TEMPERATURE AND HEAT

1. In order that the heat flows from one part of a solid to another part, what is required?
   a) uniform density
   b) temperature gradient
   c) density gradient
   d) uniform temperature
2. How much work can be obtained from 100 calories of heat energy?
   a) 100 J b) 420 J
   c) 42 J d) 4200 J

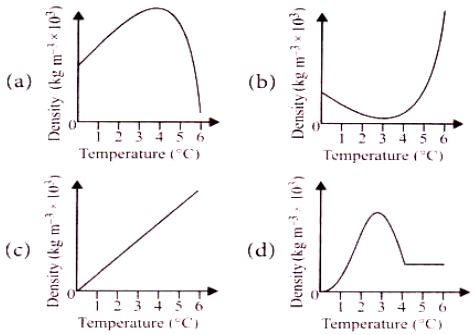
MEASUREMNENT OF TEMPERATURE

3. The temperature which has same numerical value on Celsius and Fahrenheit scale is
   a) 273 b) -273
   c) -40 d) 40
4. When a thermometer is taken from the melting ice to a warm liquid, the mercury level rises to of the distance between the lower and the upper fixed points. The temperature of liquid in K is
   a) 217.15 b) 313.15
   c) 220 d) 330

THERMAL EXPANSION

5. If the volume of a block of metal changes by 0.12% when it is heated through , then the coefficient of linear expansions is
   a) b)
   c) d)
6. There is a hole in the middle of a copper plate. When heating the plate, diameter of hole would
   a) always increase b) always decrease
   c) remains the same d) none of these
7. Length of a wire at room temperature is 4.55 m , when the temperature increases then its length becomes 4.57 m. The coefficient of linear expansion (a) of the given wire is
   a) b)
   c) d)
8. To increase the length of brass rod by 2% its temperature should increase by $\left(a = 0.00002^{o}C^{-1}\right)$
   a) $800^{o}C$ b) $900^{o}C$
   c) $1000^{o}C$ d) $1100^{o}C$
9. At $50^{o}C$, a brass rod has a length 50 cm and a diameter 2mm. It is joined to a steel rod of the same length and diameter at the sake temperature. The change in the length of the composite rod when it is heated to $250^{o}C$ is (Coefficient of linear expansion of brass= $2.0\times10^{-5o}C^{-1}$, coefficient of linear expansion of steel = $1.2\times10^{-5o}C^{-1}$
   a) 0.28 cm b) 0.30 cm
   c) 0.32 cm d) 0.34 cm
10. The moment of inertia of a rod about is perpendicular bisector is . When the temperature of the rod is increased by the increase in the moment of inertia of the rod about the same axis is (Here, a is the coefficient of linear expansion of the rod)
    a) b)
    c) d)
11. A brass wire 1.8 m long at is held taut with negligible tension between two rigid supports. **.** Diameter of the wire is 2mm, its coefficient of linear expansion, and its Young's modulus, . If the wire if cooled to a temperature , tension develop in the wire is
    a) b)
    c) d)
12. The coefficient of volume expansion of liquid is . The fractional change in its density for rise In temperature is
    a) b)
    c) d)
13. A rectangular block is heated from . The percentage increase in its length is 0.2%. The percentage increase in its volume is
    a) 0.6% b) 0.10%
    c) 0.2% d) 0.4%
14. Which of the following graphs correctly shows variation of coefficient of volume expansion of copper as a function of temperature?
15. If $a,\beta and\gamma$ are coefficient of linear, superficial and volume expansion respectively, then
    a) $\frac{\beta}{\alpha}=\frac{1}{2}$ b) $\frac{\beta}{\gamma}=\frac{2}{3}$
    c) $\frac{\gamma}{\alpha}=\frac{3}{2}$ d) $\frac{\beta}{\alpha}=\frac{\gamma}{\beta}$

