Which of the following statements is true
   a) In comparison with the plate, the spot will shine more
   b) In comparison with the plate, the spot will appear more black
   c) The spot and the plate will be equally bright
   d) The plate and the black spot can not be seen in the dark room

259. The quantities of heat required to raise the temperatures of two copper spheres of radii r_1 and r_2 ($r_1 = 1.5r_2$) through 1 K are in the ratio of
   a) 1 b) $\frac{3}{2}$ c) $\frac{9}{4}$ d) $\frac{27}{8}$

260. The energy distribution E with the wavelength (λ) for the black body radiation at temperature T $kelvin$ is shown in the figure. As the temperature is increased the maxima will



   a) Shift towards left and become higher b) Rise high but will not shift
   c) Shift towards right and become higher d) Shift towards left and the curve will become broader

261. The coefficient of volumetric expansion of mercury is 18×10^{-5}/°C. A thermometer bulbs has a volume $10^{-6}m^3$ and cross section of stem is 0.004 cm^2. Assuming that bulb is filled with mercury at 0°C then the length of the mercury column at 100°C is
   a) 18.8 mm b) 9.2 mm c) 7.4 cm d) 4.5 cm

262. A body of length $1m$ having cross sectional area $0.75m^2$ has heat flow through it at the rate of 6000 $Joule/s$. Then find the temperature difference if $K = 200\ Jm^{-1}K^{-1}$
   a) 20°C b) 40°C c) 80°C d) 100°C

263. Wien's displacement law for emission of radiation can be written as
   a) λ_{max} is proportional to absolute temperature(T)
   b) λ_{max} is proportional to square of absolute temperature(T^2)
   c) λ_{max} is inversely proportional to square of absolute temperature(T)
   d) λ_{max} is inversely proportional to square of absolute temperature(T^2) (λ_{max}=wavelength whose energy density is greatest)

264. An ideal gas is expanding such that PT^2 = constant. The coefficient of volume expansion of the gas is
   a) $\frac{1}{T}$ b) $\frac{2}{T}$ c) $\frac{3}{T}$ d) $\frac{4}{T}$

265. Amount of heat required to convert 10 g of ice to water at 20°C is
   a) 80 cal b) 100 cal c) 1000 cal d) 540 cal

266. Two metallic spheres S_1 and S_2 are made of the same material and have identical surface finish. The mass of S_1 is three times that of S_2. Both the spheres are heated to the same high temperature and placed in the

same room having lower temperature but are thermally insulated from each other. The ratio of the initial rate of cooling of S_1 to that of S_2 is

a) $1/3$ b) $(1/3)^{1/3}$ c) $1/\sqrt{3}$ d) $\sqrt{3}/1$

267. On investigation of light from three different stars A, B and C, it was found that in the spectrum of A the intensity of red colour is maximum, in B the intensity of blue colour is maximum and in C the intensity of yellow colour is maximum. From these observations it can be concluded that
   a) The temperatures of A is maximum, B is minimum and C is intermediate
   b) The temperatures of A is maximum, C is minimum and B is intermediate
   c) The temperatures of B is maximum, A is minimum and C is intermediate
   d) The temperatures of C is maximum, B is minimum and A is intermediate
268. A body has same temperature as that of the surrounding. Then
   a) It radiates same heat as it absorbs
   b) It absorbs more, radiates less heat
   c) It radiates more, absorbs less heat
   d) It never radiates heat
269. The area of the glass of a window of a room is 10 m^2 and thickness $2mm$. The outer and inner temperature are 40°C and 20°C respectively. Thermal conductivity of glass in MKS system is 0.2. The heat flowing in the room per second will be

   a) 3×10^4 $joules$ b) 2×10^4 $joules$ c) 30 $joules$ d) 45 $joules$
270. A substance of mass m kg requires a power input of P watts to remain in the molten state at its melting point. When the power is turned off, the sample completely solidifies in time t sec. What is the latent heat of fusion of the substance

   a) $\frac{Pm}{t}$ b) $\frac{Pt}{m}$ c) $\frac{m}{Pt}$ d) $\frac{t}{Pm}$
271. A lead bullet strikes against a steel plate with a velocity 200 m/s. If the impact is perfectly inelastic and the heat produced is equally shared between the bullet and the target, then the rise in temperature of the bullet is (specific heat capacity of lead=125Jkg^{-1} K^{-1})

   a) 80°C b) 60°C c) 40°C d) 120°C
272. If the temperature of the sun were to increase from T to $2T$ and its radius from R to $2R$, when the ratio of radiant energy received on earth to what it was previously, will be

   a) 4 b) 16 c) 32 d) 64
273. A composite rod made of copper ($\alpha = 1.8 \times 10^{-5}$ K^{-1}) and steel ($\alpha = 1.2 \times 10^{-5}$ K^{-1}) is heated. Then
   a) It bends with steel on concave side
   b) It bends with copper on concave side
   c) It does not expand
   d) Data is insufficient
274. Two friends A and B are waiting for another friend for tea. A took the tea in a cup and mixed the cold milk and then waits. B took the tea in the cup and then mixed the cold milk when the friend comes. Then the tea will be hotter in the cup of

   a) A
   b) B
   c) Tea will be equally hot in both cups
   d) Friend's cup
275. 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

a) $Q/4\pi R^2\sigma$ b) $(Q/4\pi R^2\sigma)^{-1/2}$

c) $(4\pi R^2 Q/\sigma)^{1/4}$ d) $(Q/4\pi R^2\sigma)^{1/4}$ (σ stands for stefan's constant)

276. A hammer of mass $1kg$ having speed of 50 m/s, hit a iron nail of mass 200 gm. If specific heat of iron is 0.105 cal/gm°C and half the energy is converted into heat, the raise in temperature of nail is

a) 7.1°C b) 9.2°C c) 10.5°C d) 12.1°C

277. 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

278. A glass flask of volume one *litre* at 0°C is fille, level full of mercury at this temperature. The flask and mercury are now heated to 100°C. How much mercury will spill out, if coefficient of volume expansion of mercury is 1.82×10^{-4}/°C and linear expansion of glass is 0.1×10^{-4}/°C respectively

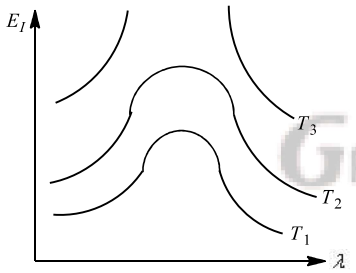
a) 21.2 cc b) 15.2 cc c) 1.52 cc d) 2.12 cc

279. One end of a thermally insulated rod is kept at a temperature T_1 and 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 two sections is

a) $(K_2l_2T_1 + K_1l_1T_2) / (K_1l_1 + K_2l_2)$ b) $(K_2l_1T_1 + K_1l_2T_2) / (K_2l_1 + K_1l_2)$

c) $(K_1l_2T_1 + K_2l_1T_2) / (K_1l_2 + K_2l_1)$ d) $(K_1l_1T_1 + K_2l_2T_2) / (K_1l_1 + K_2l_2)$

280. Variation of radiant energy emitted by sun, filament of tungsten lamp and welding are as a function of its wavelength is shown in figure. Which of the following option is the correct match?



a) Sun-T_1, tungsten filament–T_2, welding arc – T_3

b) Sun-T_2, tungsten filament–T_1, welding arc – T_3

c) Sun-T_3, tungsten filament–T_2, welding arc – T_1

d) Sun-T_1, tungsten filament–T_3, welding arc – T_2

281. When a copper ball is heated, the largest percentage increase will occur in its

a) Diameter b) Area c) Volume d) Density

282. 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

a) 2 : 1 b) 1 : 1 c) 1 : 2 d) 1 : 4

283. Heat travels through vacuum by

a) Radiation b) Conduction c) Convection d) None of these

284. If a black body emits 0.5 J of energy per second when it is at 27°C, then the amount of energy emitted by it when it is at 627°C will be

a) 40.5 J b) 162 J c) 13.5 J d) 135 J

285. Maximum density of H_2O is at the temperature

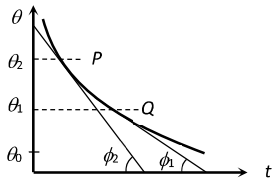
a) 32^oF b) 39.2^oF c) 42^oF d) 4^oF

286. If a graph is plotted taking the temperature in Fahrenheit along Y-axis and the corresponding temperature in Celsius along the X-axis, it will be a straight line

a) Having a $+ ve$ intercept on Y-axis
b) Having a $+ ve$ intercept on X-axis
c) Passing through the origin
d) Having a $- ve$ intercepts on both the axis

287. The absolute temperatures of two black bodies are 2000 K and 3000 K respectively. The ratio of wavelengths corresponding to maximum emission of radiation by them will be
a) 2 : 3 b) 3 : 2 c) 9 : 4 d) 4 : 9

288. A body cools in a surrounding which is at a constant temperature of θ_0. Assume that of obeys Newton's law of cooling. Its temperature θ is plotted against time t. Tangents are drawn to the curve at the points $P(\theta = \theta_2)$ and $Q(\theta = \theta_1)$. These tangents meet the time axis at angles of ϕ_2 and ϕ_1, as shown



a) $\frac{\tan\phi_2}{\tan\phi_1} = \frac{\theta_1 - \theta_0}{\theta_2 - \theta_0}$ b) $\frac{\tan\phi_2}{\tan\phi_1} = \frac{\theta_2 - \theta_0}{\theta_1 - \theta_0}$ c) $\frac{\tan\phi_1}{\tan\phi_2} = \frac{\theta_1}{\theta_2}$ d) $\frac{\tan\phi_1}{\tan\phi_2} = \frac{\theta_2}{\theta_1}$

289. A constant volume gas thermometer shows pressure reading of 50 cm and 90 cm of mercury at 0°C and 100°C respectively. When the pressure reading is 60 cm of mercury, the temperature is
a) 25°C b) 40°C c) 12°C d) 12.5°C

290. There is some change in length when a 33000 N tensile force is applied on a steel rod of area of cross-section10^{-3} m^2. The change of temperature required to produce the same elongation, if the steel rod is heated, is (The modulus of elasticity is $3 \times 10^{11} Nm^{-2}$ and the coefficient of linear expansion of steel is $1.1 \times 10^{-5} °C^{-1}$.
a) 20°C b) 15°C c) 10°C d) 0°C

291. According to 'Newton's Law of cooling', the rate of cooling of a body is proportional to the
a) Temperature of the body
b) Temperature of the surrounding
c) Fourth power of the temperature of the body
d) Difference of the temperature of the body and the surroundings

292. A hot and a cold body are kept in vacuum separated from each other. Which of the following cause decrease in temperature of the hot body
a) Radiation b) Convection
c) Conduction d) Temperature remains unchanged

293. An object is at a temperature of 400°C. At what temperature would it radiate energy twice as fast? The temperature of the surroundings may be assumed to be negligible
a) 200°C b) 200 K c) 800°C d) 800 K

