PHYSICS

BOOKS - MTG PHYSICS (ENGLISH)

THERMAL PROPERTIES OF MATTER

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

A. uniform density

B. temperature gradient

C. density gradient

D. uniform temperature

Answer: B

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2. How much work can be done by 100 calories of heat?

A. 100 J

B. 420 J

C. 42 J

D. 4200 J

Answer: B

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Measurement Of Temperature

1. At what temperature do the Celsius and Fahrenheit readings have the same numerical value ? a) 273 b) −273 c) −40 d) 40

A. 273

B. -273

C. -40

D. 40

Answer: C

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2. When a thermometer is taken from the melting ice to warm liquid , the mercury level rises to $\frac{2^{th}}{5}$ 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

A. 217.15

B. 313.15

C. 220

D. 330

Answer: B

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Thermal Expansion

1. The volume of a block of a metal changes by 0.12% when it is heated through $20^\circ C$. The coefficient of linear expansion of the metal is

A. $4 \times 10^{-5} \circ C^{-1}$

B. $2 \times 10^{-5} \circ C^{-1}$

C. $0.5 \times 10^{-5} \circ C^{-1}$

D. $4 \times 10^{-4} \circ C^{-1}$

Answer: B

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2. 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

A. always increase

B. always decrease

C. remains the same

D. none of these

Answer: A

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3. Length of wire at room temperature is 4.55 m , when the temperature increases upto $100^{\circ}C$ then its length becomes 4.57 m . The coefficient of linear expansion (α) of the given wire is

A. $5.021 \times 10^{-5} K^{-1}$

B. $6.021 \times 10^{-5} K^{-1}$

C. $7.021 \times 10^{-5} K^{-1}$

D. $8.021 \times 10^{-5} K^{-1}$

Answer: D

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4. To increase the length of brass rod by 2% its temperature should increase by

$\left(\alpha = 0.00002^{\circ}C^{-1}\right)$ a) 800 degree C b) 900 degree C c) 1000 degree C d) 1100 degree C

A. $800^{\circ}C$

B. $900^{\circ}C$

C. $1000^{\circ}C$

D. $1100^{\circ}C$

Answer: C

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5. At $50^{\circ} C$, a brass rod has a length 50 cm and a diameter 2 mm . It is joined to a steel rod of the same length and diameter at the same temperature . The change in the length of the composite rod when it is heated to $250^{\circ} C$ is (Coefficient of linear expansion of brass = $2.0 \times 10^{-5 \circ} C^{-1}$, coefficient of linear expansion of steel = $1.2 \times 10^{-5 \circ} C^{-1}$)

A. 0.28 cm

B. 0.30 cm

C. 0.32 cm

D. 0.34 cm

Answer: C

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6. The moment of inertia of a rod about its perpendicular bisector is I . When the temperature of the rod is increased by ΔT , the increase in the moment of inertia of the rod about the same axis is (Here , α is the coefficient of linear expansion of the rod)

A. $\alpha I \Delta T$

B. $2\alpha I \Delta T$

C. $\frac{\alpha I \Delta T}{2}$

D. $\frac{2I \Delta T}{\alpha}$

Answer: B

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7. A brass wire 1.8 m long at $27^{\circ} C$ is held taut with negligible tension between two rigid supports. Diameter of the wire is 2 mm, its

coefficient of linear expasion, $\alpha_{\text{Brass}} = 2 \times 10^{-5}.^{\circ} C^{-1}$ and its young's modulus, $Y_{\text{Brass}} = 9 \times 10^{10} Nm^{-2}$. If the wire is cooled to a temperature $-39^{\circ} C$, tension developed in the wire is

A. $2.7 \times 10^2 N$

B. $3.7 \times 10^2 N$

C. $4.7 \times 10^2 N$

D. $5.7 \times 10^2 N$

Answer: B

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8. The coeefficient of volume expansion of liquid is γ. The fractional change in its density for ΔT rise in tempeature is

A. $\gamma \Delta T$

B. $\frac{\Delta T}{\gamma}$

C. $1 + \gamma \Delta t$

D. $1 - \gamma \Delta T$

Answer: A

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9. A rectangular block is heated from $0^{\circ}C$ to $100^{\circ}C$. 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. $0.4\,\%$

Answer: A

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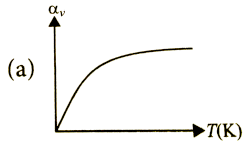
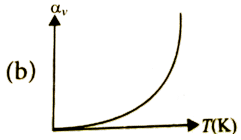
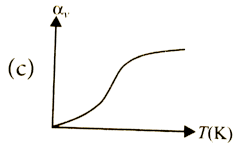
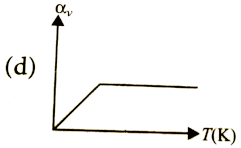
10. Which of the following graphs correctly shows variation of coefficient of volume expansion of copper as a function of temperature ?

A. 

B. 

C. 

D. 

Answer: C

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11. If α, β and γ coefficient of linear, superficial and volume expansion respectively, tehn

A. $\frac{\beta}{\alpha} = \frac{1}{2}$

B. $\frac{\beta}{\gamma} = \frac{2}{3}$

C. $\frac{\gamma}{\alpha} = \frac{3}{2}$

D. $\frac{\beta}{\alpha} = \frac{\gamma}{\beta}$

Answer: B

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12. Two spheres A and B are made of the same material and have the same radius. Sphere A is hollow alnd 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

A. A expands more than B.

B. A expands less than B.

C. Both the spheres expand equally.

D. Data is insufficient

Answer: C

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13. The volume of a metal sphere increases by $0.24\,\%$ when its temperature is raised by $40^\circ C$. The coefficient of linear expansion of the metal is ..... $.^\circ C$

A. $2 \times 10^5 .^\circ C^{-1}$

B. $6 \times 10^{-5} .^\circ C^{-1}$

C. $18 \times 10^{-5} .^\circ C^{-1}$

D. $1.2 \times 10^{-5} .^\circ C^{-1}$

Answer: A

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14. Calculate the stress developed inside a tooth cavity filled with copper when hot tea at temperature of $57^\circ C$ is drunk. You can take

body (tooth) temperature to be $37^{\circ}C$ and $\alpha_{Cu} = 1.7 \times 10^{-5}/^{\circ}C$ bulk modulus for copper $B_{Cu} = 140 \times 10^{9} N/m^{2}$.

A. $1.43 \times 10^{8} Nm^{-2}$

B. $4.13 \times 10^{8} Nm^{-2}$

C. $2.12 \times 10^{4} Nm^{-2}$

D. $3.12 \times 10^{4} Nm^{-2}$

Answer: A

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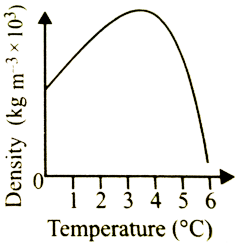
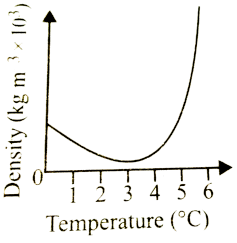
15. Which of the following graph shows the variationi of density of water increase in temperature ?

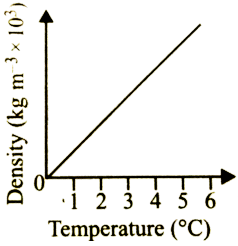
A.

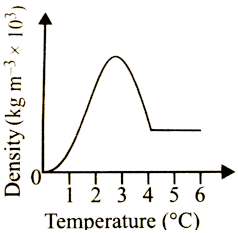


B.



C.



D. 

Answer: A

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Specific Heat

1. Which one of the following substances has highest specific heat capacity at room

temperature and atmospheric pressure ? a) Water b) Ice c) Aluminum d) Mercury

A. Water

B. Ice

C. Aluminium

D. Mercury

Answer: A

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2. If specific heat 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

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

Answer: C

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3. Water is used as a collent because a) it has lower density b) it has low specific heat. c) it has high specific heat. d) It is early available.

A. it has lower density

B. it has low specific heat.

C. it has high specific heat.

D. It is earily available.

Answer: C

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4. 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 surropundings.