16. Two spheres A and B are made of the same material and have the same radius. Sphere A is hollow and sphere B is solid. Both the spheres are heated to the same temperature. Which of the following is correct?
    a) A expands more than B.
    b) A expands less than B.
    c) Both the spheres expand equally.
    d) Data is insufficient.
17. The volume of a metal sphere increases by 0.24% when its temperature is raised by 40^oC. The coefficient of linear expansion of the metal is
    a) $2\times10^{-5o}C^{-1}$ b) $6\times10^{-5o}C^{-1}$
    c) $18\times10^{-5o}C^{-1}$ d) $1.2\times10^{-5o}C^{-1}$
18. Find the stress developed inside a tooth cavity filled with copper when hot tea at temperature of 57^oC is drunk.(Take temperature of tooth to be 37^oC, $\alpha = 1.7\times10^{-5o}C^{-1}$ and bulk modulus for copper=$140\times10^9 Nm^{-2}$)
    a) $1.43\times10^8 Nm^{-2}$ b) $4.13\times10^8 Nm^{-2}$
    c) $2.12\times10^4 Nm^{-2}$ d) $3.12\times10^4 Nm^{-2}$
19. Which of the following graph shows the variation of density of water with increase in temperature?



SPECIFIC HEAT CAPACITY

20. Which one of the following substance has highest specific heat capacity at room temperature and atmospheric pressure?
    a) Water b) Ice
    c) Aluminium d) Mercury
21. 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 these
22. Water is used as a coolant because
    a) it has lower density.
    b) it has low specific heat.
    c) it has high specific heat
    d) it is easily available.
23. A 10 kW drilling machine is used to drill a bore in a small aluminium block of mass 8 kg. Find the rise in temperature of the block in 2.5 minutes, assuming 50% power is used up in heating the machine itself or lost to the surroundings. (Specific heat of aluminium = $.91 jg^{-1o}C^{-1}$)
    a) 100^oC b) 103^oC
    c) 150^oC d) 155^oC
24. A person weighing 50 kg takes in 1500 kcal diet per day. If this energy were to be used in heating the body of person without any losses, then the rise in his temperature is (specific heat of human body $= 0.83 ca\,\mathrm{lg}^{-1}C^{-1}$)
    a) 30^oC b) 48^oC
    c) 40.16^oC d) 36.14^oC

CALORIMETRY

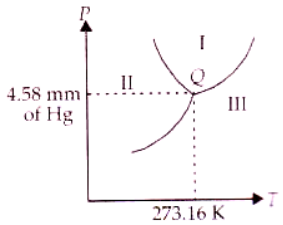
25. 10 g of ice at 0^oC is mixed with 100 g of water at 50^oC a calorimeter. The final temperature of the mixture is [Specific heat of water $1 ca\,\mathrm{lg}^{-1o}C^{-1}$, latent heat of fusion of ice= $80 ca\,\mathrm{lg}^{-1}$]
    a) 31.2^oC b) 32.8^oC
    c) 36.7^oC d) 38.2^oC
26. When 1.5 kg of ice at 0^oC mixed with 2 kg of water at 70^oC in a container, the resulting temperature is 5^oC the heat of fusion of ice ($s_{water} = 4186 Jkg^{-1}K^{-1}$)
    a) $1.42\times10^5 Jkg^{-1}$ b) $2.42\times10^5 Jkg^{-1}$
    c) $3.42\times10^5 Jkg^{-1}$ d) $4.42\times10^5 Jkg^{-1}$
27. The temperature of equal masses of three different liquids A,B and C are $12^oC, 19^oC$ and 28^oC respectively. The temperature when A and B are mixed is 16^oC and when B and C are mixed is 23^oC .The temperature when A and C are mixed is
    a) 18.2^oC b) 22^oC
    c) 20.3^oC **d)** 24.2^oC
28. An ice cube of mass 0.1 kg at 0^oC is placed in an isolated container which is at 227^oC. The specific heat s of the container varies with temperature T according to the empirical relation $s = A + BT$, where $A = 100 calkg^{-1}K^{-1}$ and $B = 2\times10^{-2} calkg^{-1}$. If the final temperature of the container is 27^oC, the mass of the container is (Latent heat of fusion of water= $8\times10^4 calkg^{-1}$, specific heat of water = $10 calkg^{-1}K^{-1}$)
    a) 0.495 kg b) 0.595 kg
    c) 0.695 kg d) 0.795 kg.

