PHYSICS

BOOKS - A2Z PHYSICS (HINGLISH)

THERMAL PROPERTIES OF MATTER

Thermometry And Thermal Exapansion

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

A. Diameter

B. Area

C. Volume

D. Density

Answer: C

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2. When a bimetallic strip is heated, it

A. Does not bend at all

B. Gets twisted in the form of an helix

C. Bend in the form of an arc with the more expandable metal outside

D. Bends in the form of an arc with the more expandable metal inside

Answer: C

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3. At some temperature T, a bronze pin is a little large to fit into a hole drilled in a steel block. The change in temperature required for an exact fit is minimum when

A. Only the block is heated

B. Both block and pin are heated together

C. Both block and pin are cooled together

D. Only the pin is cooled

Answer: A

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4. If the length of a cylinder on heating increases by 2%, the area of its base will increase by

A. 0.5%

B. 2%

C. 1%

D. 4%

Answer: D

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5. A solids floats submerged in a liquid. When the liquid is heated, which of the following is most likely to happen?

A. Solid may sink

B. solid may float with a part outside the surface

C. Solid may first sink and then rise upwards

D. Solid may oscillate vertically

Answer: A

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6. A uniform metal rod is used as a bar pendulum. If the room temperature rises by $10^{\circ}C$, and the coefficient of linear expansion of the metal of the rod is $2 \times 10^{-6} per^{\circ}C$, the period of the pendulum will have percentage increase of

A. -2×10^{-3}

B. -1×10^{-3}

C. 2×10^{-3}

D. 1×10^{-3}

Answer: D

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7. If on heating liquid through $80^{\circ}C$, the mass expelled is $\left(\frac{1}{100}\right)^{th}$ of mass still remaining , the coefficient of apparent expansion of liquid is

A. $1.25 \times 10^{-4}/^{\circ}C$

B. $12.5 \times 10^{-4}/^{\circ}C$

C. $1.25 \times 10^{-5}/^{\circ}C$

D. None of these

Answer: A

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8. A glass flask of volume one liter at $0^\circ C$ is filled, level full of mercury at this temperature. The flask and mercury are now heated to $100^\circ C$. How much mercury will spill out if coefficient of volume expansion of mercury is $1.82 \times 10^{-4}/^\circ C$ and linear expansion of glass is $0.1 \times 10^{-4}/^\circ C$ respectively?

A. 21.2

B. 15.2

C. 1.52

D. 2.12

Answer: B

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9. A steel scale measures the length of a copper wire as $80.0cm$ when both area at $20^\circ C$ (the calibration temperature for scale). What would be the scale read for the length of the wire when both are at $40^\circ C$? (Given $\alpha_{\text{steel}} = 11 \times 10^{-6} per^\circ C$ and $\alpha_{\text{copper}} = 17 \times 10^{-6} per^\circ C$)

A. $80.0096cm$

B. $80.0272cm$

C. $1cm$

D. $25.5cm$

Answer: A

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10. A piece of metal weighs 46 g in air and 30 g in lipuid of density $1.24 \times 10^3 kgm^{-3}$ kept at $27^0 C$. When the temperature of the liquid is raised to $42^0 C$ the metal piece weights 30.5 g . The density of the liqued at $42^0 C$ is $1.20 \times 10^3 kgm^{-3}$. Calculate the coefficient of linear expandsion of the metal.

A. $3.316 \times 10^{-5} / ^\circ C$

B. $2.316 \times 10^{-5} / ^\circ C$

C. $4.316 \times 10^{-5} / ^\circ C$

D. None of these

Answer: B

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11. The coefficient of linear expansion of crystal in one direction is α_1 and that in every direction perpendicular to it is α_2. The coefficient of cubical expansion is

A. $\alpha_1 + \alpha_2$

B. $2\alpha_1 + \alpha_2$

C. $\alpha_1 + 2\alpha_2$

D. None of these

Answer: C

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12. On an X temperature scale, water freezes at $-125.0^\circ X$ and boils at $375.0^\circ X$. On a Y temperature scale, water freezes at $-70.0^\circ Y$ and boils at $-30.0^\circ Y$. The value of temperature on X-scale equal to the temperature of $50.0^\circ Y$ on Y-scale is

A. $455.0^\circ X$

B. $-125.0^\circ X$

C. $1375.0^\circ X$

D. $1500.0^\circ X$

Answer: C

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13. At what temperature the Fahrenheit and kelvin scales of temperature give the same reading ?