(Specific heat of aluminium $= 0.91 Jg^{-1}.^{\circ} C^{-1}$)

A. $100.^{\circ} C$

B. $103.^{\circ} C$

C. $150.^{\circ} C$

D. $155.^{\circ} C$

Answer: B

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5. A person weighing 50 kg takes in 1500 kcal dict 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 $= 0.83 cal g^{-1} C^{-1}$)

A. $30.^{\circ} C$

B. $48.^{\circ} C$

C. $40.16.^{\circ} C$

D. $36.14.^{\circ} C$

Answer: D

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Calorimetery

1. 10 g of ice of $0^\circ C$ is mixed with $100g$ of water at $50^\circ C$ in a calorimeter. The final temperature of the mixture is [Specific heat of water $= 1calg^{-1}.^\circ C^{-1}$, latent of fusion of ice $= 80calg^{-1}$]

A. $31.2^\circ C$

B. $32.8^\circ C$

C. $36.7^\circ C$

D. $38.2^\circ C$

Answer: D

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2. When $1.5kg$ of ice at $0^\circ C$ mixed with 2 kg of water at $70^\circ C$ in a container, the resulting temperature is $5^\circ C$ the heat of fusion of ice is ($s_{\text{water}} = 4186jkg^{-1}K^{-1}$)

A. $1.42 \times 10^5 jkg^{-1}$

B. $2.42 \times 10^5 jkg^{-1}$

C. $3.42 \times 10^5 jkg^{-1}$

D. $4.42 \times 10^5 jkg^{-1}$

Answer: C

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3. The temperature of equal masses of three different liquids A,B and C are $12^\circ C, 19^\circ C$ and $28^\circ C$ respectively. The temperature when A and B are mixed is $16^\circ C$ and when B and C are mixed it is $23^\circ C$. What should be the temperature when A and C are mixed?

A. $18.2.^\circ C$

B. $22.^{\circ} C$

C. $20.3.^{\circ} C$

D. $24.2.^{\circ} C$

Answer: C

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4. An ice cube of mass 0.1 kg at $0^{\circ} C$ is placed in an isolated container which is at $227^{\circ} C$. The specific heat s of the container varies with temperature T according to the empirical

relation $s = A + BT$, where $A = 100 cal/kg.K$ and $B = 2 \times 10^{-2} cal/kg.K^2$. If the final temperature of the container is $27^\circ C$, determine the mass of the container. (Latent heat of fusion for water = $8 \times 10^4 cal/kg$, specific heat of water $= 10^3 cal/kg.K$).

A. $0.495kg$

B. $0.595kg$

C. $0.695kg$

D. $0.795kg$

Answer: A

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Change Of State

1. The change from solid sate to vapour state without passing through the liquid state is called.....

A. Fusion

B. Regulation

C. vaporation

D. sublimation

Answer: D

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2. Match the following.

	Column I		Column II
(A)	Conversion of a liquid into 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. $A - q, B - p, C - s, D - r$

D. $A - p, B - q, C - r, D - s$

Answer: B

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3. Which of the following statement is correct ?

a) The triple point of water is 253.16 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.

A. The triple point of water is $253.16K$.

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 ballon is immersed in cold water, it will contract.

Answer: D

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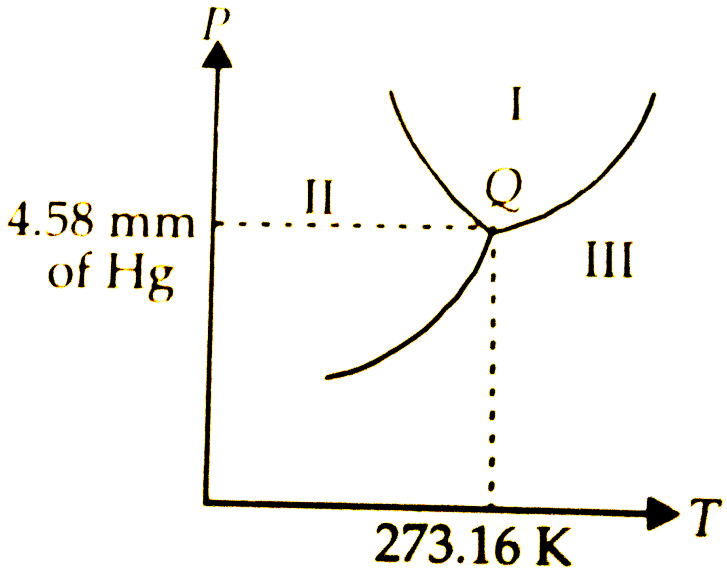
4. In the phase diagram showns, the point Q corresponds to the triple point of water. The region I, II and III respectively correspond to phases



A. liquid, solid, vapour

B. solid, liquid, vapour

C. liquid, vapour, solid

D. solid, vapour, liquid

Answer: A

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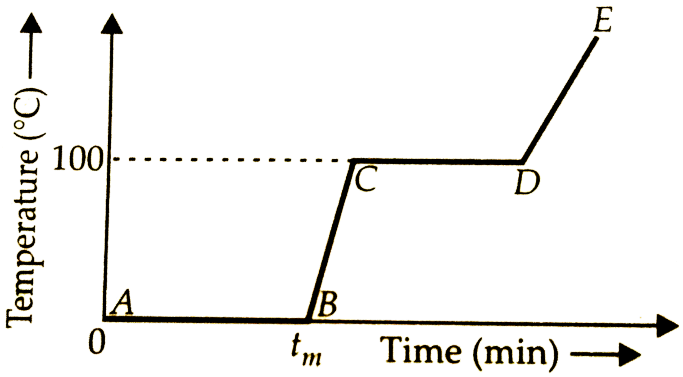
5. Refer to the plot of temperature versus time showing the changes in the state of ice on heating (not to scale).



Which of the following is correct ?

A. AB 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.

Answer: D

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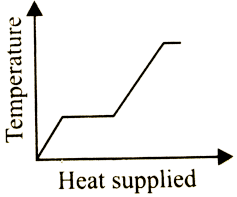
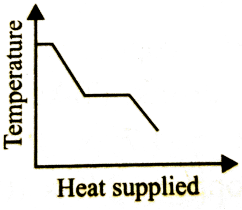
6. A block of ice at $-10^{\circ}C$ is slowly heated and converted to steam at $100^{\circ}C$. Which of the following curves represents the phenomenon qualitatively?

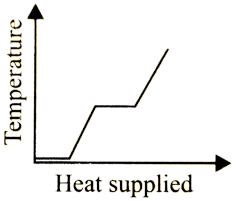
A.



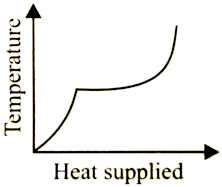
B.



C.



D.



Answer: A

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7. Two absolute scales A and B have triple points of water defined to be $200A$ and $350B$. What is the relation between T_A and T_B?