CHANGE OF STATE

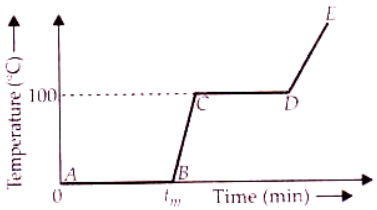
29. The change from solid state to vapour state without passing through the liquid state is called
    a) Fusion b) Regulation
    c) vaporisation d) sublimation
30. Match the following.

Column I		Column II	
(A)	Conversion of a liquid in to solid is	(p)	Regelation
(B)	Conversion of a liquid into vapour is	(q)	Sublimation
(C)	Conversion of solid into vapour directly	(r)	Fusion
(D)	Melting of ice caused by pressure is	(s)	Vaporisation

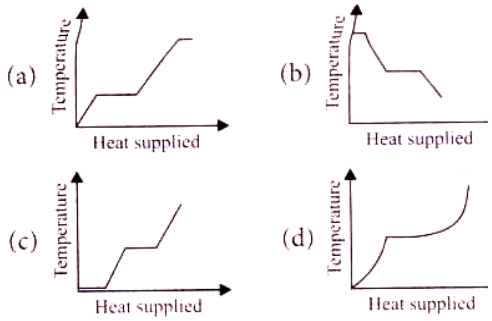
    (a) A-r, B-q, C-p, D-s (b) A-r, B-s, C-q, D-p
    (c) A-r, B-s, C-q, D-p (d) A-p, B-q, C-r,D-s
31. Which of the following statements is correct?
    a) The triple of water is253.16 K.
    b) Burns from steam are less severe than those from boiling water.
    c) Ethyl alcohol expands less than mercury for the same rise in temperature.
    d) When fully inflated balloon is immersed in cold water, it will contract.
32. In the phase diagram shown, the point Q corresponds to the triple point of water. The regions I, II and III respectively correspond to phases



    a) liquid, solid, vapour
    b) solid, liquid, vapour
    c) liquid, vapour, solid
    d) solid, vapour, liquid
33. Refer to the plot of temperature versus time showing the changes in the sate of ice on heating nor to scale).



    a) A,B represents ice and water are not in the thermal equilibrium.
    b) At B water starts boiling.
    c) At C all the water gets converted into steam.
    d) CD represents water and steam in equilibrium at boiling point.
34. A block of ice at -8^oC is slowly heated and converted to steam at 100^oC. Which of the following curves represents the phenomena qualitatively?



35. Two absolute scale A and B have triple points of water defined to be at 200 A and 350 B. the relation between $T_A and T_B$ IS
    a) $T_A = 4/7T_B$ b) $T_B = 4/7T_A$
    c) $T_A = 2/7T_B$ d) $T_B = 2/7T_B$
36. The triple point of carbon dioxide is 216.55 K the corresponding temperature on the Celsius and Fahrenheit scale respectively are
    a) $56.45^oC, -69.61^oF$
    b) $-56.45^oC, 69.61^oF$
    c) $56.45^oC, 69.61^oF$
    d) $-56.45^oC, -69.61^oF$
37. The latent heat of vaporisation of a substance is always
    a) greater than its latent heat of fusion
    b) greater than its latent heat of sublimation
    c) equal to its latent heat of sublimation
    d) less than its latent heat of fusion
38. 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 of water is high
    c) water has large latent heat of vaporisation
    d) water is a bad conductor of heat.
39. If 10 g of ice is added to 40 g of water at 15^oC, then the temperature of the mixture is (specific heat of water= $4.2\times10^3 Jkg^{-1}K^{-1}$, latent heat of fusion of ice = $3.36\times10^5 Jkg^{-1}$
    a) 15^oC b) 12^oC
    c) 10^oC d) 0^oC
40. If a ball of 80 kg mass hits an ice cube and temperature of ball is 100^oC, then how much ice converted into water?(Specific heat of ball is $0.2ca\lg^{-1}$)
    a) 20 g b) 200g

c) $2\times10^{3}g$ d) $2\times10^{4}g$

41. Rays from the sun are focused by a lens of diameter 5cm to a block of ice and 10 g of ice is melted in 20 min. Therefore the heat from the sun reaching the earth per min per square centimetre is