294. The thermal conductivity of a material in CGS system is 0.4. In steady state, the rate of flow of heat is 10 $cal/s\text{-}cm^2$, then the thermal gradient will be
a) 10°C/cm b) 12°C/cm c) 25°C/cm d) 20°C/cm

295. The temperatures of two bodies A and B are respectively 727°C and 327°C. The ratio $H_A : H_B$ of the rates of heat radiated by them is
a) 727 : 327 b) 5 : 3 c) 25 : 9 d) 625 : 81

296. Two spherical bodies A (radius 6 cm) and B (radius 18 cm) are at temperature T_1 and T_2 respectively. The maximum intensity in the emission spectrum of A is at 500 nm and in that of B is at 1500 nm. Considering them to be black bodies, what will be the ratio of the rate of total energy radiated by A to that of ?
a) 9 b) 9.5 c) 8 d) 8.5

297. Four rods of different radii r and length l are used to connect two reservoirs of heat at different temperatures. Which one will conduct heat fastest?

a) $r = 2$ cm, l 0.5 m b) $r = 1$ cm, $l = 0.5$ m c) $r = 2$ cm, $l = 2$ m d) $r = 1$ cm, $l = 1$ m

298. A body initially at 80°C cools to 64°C in 5 min and to 52°C in 10 min. the temperature of the surrounding is
a) 26°C b) 16°C c) 36°C d) 40°C

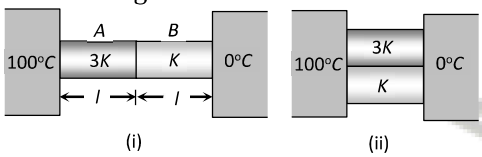
299. Mercury thermometers can be used to measure temperatures upto
a) 100°C b) 212°C c) 360°C d) 500°C

300. When a rod is heated but prevented from expanding, the stress developed is independent of
a) Material of the rod b) Rise in temperature c) Length of rod d) None of above

301. Two rods A and B are of equal lengths. Their ends are kept between the same temperature and their area of cross-sections are A_1 and A_2 and thermal conductivities K_1 and K_2. The rate of heat transmission in the two rods will be equal, if
a) $K_1A_2 = K_2A_1$ b) $K_1A_1 = K_2A_2$ c) $K_1 = K_2$ d) $K_1A_1^2 = K_2A_2^2$

302. A sphere, a cube and a thin circular plate, all made of the same material and having the same mass are initially heated to a temperature of 1000°C. Which one of these will cool first
a) Plate b) Sphere c) Cube d) None of these

303. Two conducting rods A and B of same length and cross-sectional area are connected (i) In series (ii) In parallel as shown. In both combination a temperature difference of 100°C is maintained. If thermal conductivity of A is $3K$ and that of B is K then the ratio of heat current flowing in parallel combination to that flowing in series combination is



a) $\frac{16}{3}$ b) $\frac{3}{16}$ c) $\frac{1}{1}$ d) $\frac{1}{3}$

304. The heat is flowing through a rod of length 50 cm and area of cross-section $5cm^2$. Its ends are respectively at 25°C and 125°C. The coefficient of thermal conductivity of the material of the rod is 0.092 $kcal/m \times s \times$ °C. The temperature gradient in the rod is
a) 2°C/cm b) 2°C/m c) 20°C/cm d) 20°C/m

305. A partition wall has two layers A and B in contanct, each made of a different material. They have the same thickness but the thermal conductivity of layer A is twice that of layer B. If the steady state temperature difference across the wall is $60K$, then the corresponding difference across the layer A is
a) 10 K b) 20 K c) 30 K d) 40 K

306. A solid cube and a solid sphere of the same material have equal surface area. Both are at the same temperature 120°C, then
a) Both the cube and the sphere cool down at the same rate
b) The cube cools down faster than the sphere
c) The sphere cools down faster than the cube
d) Whichever is having more mass will cool down faster

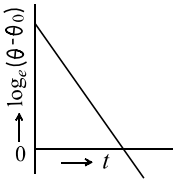
307. When fluids are heated from the bottom, convection currents are produced because
a) Molecular motion of fluid becomes aligned
b) Molecular collisions take place within the fluid
c) Heated fluid becomes more dense than the cold fluid above it
d) Heated fluid becomes less dense than the cold fluid above it

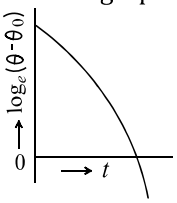
308. If the initial temperatures of metallic sphere and disc, of the same mass, radius and nature are equal, then the ratio of their rate of cooling in same environment will be
a) 1 : 4 b) 4 : 1 c) 1 : 2 d) 2 : 1

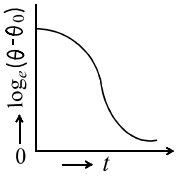
309. Colour of shinning bright star is an indication of its
a) Distance from the earth b) Size

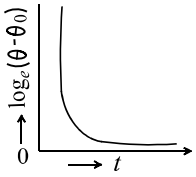
c) Temperature d) Mass

310. A liquid in a beaker has temperature $\theta(t)$ at time t and θ_0 is temperature of surroundings, then according to Newton's law of cooling the correct graph between $\log_e(\theta - \theta_0)$ and t is

a) 

b) 

c) 

d) 

311. Water is used to cool the radiators of engines in cars because
a) Of its low boiling point b) Of its high specific heat
c) Of its low density d) Of its easy availability

312. A closed bottle containing water at 30°C is carried to the moon in a space-ship. If it is placed on the surface of the moon, what will happen to the water as soon as the lid is opened
a) Water will boil b) Water will freeze
c) Nothing will happen on it d) It will decompose into H_2 and O_2

313. The factor not needed to calculate heat lost or gained when there is no change of state is
a) Weight b) Specific heat c) Relative density d) Temperature change

314. A black metal foil is warmed by radiation from a small sphere at temperature T and at a distance d. It is found that the power received by the foil is 'P'. If both the temperature and the distance are doubled, the power received by the foil will be
a) $16P$ b) $4P$ c) $2P$ d) P

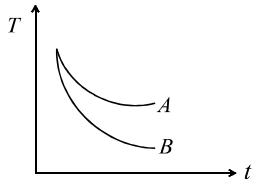
315. What is rise in temperature of a collective drop when initially 1 gm and 2 gm drops travel with velocities 10 cm/sec and 15 cm/sec
a) 6.6×10^{-3}°C b) 66×10^{-3}°C c) 660×10^{-3}°C d) 6.6°C

316. If γ is the ratio of specific heats and R is the universal gas constant, then the molar specific heat at constant volume C_v is given by
a) $\frac{R}{\gamma - 1}$ b) $\frac{\gamma R}{\gamma - 1}$ c) γR d) $\frac{(\gamma - 1)R}{\gamma}$

317. 10 g of ice at 0°C is mixed with 100 g of water at 50°C. What is the resultant temperature of mixture
a) 31.2°C b) 32.8°C c) 36.7°C d) 38.2°C

318. The thermal radiation from a hot body travels with a velocity of
a) 330 ms^{-1} b) 2×10^8 ms^{-1} c) 1200 ms^{-1} d) 3×10^8 ms^{-1}

319. Water and turpentine oil (specific heat less than that of water) are both heated to same temperature. Equal amounts of these placed in identical calorimeters are then left in air



a) Their cooling curves will be identical
b) A and B will represent cooling curves of water and oil respectively
c) B and A will represent cooling curves of water and oil respectively
d) None of the above

320. The study of physical phenomenon at low temperatures (below liquid nitrogen temperature) is called
a) Refrigeration b) Radiation c) Cryogenics d) Pyrometry

321. Solids expand on heating because
a) Kinetic energy of the atoms increases
b) Potential energy of the atoms increases
c) Total energy of the atoms increases

d) The potential energy curve is asymmetric about the equilibrium distance between neighbouring atoms

322. A $5cm$ thick ice block is there on the surface of water in a lake. The temperature of air is $-10°C$; how much time it will take to double the thickness of the block
($L = 80\ cal/g, K_{ice} = 0.004\ erg/s\text{-}k, d_{ice} = 0.92\ g\ cm^{-3}$)
a) 1 *hour* b) 191 *hours* c) 19.1 *hours* d) 1.91 *hours*

323. The radiation emitted by a star A is 10,000 times that of the sun. If the surface temperature of the sun and the star A are 6000 K and 2000 K respectively, the ratio of the radii of the star A and the sun is
a) 300:1 b) 600:1 c) 900:1 d) 1200:1

324. 0.1 m^3 of water at 80°C is mixed with 0.3m^3 of water at 60°C. The final temperature of the mixture is
a) 65°C b) 70°C c) 60°C d) 75°C

325. When a bimetallic strip is heated, it
a) Does not bend at all
b) Gets twisted in the from of an helix
c) Bend in the form of an arc with the more expandable metal outside
d) Bends in the form of an arc with the more expandable metal inside

326. Two rods of the same length and diameter having thermal conductivities K_1 and K_2 are joined in parallel. The equivalent thermal conductivity of the combination is
a) $\frac{K_1K_2}{K_1+K_2}$ b) K_1+K_2 c) $\frac{K_1K_2}{2}$ d) $\sqrt{K_1}K_2$

327. Absolute scale of temperature is reproduced in the laboratory by making use of a
a) Radiation pyrometer
b) Platinum resistance thermometer
c) Constant volume helium gas thermometer
d) Constant pressure ideal gas thermometer

328. The temperature at which a black body ceases to radiate energy, is
a) Zero b) 273 K c) 30 K d) 100 K

329. Two identical conducting rods are first connected independently to two vessels, one containing water at 100°C and the other containing ice at 0°C. In the second case, the rods are joined end to end and connected to the same vessels. Let q_1 and q_2 gs^{-1} be the rate of melting of ice in the two cases respectively. The ratio $\frac{q_1}{q_2}$ is
a) $\frac{1}{2}$ b) $\frac{2}{1}$ c) $\frac{4}{1}$ d) $\frac{1}{4}$

330. Two slabs are of the thickness d_1 and d_2. Their thermal conductivities are K_1 and K_2 respectively. They are in series. The free ends of the combination of these two slabs are kept at temperature θ_1 and θ_2. Assume $\theta_1 > \theta_2$. The temperature θ of their common junction is
a) $\frac{K_1\theta_1+K_2\theta_2}{\theta_1+\theta_2}$ b) $\frac{K_1\theta_1d_1+K_2\theta_2d_2}{K_1d_2+K_2d_1}$ c) $\frac{K_1\theta_1d_2+K_2\theta_2d_1}{K_1d_2+K_2d_1}$ d) $\frac{K_1\theta_1+K_2\theta_2}{K_1+K_2}$

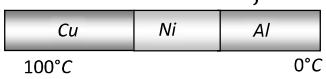
331. A centigrade and a Fahrenheit thermometer are dipped in boiling water. The water temperature is lowered until the Fahrenheit thermometer registers 140^o. What is the fall in temperature as registered by the Centigrade thermometer
a) 30^o b) 40^o c) 60^o d) 80^o

332. Star A has radius r surface temperature T while star B has radius $4r$ and surface temperature $T/2$. The ratio of the power of two starts, P_A: P_B is
a) 16 : 1 b) 1 : 16 c) 1 : 1 d) 1 : 4