A. $T_A = 4/7T_B$

B. $T_B = 4/7T_A$

C. $T_A = 2/7T_B$

D. $T_B = 2/7T_A$

Answer: A

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8. The triple point of carbon dioxide is 216.55 K the corresponding temperature on the celsius and Fahrenheit scale respectively are

A. $-56.45^\circ C, \ -69.61^\circ F$

B. $-56.45^\circ C, 69.61^\circ F$

C. $54.45^\circ C, 69.61^\circ F$

D. $-5445^\circ, \ -6961^\circ F$

Answer: D

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9. The letent heat of vaporisation of a substance is always

A. greater than its latents heat of fusions

B. greater than its latent heat of sublimation

C. equal to its latent heat of sublimation

D. less than its latent heat of fusion

Answer: A

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10. The sprinkling of water slightly reduces the temperature of a closed room because

A. temperature of water of less than that of the room

B. specific heat of water is high

C. water has large latent heat of vaportisation

D. water is a bad conductor of heat.

Answer: C

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11. If 10 g of ice is added to 40 g of water at $15^\circ C$, then the temperature of the mixture is (specific heat of water $= 4.2 \times 10^3 jkg^{-1}K^{-1}$, Latent heat of fusion of ice $= 3.36 \times 10^5 jkg^{-1}$)

A. $15^\circ C$

B. $12^\circ C$

C. $10^2 C$

D. $0^\circ C$

Answer: D

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12. If a ball of 80 kg mass hits an ice cube and temperature of ball is $100.^{\circ} C$, then how much ice converted into water ? (Specific heat of ball is $0.2 cal g^{-1}$, Latent heat of ice $= 80 cal g^{-1}$)

A. a. 20 g

B. b. $200 g$

C. c. $2 \times 10^{3} kg$

D. d. $2 \times 10^4 g$

Answer: D

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13. Rays from the sun ar focuseed by a lens of diameter 5 cm on 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 centrimetre is

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

A. $2.04cal$

B. $0.51cal$

C. $4.08cal$

D. $3.02cal$

Answer: A

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Heat Transper

1. 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)

Answer: D

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2. One end of a 0.25 m long metal bar is in steam and the other is in contact with ice . If 12 g of ice melts per minute, what is the thermal conductivity of the metal? Given cross-section of the bar $= 5 \times 10^{-4} m^2$ and latent heat of ice is $80 cal g^{-1}$

A. $20 cals^{-1} m^{-1} .^{\circ} C^{-1}$

B. $10 cals^{-1} m^{-1} .^{\circ} C^{-1}$

C. $40 cals^{-1} m^{-1} .^{\circ} C^{-1}$

D. $80 cals^{-1} m^{-1} .^{\circ} C^{-1}$

Answer: D

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3. A pan filled with hot food cools from $94^\circ C$ to $86^\circ C$ in 2 minutes when the room temperature is at $20^\circ C$. How long will it take to cool from $71^\circ C$ to $69^\circ C$? Here cooling takes place according to Newton's law of cooling.

A. 12 s

B. 22 s

C. 32 s

D. 40 s

Answer: D

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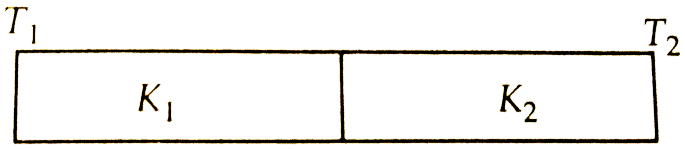
4. Two bars of same length and same cross-sectional area but of different thermal conductivites K_1 and K_2 are joined end to end as shown in the figure. One end of the compound bar it is at temperature T_1 and the

opposite end at temperature T_2 (where$T_1 > T_2$

). The temperature of the junction is



A. $\frac{K_1T_1 + K_2T_2}{K_1 + K_2}$

B. $\frac{K_1T_2 + K_2T_1}{K_1 + K_2}$

C. $\frac{K_1(T_1 + T_2)}{K_1 + K_2}$

D. $K_2\frac{T_1 + T_2}{K_1}$

Answer: A

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

A. $\frac{K_1 K_2}{K_1 + K_2}$

B. $\frac{2K_1 K_2}{K_1 + K_2}$

C. $\frac{K_1}{K_1 + K_2}$

D. $\frac{K_2}{K_1 + K_2}$

Answer: B

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6. Consider a compound slab consisting of two different material having equal thickness and thermal conductivities K and $2K$ respectively. The equivalent thermal conductivity of the slab is

A. $\frac{2}{3}K$

B. $\sqrt{2}K$

C. $3K$

D. $\frac{4}{3}K$

Answer: D

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7. Two rods of equal length and diameter have thermal conductivite 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

Answer: A

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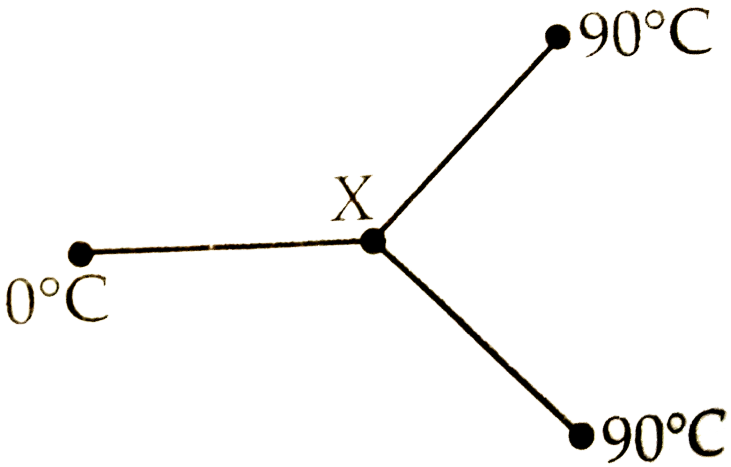
8. Three metal rods of the same material and identical in all respect are joined as shown in the figure. The temperatures at the ends are maintained as indicated. Assuming no loss of heat from the curved surface of the rods, the

temperature at the junction X would be



A. $45^\circ C$

B. $60^\circ C$

C. $30^\circ C$

D. $20^\circ C$

Answer: B

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9. Three very large plates of same area are kept parrallel and close to each other. They are considered as ideal black surfaces and have 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. $\left(\frac{65}{2}\right)^{1/4} T$

B. $\left(\frac{97}{4}\right)^{1/4} T$

C. $\left(\frac{97}{2}\right)^{1/4} T$

D. $(97)^{1/4} T$

Answer: C

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10. A cubical ice box of side 50 cm has a thickness of 5.0 cm. if 5 kg of ice is put in the box, estimate the amount of ice remaining after 4 hours. The outside temperature is $40^{\circ} C$ and coefficient of thermal conductivity of the

material of the box = $0.01 Js^{-1}m^{-1}.^{\circ}C^{-1}$.

Heat of fusion of ice $= 335 Jg^{-1}$.

A. $3.7kg$

B. $3.9kg$

C. $4.7kg$

D. $4.9kg$

Answer: C

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11. A wall has two layers A and B, each made of different material. Both the layers have the same thickness. The thermal conductivity of the material of A is twice that of B . Under thermal equilibrium, the temperature difference across the wall is $36^\circ C$. The temperature difference across the layer A is

A. $12.^\circ C$

B. $18.^\circ C$

C. $6.^\circ C$

D. $24.^\circ C$

Answer: A

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12. Mud houses are cooler in summer and warmer in winter because

A. mud is a good condutor of heat

B. mud is a superconductor of heat

C. mud is a bad conductor of heat

D. none of these

Answer: C

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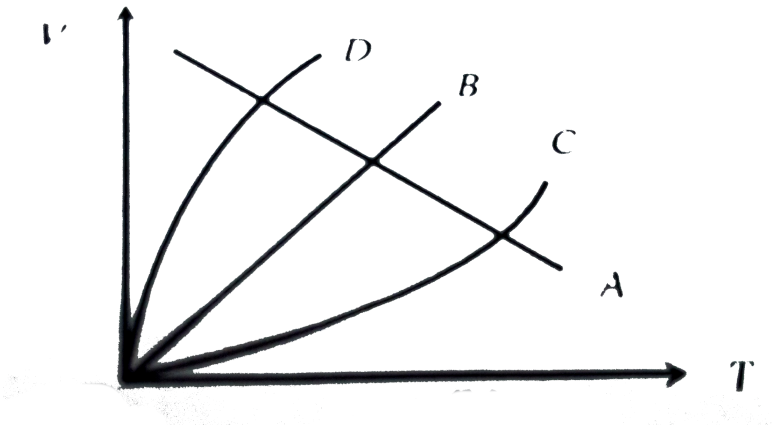
13. Which of the following is the v_m = T graph for a perfectly black body (v_m =maximum frequency of radiation)



A. A

B. B

C. C

D. D

Answer: C

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14. 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

Answer: C

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15. 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

Answer: D

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16. Wien's displacment 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

Answer: D

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17. If λ_m denotes

A. $\lambda_m \propto T$

B. $\lambda_m \propto T^{-1}$

C. $\lambda_m \propto T$

D. λ_m is independent on T

Answer: B

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18. A black body has maximum wavelength λ_m at temperature $2000K$. Its corresponding wavelength at temperature 3000 will be

A. $\frac{3}{2}\lambda_m$

B. $\frac{2}{3}\lambda_m$

C. $\frac{16}{81}\lambda_m$

D. $\frac{81}{16}\lambda_m$

Answer: B

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19. The thermal radiation from a hot body travels with a velocity of

A. $330ms^{-1}$

B. $2 \times 10^8 ms^{-1}$

C. $1200 ms^{-1}$

D. $3 \times 10^8 ms^{-1}$

Answer: D

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20. Experimental investigations show that the intensity of solar radiation is maximum for a wavelength $480nm$ in the visible ragion.