A. $\theta = -40$

B. $\theta = 40$

C. $\theta = 574.25$

D. 512.45

Answer: C

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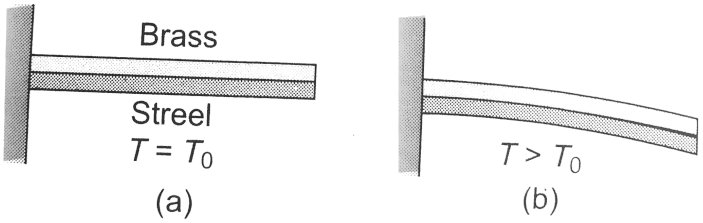
14. In figure which strip brass or steel have higher coefficient of linear expansion.



A. brass strip

B. steel strip

C. both strips has same coefficient of linear expansion

D. cannot be decided from given data

Answer: A

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15. The co-efficient of thermal expansion of a rod is temperature dependent and is given by the formula $\alpha = aT$, where a is a positive constant at T $\text{in}^\circ C$. if the length of the

rod is l at temperature $0^\circ C$, then the temperature at which the length will be $2l$ is

A. $\sqrt{\frac{\ln 2}{\alpha}}$

B. $\sqrt{\frac{\ln 4}{\alpha}}$

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

D. $\frac{2}{\alpha}$

Answer: B

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16. The length of two metallic rods at temperatures θ are L_A and L_B and their linear coefficient of expansion are α_A and α_B respectively. If the difference in their lengths is to remain constant at any temperature then

A. $L_A / L_B = \alpha_A / \alpha_B$

B. $L_A / L_B = \alpha_B / \alpha_A$

C. $\alpha_A = \alpha_B$

D. $\alpha_A \alpha_B = 1$

Answer: B

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17. A perpendicular clock (fitted with a small heavy bob that is connected with a metal rod) is 5 seconds fast each day at a temperature of $15^\circ C$ and 10 seconds slow at a temperature of $30^\circ C$. The temperature at which it is designed to give correct time, is

A. $18^\circ C$

B. $20^\circ C$

C. $24^\circ C$

D. $25^\circ C$

Answer: B

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18. A $30.0cm$ long metal rod expands by $0.0650cm$ when its temperature is raised from $0^\circ C$ to $100^\circ C$. A second rod of different metal and of the same length expands by $0.0350cm$ for the same rise in temperature. A third composite rod, also $30.0cm$ long, is made up of pieces of each of the above metals placed end to end and expands by $0.0580cm$ when

temperature is increased from $0^\circ C$ to $100^\circ C$. the length of the longer portion of the composite bar in cm at $0^\circ C$ is

A. $23cm$

B. $16cm$

C. $18cm$

D. $20cm$

Answer: A

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19. A steel rod of length $1m$ is heated from $25^\circ \text{to} 75^\circ C$ keeping its length constant. The longitudinal strain developed in the rod is (Given, coefficient of linear expansion of steel = $12 \times 10^{-6}/^\circ C$).

A. -6×10^{-6}

B. -6×10^{-5}

C. -6×10^{-4}

D. zero

Answer: C

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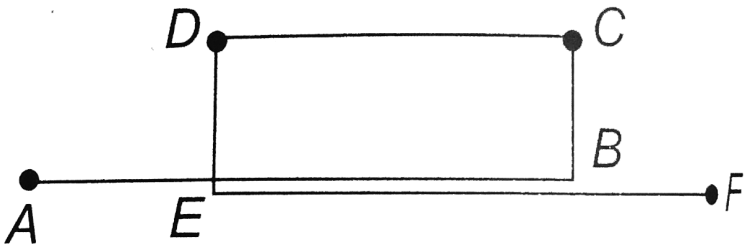
20. In the shown planar frame made of thin uniform rods, the length of section AB and EF is l_1 and its thermal linear coefficient of expansion is α_1. The length of section CD is l_2 and its thermal linear coefficient of expansion is α_2. CB and DE are of same length having thermal linear coefficient of expansion α_2. point A, B, E and F reside on

same line, that is, sections AB and EF overlap. then the ratio of $\frac{l_1}{l_2}$ for which the distance between end A and end F remains the same at all temperatures, is



A. $\frac{\alpha_2}{2\alpha_1}$

B. $\frac{2\alpha_2}{\alpha_1}$

C. $\frac{2\alpha_1}{\alpha_2}$

D. $\frac{\alpha_1}{2\alpha_2}$

Answer: A

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21. A brass rod of length $50cm$ and diameter $3.0cm$ is joined to a steel rod of the same length and diameter. What is the change in length of the combined rod at $250^\circ C$, if the original length are at $40.0^\circ C$?