333. Consider two hot bodies B_1 and B_2 which have temperatures 100°C and 80°C respectively at $t = 0$. The temperature of the surroundings is 40°C. The ratio of the respective rates of cooling, R_1 and R_2 of these two bodies at $t = 0$ will be

a) $R_1 : R_2 = 3:2$ b) $R_1 : R_2 = 5:4$ c) $R_1 : R_2 = 2:3$ d) $R_1 : R_2 = 4:5$

334. A composite metal bar of uniform section is made up of length 25 cm of copper, 10 cm of nickel and 15 cm of aluminium. Each part being in perfect thermal contact with the adjoining part. The copper end of the composite rod is maintained at 100°C and the aluminium end at 0°C. The whole rod is covered with belt so that no heat loss occurs at the sides. If $K_{Cu} = 2K_{Al}$ and $K_{Al} = 3K_{Ni}$, then what will be the temperatures of $Cu - Ni$ and $Ni - Al$ junctions respectively



a) 23.33°C and 78.8°C b) 83.33°C and 20°C c) 50°C and 30°C d) 30°C and 50°C

335. If temperature of an object is $140^{o}F$, then its temperature in centigrade is

a) 105°C b) 32°C c) 140°C d) 60°C

336. If at temperature $T_1 = 1000K$, the wavelength is $1.4 \times 10^{-6}m$, then at temperature the wavelength will be $2.8 \times 10^{-6}m$

a) $2000K$ b) $500K$ c) $250K$ d) None of these

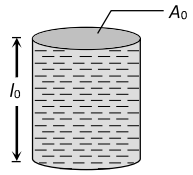
337. The temperature of a liquid drops from $365K$ to 361 K in 2 $minutes$. Find the time during which temperature of the liquid drops from 344 K to $342K$. Temperature of room is 293 K

a) 84 s b) 72 s c) 66 s d) 60 s

338. An amount of water of mass 20 g at 0°C is mixed with 40 g of water 10°C, final temperature of the mixture is

a) 5°C b) 0°C c) 20°C d) 6.66°C

339. The figure shows a glass tube (linear co-efficient of expansion is α) completely filled with a liquid of volume expansion co-efficient γ. On heating length of the liquid column does not change. Choose the correct relation between γ and α



a) $\gamma = \alpha$ b) $\gamma = 2\alpha$ c) $\gamma = 3\alpha$ d) $\gamma = \frac{\alpha}{3}$

340. The coefficient of real expansion of mercury is $0.18 \times 10^{-3}°C^{-1}$. If the density of mercury at 0°C is 13.6 g/cc, its density at 473 K will be

a) 13.11 g/cc b) 13.65 g/cc c) 13.51 g/cc d) 13.22 g/cc

341. In the Ingen Hauz's experiment the wax melts up to lengths 10 and $25cm$ on two identical rods of different materials. The ratio of thermal conductivities of the two material is

a) 1 : 6.25 b) 6.25 : 1 c) $1:\sqrt{2.5}$ d) 1 : 2.5

342. The amount of heat conducted out per second through a window, when inside temperature is 10°C and outside temperature is −10°C, is 1000 J. Same heat will be conducted in through the window, when outside temperature −23°C and inside temperature is

a) 23°C b) 230 K c) 270 K d) 296 K

343. The rate of radiation of a black body at 0°C is EJ/s. The rate of radiation of this black body at 273°C will be

a) 16 E b) 8 E c) 4 E d) E

344. 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

345. Of two masses of 5 kg each falling from height of 10 m, by which $2kg$ water is stirred. The rise in temperature of water

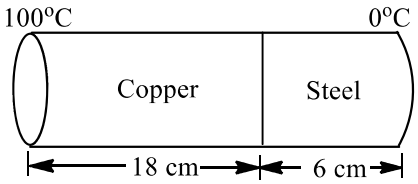
a) 2.6°C b) 1.2°C c) 0.32°C d) 0.12°C

346. The wavelength $\lambda_m = 5.5 \times 10^{-7}$ m when temperature of sun is 5500 K. If the furnace has wavelength λ_m equal to 11×10^{-7}m, then temperature of furnace is
a) 5000 K b) 1750 K c) 3750 K d) 2750 K

347. Wien's constant is 2892×10^{-6} MKS unit and the value of λ_m from moon is 14.46 microns. What is the surface temperature of moon
a) 100 K b) 300 K c) 400 K d) 200 K

348. In a water-fall the water falls from a height of $100m$. If the entire K. E. of water is converted into heat, the rise in temperature of water will be
a) 0.23°C b) 0.46°C c) 2.3°C d) 0.023°C

349. The coefficient of thermal conductivity of copper is 9 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?



a) 75°C b) 67°C c) 25°C d) 33°C

350. The layers of atmosphere are heated through
a) Convection b) Conduction c) Radiation d) (b) and (c) both

351. The two opposite faces of a cubical piece of iron (thermal conductivity = 0.2 CGS unit) are at 100°C and 0°C in ice. If the area of a surface is $4cm^2$, then the mass of ice melted in a 10 minutes will be
a) 30 g b) 300 g c) 5 g d) 50 g

352. A black body is at a temperature 300 K. It emits energy at a rate, which is proportional to
a) 300 b) $(300)^2$ c) $(300)^3$ d) $(300)^4$

353. A container contains hot water at 100°C. If in time T_1 temperature falls to 80°C and in time T_2 temperature falls to 60°C from 80°C, then
a) $T_1 = T_2$ b) $T_1 > T_2$ c) $T_1 < T_2$ d) None

354. The saturation vapour pressure of water at 100°C is
a) 739 mm of mercury b) 750 mm of mercury c) 760 mm of mercury d) 712 mm of mercury

355. The correct value of 0°C on Kelvin scale will be
a) 273.15 K b) 273.00 K c) 273.05 K d) 273.63 K

356. 540 g of ice at 0°C is mixed with 540 g of water at 80°C. The final temperature of the mixture is
a) 0°C b) 40°C c) 80°C d) Less than 0°C

357. Two spheres made of same substance have diameters in the ratio 1 : 2. Their thermal capacities are in the ratio of
a) 1 : 2 b) 1 : 8 c) 1 : 4 d) 2 : 1

358. If the temperature of a hot body is increased by 50% then the increase in the quantity of emitted heat radiation will be
a) 125% b) 200% c) 300% d) 400%

359. Hot water cools from 60°C to 50°C in the first 10 min and to 42°C in the first 10 min and to 42°C in the next 10 min. Then the temperature of the surroundings is
a) 20°C b) 30°C c) 15°C d) 10°C

360. Heat capacity of a substance is infinite. It means
a) Heat is given out
b) Heat is taken in
c) No change in temperature whether heat is taken in or given out

d) All of the above

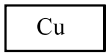
361. A black body radiates 20 W at temperature 227°C. If temperature of the black body is changed to 727°C then its radiating power will be

a) 120 W b) 240 W c) 320 W d) 360 W

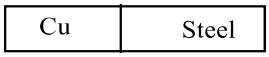
362. Mercury boils at 367°C.However,mercury thermometers are made such that they can measure temperature are made such that they can measure temperature upto 500°C.This is done by

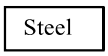
a) Maintaining vacuum above mercury column in the stem of the thermometer
b) Filling nitrogen gas at high pressure above the mercury column
c) Filling oxygen gas at high pressure above the mercury column
d) Filling nitrogen gas at low pressure above the mercury column

363. Heat current is maximum in which of the following (rods are of identical dimension)?

a) 

b) 

c) 

d) 

364. No other thermometer is as suitable as a platinum resistance thermometer to measure temperature in the entire range of

a) 0°C to 100°C b) 100°C to 1500°C c) −50°C to + 350°C d) −200°C to 600°C

365. Three identical rods A, B and C are placed end to end. A temperature difference is maintained between the free ends of A and C. The thermal productivity of B is thrice that if C and half of that of A. the effective thermal conductivity of the system will be (KA is the thermal conductivity of rod A)

a) $\frac{3}{2}KA$ b) $2\,KA$ c) $3\,KA$ d) $\frac{1}{3}\,KA$

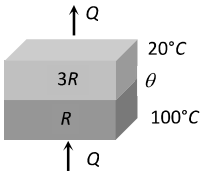
366. A gas undergoes an adiabatic change. Its specific heat in the process is

a) Zero b) 1 c) ∞ d) None of these

367. The temperature, at which Centigrade and Fahrenheit scales give the same reading is

a) -40° b) 40° c) -30° d) 30°

368. In the following figure, two insulating sheets with thermal resistances R and $3R$ as shown in figure. The temperature θ is



a) 20°C b) 60°C c) 75°C d) 80°C

369. On Centigrade scale the temperature of a body increases by 30°.The increase in temperature on Fahrenheit scale is

a) 50° b) 40° c) 30° d) 54°

370. If wavelengths of maximum intensity of radiations emitted by the sun and the moon are $0.5 \times 10^{-6}m$ and $10^{-4}m$ respectively, the ratio of their temperature is

a) 1/100 b) 1/200 c) 100 d) 200

371. The absolute zero temperature in Fahrenheit scale is

a) $-273^{o}F$ b) $-32^{o}F$ c) $-460^{o}F$ d) $-132^{o}F$

372. Solar radiation emitted by sun correspond to that emitted by black body at a temperature of 6000 K. Maximum intensity is emitted at wavelength of 4800Å. If the sun was to cool down from 6000 K to 3000 K, then the peak intensity of emitted radiation would occur at a wavelength

a) 4800Å b) 9600Å c) 2400Å d) 19200Å

373. When vapour condenses into liquid
   a) It absorbs heat
   b) It liberates heat
   c) Its temperature increases
   d) Its temperature decreases

374. According to Newton's law of cooling, the rate of cooling is proportional to $(\Delta\theta)^n$, where $\Delta\theta$ is the temperature differences between the body and the surroundings and n is equal to
   a) 3 b) 2 c) 1 d)

375. A steel meter scale is to be ruled so that millimeter intervals are accurate within about $5 \times 10^{-5} mm$ at a certain temperature. The maximum temperature variation allowable during the ruling is (Coefficient of linear expansion of steel $= 10 \times 10^{-6} K^{-1}$)
   a) 2°C b) 5°C c) 7°C d) 10°C

376. An iron bar of length l and having a cross-section A is heated from 0 to 100°C. If this bar is so held that it is not permitted to expand or bend, the force that is developed, is
   a) Inversely proportional to the cross-sectional area of the bar
   b) Independent of the length of the bar
   c) Inversely proportional to the length of the bar
   d) Directly proportional to the length of the bar

377. The Wien's displacement law express relation between
   a) Frequency and temperature
   b) Temperature and amplitude
   c) Wavelength and radiating power of black body
   d) Wavelength corresponding to maximum energy and temperature

378. A metallic ball and highly stretched spring are made of the same material and have the same mass. They are heated so that they melt, the latent heat required
   a) Are the same for both
   b) Is greater for the ball
   c) Is greater for the spring
   d) For the two may or may not be the same depending upon the metal