Estimate the surface temperature of sun. (Given Wien's constant $b = 2.88 \times 10^{-3} mK$).

A. $4000K$

B. $6000K$

C. $8000K$

D. $10^6 K$

Answer: B

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21. 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 $5.67 \times 10^{-8} Wm^{-2} K^{-4}$, constant $b = 2898 \mu m K$)-

A. $5.67 \times 10^{8} Wm^{-2}$

B. $5.67 \times 10^{12} Wm^{-2}$

C. $10.67 \times 10^{7} Wm^{-2}$

D. $10.67 \times 10^{14} Wm^{-2}$

Answer: A

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22. The temperature of a radiation body increases by 30%. Then the increase in the amount of radiation is

A. 185%

B. 285%

C. 325%

D. 130%

Answer: A

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23. 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. $42\ \%$

Answer: B

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24. Two spheres of same material have radius 1 m and 4 m and temperature 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 information is incomplete to draw any conclusion

Answer: C

25. If the temperature of the Sun were to increase from T to 2T and its radius from R to 2R. The rat io of power, radiated by it would become

A. 64 times

B. 16 times

C. 32 times

D. 4 times

Answer: A

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26. The rate of cooling at $600K$. If surrounding temperature is $300K$ is H. The rate of cooling at $900K$ is

A. $\frac{16}{3}H$

B. $2H$

C. $3H$

D. $\frac{2}{3}H$

Answer: A

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27. Assertion: According to Newton's law of cooling, the rate of loss of heat, $-dQ/dt$ of the body is directly proportional to the difference of temperature.

Reason :This law holds for all type of temperature differences.

A. law of thermometry

B. Newton's law of cooling

C. law of calorimetry

D. zeroth law

Answer: B

Watch Video Solution

28. A glass full of hot milk is poured in 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 will time.

C. While cooling, there is a flow of heat from milk to the sourroundings 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, conduction, convection and radiation are responsible for the loss of heat from milk to the surroundings.

Answer: A

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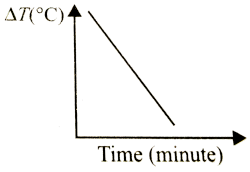
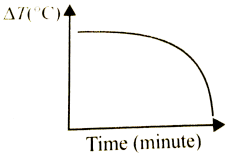
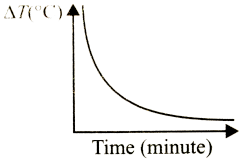
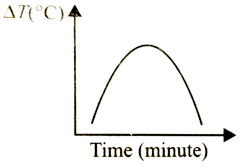
29. A hot liquid is kept in a bog room. Accoding to Newton's law of cooling rate of cooling liquid (represented as y) is plotted against its

temperature T. Which of the following curves may represent the plot?

A. 

B. 

C. 

D. 

Answer: C

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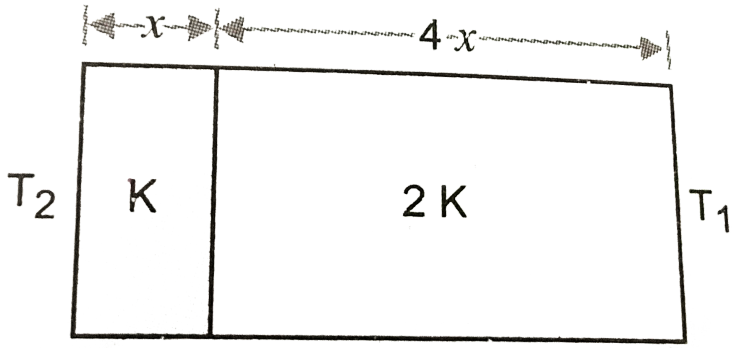
Higher Order

1. 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. Temperatures on the opposite faces of composite slab are T_1 and T_2 where $T_2 > T_1$, as shown in fig. what is the rate of flow of heat

through the slab in a steady state?



A. 1

B. $\frac{1}{2}$

C. $\frac{2}{3}$

D. $\frac{1}{3}$

Answer: D

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2. A wall of dimensions 2.00 m by $3.50m$ has a single-pane window of dimensions $0.75m$ by $1.20m$. If the inside temperature is $20^\circ C$ and the outside temperature is $-10^\circ C$, effective thermal resistance of the opaque wall and window are $2.10KW^{-1}$ and $0.21KW^{-1}$ respectively. The heat flow through the entire wall will be .

A. $215W$

B. $205W$

C. $175W$

D. $110W$

Answer: A

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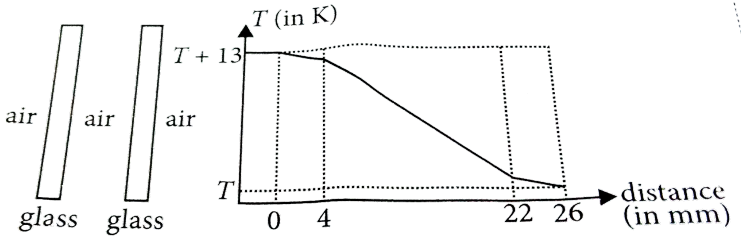
3. The figure show a cross-section of a double glass unit of a window on a vertical wall. A graph wall. A graph of the temperature at different points within the unit is show next to it. The temperature difference across the unit is $13K$. It

has a crossp-sectional area of $1.3m^2$ and the rate of heat flow through it is $65W$. 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 equalibrium.

C. The unit is not in steady state but is in thermal

D. The unit neither in steady state nor in thermal equilibrium

Answer: B

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4. In question number 3, the thermal conductivity (in $Wm^{-1}K^{-1}$) if air is

A. $\frac{1}{10}$

B. $\frac{1}{12}$

C. $\frac{1}{14}$

D. $\frac{9}{130}$

Answer: C

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5. A lake surface is exposed to an atmosphere where the temperature is $< 0^{\circ}C$. If the thickness of the ice layer formed on the surface

grows form $2cm$ to $4cm$ in 1 hour. The atmospheric temperature, T_a will be- (Thermal conductivity of ice $K = 4 \times 10^{-3} cal/cm/s/.^\circ C$, density of ice $= 0.9gm/ice$. Latent heat of fustion of ice $= 80cal/m$. Neglect the change of density during the state change. Assume that the water below the ice has 0° temperature every where)

A. $-20.^\circ C$

B. $0.^\circ C$

C. $-30.^\circ C$

D. $15.^\circ C$

Answer: C

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6. Two chunks of metal with heat capacities C_1 and C_2, are interconnected by a rod length l and cross-sectional area S and fairly low heat conductivity K. The whole system is thermally insulated from the environment. At a moment $t = 0$ the temperature difference betwene the two chunks of metal equals $(\Delta T)_0$. Assuming the heat capacity of the rod to be negligible,

find the temperature difference between the chucks as a function of time.

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

B. $T_0 \exp\left(\frac{-KA(C_1+C_2)}{C_1C_2}\right)$

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

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

Answer: A

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7. A double pan window used for insulating a room thermally from outside consists of two glass sheets each of area 1 m^2 and thickness $0.01m$ separated by 0.05 m thick stagnant air space. In the steady state, the room-glass interface and the glass-outdoor interface are at constant temperatures of $27^\circ C$ and $0^\circ C$ respectively. The thermal conductivity of glass is $0.8Wm^{-1}K^{-1}$ and of air $0.08Wm^{-1}K^{-1}$. Answer the following questions.