(Latent heat of ice $L=80cal\,g^{-1}$)

a) 2.04 cal b) 0.51 cal
c) 4.08 cal d) 3.02 cal

HEAT TRANSFER

42. For transmission of heat from one place to the other, medium is required in

a) conduction b) convection
c) radiation d) both (a) and (b)

43. One end of a 0.25 m long metal bar is in steam and the other is in contact with ice. If 2 g of ice melts per minute, then the thermal conductivity of the metal is (Given cross section of the bar= $5\times10^{-4}m^{2}$ and latent heat of ice is $80cal\,g^{-1}$).

a) $20cals^{-1}m^{-1o}C^{-1}$

b) $10cals^{-1}m^{-1o}C^{-1}$

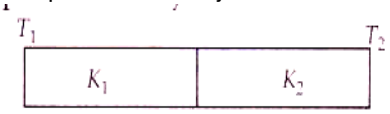
c) $40cals^{-1}m^{-1o}C^{-1}$

d) $80cals^{-1}m^{-1o}C^{-1}$

44. A pan filled with hot food cools from $94^{o}Cto86^{o}C$ in 2 minutes when the room temperature is at $20^{o}C$. The time taken to cool it from $71^{o}Cto69^{o}C$ is

a) 12 s b) 22 s
c) 32 s d) 40 s

45. Two bars of same length and same cross-sectional area but of different thermal conductivities K_1 and K_2 are joined end to end as shown in the figure. One end of the compound bar is at temperature T_1 and the opposite end at temperature T_2 (where $T_1>T_2$). The temperature of the junction is



a) $\dfrac{K_1T_1+K_2T_2}{K_1+K_2}$ b) $\dfrac{K_1T_2+K_2T_1}{K_1+K_2}$

c) $\dfrac{K_1(T_1+T_2)}{K_2}$ d) $\dfrac{K_2(T_1+T_2)}{K_1}$

46. In the question number 45, the equivalent thermal conductivity of the compound bar is

a) $\dfrac{K_1K_2}{K_1+K_2}$ b) $\dfrac{2K_1K_2}{K_1+K_2}$

c) $\dfrac{K_1}{K_1+K_2}$ d) $\dfrac{K_2}{K_1+K_2}$

47. Consider a composite slab consisting of two different materials having equal thickness and thermal conductivities K and 2K respectively. The equivalent thermal conductivity of the slab is

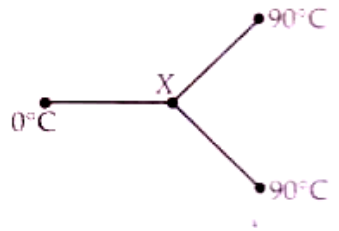
a) $\dfrac{2}{3}K$ b) $\sqrt{2}K$

c) $3K$ d) $\dfrac{4}{3}K$

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

a) 3.43 b) 4.43
c) 5.43 d) 2.43

49. Three metal rods of the same material and identical in all respects are joined as shown in the figure. The temperatures at the ends are maintained as indicated. Assuming no loss of heat from the curved surfaces of the rods , the temperature at the junction X would be



a) $45^{o}C$ b) $60^{o}C$
c) $30^{o}C$ d) $20^{o}C$

50. 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) $\left(\dfrac{65}{2}\right)^{1/4}T$ b) $\left(\dfrac{97}{4}\right)^{1/4}T$

c) $\left(\dfrac{97}{2}\right)^{1/4}T$ d) $(97)^{1/4}T$

51. A cubical thermocole ice box of side 20 cm has a thickness 5 cm. If 5 kg of ice is put in the box, the amount of nice remaining after 10 hours is