(Coefficient of linear expansion of brass $= 2.0 \times 10^{-5}/^\circ C$, $steel = 1.2 \times 10^{-5}/^\circ C$

A. $0.27cm$

B. $0.34cm$

C. $0.21cm$

D. $0.18cm$

Answer: B

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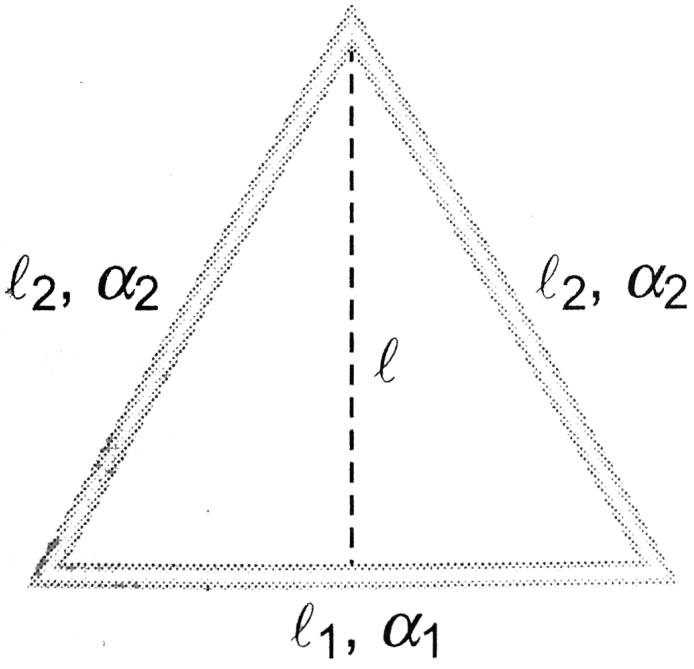
22. An isosceles triangle is formed with a thin rod of length l_1 and coefficient of linear expansion α_1, as the base and two thin rods each of length l_2 and coefficient of linear expansion α_2 as the two sides. The distance between the apex and the midpoint of the base remain unchanged as the temperature is varied. the ratio of lengths $\frac{l_1}{l_2}$ is



A. $2\sqrt{\frac{\alpha_1}{\alpha_2}}$

B. $\sqrt{\frac{\alpha_2}{\alpha_1}}$

C. $2\sqrt{\frac{\alpha_2}{\alpha_1}}$

D. $\frac{1}{2}\sqrt{\frac{\alpha_2}{\alpha_1}}$

Answer: C

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23. A copper and a tungsten plate having a thickness d each are riveted together so that at $0^\circ C$ they form a flat bimetallic plate. Find the average radius of the curvature of this plate at temperature T. the coefficient of linear expansion for copper and tungsten are α_{Cu} and α_W.

A. $\delta\frac{[1+(\alpha_c+\alpha_t)T]}{[2(\alpha_c-\alpha_t)T]}$

B. $\delta\frac{[1+(\alpha_c+\alpha_t)T]}{[(\alpha_c-\alpha_t)T]}$

C. $\delta\frac{[2+(\alpha_c+\alpha_t)T]}{[(\alpha_c-\alpha_t)T]}$

D. $\delta\frac{[2+(\alpha_c+\alpha_t)T]}{[2(\alpha_c-\alpha_t)T]}$

Answer: D

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24. A brass wire $1.8m$ long at $27^\circ C$ is held taut with little tension between two rigid supports. If the wire cooled to a temperature of $-39^\circ C$, what is the tension developed in the wire, if its diameter is $2.0mm$? Coefficient of linear expansion of brass $= 2.0\times10^{-5}/^\circ C$, Young's modulus of brass $= 0.91\times10^{11}Pa.$

A. 2.4×10^2N

B. $3.8 \times 10^2 N$

C. $1.8 \times 10^2 N$

D. $4.8 \times 10^2 N$

Answer: B

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25. A steel tape $1m$ long is correctly calibrated for a temperature of $27.0^\circ C$. The length of a steel rod measured by this tape is found to be $63.0cm$ on a hot day when the temperature is $45^\circ C$. Coefficient of linear expansion of steel $= 1.20 \times 10^{-5}/K$. what is the actual length of the steel rod on that day?

A. $63.0136cm$

B. $63.2134cm$

C. $63.1526cm$

D. $63.3136cm$

Answer: A

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26. A steel scale measures the length of a copper wire as $80.0cm$ when both area at $20^\circ C$ (the calibration temperature for scale). What would be the scale read for the length of the wire when both are at $40^\circ C$? (Given $\alpha_{\text{steel}} = 11 \times 10^{-6} per^\circ C$ and $\alpha_{\text{copper}} = 17 \times 10^{-6} per^\circ C$)

A. $80.1126cm$

B. $80.2136cm$

C. $80.0096cm$

D. $80.1006cm$

Answer: C

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27. The coefficient of volume expansion of glycerine is $49 \times 10^{-5} / {}^{\circ} C$. What is the fractional change in its density (approx.) for $30^{\circ} C$ rise in temperature?