(a) Calculate the temperature of the inner glass-air interface.

(b) Calculate the temperature of the outer glass-air interface.

(c) Calculate the rate of flow of heat through the window pane.

A. $41.5W$

B. $31.5W$

C. $21.5W$

D. $11.5W$

Answer: A

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8. In question number 7, the temperature of other interfaces (in $.^{\circ} C$) is

A. $26.5, 0.5$

B. $27.5, 1$

C. $28.5, 2$

D. $29.5, 3$

Answer: A

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Exampler Problems

1. A bimetallic strip made of aluminum and steel $(\alpha_{Al} > \alpha_{steel})$ on heating the strip will a) remain straight b) get twisted c) will bend with aluminum on concave side d) will bend with steel on concave side.

A. remain straight

B. get twisted

C. will bend with aluminium on concave side

D. will bend with steel on concave side.

Answer: D

2. A uniform metallic rod rotates about its perpendicular bisector with constant angualr speed. If it is heated uniformly to raise its temperature slightly, then 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

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

Answer: B

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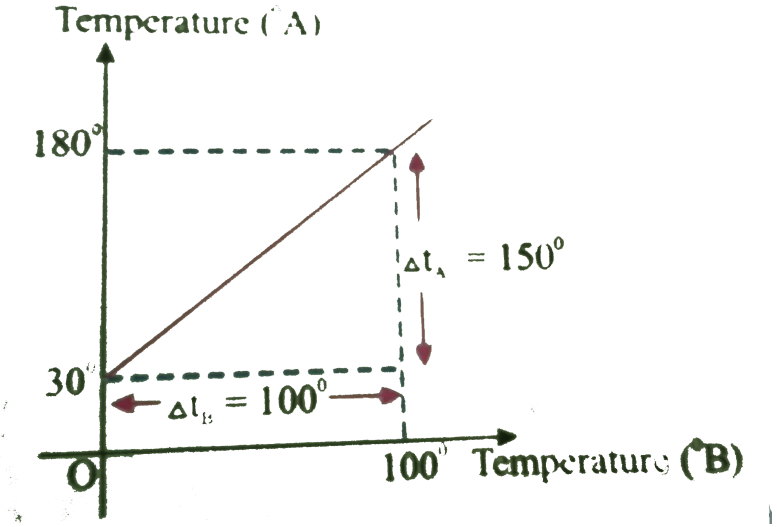
3. The graph between two temperature scales A and B is shown in Fig. Between upper fixed

point and lower fixed point there are 150 equal divisions on scales A and 100 on scale B. The relation between the temperature in 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. $\frac{T_B - 40}{100} = \frac{T_A}{180}$

Answer: B

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4. An aluminium sphere is dipped into water. Which of the following is true ?

A. Buoyancy will be less in water at $0^\circ C$ than that in water at $4^\circ C$.

B. Buoyancy will be more in water at $0^\circ C$ than that in water at $4^\circ C$.

C. Buoyancy in water at $0^\circ C$ will be same as that in water at $4^\circ C$.

D. Buoyancy may be more or less in water at $4^\circ C$ depending on the radius of the sphere.

Answer: A

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5. As the temperature is increased, the period of a pendulum a) Increases as its effective length increases even through its centre of mass still remains at the centre of the bob. b) decreases as its effective length increases even though its centre of mass still remains at 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.

A. Increases as its effective length increases even through its centre of mass still remains at the centre of the bob.

B. decreases as its effective length increases even though its centre of mass still remains at the centre of thed 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.

Answer: A

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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.

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.

Answer: A

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7. The radius of metal sphere at room temperature T is R and the coefficient of linear expansion of the metal is α. The sphere is heated a little by a temperature T, so that new temperature is $T + \Delta T$. The increase in volume of sphere is approximately

A. $2\pi R\alpha\Delta T$

B. $\pi R^2\alpha\Delta T$

C. $4\pi R^3\alpha\Delta T/3$

D. $4\pi R^3\alpha\Delta T$

Answer: D

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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.

A. Plate will cool fastet 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.

Answer: C

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Asseration And Reason

1. Assertion : A change in the temperature of a body cause change in dimentions.

Reason : The dimentions of a body decrease due to the increase in its temperature.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true and reason is not the correct explanation of assertion.

C. If assertion is true and reason is false.

D. If both assertion and reason are false.

Answer: C

2. The Kelvin scale temperature is 0 K. What is the corresponding Celsius scale temperature ?

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true and reason is not the correct explanation of assertion.

C. If assertion is true and reason is false.

D. If both assertion and reason are false.

Answer: B

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3. Assertion : The density of water remains constant as it is cooled from room temperature untill its temperature reached $4^{\circ}C$.

Reason : Below $4^{\circ}C$, the density increases.

A. If both assertion and reason are true and reason is the correct explanation of

assertion.

B. If both assertion and reason are true and reason is not the correct explanation of assertion.

C. If assertion is true and reason is false.

D. If both assertion and reason are false.

Answer: D

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4. Water is used in car radiators as coolant because

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true and reason is not the correct explanation of assertion.

C. If assertion is true and reason is false.

D. If both assertion and reason are false.

Answer: A

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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.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true and reason is not the correct explanation of assertion.

C. If assertion is true and reason is false.

D. If both assertion and reason are false.

Answer: A

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6. Assertion : In change of state from solid to liquid the temperature decreases untill the

entire amount of the solid subtance melts.

Reason : The phenomenon of refreezing is called melting

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true and reason is not the correct explanation of assertion.

C. If assertion is true and reason is false.

D. If both assertion and reason are false.

Answer: D

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7. Assertion : Cooking food is difficult on hills.

Reason : The boiling point decreases with increase in pressure a) If both assertion and reason are true and reason is the correct explanation of assertion. b) If both assertion and reason are true and reason is not the correct explanation of assertion. c) If assertion

is true and reason is false. d) If both assertion and reason are false.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true and reason is not the correct explanation of assertion.

C. If assertion is true and reason is false.

D. If both assertion and reason are false.

Answer: c

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8. Assertion : In the human body the heart acts as the pump that circulates blood through differences parts of the body, transferring heat by force convection.

Reason : In forced convection , material is force to move by a pump or by some other physics means.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true and reason is not the correct explanation of assertion.

C. If assertion is true and reason is false.

D. If both assertion and reason are false.

Answer: a

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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.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true and reason is not the correct explanation of assertion.

C. If assertion is true and reason is false.

D. If both assertion and reason are false.

Answer: b

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10. Assertion: According to Newton's law of cooling, the rate of loss of heat, $-dQ/dt$ of the body is directly proportional to the difference of temperature.

Reason :This law holds for all type of

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

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true and reason is not the correct explanation of assertion.

C. If assertion is true and reason is false.

D. If both assertion and reason are false.

Answer: c

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Specific Heat Capacity

1. Which one of the following substances has highest specific heat capacity at room temperature and atmospheric pressure ? a) Water b) Ice c) Aluminum d) Mercury

A. Water

B. Ice

C. Aluminium

D. Mercury

Answer: A

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2. If specific heat 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

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

Answer: C

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3. Water is used as a collent because a) it has lower density b) it has low specific heat. c) it has high specific heat. d) It is early available.

A. it has lower density

B. it has low specific heat.

C. it has high specific heat.

D. It is earily available.

Answer: C

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4. 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 surropundings.