379. Two spheres made of same material have radii in the ratio 2:1. If both the spheres are at same temperature, then what is the ration of heat radiation energy emitted per second by them?
   a) 1:4 b) 4:1 c) 3:4 d) 4:3

380. 1 g of steam at 100°C and equal mass of ice at 0°C are mixed. The temperature of the mixture in steady state will be (latent heat of steam=540calg^{-1}, latent heat of ice=80calg^{-1})
   a) 50°C b) 100°C c) 67°C d) 33°C

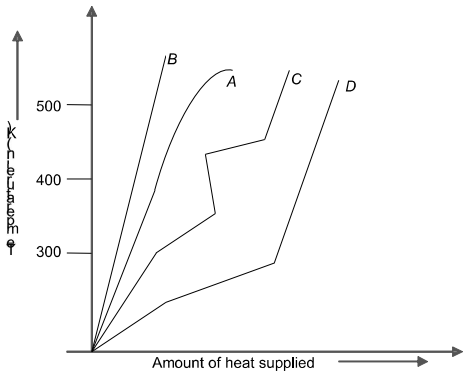
381. A *litre* of alcohol weighs
   a) Less in winter than in summer
   b) Less in summer than in winter
   c) Same both in summer and winter
   d) None of the above

382. At NTP water boils at 100°C. Deep down the mine, water will boil at a temperature
   a) 100°C b) $>$ 100°C c) $<$ 100°C d) Will not boil at all

383. The surface temperature of the sun is
   a) 2900 K b) 4000 K c) 5800 K d) 9000 K

384. Two spheres of radii 8 cm and 2 cm are cooling. Their temperatures are 127°C and 527°C respectively. Find the ratio of energy radiated by them in the same time
   a) 0.06 b) 0.5 c) 1 d) 2

385. Which curve shows the rise of temperature with the amount of heat supplied, for a piece of ice?



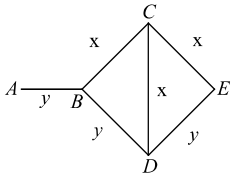
a) A b) B c) C d) D

386. 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
a) Newton's law of cooling b) Wien's law
c) Kirchhoff's law d) Stefan's

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

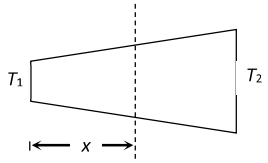
388. The energy supply being cut-off, an electric heater element cools down to the temperature of its surroundings, but it will not cool further because
a) Supply is cut off b) It is made of metal
c) Surroundings are radiating d) Element & surroundings have same temp.

389. Three rods of material X and three rods of material Y are connected as shown in figure. All are identical in length and cross sectional area. If end A is maintained at 60°C, end E at 10°C, thermal conductivity of X is 0.92 cals^{-1} cm^{-1}°C^{-1} and that Y is 0.46 cals^{-1} cm^{-1}°C^{-1} , then find the temperature of junctionsB, C, D.

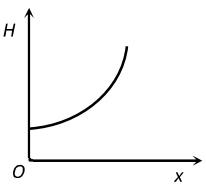


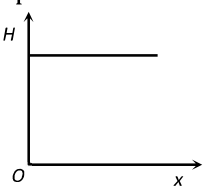
a) 20°C, 30°C, 20°C b) 30°C, 20°C , 20°C c) 20°C, 20°C , 30°C d) 20°C , 20°C, 20°C

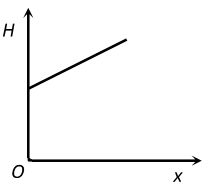
390. Radius of a conductor increases uniformly from left end to right end as shown in fig

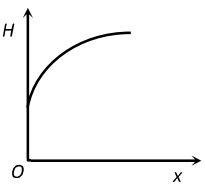


Material of the conductor is isotropic and its curved surface is thermally insulated from surrounding. Its ends are maintained at temperatures T_1 and $T_2 (T_1 > T_2)$: If, in steady state, heat flow rate is equal to H, then which of the following graphs is correct

a) 

b) 

c) 

d) 

391. One end of a metal rod of length 1.0 m and area of cross-section $100cm^2$ is maintained at 100 °C. If the other end of the rod is maintained at 0°C, the quantity of heat transmitted through the rod per minute is (coefficient of thermal conductivity of material of rod =100W/m-K)
a) 3×10^3 J b) 6×10^3 J c) 9×10^3 J d) 12×10^3 J

392. For an opaque body coefficient of transmission is
a) Zero b) 1 c) 0.5 d) ∞

393. There is formation of layer of snow $x\ cm$ thick on water, when the temperature of air is $-\theta$°C (less than freezing point). The thickness of layer increases from x to y in the time t, then the value of t is given by
a) $\frac{(x+y)(x-y)\rho L}{2k\theta}$ b) $\frac{(x-y)\rho L}{2k\theta}$ c) $\frac{(x+y)(x-y)\rho L}{k\theta}$ d) $\frac{(x-y)\rho Lk}{2\theta}$

394. A vessel contains 110 g of water. The heat capacity of the vessel is equal to 10 g of water. The initial temperature of water in vessel in 10°C. If 220 g of hot water at 70°C is poured in the vessel, the final temperature neglecting radiation loss will be
a) 70°C b) 80°C c) 60°C d) 50°C

395. A cane is taken out from a refrigerator at 0°C. The atmospheric temperature is 25°C. If t_1 is the time taken to heat from 0°C to 5°C and t_2 is the time taken from 10°C to 15°C, then
a) $t_1 > t_2$ b) $t_1 < t_2$ c) $t_1 = t_2$ d) There is no relation

396. The tungsten filament of an electric lamp has a surface area A and a power rating P. If the emissivity of the filament is ε and σ is Stefan's constant, the steady temperature of the filament will be
a) $T = \left(\frac{P}{A\varepsilon\sigma}\right)^4$ b) $T = \left(\frac{P}{A\varepsilon\sigma}\right)$ c) $T = \left(\frac{A\varepsilon\sigma}{P}\right)^{\frac{1}{4}}$ d) $T = \left(\frac{P}{A\varepsilon\sigma}\right)^{\frac{1}{4}}$

397. A piece of ice (heat capacity=$2100 JKg^{-1}\ °C^{-1}$ and latent heat=$3.36 \times 10^5\ Jkg^{-1}$) of mass m gram is at −5°C at atmospheric pressure. It is given 420 J of heat so that the ice starts melting. Finally when the ice-water mixture is in equilibrium, it is found that 1 g of ice has melted. Assuming there is no other heat exchange in the process, the value of m is
a) 8 b) 6 c) 4 d) 8.5

398. When red glass is heated in dark room it will seen
a) Green b) Purple c) Black d) Yellow

399. At some temperature T, a bronze pin is a little large to fit into a hole drilled in a steel block. The change in temperature required for an exact fit is minimum when
a) Only the block is heated
b) Both block and pin are heated together
c) Both block and pin are cooled together
d) Only the pin is cooled

400. A metal ball immersed in alcohol weighs W_1 at 0°C and W_2 at 59°C. The coefficient of cubical expansion of the metal is less than that of alcohol. Assuming that the density of metal is large compared to that of alcohol, it can be shown that
a) $W_1 > W_2$ b) $W_1 = W_2$ c) $W_1 < W_2$ d) $W_2 = (W_1/2)$

401. It is known that wax contracts on solidification. If molten wax is taken in a large vessel and it is allowed to cool slowly, then
a) It will start solidifying from the top to downward
b) It will start solidifying from the bottom to upward
c) It will start solidifying from the middle, upward and downward at equal rates
d) The whole mass will solidify simultaneously

402. A faulty thermometer has its fixed points marked 5 and 95. When this thermometer reads 68, the correct temperature in Celsius is
a) 68°C b) 70°C c) 66°C d) 72°C

403. Newton's law of cooling is used in laboratory for the determination of the
a) Specific heat of the gases
b) The latent heat of gases

c) Specific heat of liquids d) Latent heat of liquids

404. A pendulum clock keeps correct time at 0°C. Its mean coefficient of linear expansions is α/°C, then the loss in seconds per day by the clock if the temperature rises by t°C is

a) $\frac{\frac{1}{2}\alpha t \times 864000}{1-\frac{\alpha t}{2}}$ b) $\frac{1}{2}\alpha t \times 86400$ c) $\frac{\frac{1}{2}\alpha t \times 86400}{\left(1-\frac{\alpha t}{2}\right)^2}$ d) $\frac{\frac{1}{2}\alpha t \times 86400}{1+\frac{\alpha t}{2}}$

405. 1 g of a steam at 100°C melts how much ice at 0°C? (Latent heat of ice = 80 cal/gm and latent heat of steam = 540 cal/gm)

a) 1 gm b) 2 gm c) 4 gm d) 8 gm

406. 2 kg of ice at −20°C is mixed with 5 kg of water at 20°C in an insulating vessel having a negligible heat capacity. Calculate the final mass of water remaining in the container. It is given that the specific heats of water and ice are 1 kcal/kg/°C and 0.5 kcal/kg/°C while the latent heat of fusion of ice is 80 kcal kg^{-1}

a) 7 kg b) 6 kg c) 4 kg d) 2 kg

407. Two solid spheres of the same material have the same radius but one is hollow while the other is solid. Both spheres are heated to same temperature. Then

a) The solid sphere expands more

b) The hollow sphere expands more

c) Expansion is same for both

d) Nothing can be said about their relative expansion if their masses are not given

408. The temperature at which a black body of unit area loses its energy at the rate of 1 $joule/second$ is

a) −65°C b) 65°C c) 65 K d) None of these

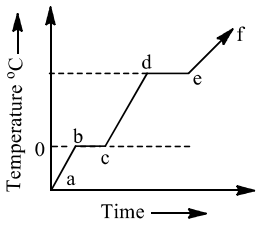
409. A calorimeter of mass 0.2 kg and specific heat 900 J/kg-K. Containing 0.5 kg of a liquid of specific heat 2400 J/kg-K. Its temperature falls from 60°C to 55°C in one minute. The rate of cooling is

a) 5 J/s b) 15 J/s c) 100 J/s d) 115 J/s

410. A piece of metal weighs 45 g in air and 25 g in a liquid of density $1.5 \times 10^3 kg - m^{-3}$ kept at 30°C. When the temperature of the liquid is raised to 40°C, the metal piece is weighs 27 g. The density of liquid at 40°C, is $1.25 \times 10^3 kg - m^{-3}$. The coefficient of linear expansion of metal is

a) 1.3×10^{-3}/°C b) 5.2×10^{-3}/°C c) 2.6×10^{-3}/°C d) 0.26×10^{-3}/°C

411. The following figure represents the temperature $versus$ time plot for a given amount of a substance when heat energy is supplied to it at a fixed rate and at a constant pressure.