(The outside temperature is $50^{o}C$ and the coefficient of thermal conductivity of thermocole $=0.01Js^{-1}m^{-1o}C^{-1}$, latent heat of fusion of the ice $=335\times10^{3}Jkg^{-1}$)

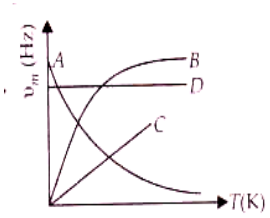
a) 3.7 kg b) 3.9 kg
c) 4.7 kg d) 4.9 kg

52. A wall is made of equally thick layers A and B of different materials. Thermal conductivity of A is twice that of B. In the steady state, the temperature difference across the wall is $36^{o}C$. The temperature difference across the layer A is

a) $12^{o}C$ b) $18^{o}C$
c) $6^{o}C$ d) $24^{o}C$

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

54. 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) A b) B
    c) C d) D

55. The equatorial and polar regions of the earth receive unequal solar heat. The convection current arising due to this is called
    a) land breeze b) sea breeze
    c) trade wind d) tornado

56. In which of the following process convection does not take place primarily?
    a) Sea and land breeze b) Trade wind
    c) Boiling of water
    d) Warming of glass of bulb due to filament

57. Wien's displacement law expresses relation between
    a) colour of light and temperature
    b) wavelength and temperature
    c) radiation energy and wavelength
    d) wavelength corresponding to maximum energy and temperature

58. If λ_m denotes the wavelength at which the radius emission from a black body at a temperature T K is maximum, then
    a) $\lambda_m \propto T$ b) $\lambda_m \propto T - 1$
    c) $\lambda_m \propto T$ d) λ_m is independent on T

59. A rectangular body has maximum wavelength λ_m at 2000 K. Its corresponding wavelength at 3000 K will be
    a) $\frac{3}{2}\lambda_m$ b) $\frac{2}{3}\lambda_m$
    c) $\frac{16}{81}\lambda_m$ d) $\frac{81}{16}\lambda_m$

60. The thermal radiation from a hot body travels with a velocity of
    a) $330 ms^{-1}$ b) $2\times10^8 ms^{-1}$
    c) $1200 ms^{-1}$ d) $3\times10^8 ms^{-1}$

61. Experimental investigations show that the intensity of solar radiation is maximum for a wavelength 480 nm in the visible region. Estimate the surface temperature of sun.(Given Wien's constant $b = 2.88\times10^{-3} mK$).
    a) 4000K b) 6000K
    c) 8000K d) $10^6 K$

62. The wave length of maximum intensity of radiation emitted by a star is 289.8 nm. The radiation intensity of the star is
    (Stefan's constant $= 5.67\times10^{-8} Wm^{-2}K^{-4}$, Wien's constant b= $2898 \mu mK$)
    a) $5.67\times10^8 Wm^{-2}$
    b) $5.67\times10^{12} Wm^{-2}$
    c) $10.67\times10^7 Wm^{-2}$
    d) $10.67\times10^{14} W/m^{-2}$

63. The temperature of a radiating body increases by 30%. Then the increase in the amount of radiation is
    a) 185% b) 285 %
    c) 3255 d0 130%

64. If the temperature of hot black body is raised by 5% rate of heat energy radiated would be increased by how much percentage?
    a) 12% b) 22%
    c) 32% d) 42%

65. Two spheres of the same material have radii 1m and 4 m and temperatures 4000 K and 2000 K respectively. The energy radiated per second by the first sphere is
    a) greater than that by the second
    b) less than that by the second
    c) equal in both cases
    d) the formation is incomplete to draw and conclusion

66. If the temperature of the sun were to increase from T to 2T and its radius from R to 2R. The ratio of power, radiated by it would become
    a) 64 time b) 16 times
    c) 32 times d) 4 times

67. The rate of cooling at 600K, if surrounding temperature is 300 K is H. The rate of cooling at 900 K is
    a) $\frac{16}{3}H$ b) $2H$
    c) 3H d) $\frac{2}{3}H$