(Specific heat of aluminium $= 0.91 Jg^{-1}.^{\circ} C^{-1}$)

A. $100.^{\circ} C$

B. $103.^{\circ} C$

C. $150.^{\circ} C$

D. $155.^{\circ} C$

Answer: B

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5. A person weighing 50 kg takes in 1500 kcal dict 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 $= 0.83 cal g^{-1} C^{-1}$)

A. $30.^{\circ} C$

B. $48.^{\circ} C$

C. $40.16.^{\circ} C$

D. $36.14.^{\circ} C$

Answer: D

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Calorimetry

1. 10 g of ice of $0^\circ C$ is mixed with $100g$ of water at $50^\circ C$ in a calorimeter. The final temperature of the mixture is [Specific heat of water $= 1calg^{-1}.^\circ C^{-1}$, latent of fusion of ice $= 80calg^{-1}$]

A. $31.2^\circ C$

B. $32.8^\circ C$

C. $36.7^\circ C$

D. $38.2^\circ C$

Answer: D

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2. When $1.5kg$ of ice at $0^\circ C$ mixed with 2 kg of water at $70^\circ C$ in a container, the resulting temperature is $5^\circ C$ the heat of fusion of ice is ($s_{\text{water}} = 4186jkg^{-1}K^{-1}$)

A. $1.42 \times 10^5 jkg^{-1}$

B. $2.42 \times 10^5 jkg^{-1}$

C. $3.42 \times 10^5 jkg^{-1}$

D. $4.42 \times 10^5 jkg^{-1}$

Answer: C

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3. The temperature of equal masses of three different liquids A,B and C are $12^\circ C, 19^\circ C$ and $28^\circ C$ respectively. The temperature when A and B are mixed is $16^\circ C$ and when B and C are mixed it is $23^\circ C$. What should be the temperature when A and C are mixed?

A. $18.2.^\circ C$

B. $22.^{\circ} C$

C. $20.3.^{\circ} C$

D. $24.2.^{\circ} C$

Answer: C

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4. An ice cube of mass 0.1 kg at $0^{\circ} C$ is placed in an isolated container which is at $227^{\circ} C$. The specific heat s of the container varies with temperature T according to the empirical

relation $s = A + BT$, where $A = 100 cal/kg.K$ and $B = 2 \times 10^{-2} cal/kg.K^2$. If the final temperature of the container is $27^\circ C$, determine the mass of the container. (Latent heat of fusion for water = $8 \times 10^4 cal/kg$, specific heat of water $= 10^3 cal/kg.K$).

A. $0.495kg$

B. $0.595kg$

C. $0.695kg$

D. $0.795kg$

Answer: A

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Heat Transfer

1. 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)

Answer: D

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2. One end of a 0.25 m long metal bar is in steam and the other is in contact with ice . If 12 g of ice melts per minute, what is the thermal conductivity of the metal? Given cross-section of the bar $= 5 \times 10^{-4} m^2$ and latent heat of ice is $80 cal g^{-1}$

A. $20 cal s^{-1} m^{-1} .^{\circ} C^{-1}$

B. $10cals^{-1}m^{-1}.^{\circ}C^{-1}$

C. $40cals^{-1}m^{-1}.^{\circ}C^{-1}$

D. $80cals^{-1}m^{-1}.^{\circ}C^{-1}$

Answer: D

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3. A pan filled with hot food cools from $94^{\circ}C$ to $86^{\circ}C$ in 2 minutes when the room temperature is at $20^{\circ}C$. How long will it take to cool from

$71^\circ C$ to $69^\circ C$? Here cooling takes place according to Newton's law of cooling.

A. 12 s

B. 22 s

C. 32 s

D. 40 s

Answer: D

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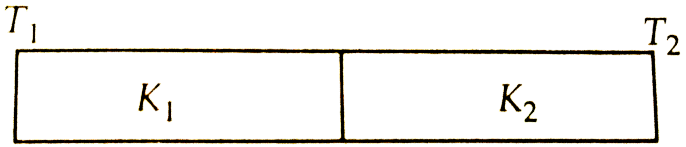
4. Two bars of same length and same cross-sectional area but of different thermal conductivites K_1 and K_2 are joined end to end as shown in the figure. One end of the compound bar it is at temperature T_1 and the opposite end at temperature T_2 (where$T_1 > T_2$). The temperature of the junction is



A. $\frac{K_1T_1 + K_2T_2}{K_1 + K_2}$

B. $\frac{K_1T_2 + K_2T_1}{K_1 + K_2}$

C. $\frac{K_1(T_1+T_2)}{K_1+K_2}$

D. $K_2\frac{T_1+T_2}{K_1}$

Answer: A

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

A. $\frac{K_1K_2}{K_1+K_2}$

B. $\frac{2K_1K_2}{K_1+K_2}$

C. $\frac{K_1}{K_1 + K_2}$

D. $\frac{K_2}{K_1 + K_2}$

Answer: B

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6. Consider a compound slab consisting of two different material having equal thickness and thermal conductivities K and $2K$ respectively. The equivalent thermal conductivity of the slab is

A. $\frac{2}{3}K$

B. $\sqrt{2}K$

C. $3K$

D. $\frac{4}{3}K$

Answer: D

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7. Two rods of equal length and diameter have thermal conductivite 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

Answer: A

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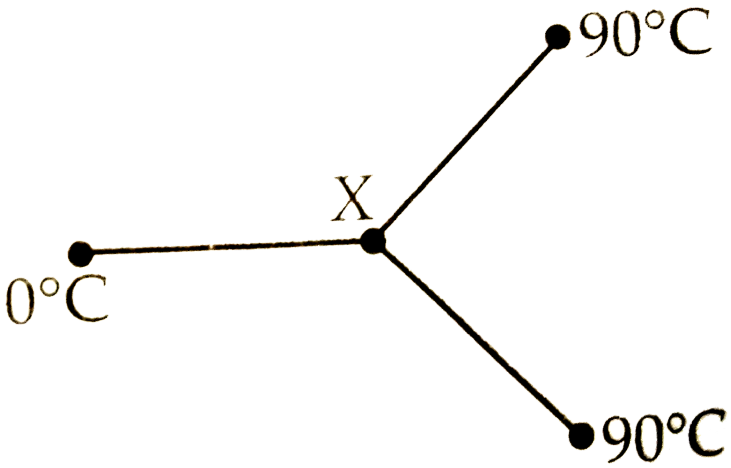
8. Three metal rods of the same material and identical in all respect are joined as shown in the figure. The temperatures at the ends are maintained as indicated. Assuming no loss of heat from the curved surface of the rods, the temperature at the junction X would be



A. $45^\circ C$

B. $60^\circ C$

C. $30^\circ C$

D. $20^\circ C$

Answer: B

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9. Three very large plates of same area are kept parrallel and close to each other. They are considered as ideal black surfaces and have 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. $\left(\frac{65}{2}\right)^{1/4} T$

B. $\left(\frac{97}{4}\right)^{1/4} T$

C. $\left(\frac{97}{2}\right)^{1/4} T$

D. $(97)^{1/4} T$

Answer: C

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10. A cubical ice box of side 50 cm has a thickness of 5.0 cm. if 5 kg of ice is put in the box, estimate the amount of ice remaining after 4 hours. The outside temperature is $40^{\circ}C$ and coefficient of thermal conductivity of the material of the box = $0.01Js^{-1}m^{-1}.^{\circ}C^{-1}$. Heat of fusion of ice $= 335Jg^{-1}$.

A. $3.7kg$

B. $3.9kg$

C. $4.7kg$

D. $4.9kg$

Answer: C

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11. A wall has two layers A and B, each made of different material. Both the layers have the same thickness. The thermal conductivity of the material of A is twice that of B . Under thermal equilibrium, the temperature difference across the wall is $36^\circ C$. The temperature difference across the layer A is

A. $12.^\circ C$

B. $18.^{\circ} C$

C. $6.^{\circ} C$

D. $24.^{\circ} C$

Answer: A

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12. Mud houses are cooler in summer and warmer in winter because

A. mud is a good condutor of heat

B. mud is a superconductor of heat

C. mud is a bad conductor of heat

D. none of these

Answer: C

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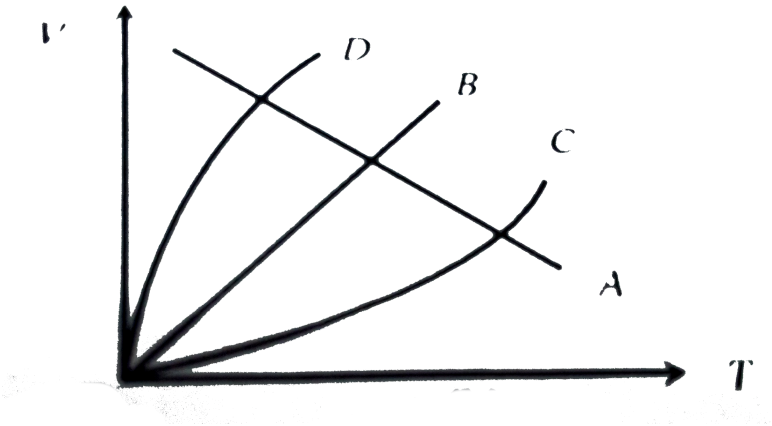
13. Which of the following is the v_m = T graph for a perfectly black body (v_m =maximum frequency

of radiation)