Which parts of the above plot represents a phase change?

a) a to b and e to f b) b to c and c to d

c) d to $e$and e to f d) b to c and d to e

412. Standardisation of thermometers is obtained with

a) Jolly's thermometer b) Platinum resistance thermometer

c) Thermocouple thermometer d) Gas thermometer

413. If a black body is heated at a high temperature, it seems to be

a) Blue b) White c) Red d) Black

414. 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

a) 1 : 3 b) 4 : 3 c) 8 : 9 d) 3 : 2

415. Triple point of water is

a) $273.16^{o}F$ b) $273.16\ K$ c) 273.16°C d) $273.16R$

416. Hailstone at 0°C falls from a height of 1 km on an insulating surface converting whole of its kinetic energy into heat. What part of it will melt ($g = 10m/s^2$)

a) $\frac{1}{33}$ b) $\frac{1}{8}$ c) $\frac{1}{33} \times 10^{-4}$ d) All of it will melt

417. A clock which keeps correct time at 20°C, is subjected to 40°C. If coefficient of linear expansion of the pendulum is $12 \times 10^{-6}°C^{-1}$. How much will it gain or lose time?

a) 10.3 s day^{-1} b) 20.6 s day^{-1} c) 5 s day^{-1} d) 20 min day^{-1}

418. Which of the following statements is wrong

a) Rough surfaces are better radiators than smooth surface
b) Highly polished mirror like surfaces are very good radiators
c) Black surfaces are better absorbers than white ones
d) Black surfaces are better radiators than white

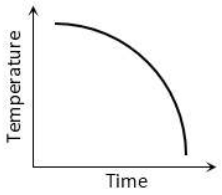
419. If l is length A is the area of cross section and K is thermal conductivity, then the thermal resistance of the block is given by

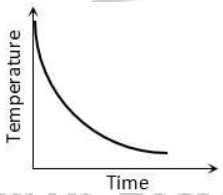
a) $K\ l\ A$ b) $1/\ K\ l\ A$ c) $l + KA$ d) $l\ /\ KA$

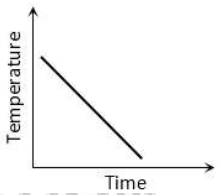
420. Which of the following is the example of ideal black body

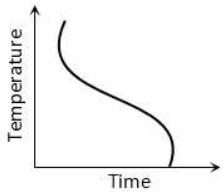
a) Kajal b) Black board c) A pin hole in a box d) None of these

421. A block of metal is heated to a temperature much higher than the room temperature and allowed to cool in a room free from air currents. Which of the following curves correctly represents the rate of cooling

a) 

b) 

c) 

d) 

422. The heat is flowing through two cylindrical rods of same material. The diameters of the rods are in the ratio 1:2 and their lengths are in the ratio 2:1. If the temperature difference between their ends is the same, the ratio of rate of flow of heat through them will be

a) 1 : 1 b) 2 : 1 c) 1 : 4 d) 1 : 8

423. The temperature of equal masses of three different liquids A, B and C are 12°C, 19°C and 28°C respectively. The temperature when A and B are mixed is 16°C and when B and C are mixed is 23°C. The temperature when A and C are mixed is

a) 18.2°C b) 22°C c) 20.2°C d) 24.2°C

424. An iron bar of length 10m is heated from 0°C to 100°C. If the coefficient of linear thermal expansion of iron is $10 \times 10^{-6}°C^{-1}$, the increase in the length of bar is

a) 0.5 cm b) 1.0 cm c) 1.5 cm d) 2.0 cm

425. If the sun's surface radiates heat at $6.3 \times 10^{7} Wm^{-2}$. Calculate the temperature of the sun assuming it to be a black body ($\sigma = 5.7 \times 10^{-8} Wm^{-2}K^{-4}$)

a) $5.8 \times 10^{3}K$ b) $8.5 \times 10^{3}K$ c) $3.5 \times 10^{8}K$ d) $5.3 \times 10^{8}K$

426. On increasing the temperature of a substance gradually, which of the following colours will be noticed by you

a) White b) Yellow c) Green d) Red

427. If the ratio of densities of two substances is 5 : 6 and that of the specific heats is 3 : 5. Then the ratio between heat capacities per unit volume is

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

428. Two spheres made of same material have radii in the ratio 1:2. Both are at same temperature. Ratio of heat radiation energy emitted per second by them is
a) 1 : 2 b) 1 : 8 c) 1 : 4 d) 1 : 16

429. Can we boil water inside the earth satellite by convection
a) Yes b) No
c) Nothing can be said d) In complete information is given

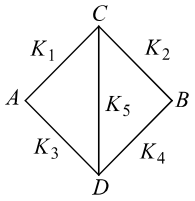
430. Two rods, one of aluminium and the other made of steel, having initial length l_1 and l_2 are connected together to form a single rod of length l_1+l_2. The coefficients of linear expansion for aluminium and steel are α_a and α_s respectively. If the length of each rod increases by the same amount when their temperature are raised by t°C, then find the ratio $\frac{l_1}{(l_1+l_2)}$.
a) $\frac{\alpha_s}{\alpha_a}$ b) $\frac{\alpha_a}{\alpha_s}$ c) $\frac{\alpha_s}{(\alpha_a+\alpha_s)}$ d) $\frac{\alpha_a}{(\alpha_{a+}\alpha_s)}$

431. Density of substance at 0°C is 10 g/cc and at 100°C, its density is 9.7 g/cc. The coefficient of linear expansion of the substance is
a) 1.03×10^{-4} b) 3×10^{-4} c) 19.7×10^{-3} d) 10^{-3}

432. The temperature of a substance increases by 27°C. On the Kelvin scale this increase is equal to
a) 300 K b) 2.46 K c) 27 K d) 7 K

433. An electric kettle takes 4A 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

434. Five rods of same dimensions are arranged as shown in figure. They have thermal conductivities K_1, K_2, K_3, K_4 and K_5. When points A and B are maintained at different temperature, no heat would flow through central rod, if



a) $K_1K_4 = K_2K_3$ b) $K_1 = K_4$ and $K_2 = K_3$
c) $\frac{K_1}{K_4} = \frac{K_2}{K_3}$ d) $K_1K_2 = K_3K_4$.

435. A black body at a temperature of 227°C radiates heat at the rate of 5 cal $cm^{-2}s^{-1}$. At a temperature of 727°C the rate of heat radiated per unit area in cal $cm^{-2}s^{-1}$ is
a) 400 b) 80 c) 40 d) 15

436. Calorimeters are made of which of the following
a) Glass b) Metal c) Wood d) Either (a) or (c)

437. A wall has two layers A and B made of different materials. The thickness of both the layers is the same. The thermal conductivity of A and B are K_A and K_B such that $K_A = 3K_B$. The temperature across the wall is 20°C. In thermal equilibrium
a) The temperature difference across A = 15°C
b) The temperature difference across A = 5°C
c) The temperature difference across A is 10°C
d) The rate of transfer of heat through A is more than that through B

438. A bubble of 8 mole of helium is submerged at a certain depth in water. The temperature of water increases by 30°C. How much that is added approximately to helium during expansion
a) 4000 J b) 3000 J c) 3500 J d) 5000 J

439. What will be the ratio of temperatures of sun and moon, if the wavelengths of their maximum emission radiations rates are 140 Å and 4200 Å respectively?
a) 1:30 b) 30:1 c) 42:14 d) 14:42

440. The temperature of two bodies A and B are 727°C and 127°C. The ratio of rate of emission of radiations will be
a) 727/127 b) 625/16 c) 1000/400 d) 100/16

441. Which of the following statements is correct
a) A good absorber is a bad emitter
b) Every body absorbs and emits radiations at every temperature
c) The energy of radiations emitted from a black body is same for all wavelengths
d) The law showing the relation of temperatures with the wavelength of maximum emission from an ideal black body is Plank's law

442. A metal plate 4 mm thick has a temperature difference of 32°C between its faces. It transmits 200 $kcal/h$ through an area of $5cm^2$. Thermal conductivity of the material is
a) 58.33 W/m-°C b) 33.58 W/m-°C c) 5×10^{-4} W/m-°C d) None of these

443. Hot water cools from 60°C to 50°C in the first 10 min and to 42°C in the next 10 min. The temperature of the surroundings is
a) 10°C b) 5°C c) 15°C d) 20°C

444. A cylindrical rod with one end in a steam chamber and the other end in ice results in melting of 0.1 g of ice per second. If the rod is replaced by another with half the length and double the radius of the first and if the thermal conductivity of the material of the second rod is 1/4 that of the first, the rate at which ice melts in gs^{-1} will be
a) 3.2 b) 1.6 c) 0.2 d) 0.1

445. Surface of the lake is at 2°C. Find the temperature of the bottom of the lake
a) 2°C b) 3°C c) 4°C d) 1°C

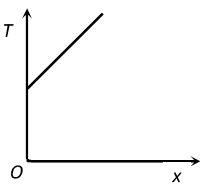
446. If the temperature of the sun (black body) is doubled, the rate of energy received on earth will be increased by a factor of
a) 2 b) 4 c) 8 d) 16

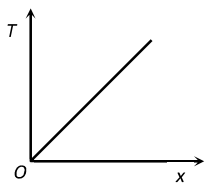
447. If the length of a cylinder on heating increases by 2%, the area of its base will increase by
a) 0.5% b) 2% c) 1% d) 4%

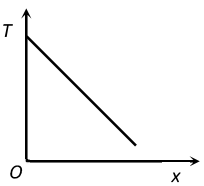
448. The wavelength of maximum energy, released during an atomic explosion was 2.93×10^{-10}m. Given that the Wien's constant is 2.93×10^{-3} m – K, the maximum temperature attained must be of the order of
a) 10^{-7} K b) 10^{7} K c) 10^{-3} K d) 5.86×10^{7} K

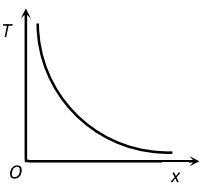
449. Two identical rods of copper and iron are coated with wax uniformly. When one end of each is kept at temperature of boiling water, the length upto which wax melts are 8.4cm and 4.2cm respectively. If thermal conductivity of copper is 0.92, then thermal conductivity of iron is
a) 0.23 b) 0.46 c) 0.115 d) 0.69

450. In which case the thermal conductivity increases from left to right
a) Al, Cu, Ag b) Ag, Cu, Al c) Cu, Ag, Al d) Al, Ag, Cu

451. Heat is flowing through a conductor of length l from $x = 0$ to $x = l$. If its thermal resistance per unit length is uniform, which of the following graphs is correct
a) 

b) 

c) 

d) 

452. The temperature of a piece of iron is 27°C and it is radiating energy at the rate of $Q\ kWm^{-2}$. If its temperature is raised to 151°C, the rate of radiation of energy will become approximately
a) $2Q\ kWm^{-2}$ b) $4Q\ kWm^{-2}$ c) $6Q\ kWm^{-2}$ d) $8Q\ kWm^{-2}$

453. Two rods of different materials having coefficient of thermal expansions α_1 and α_2 and Young's moduli Y_1 and Y_2 respectively are fixed between two rigid walls. The rods are heated, such that they undergo the same increase in temperature. There is no bending of rods. If α_1/α_2=2/3 and stresses developed in the two rods are equal, then $\frac{Y1}{Y2}$ is
a) 3/2 b) 1 c) 2/3 d) 1/2