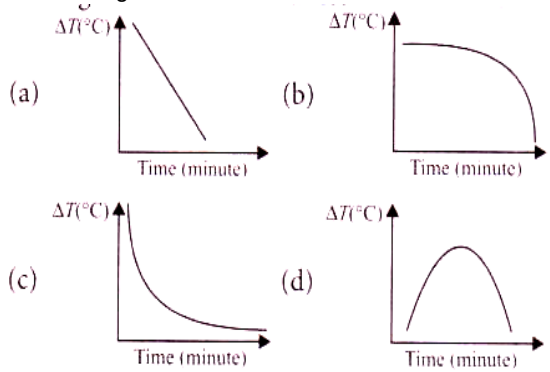
NEWTON'S LAW OF COOLING

68. " The rate of loss of heat –dQ/dt of the body is directly proportional to the temperature difference $\Delta T = (T_2 - T_1)$ of the body and surroundings".
    This statement is
    a) law of thermometry
    b) Newton's law of cooling
    c) law of calorimetry
    d) zeroth law

69. A glass full of hot milk is poured on the table. It begins to cool gradually. Which of the following is incorrect?

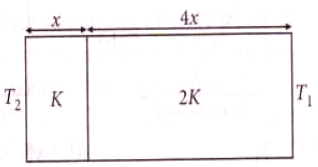
a) The rate of cooling is constant till milk attains the temperature of the surroundings.
b) The temperature of milk falls off exponentially with time.
c) While cooling, there is a flow of heat from milk to the surroundings as well as from surroundings to the milk but the net flow of heat is from milk to the surroundings and that is why it cools.
d) All three phenomenon, condition, convection and radiation are responsible for the loss of heat from milk to the surroundings.

70. Which of the following graph is best explanation of cooling of hot water with time?



HOTS (HIGHER ORDER THINKING SKILLS)

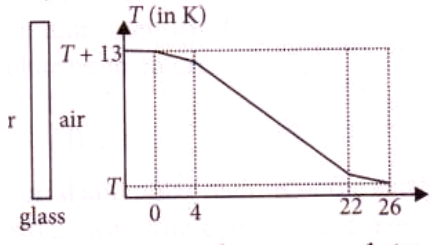
1. The temperature of the two cutter surface of a composite slab, consisting of two materials having coefficients of thermal conductivity K and 2K and thickness x and 4x, respectively are T_2 and $T_1\left(T_2 > T_1\right)$. The rate of heat transfer through the slab, in a steady state is $\left(\frac{A\left(T_2 - T_1\right)K}{x}\right)f$, with f equal to



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

2. A wall of dimensions 2.00 m by 3.50 m has a single -pane window of dimensions 0.75 m by 1.20 m. If the inside temperature is 20^oC and the outside temperature is -10^oC, effective thermal resistance of the opaque wall and window are $2.10m^2KW^{-1}$ and $0.21m^2KW^{-1}$ respectively. The heat flow through the entire wall will be .
a) 215W b) 205W
c) 175 W d) 110W

3. The figure shows a cross- section of a double glass unit of a window on a vertical wall. A graph of the temperatures at different points within the units is shown next to it. The temperature difference across the unit is 13 K. It has a cross-sectional area of $1.3m^2$ and the rate of heat flow through it is 65 W. Then the correct statement is (Glass has a thermal conductivity of $1Wm^{-1}K^{-1}$)



a) The unit is in steady state and in thermal equilibrium.
b) The unit is in steady state but not in thermal equilibrium.
c) The unit is not in steady state but is in thermal equilibrium.
d) The unit neither in steady state nor in thermal equilibrium.