A. A

B. B

C. C

D. D

Answer: C

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14. 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

Answer: C

Watch Video Solution

15. 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

Answer: D

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16. Wien's displacment 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

Answer: D

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17. If λ_m denotes

A. $\lambda_m \propto T$

B. $\lambda_m \propto T^{-1}$

C. $\lambda_m \propto T$

D. λ_m is independent on T

Answer: B

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18. A black body has maximum wavelength λ_m at temperature $2000K$. Its corresponding wavelength at temperature 3000 will be

A. $\frac{3}{2}\lambda_m$

B. $\frac{2}{3}\lambda_m$

C. $\frac{16}{81}\lambda_m$

D. $\frac{81}{16}\lambda_m$

Answer: B

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19. The thermal radiation from a hot body travels with a velocity of

A. $330ms^{-1}$

B. $2 \times 10^8 ms^{-1}$

C. $1200ms^{-1}$

D. $3 \times 10^8 ms^{-1}$

Answer: D

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20. Experimental investigations show that the intensity of solar radiation is maximum for a wavelength $480nm$ in the visible ragion. Estimate the surface temperature of sun. (Given Wien's constant $b = 2.88 \times 10^{-3} mK$).

A. $4000K$

B. $6000K$

C. $8000K$

D. $10^6 K$

Answer: B

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21. 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 $5.67 \times 10^{-8} Wm^{-2} K^{-4}$, constant $b = 2898 \mu mK$)-

A. $5.67 \times 10^{8} Wm^{-2}$

B. $5.67 \times 10^{12} Wm^{-2}$

C. $10.67 \times 10^{7} Wm^{-2}$

D. $10.67 \times 10^{14} Wm^{-2}$

Answer: A

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22. The temperature of a radiation body increases by 30%. Then the increase in the amount of radiation is

A. 185%

B. 285%

C. 325%

D. 130%

Answer: A

23. 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. $42\ \%$

Answer: B

24. Two spheres of same material have radius 1 m and 4 m and temperature 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 information is incomplete to draw any conclusion

Answer: C

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25. If the temperature of the Sun were to increase from T to 2T and its radius from R to 2R. The rat io of power, radiated by it would become

A. 64 times

B. 16 times

C. 32 times

D. 4 times

Answer: A

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26. The rate of cooling at $600K$. If surrounding temperature is $300K$ is H. The rate of cooling at $900K$ is

A. $\frac{16}{3}H$

B. $2H$

C. $3H$

D. $\frac{2}{3}H$

Answer: A

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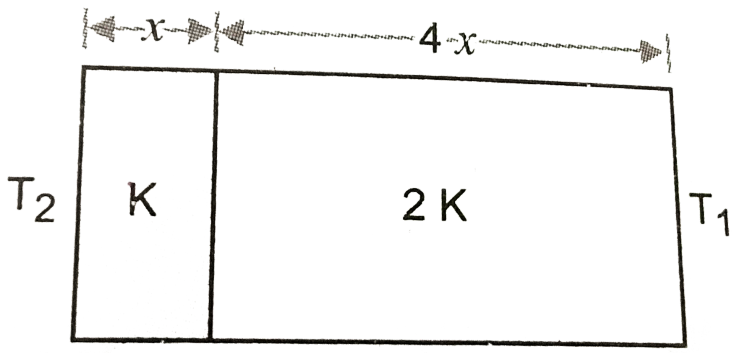
Higher Order Thinking Skills

1. 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. Temperatures on the opposite faces of composite slab are T_1 and T_2 where $T_2 > T_1$, as shown in fig. what is the rate of flow of heat through the slab in a steady state?



A. 1

B. $\frac{1}{2}$

C. $\frac{2}{3}$

D. $\frac{1}{3}$

Answer: D

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2. A wall of dimensions 2.00 m by $3.50m$ has a single-pane window of dimensions $0.75m$ by $1.20m$. If the inside temperature is $20^\circ C$ and the outside temperature is $-10^\circ C$, effective thermal resistance of the opaque wall and

window are $2.10KW^{-1}$ and $0.21KW^{-1}$ respectively. The heat flow through the entire wall will be .

A. $215W$

B. $205W$

C. $175W$

D. $110W$

Answer: A

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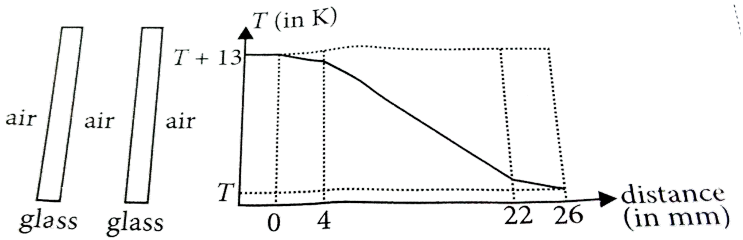
3. The figure show a cross-section of a double glass unit of a window on a vertical wall. A graph wall. A graph of the temperature at different points within the unit is show next to it. The temperature difference across the unit is $13K$. It has a crossp-sectional area of $1.3m^2$ and the rate of heat flow through it is $65W$. 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 equalibrium.

C. The unit is not in steady state but is in thermal

D. The unit neither in steady state nor in thermal equilibrium

Answer: B

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4. In question number 3, the thermal conductivity (in $Wm^{-1}K^{-1}$) if air is

A. $\frac{1}{10}$

B. $\frac{1}{12}$

C. $\frac{1}{14}$

D. $\frac{9}{130}$

Answer: C

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5. A lake surface is exposed to an atmosphere where the temperature is $< 0^{\circ} C$. If the thickness of the ice layer formed on the surface grows form $2cm$ to $4cm$ in 1 hour. The atmospheric temperature, T_a will be- (Thermal conductivity of ice $K = 4 \times 10^{-3} cal/cm/s/.^{\circ} C$, density of ice $= 0.9gm/ice$. Latent heat of fustion of ice $= 80cal/m$. Neglect the change of density during the state change. Assume that the water below the ice has 0° temperature every where)

A. $-20.^{\circ} C$

B. $0.^{\circ} C$

C. $-30.^{\circ} C$

D. $15.^{\circ} C$

Answer: C

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6. Two chunks of metal with heat capacities C_1 and C_2, are interconnected by a rod length l and cross-sectional area S and fairly low heat conductivity K. The whole system is thermally

insulated from the environment. At a moment $t = 0$ the temperature difference betwene the two chunks of metal equals $(\Delta T)_0$. Assuming the heat capacity of the rod to be negligible, find the temperature difference between the chucks as a function of time.

A. $T_0 \exp\left(\frac{-KA(C_1 + C_2)t}{C_1 C_2}\right)$

B. $T_0 \exp\left(\frac{-KA(C_1 + C_2)}{C_1 C_2}\right)$

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

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

Answer: A

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7. A double pan window used for insulating a room thermally from outside consists of two glass sheets each of area 1 m^2 and thickness $0.01m$ separated by 0.05 m thick stagnant air space. In the steady state, the room-glass interface and the glass-outdoor interface are at constant temperatures of $27^\circ C$ and $0^\circ C$ respectively. The thermal conductivity of glass is $0.8Wm^{-1}K^{-1}$ and of air $0.08Wm^{-1}K^{-1}$. Answer the following questions.

(a) Calculate the temperature of the inner glass-air interface.

(b) Calculate the temperature of the outer glass-air interface.

(c) Calculate the rate of flow of heat through the window pane.