A. 1.5×10^{-2}

B. 2.5×10^{-2}

C. 2.0×10^{-2}

D. 2.8×10^{-2}

Answer: A

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28. A body is float inside liquid. If we increase temperature then what changes occur in buyancy force? (Assume body is always in floating condition)

A. Buoyancy force will increase

B. Buoyancy force will decrease

C. Buoyancy force remains constant

D. Cannot be calculated from given statement

Answer: C

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29. A solid sphere of iron at $2^{\circ}C$ is lying at the bottom of a bucket full of water at $2^{\circ}C$. If the temperature of the water is increased to $3^{\circ}C$, the buoyant force on the sphere due to water will

A. increase

B. Be unchanged

C. Decrease

D. Increase or decrease depends upon the numerical values of coefficient of expansion of water and iron.

Answer: A

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30. A thin rod of negligible mass and a cross-section of $2 \times 10^{-6} m^2$ suspended vertically from one end, has a length of $0.5m$ at $200^\circ C$. The rod is cooled at $0^\circ C$, but prevented from contracting by attaching a mass at the lower end. The value of this mass is : (Young's modulus $= 10^{11} N/m^2$, Coefficient of linear expansion $10^{-5} K^{-1}$ and $g = 10m/s^2$):

A. $20kg$

B. $30kg$

C. $40kg$

D. $50kg$

Answer: C

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31. A rod of length $1000\ mm$ and co-efficient of linear expansion $\alpha = 10^{-4}$ per degree celsius is placed in horizontal smooth surface symmetrically between fixed walls separated by $1001\ mm$. The young's modulus of rod is $10^{11} N/m^2$. If the temperature is increased by $20^\circ C$, then the stress developed in the rod is (in N/m^2)

A. 10

B. 10^8

C. 2×10^8

D. cannot be calculated

Answer: B

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32. A steel rod of length $1m$ is heated from 25° to $75^\circ C$ keeping its length constant. The longitudinal strain developed in the rod is (Given, coefficient of linear expansion of steel = $12 \times 10^{-6}/^\circ C$).

A. 6×10^{-6}

B. -6×10^{-5}

C. -6×10^{-4}

D. zero

Answer: C

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33. 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. $42 \times 10^{6} N/m^{2}$

B. $22 \times 10^{6} N/m^{2}$

C. $36 \times 10^{6} N/m^{2}$

D. $18 \times 10^{6} N/m^{2}$

Answer: A

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34. Thermal coefficient of volume expansion at constant pressure for an ideal gas sample of n moles having pressure P_0, volume V_0, and temperature T_0 is

A. $\frac{R}{P_0V_0}$

B. $\frac{P_0V_0}{R}$

C. $\frac{1}{T_0}$

D. $\frac{1}{nT_0}$

Answer: C

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35. A uniform pressure P is exerted by an external agent on all sides of a solid cube at temperature $t^\circ C$. By what amount should the temperature of the cube be raised in order to bring its volume back to its original volume before the pressure was applied if the bulk modulus is B and co-efficient of volumetric expansion is γ?

A. $\frac{P\gamma}{B}$

B. $\frac{P}{B\gamma}$

C. $\frac{B}{P\gamma}$

D. $\frac{1}{BP\gamma}$

Answer: B

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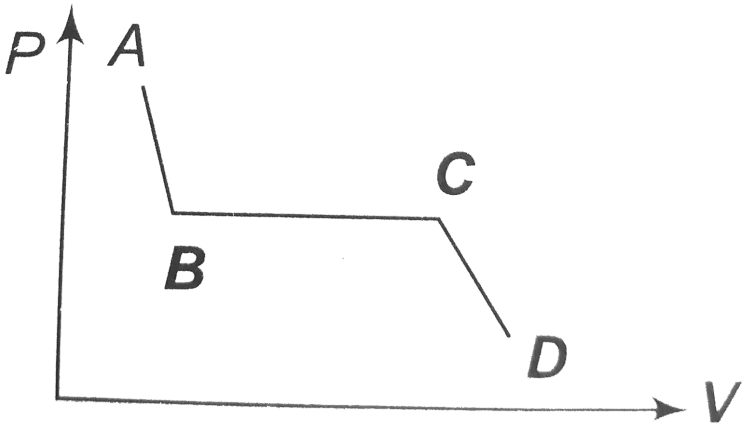
Calorimetry