4. In question number 3, thermal conductivity (in $Wm^{-1}K^{-1}$) of air is
a) $\frac{1}{10}$ b) $\frac{1}{12}$
c) $\frac{1}{14}$ d) $\frac{9}{130}$

5. A lake surface is exposed to an atmosphere where the temperature is less than 0^oC. If the thickness of the ice layer formed on the surface grows from 2cm to 4cm in 1 hour, the atmospheric temperature will be (Thermal conductivity of ice, $K = 4\times10^{-3}calcm^{-1}s^{-1o}C^{-1}$,density of ice $= 0.9gcc^{-1}$. Latent heat of fusion of ice $= 80cal\,g^{-1}$ Neglect the change of density during state change. Assume that the water below the ice has 0^oC temperature every where.)
a) -20^oC b) 0^oC
c) -30^oC d) -15^oC

6. Two blocks with heat capacities C_1 and C_2 are connected by a rod of length l, cross sectional area A and heat conductivity K. Initial temperature difference between the two blocks is T_0. Assuming the entire system to be isolated from surroundings , heat capacity of the rod to be negligible. The temperature difference between the blocks as a function of time is
a) $T_0\exp\left(\frac{-KA\left(C_1 + C_2\right)t}{C_1C_2}\right)$
b) $T_0\exp\left(\frac{-KA\left(C_1 + C_1\right)}{C_1C_2}\right)$

c) $T_0 \exp\left(\frac{KA(C_1+C_2)t}{C_1C_2}\right)$

d) $T_0 \exp\left(\frac{KA(C_1+C_2)t^2}{C_1C_2}\right)$

7. A double –plane window consists of two glass sheets each of area $1m^2$ and thickness 0.01 m separated by a 0.05 m thick stagnant air space. In the steady state, the room glass interface and the glass outdoor interface are at constant temperature of 27^oC and respectively. The rate of heat flow through the window pane is (Given, $K_{glass} = 0.8Wm^{-1}K^{-1}$, $K_{air} = 0.08Wm^{-1}K^{-1}$)

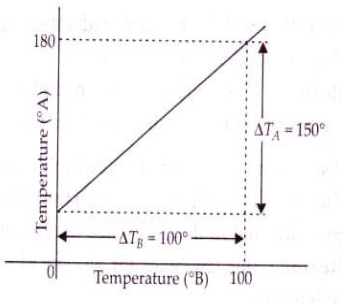
a) 41.5 W b) 31.5 W
c) 21.5W d) 11.5 W

8. In question number 7, the temperature of other interfaces $\left(in^oC\right)$ is

a) 26.5,0.5 b) 27.5,1
c) 28.5,2 d) 29.5, 3

NCERT EMEMPLAR PROBLEMS

1. A bimetallic strip is made of aluminium and steel $(\alpha_{Al}\alpha_{steel})$, On heating , the strip will
   a) remain straight b) get twisted
   c) will bend with aluminium on concave side
   d) will bend with steel on concave side.
2. A uniform metallic rod rotates about its perpendicular bisector with constnt angular speed. If it is heated uniformly to rise its temperature slightly
   a) its speed of rotation increases
   b) its speed of rotation decreases
   c) its speed of rotation remains same
   d) its speed increases because its moment of inertia increases
3. The graph between two temperature scales A and B is shown in figure. Between upper fixed point and lower fixed point there are 150 equal division on scale A and 100 on scale B. The relationship for conversion between the two scales is given by



a) $\frac{T_A - 180}{100} = \frac{T_B}{150}$

b) $\frac{T_A - 30}{150} = \frac{T_B}{100}$

c) $\frac{T_B - 180}{150} = \frac{T_A}{100}$

d) $\frac{T_B - 40}{100} = \frac{T_A}{180}$

4. An aluminium sphere is dipped into water. Which of the following is true?
   a) Buoyancy will be less in water at 0^oC than that in water at 4^oC
   b) Buoyancy will be more in water at 0^oC than that in water at 4^oC.
   c) Buoyancy in water at 0^oC will be same as that in water at 4^oC.
   d) Buoyancy may be more or less in water at 4^oC depending on the radius of the sphere.