454. In a closed room, which method is based on gravitation
a) Conduction b) Convection c) Radiation d) All of these

455. A brass disc fits simply in a hole of a steel plate. The disc from the hole can be loosened if the system
a) First heated then cooled b) First cooled then heated
c) Is heated d) Is cooled

456. 0.93 $watt-hour$ of energy is supplied to a block of ice weighing 10 g. It is found that
a) Half of the block melts
b) The entire block melts and the water attains a temperature of 4°C
c) The entire block just melts
d) The block remains unchanged

457. Melting point of ice
a) Increases with increasing pressure b) Decreases with increasing pressure
c) Is independent of pressure d) Is proportional to pressure

458. The total energy radiated from a black body source is collected for 1 min and is used to heat a quantity of water. The temperature of water is found to increase from 20°C to 20.5°C . If the absolute temperature of the black body is doubles and the experiment is repeated with the same quantity of water at 20°C, the temperature of water will be
a) 21°C b) 22°C c) 24°C d) 28°C

459. According to Wien's law
a) $\lambda_m T$ = constant b) $\frac{\lambda_m}{T}$ = constant c) $\frac{T}{\lambda_m}$ = constant d) $T+\lambda_m$ = constant

460. Two black metallic spheres of radius $4m$, at 2000 K and $1m$ at 4000 K will have ratio of energy radiation as
a) 1 : 1 b) 4 : 1 c) 1 : 4 d) 2 : 1

461. Three objects coloured black, gray and white can with stand hostile conditions at 2800°C. These objects are thrown into furnace where each of them attains a temperature of 2000°C. Which object will glow brightest?
a) The white object b) The black object
c) All glow with equal brightness d) Gray object

462. A black body at a temperature of 227°C radiates heat at the rate of 20 cal $m^{-2}s^{-1}$. When its temperature rises to 727°C, the rate of heat radiated will be
a) 40 cal $m^{-2}s^{-1}$ b) 160 cal $m^{-2}s^{-1}$ c) 320 cal $m^{-2}s^{-1}$ d) 640 cal $m^{-2}s^{-1}$

463. The ratio of thermal conductivity of two rods of different material is 5:4. The two rods of same area of cross-section and same thermal resistance will have the lengths in the ratio
a) 4 : 5 b) 9 : 1 c) 1 : 9 d) 5 : 4

464. The coefficient of thermal conductivity of a rod depends on
a) Area b) Length
c) Material of rod d) Temperature difference

465. A bar of iron is 10 cm at 20°C. At 19°C it will be (α of iron = 11×10^{-6}/°C)

a) $11 \times 10^{-6} cm$ longer b) $11 \times 10^{-6} cm$ shorter c) $11 \times 10^{-5} cm$ shorter d) $11 \times 10^{-5} cm$ longer

466. A clock with an iron pendulum keeps correct time at 15°C. What will be the error, in second per day, if the room temperature is 20°C?
(The coefficient of linear expansion of iron is $0.000012°C^{-1}$.)
a) 2.6 s b) 6.2 s c) 1.3 s d) 3.1 s

467. On the Celsius scale the absolute zero of temperature is at
a) 0°C b) −32°C c) 100°C d) −273.15°C

468. A black body is heated from 27°C to 927°C. The ratio of radiation emitted will be
a) 1:4 b) 1:8 c) 1:16 d) 1:256

469. Mud houses are cooler in summer and warmer in winter because
a) Mud is superconductor of heat b) Mud is good conductor of heat
c) Mud is bad conductor of heat d) None of these

470. Mode of transmission of heat, in which heat is carried by the moving particles, is
a) Radiation b) Conduction c) Convection d) Wave motion

471. Which of the following is more close to a black body?
a) Black board paint b) Green leaves c) Black holes d) Red roses

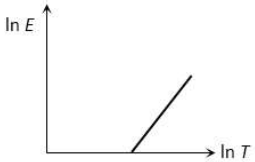
472. A black body has maximum wavelength λ_m at temperature 2000 K. Its corresponding wavelength at temperature 3000 K will be
a) $\frac{3}{2}\lambda_m$ b) $\frac{2}{3}\lambda_m$ c) $\frac{4}{9}\lambda_m$ d) $\frac{9}{4}\lambda_m$

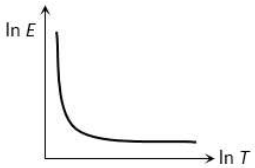
473. The Fahrenheit and Kelvin scales of temperature will give the same reading at
a) −40 b) 313 c) 574.25 d) 732.75

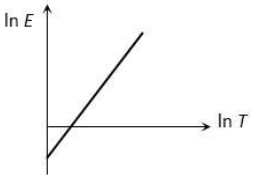
474. Four rods of silver, copper, brass and wood are of same shape. They are heated together after wrapping a paper on it, the paper will burn first on
a) Silver b) Copper c) Brass d) Wood

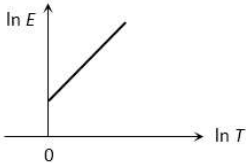
475. The wavelength of maximum intensity of radiation emitted by a star is 289.8 nm. The radiation intensity for the star is : (Stefan's constant $5.67 \times 10^{-8} W m^{-2} K^{-4}$, constant $b = 2898 \mu m K$)
a) $5.67 \times 10^{8} W/m^2$ b) $5.67 \times 10^{12} W/m^2$ c) $10.67 \times 10^{7} W/m^2$ d) $10.67 \times 10^{14} W/m^2$

476. Which of the following graphs correctly represents the relation between $\ln E$ and $\ln T$ where E is the amount of radiation emitted per unit time from unit area of a body and T is the absolute temperature

a) 

b) 

c) 

d) 

477. A wire 3 m in length and 1 mm in diameter at 30°C is kept in a low temperature at −170°C and is stretched by hanging a weight of 10 kg at one end. The change in length of the wise is
($Y = 2 \times 10^{11}$ Nm^{-2}, g=10ms^{-2} and $\alpha = 1.2 \times 10^{-5}$ °C^{-1})
a) 5.2 mm b) 2.5 mm c) 52 mm d) 25 mm

478. In which mode of transmission, the heat waves travel along straight line with the speed of light?
a) Thermal radiation b) Forced convection
c) Natural convection d) Thermal conduction

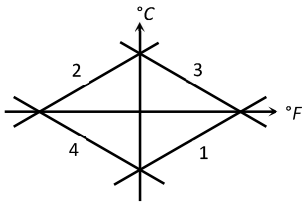
479. One quality of a thermometer is that its heat capacity should be small. If P is a mercury thermometer, Q is a resistance thermometer and R thermocouple type then
a) P is best, R worst b) R is best, P worst c) R is best, Q worst d) P is best, Q worst

480. We consider the radiation emitted by the human body. Which of the following statements is true?
a) The radiation is emitted during the summers and absorbed during the winters
b) The radiation emitted lies in the ultraviolet region and hence is not visible

c) The radiation emitted is in the infrared region

d) The radiation is emitted only during the day

481. Which of the curves in figure represents the relation between Celsius and Fahrenheit temperatures



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

482. Two vessels of different materials are similar in size in every respect. The same quantity of ice filled in them gets melted in 20 $minutes$ and 40 $minutes$ respectively. The ratio of thermal conductivities of the materials is

a) 5 : 6 b) 6 : 5 c) 3 : 1 d) 2 : 1

483. During illness an 80 kg man ran fever of 102.2^oF instead of normal body temperature of 98.6^oF. Assuming that human body is mostly water, how much heat is required to raise his temperature by that amount

a) 100 $kcal$ b) 160 $kcal$ c) 50 $kcal$ d) 92 $kcal$

484. The intensity of radiation emitted by the sun has its maximum value at a wavelength of 510 nm and that emitted by the north star has the maximum value at wavelength of 350 nm. If these stars behave like black bodies, then the ratio of surface temperatures of the sun and north star is

a) 1.46 b) 0.69 c) 1.21 d) 0.83

485. If the ratio of coefficient of thermal conductivity of silver and copper is 10 : 9, then the ratio of the lengths upto which wax will melt in Ingen Hauz experiment will be

a) 6 : 10 b) $\sqrt{10}$: 3 c) 100 : 81 d) 81 : 100

486. Water falls from a height 500 m. The rise in temperature of water at bottom if whole of energy remains in water, will be (specific heat of water is c=4.2 kJ kg^{-1})

a) 0.23°C b) 1.16°C c) 0.96°C d) 1.02°C

487. A metal ball of surface area 200 cm^2 and temperature 527°C is surrounded by a vessel at 27°C. If the emissivity of the metal is 0.4, then the rate of loss of heat from the ball is ($\sigma = 5.67 \times 10^{-8} J/m^2 - s - K^4$)

a) 108 joules approx b) 168 joules approx c) 182 joules approx d) 192 joules approx

488. A sphere at temperature 600K is placed in an environment of temperature is 200K. Its cooling rate is H. If its temperature reduced to 400K then cooling rate in same environment will become

a) $(3/16)H$ b) $(16/3)H$ c) $(9/27)H$ d) $(1/16)H$

489. A bimetallic is made of two strips A and B having coefficients of linear expansion α_A and α_B. If $\alpha_A < \alpha_B$, then on heating, the strip will

a) Bend with A on outer side b) Bend with B on outer side

c) Not bend at all d) None of the above

490. Two walls of thicknesses d_1 and d_2 and thermal conductivities k_1 and k_2 are in contact. In the steady state, if the temperatures at the outer surfaces are T_1 and T_2, the temperature at the common wall is

a) $\frac{k_1T_1d_2 + k_2T_2d_1}{k_1d_2 + k_2d_1}$ b) $\frac{k_1T_1 + k_2d_2}{d_1 + d_2}$ c) $\left(\frac{k_1d_1 + k_2d_2}{T_1 + T_2}\right)T_1T_2$ d) $\frac{k_1d_1T_1 + k_2d_2T_2}{k_1d_1 + k_2d_2}$

491. Relation between the colour and the temperature of a star is given by

a) Wien's displacement law b) Planck's law

c) Hubble's law d) Fraunhoffer diffraction law

492. The velocity of heat radiation in vacuum is

a) Equal to that of light b) Less than that of light

c) Greater than that of light d) Equal to that of sound

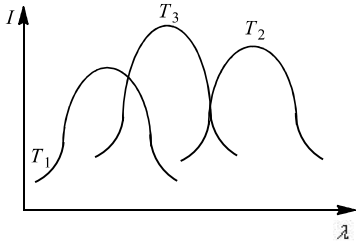
493. A stationary object at 4°C and weighing 3.5 kg falls from a height of 2000 m on a snow mountain at 0°C. If the temperature of the object just before hitting the snow is 0°C and the object comes to rest immediately ($g = 10m/s^2$) and (latent heat of ice $= 3.5 \times 10^5$ $joule/s$), then the mass of ice that will melt is
a) 2 kg b) 200 g c) 20 g d) 2 g

494. The amount of work, which can be obtained by supplying 200 cal of heat, is
a) 840 $dyne$ b) 840 W c) 840 erg d) 840 J