A. $41.5W$

B. $31.5W$

C. $21.5W$

D. $11.5W$

Answer: A

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8. In question number 7, the temperature of other interfaces (in $.^{\circ} C$) is

A. $26.5, 0.5$

B. $27.5, 1$

C. $28.5, 2$

D. $29.5, 3$

Answer: A

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Ncert Exemplar

1. A bimetallic strip made of aluminum and steel $(\alpha_{Al} > \alpha_{steel})$ on heating the strip will a) remain straight b) get twisted c) will bend with aluminum on concave side d) will bend with steel on concave side.

A. remain straight

B. get twisted

C. will bend with aluminium on concave side

D. will bend with steel on concave side.

Answer: D

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2. A uniform metallic rod rotates about its perpendicular bisector with constant angualr speed. If it is heated uniformly to raise its temperature slightly, then 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

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

Answer: B

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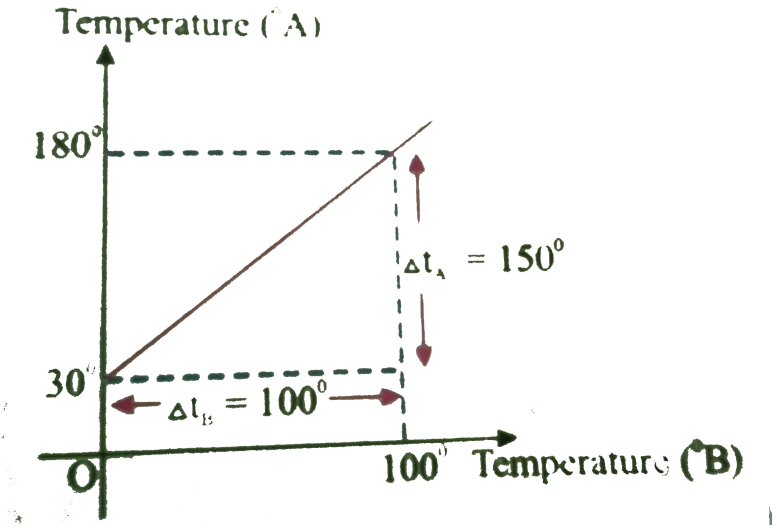
3. The graph between two temperature scales A and B is shown in Fig. Between upper fixed point and lower fixed point there are 150 equal divisions on scales A and 100 on scale B. The relation between the temperature in two scales is given by_



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

Answer: B

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4. An aluminium sphere is dipped into water. Which of the following is true ?

A. Buoyancy will be less in water at $0^\circ C$ than that in water at $4^\circ C$.

B. Buoyancy will be more in water at $0^\circ C$ than that in water at $4^\circ C$.

C. Buoyancy in water at $0^\circ C$ will be same as that in water at $4^\circ C$.

D. Buoyancy may be more or less in water at $4^\circ C$ depending on the radius of the sphere.

Answer: A

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5. As the temperature is increased, the period of a pendulum a) Increases as its effective length increases even through its centre of mass still remains at the centre of the bob. b) decreases as its effective length increases even though its centre of mass still remains at 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.

A. Increases as its effective length increases even through its centre of mass still remains at the centre of the bob.

B. decreases as its effective length increases even though its centre of mass still remains at the centre of thed 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.

Answer: A

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.

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.

Answer: A

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7. The radius of metal sphere at room temperature T is R and the coefficient of linear expansion of the metal is α. The sphere is heated a little by a temperature T, so that new

temperature is $T + \Delta T$. The increase in volume of sphere is approximately

A. $2\pi R\alpha\Delta T$

B. $\pi R^2\alpha\Delta T$

C. $4\pi R^3\alpha\Delta T/3$

D. $4\pi R^3\alpha\Delta T$

Answer: D

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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.

A. Plate will cool fastet 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.

Answer: C

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Assertion And Reason

1. Assertion : A change in the temperature of a body cause change in dimentions.

Reason : The dimentions of a body decrease due to the increase in its temperature.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true and reason is not the correct explanation of assertion.

C. If assertion is true and reason is false.

D. If both assertion and reason are false.

Answer: C

2. The Kelvin scale temperature is 0 K. What is the corresponding Celsius scale temperature ?

A. If both assertion and reason are true and reason is the correct explanation of

assertion.

B. If both assertion and reason are true and reason is not the correct explanation of assertion.

C. If assertion is true and reason is false.

D. If both assertion and reason are false.

Answer: B

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3. Assertion : The density of water remains constant as it is cooled from room temperature untill its temperature reached $4^{\circ}C$.

Reason : Below $4^{\circ}C$, the density increases.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true and reason is not the correct explanation of assertion.

C. If assertion is true and reason is false.

D. If both assertion and reason are false.

Answer: D

4. Water is used in car radiators as coolant because

A. If both assertion and reason are true and reason is the correct explanation of

assertion.

B. If both assertion and reason are true and reason is not the correct explanation of assertion.

C. If assertion is true and reason is false.

D. If both assertion and reason are false.

Answer: A

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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.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true and reason is not the correct explanation of assertion.

C. If assertion is true and reason is false.

D. If both assertion and reason are false.

Answer: A

6. Assertion : In change of state from solid to liquid the temperature decreases untill the entire amount of the solid subtance melts.

Reason : The phenomenon of refreezing is called melting

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true and reason is not the correct explanation of assertion.

C. If assertion is true and reason is false.

D. If both assertion and reason are false.

Answer: D

7. Assertion : Cooking food is difficult on hills.

Reason : The boiling point decreases with increase in pressure a) If both assertion and reason are true and reason is the correct explanation of assertion. b) If both assertion and reason are true and reason is not the correct explanation of assertion. c) If assertion is true and reason is false. d) If both assertion and reason are false.

A. If both assertion and reason are true and reason is the correct explanation of

assertion.

B. If both assertion and reason are true and reason is not the correct explanation of assertion.

C. If assertion is true and reason is false.

D. If both assertion and reason are false.

Answer: c

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8. Assertion : In the human body the heart acts as the pump that circulates blood through differences parts of the body, transferring heat by force convection.

Reason : In forced convection , material is force to move by a pump or by some other physics means.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true and reason is not the correct explanation of assertion.

C. If assertion is true and reason is false.

D. If both assertion and reason are false.

Answer: a

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.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true and reason is not the correct explanation of assertion.

C. If assertion is true and reason is false.

D. If both assertion and reason are false.

Answer: b

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10. Assertion: According to Newton's law of cooling, the rate of loss of heat, $-dQ/dt$ of the body is directly proportional to the difference of temperature.

Reason :This law holds for all type of temperature differences. a) If both assertion and reason are true and reason is the correct explanation of assertion. b) If both assertion

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

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true and reason is not the correct explanation of assertion.

C. If assertion is true and reason is false.

D. If both assertion and reason are false.

Answer: c

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Others

1. Assertion: According to Newton's law of cooling, the rate of loss of heat, $-dQ/dt$ of the body is directly proportional to the difference of temperature.

Reason :This law holds for all type of temperature differences.

A. law of thermometry

B. Newton's law of cooling

C. law of calorimetry

D. zeroth law

Answer: B

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2. A glass full of hot milk is poured in 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 will time.

C. While cooling, there is a flow of heat from milk to the sourroundings 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, conduction, convection and radiation are responsible for the loss of heat from milk to the surroundings.

Answer: A

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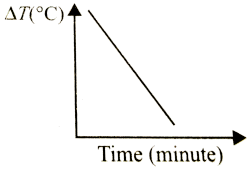
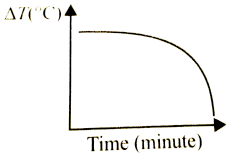
3. A hot liquid is kept in a bog room. Accoding to Newton's law of cooling rate of cooling liquid (represented as y) is plotted against its temperature T. Which of the following curves may represent the plot?

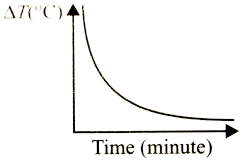
A.



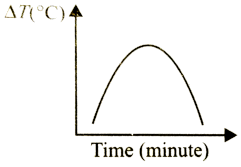
B.



C.



D.



Answer: C

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