5. As the temperature is increased, the time period of a pendulum
   a) increases as its effective length increases even though its centre of mass still remains at the centre of the bob.
   b) Increases as its effective length due to shifting of centre of mass below the centre of the bob.
   c) increases as its effective length increases due to shifting of centre of mass below the centre of the bob.
   d) decreases as its effective length remains same but the centre of mass shifts above the centre of the bob.
6. Heat is associated with
   a) kinetic energy of random motion of molecules
   b) kinetic energy of orderly motion of molecules
   c) total kinetic energy of random and orderly motion of molecules
   d) kinetic energy of random motion in some cases and kinetic energy orderly motion in other.
7. The radius of a metal sphere at room temperature T is R, and the coefficient of linear expansion of the metal is a. The sphere is heated a little by a temperature ΔT so that its new temperature is $(T + \Delta T)$. The increase in the volume of the sphere is approximately

a) $2\pi Ra\Delta T$ b) $\pi R^2 a\Delta T$
c) $4\pi R^3 a\Delta T / 3$ d) $4\pi R^3 a\Delta T$

8. A sphere, a cube and a thin circular plate, all of same material and same mass, are initially heated to same high temperature.
   a) Plate will cool fastest and cube the slowest.
   b) Sphere will cool fastest and cube the slowest.
   c) Plate will cool fastest and sphere the slowest.
   d) Cube will cool fastest and plate the slowest.

Assertion-Reason

Directions : In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as:

a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false.
d) If both assertion and reason are false.

1. Assertion: A change in the temperature of a body causes change in its dimensions.
   Reason: The dimensions of a body decreases due to the increase in its temperature.
2. Assertion: The lowest attainable temperature is absolute zero, i.e., O.K= $-273.15^{o}C$
   Reason: Size of each degree on Kelvin scale is same as that on celsius scale.
3. Assertion: The density of water remains constant as it is cooled from room temperature until its temperature reaches $4^{o}C$.
   Reason : Below $4^{o}C$, the density increases.
4. Assertion : Water is used as a coolant in automobile radiators as well as heater in hot water bags.
   Reason: Water has high specific heat capacity.
5. Assertion : The specific heat capacity of a given solid can be determined by using the principle of calorimetry.
   Reason: Heat gained is equal to the heat lost.
6. Assertion: In change of state from solid to liquid the temperature decreases until the entire amount of the solid substance melts.
   Reason: The phenomenon of refreezing is called melting.
7. Assertion: Cooking food is difficult on hills
   Reason: The boiling point decreases with increase in pressure
8. Assertion: In the human body the heart acts as the pump that circulates blood through different parts of the body, transferring heat by forced convection.
   Reason: In forced convection, material is forced to move by a pump or by some other physical means.
9. Assertion: All bodies emit radiant energy whether they are solid, liquid or gases.
   Reason: Black bodies absorb and emit radiant energy better than bodies of lighter colours.
10. Assertion: According to Newton's law of cooling the rate of loss of heat, -dQ/dt of the body is directs proportional to the difference of temperature.
    Reason: This law holds for all type of temperature differences.

ANSWER KEY

1.b) 2. b) 3. c) 4. b) 5. b)
6.a) 7. b) 8. c) 9. c) 10. b)
11.b) 12. a) 13. a) 14. c) 15. b)
16.c) 17. a) 18. a) 19. a) 20. a)
21.c) 22. c) 23. b) 24. d) 25. d)
26.c) 27. c) 28. a) 29. d) 30. b)
31. d) 32. a) 33. d) 34. a) 35. a)
36. d) 37. a) 38. a) 39. d) 40. d)
41. a) 42. d) 43. d) 44. d) 45. a)
46. b) 47. d) 48. a) 49. b) 50. c)
51. c) 52. a) 53. c) 54. c) 55. c)
56. d) 57. d) 58. b) 59. b) 60. d)
61. b) 62. a) 63. a) 64. b) 65. c)
66. a) 67. a) 68. b) 69. a) 70. c)

HOTS

1. d) 2. a) 3. b) 4. c) 5. c)
6. a) 7. a) 8. a)

NCERT EXEMPLAR PROBLEMS

1. d) 2. b) 3. b) 4. a) 5. a)
6. a) 7. d) 8. c

ASSERTION & REASON CORNER

1. c) 2. b) 3. d) 4. a) 5. a)
6. d) 7. c) 8. a) 9. b) 10. c)