495. 1.56×10^5 J of heat is conducted through is 2 m^2 wall of 12 cm thick in one hour. Temperature difference between the two sides of the wall is 20°C. The thermal conductivity of the material of the wall is (in $Wm^{-1}K^{-1}$)
a) 0.11 b) 0.13 c) 0.15 d) 1.2

496. The surface temperature of the stars is determined using
a) Planck's law b) Wien's displacement law
c) Rayleigh-Jeans law d) Kirchhoff's law

497. The plots of intensity of radiation *versus* wavelength of three black bodies at temperatures T_1, T_2 and T_3 are shown. Then,



a) $T_3 > T_2 > T_1$ b) $T_1 > T_2 > T_3$ c) $T_2 > T_3 > T_1$ d) $T_1 > T_3 > T_2$

498. Two uniform brass rods A and B of lengths l and $2l$ and radii $2r$ and r respectively are heated to the same temperature. The ratio of the increase in the volumes of A to that of B is
a) 1: 1 b) 1: 2 c) 2: 1 d) 1: 4

499. A steel scale measures the length of copper wire as 80.0cm, when both are at 20°C (the calibration temperature for scale). What would be the scale read for the length of the wire when both are at 40°C? (Given $\alpha_{\text{steel}} = 11 \times 10^{-6}$ per°C and $\alpha_{\text{copper}} = 17 \times 10^{-6}$per°C)
a) 80.0096 cm b) 80.0272 cm c) 1 cm d) 25.2 cm

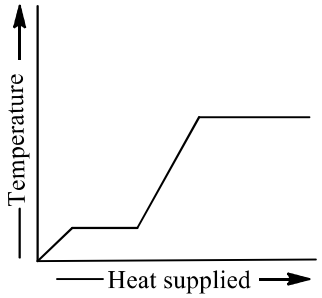
500. A black body emits radiations of maximum intensity at a wavelength of 5000Å, when the temperature of the body is 1227°C. If the temperature of the body is increased by 2227°C, the maximum intensity of emitted radiation would be observed at
a) 2754.8Å b) 3000Å c) 3500Å d) 4000Å

501. Which of the following circular rods. (given radius r and length l) each made of the same material as whose ends are maintained at the same temperature will conduct most heat?
a) $r = 2r_0; l = 2l_0$ b) $r = 2r_0; l = l_0$ c) $r = r_0; l = l_0$ d) $r = r_0; l = 2l_0$

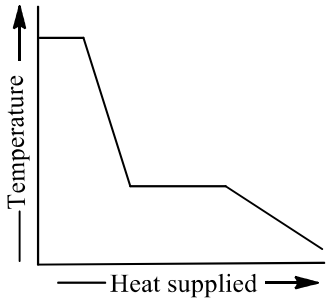
502. 2 g of water condenses when passed through 40 g of water initially at 25°C. The condensation of steam raises the temperature of water to 54.3°C. What is the latent heat of steam?
a) 540 $calg^{-1}$ b) 536 $calg^{-1}$ c) 270 $calg^{-1}$ d) 480 $calg^{-1}$

503. A block of ice at -10° c slowly heated and converted to steam at 100°C. Which of the following curves represents this phenomenon qualitatively?

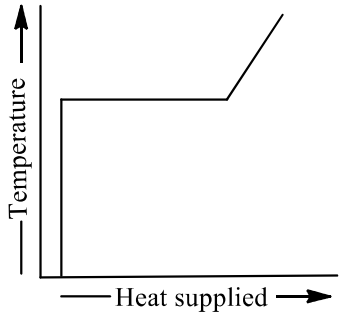
a)



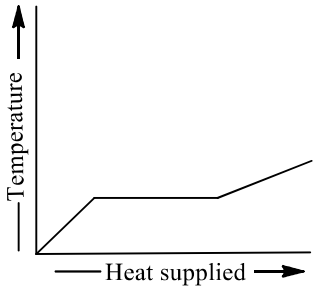
b)



c)



d)



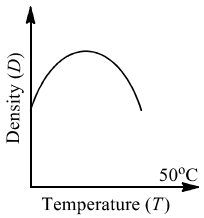
504. A thermos flask is polished well
   a) To make attractive
   b) For shining
   c) To absorb all radiations from outside
   d) To reflect all radiations from outside

505. As compared to the person with white skin, the person with black skin will experience
   a) Less heat and more cold
   b) More heat and more cold
   c) More heat and less cold
   d) Less heat and less cold

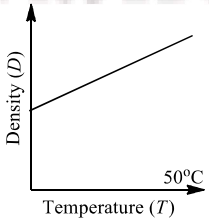
506. When the pressure on water is increased the boiling temperature of water as compared to 100°C will be
   a) Lower
   b) The same
   c) Higher
   d) On the critical temperature

507. Which one of the figure gives the temperature dependence of density water correctly?

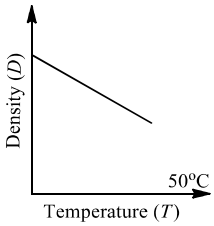
a)



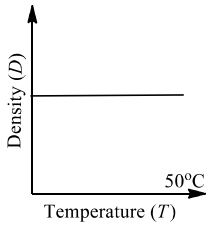
b)



c)

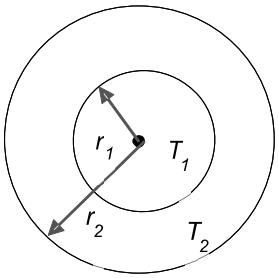


d)



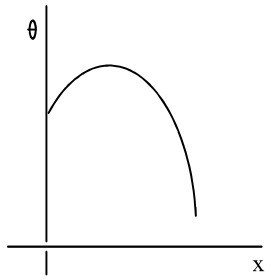
508. In order that the heat flows from one part of a solid to another part, what is required
   a) Uniform density
   b) Density gradient
   c) Temperature gradient
   d) Uniform temperature

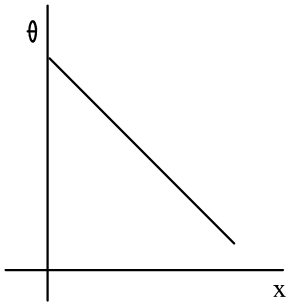
509. The figure shows a system of two concentric spheres of radii r_1 and r_2 and kept at temperatures T_1 and T_2 respectively. The radial rate of flow of heat in a substance between the two concentric spheres, is proportional to

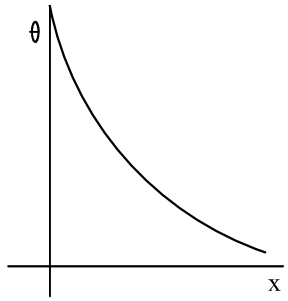


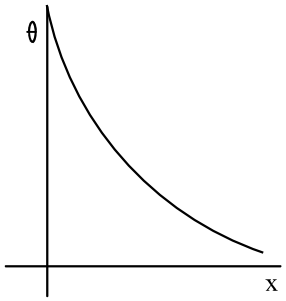
a) $\frac{(r_2 - r_1)}{(r_1 r_2)}$ b) $\text{In}\left(\frac{r_2}{r_1}\right)$ c) $\frac{(r_1 r_2)}{(r_2 - r_1)}$ d) $(r_2 - r_1)$

510. 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 figure?

a) 

b) 

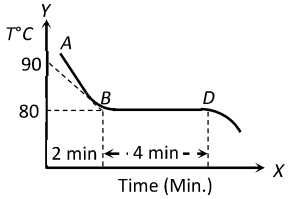
c) 

d) 

511. Four rods of identical cross-sectional area and made from the same metal form the sides of square. The temperature of two diagonally opposite points are T and $\sqrt{2}\,T$ respectively in the steady state. Assuming that only heat conduction takes place, what will be the temperature difference between other two points

a) $\frac{\sqrt{2}+1}{2}T$ b) $\frac{2}{\sqrt{2}+1}T$ c) 0 d) None of these

512. The figure given below shows the cooling curve of pure wax material after heating. It cools from A to B and solidifies along BD. If L and C are respective values of latent heat and the specific heat of the liquid wax, the ratio L/C is

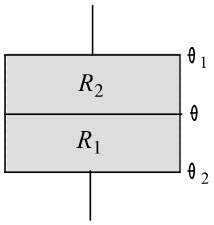


a) 40 b) 80 c) 100 d) 20

513. On a new scale of temperature (which is linear) and called the W scale, the freezing and boiling points of water are $39^{o}\ W$ and $239^{o}W$ respectively. What will be the temperature on the new scale, corresponding to a temperature of 39°C on the Celsius scale

a) $200^{o}W$ b) $139^{o}W$ c) $78^{o}W$ d) $117^{o}W$

514. Consider two insulating sheets with thermal resistances R_1 *and* R_2 as shown in figure. The temperature θ is



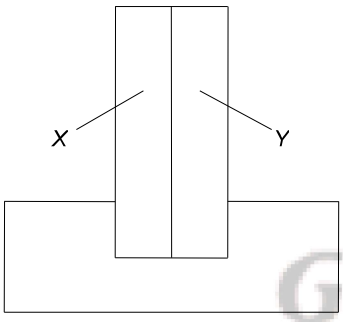
a) $\frac{\theta_1 R_2 + \theta_2 R_1}{R_1 + R_2}$ b) $\frac{(\theta_1 + \theta_2) R_1 R_2}{R_1^2 + R_2^2}$ c) $\frac{\theta_1 R_1 + \theta_2 R_2}{R_1 + R_2}$ d) $\frac{\theta_1 \theta_2 \, R_1 R_2}{(\theta_1 + \theta_2)(R_1 R_2)}$

515. The SI unit of mechanical equivalent of heat is
a) $Joule \times Calorie$ b) $Joule/Calorie$ c) $Calorie \times Erg$ d) $Erg/Calorie$

516. The mechanical equivalent of heat J is
a) A constant b) A physical quantity c) A conversion factor d) None of the above

517. When a liquid in a glass vessel is heated, is apparent expansion is$10.30 \times 10^{-4}°C^{-1}$. When the same liquid is heated in a metal vessel, its apparent expansion is $10.06 \times 10^{-4}°C^{-1}$. If the coefficient of linear expansion of glass $= 9 \times 10^{-6}°C^{-1}$, what is the coefficient of linear expansion of metal?
a) $51 \times 10^{-6}°C^{-1}$ b) $17 \times 10^{-6}°C^{-1}$ c) $25 \times 10^{-6}°C^{-1}$ d) $43 \times 10^{-6}°C^{-1}$

518. A bimetallic strip consists of metals X and Y. It is mounted rigidly at the base as shown. The metal X has a higher coefficient of expansion compared to that for metal Y. when bimetallic strip is placed in a cold bath



a) It will bend towards the right b) It will bend towards the left
c) It will not bend but shrink d) It will neither bend nor shrink

519. A piece of blue glass heated to a high temperature and a piece of red glass at room temperature, are taken inside a dimly lit room then
a) The blue piece will look blue and red will look as usual
b) Red look brighter red and blue look ordinary blue
c) Blue shines like brighter red compared to the red piece
d) Both the pieces will look equally red

520. In determining the temperature of a distant star, one makes use of
a) Kirchhoff's law b) Stefan's law
c) Wien's displacement law d) None of the above

521. The two ends of a rod of length L and a uniform cross-sectional area A are kept at two temperature 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
a) $\frac{dQ}{dt} = \frac{kL(T_1 - T_2)}{A}$ b) $\frac{dQ}{dt} = \frac{k(T_1 - T_2)}{LA}$ c) $\frac{dQ}{dt} = kLA(T_1 - T_2)$ d) $\frac{dQ}{dt} = \frac{kA(T_1 - T_2)}{L}$

522. A black body is heated from 27°C to 127°C. The ratio of their energies of radiations emitted will be
a) 3 : 4 b) 9 : 16 c) 27 : 64 d) 81 : 256

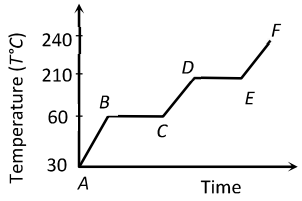
523. The radiation energy density per unit wavelength at a temperature T has a maximum at a wavelength λ_0. At temperature $2T$, it will have a maximum at a wavelength
a) $4\lambda_0$ b) $2\lambda_0$ c) $\lambda_0/2$ d) $\lambda_0/4$

524. Which of the following is the correct device for the detection of thermal radiation
   a) Constant volume thermometer b) Liquid-in-glass thermometer
   c) Six's maximum and minimum thermometer d) Thermopile

525. Two bodies A and B having temperatures 327°C and 427°C are radiating heat to the surrounding. The surrounding temperature is 27°C . The ration of rate of heat radiation of A to that of B is
   a) 0.52 b) 0.31 c) 0.81 d) 0.42

526. The temperature of a thin uniform circular disc, of one metre diameter is increased by 10°C. The percentage increase in moment of inertia of the disc about an axis passing through its centre and perpendicular to the circular face (linear coefficient of expansion$=11 \times 10^{-6}\ °C^{-1}$)
   a) 0.0055 b) 0.011 c) 0.022 d) 0.044

527. A solid substance is at 30°C. To this substance heat energy is supplied at a constant rate. Then temperature versus time graph is as shown in the figure. The substance is in liquid state for the portion (of the graph)



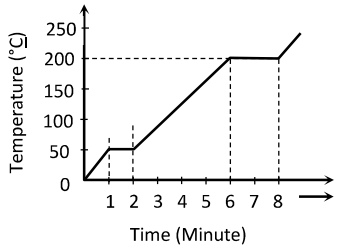
   a) BC b) CD c) ED d) EF

528. In a steady state of thermal conduction, temperature of the ends A and B of a 20 cm long rod are 100°C and 0°C respectively. What will be the temperature of the rod at a point at a distance of 6 cm from the end A of the rod
   a) -30°C b) 70°C c) 5°C d) None of the above

529. A vertical column 50 cm long at 50°C balances another column of same liquid 60 cm long at 100°C. The coefficient of absolute expansion of the liquid is
   a) 0.005/°C b) 0.0005/°C c) 0.002/°C d) 0.0002/°C

530. 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 centre of the sun is
   Where σ is the stefan's constant.
   a) $\frac{4\pi r^2\sigma t^4}{R^2}$ b) $\frac{r^2\sigma(t+273)^4}{4\pi R^2}$ c) $\frac{16\pi^2 r^2\sigma t^4}{R^2}$ d) $\frac{r^2\sigma(t+273)^4}{R^2}$

531. A student takes $50gm$ wax (specific heat $= 0.6\ kcal/kg$°C) and heats it till it boils. The graph between temperature and time is as follows. Heat supplied to the wax per minute and boiling point are respectively



   a) 500 cal, 50°C b) 1000 cal, 100°C c) 1500 cal, 200°C d) 1000 cal, 200°C

532. A black body at a temperature of 127°C radiates heat at the rate of 1 $cal/cm^2 \times sec$. At a temperature of 527°C the rate of heat radiation from the body in ($cal/cm^2 \times sec$) will be
   a) 16.0 b) 10.45 c) 4.0 d) 2.0

533. Wires A and B have identical lengths and have circular cross-section. The radius of A is twice the radius of B $i.e. r_A = 2r_B$. For a given temperature difference between the two ends, both wires conduct heat at the same rate. The relation between the thermal conductivities is given by

a) $K_A = 4K_B$ b) $K_A = 2K_B$ c) $K_A = K_B/2$ d) $K_A = K_B/4$

534. Absolute zero $(0\ K)$ is that temperature at which
   a) Matter ceases to exist
   b) Ice melts and water freezes
   c) Volume and pressure of a gas becomes zero
   d) None of these

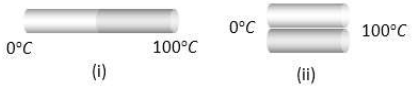
535. Absorption co-efficient of an open window is
   a) Zero b) 0.5 c) 1 d) 0.25

536. A black body at a high temperature T radiates energy at the rate of U (in $\mathrm{Wm^{-2}}$). When the temperature falls to half $(ie, \frac{T}{2})$, the radiated energy (in $\mathrm{Wm^{-2}}$) will be
   a) $\frac{U}{8}$ b) $\frac{U}{16}$ c) $\frac{U}{4}$ d) $\frac{U}{2}$

537. A perfect black body is one whose emissive power is
   a) Maximum b) Zero c) Unity d) Minimum

538. If mass-energy equivalence is taken into account, when water is cooled to form ice, the mass of water should
   a) Increase
   b) Remain unchanged
   c) Decrease
   d) First increase then decrease

539. Two identical square rods of metal are welded end to end as shown in figure (i), 20 calories of heat flows through it in 4 minutes. If the rods are welded as shown in figure (ii), the same amount of heat will flow through the rods in



   a) 1 minute b) 2 minutes c) 4 minutes d) 16 minutes

540. If two metallic plates of equal thicknesses and thermal conductivities K_1 and K_2 are put together face to face and a common plate is constructed, then the equivalent thermal conductivity of this plate will be

   a) $\frac{K_1K_2}{K_1+K_2}$ b) $\frac{2K_1K_2}{K_1+K_2}$ c) $\frac{(K_1^2+K_2^2)^{3/2}}{K_1K_2}$ d) $\frac{(K_1^2+K_2^2)^{3/2}}{2K_1K_2}$

541. The thermal capacity of 40 g of aluminium (specific heat = 0.2 $cal/g/°C$) is
   a) 40 $cal/°C$ b) 160 $cal/°C$ c) 200 $cal/°C$ d) 8 $cal/°C$

542. Which one of the following would raise the temperature of 20 g of water at 30°C most when mixed with it?
   a) 20 g of water at 40°C
   b) 40 g of water at 35 °C
   c) 10 g of water at 50°C
   d) 4 g water at 80°C

543. A rectangular block is heated from 0°C to 100°C. The percentage increase in its length is 0.2%. What is the percentage increase in its volume?
   a) 0.6% b) 0.10% c) 0.2% d) 0.4%

544. The earth radiates in the infra-red region of the spectrum. The spectrum is correctly given by
   a) Wien's law
   b) Rayleigh Jeans law
   c) Planck's law of radiation
   d) Stefan's law of radiation

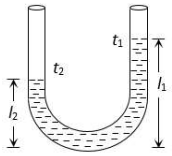
545. The coefficient of volume expansion of a liquid is $49 \times 10^{-5}\mathrm{K^{-1}}$. Calculate the fractional change in its density when the temperature is raised by 30°C.
   a) 7.5×10^{-3} b) 3.0×10^{-3} c) 1.5×10^{-2} d) 1.1×10^{-3}

546. If a cylinder a diameter 1.0 cm at 30°C is to be fitted into a hole of diameter 0.9997 cm in a steel plate at the same temperature, then minimum required rise in the temperature of the plate is : (Coefficient of linear expansion of steel $= 12 \times 10^{-6}/°C$)
   a) 25°C b) 35°C c) 45°C d) 55°C

547. Absolute temperature can be calculated by
   a) Mean square velocity
   b) Motion of the molecule

c) Both (a) and (b) d) None of the above

548. In a vertical U-tube containing a liquid, the two arms are maintained at different temperatures t_1 and t_2. The liquid columns in the two arms have heights l_1 and l_2 respectively. The coefficient of volume expansion of the liquid is equal to



a) $\frac{l_1 - l_2}{l_2 t_1 - l_1 t_2}$ b) $\frac{l_1 - l_2}{l_1 t_1 - l_2 t_2}$ c) $\frac{l_1 + l_2}{l_2 t_1 + l_1 t_2}$ d) $\frac{l_1 + l_2}{l_1 t_1 + l_2 t_2}$

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

a) $\left(\frac{287}{7}\right)^4$ b) 16 c) 4 d) 2

550. If earth suddenly stops rotating about its own axis, the increase in it's temperature will be

a) $\frac{R^2\omega^2}{5Js}$ b) $\frac{R^2\omega^2}{Js}$ c) $\frac{Rm\omega^2}{5Js}$ d) None of these

551. A constant pressure air thermometer gave a reading of 47.5 units of volume when immersed in ice cold water, and 67 units in a boiling liquids. The boiling point of the liquid will be

a) 135°C b) 125°C c) 112°C d) 100°C

552. Two identical metal balls at temperature 200°C and 400°C kept in air at 27°C. The ratio of net heat loss by these bodies is

a) 1/4 b) 1/2 c) 1/16 d) $\frac{473^4 - 300^4}{673^4 - 300^4}$

553. Total energy emitted by a perfectly black body is directly proportional to T^n where n is

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

554. The coefficient of apparent expansion of a liquid when determined using two different vessels A and B are γ_1 and γ_2 respectively. If the coefficient of linear expansion of the vessel A is α, the coefficient of linear expansion of the vessel B is

a) $\frac{\alpha\gamma_1\gamma_2}{\gamma_1 + \gamma_2}$ b) $\frac{\gamma_1 - \gamma_2}{2\alpha}$ c) $\frac{\gamma_1 - \gamma_2 + \alpha}{3}$ d) $\frac{\gamma_1 - \gamma_2}{3} + \alpha$

555. The surface area of a black body is 5×10^{-4} m^2 and its temperature is 727°C . the energy radiated by it per minute is ($\sigma = 5.67 \times 10^{-8}$ Jm^{-2} – s^{-1} – K^{-4})

a) 1.7×10^3 J b) 2.5×10^2 J c) 8×10^3 J d) 3×10^4 J

556. On heating, the temperature at which water has minimum volume is

a) 0°C b) 4°C c) 4K d) 100°C

557. A uniform metal rod is used as a bar pendulum. If the room temperature rise by 10°C and coefficient of linear expansion of the metal of the rod is 2×10^6 °C^{-1}, the period of pendulum will increase by

a) 1×10^{-3}% b) -1×10^{-3}% c) 2×10^{-3}% d) -2×10^{-3}%

558. A lead bulled strikes at target with a velocity of 480 ms^{-1}. If the bullet falls dead, the rise in temperature of bullet ($c = 0.03$), assuming that heat produced is equally shared between the bullet and target is

a) 557°C b) 457°C c) 857°C d) 754°C