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



A. The liquid state of matter

B. Gaseous state of matter

C. Change from liquid to gaseous state

D. Change from gaseous state to liquid state

Answer: A

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2. A small quantity mass m, of water at a temperature $\theta(\text{in } {}^{\circ}C)$ is poured on to a larger mass M of ice which is at its melting point. If c is the specific heat capacity of water and L the specific heat capacity of water and L the specific latent heat of fusion of ice, then the mass of ice melted is give by

A. $\frac{ML}{mc\theta}$

B. $\frac{Mc\theta}{L}$

C. $\frac{mc\theta}{ML}$

D. $\frac{mc\theta}{L}$

Answer: D

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3. A container contains hot water at $100^\circ C$. If in time T_1 temperature falls to $80^\circ C$ and in time T_2 temperature falls to $60^\circ C$ from $80^\circ C$, then

A. $T_1 = T_2$

B. $T_1 < T_2$

C. $T_1 < T_2$

D. None of these

Answer: C

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4. If two balls of same metal weighing 5 gm and 10 gm strike with a target with the same velocity. The heat energy so

developed is used for raising their temperature alone, then the temperature will be higher

A. For bigger ball

B. For smaller ball

C. Equal for both the balls

D. None is correct from the above three

Answer: C

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

A. $175gm$

B. $300g$

C. $295gm$

D. $375g$

Answer: D

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6. The ratio of thermal capacities of two spheres A and B, their diameters are in the ratio $1:2$ densities in the ratio $2:1$, and the specific heat in the ratio of $1:3$, will be

A. $1:6$

B. $1:12$

C. $1:3$

D. $1:4$

Answer: B

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7. 1 g of a steam at $100^\circ C$ melt how much ice at $0^\circ C$? (Length heat of ice $= 80cal/gm$ and latent heat of steam $= 540cal/gm$)

A. $1gm$

B. $2gm$

C. $4gm$

D. $8gm$

Answer: D

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8. One kilogram of ice at $0^\circ C$ is mixed with one kilogram of water at $80^\circ C$. The final temperature of the mixture is (Take : specific heat of water $= 4200 Jkg^{-1}K^{-1}$, latent heat of ice $= 336 kJ/kg^{-1}$)

A. $40^\circ C$

B. $60^\circ C$

C. $0^\circ C$

D. $50^\circ C$

Answer: C

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

A. $7.1^\circ C$

B. $9.2^\circ C$

C. $10.5^\circ C$

D. $12.1^\circ C$

Answer: A

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10. Calculate the amount of heat (in calories) required to convert $5gm$ of ice at $0^\circ C$ to steam at $100^\circ C$

A. 3100

B. 3200

C. 3600

D. 4200

Answer: C

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11. A vessel contains $110g$ of water. The heat capacity of the vessel is equal to $10g$ of water. The initial temperature of water in vessel is $10^\circ C$. If $220g$ of hot water at $70^\circ C$ is

poured in the vessel, the final temperature neglecting radiation loss, will be

A. $70^\circ C$

B. $80^\circ C$

C. $60^\circ C$

D. $50^\circ C$

Answer: D

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12. $10gm$ of ice at $-20^\circ C$ is dropped into a calorimeter containing $10gm$ of water at $10^\circ C$, the specific heat of water is twice that of ice. When equilibrium is reached the calorimeter will contain:

A. $20gm$ of water

B. $20gm$ of ice

C. $10gm$ ice and $10gm$ of water

D. $5gm$ ice and $15gm$ of water

Answer: C

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13. Steam is passed into $54gm$ of water at $30^\circ C$ till the temperature of mixture becomes $90^\circ C$. If the latent heat of steam is $536cal/gm$, the mass of the mixture will be

A. $80gm$

B. $60gm$

C. $50gm$

D. $24gm$

Answer: B

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14. Two spheres A and B have diameters in the ratio $1:2$, densities in the ratio $2:1$ and specific heat in the ratio $1:3$. Find the ratio of their thermal capacities.

A. $1:6$

B. $1:12$

C. $1:3$

D. $1:4$

Answer: B

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15. When 300 J of heat is added to $25gm$ of sample of a material its temperature rises from $25^\circ C$ to $45^\circ C$. The thermal capacity of the sample and specific heat of the material are respectively given by

A. $15J/^\circ C, 600J/Kg-^\circ C$

B. $600J/^\circ C, 15J/^\circ C-kg$

C. $150J/^\circ C, 60J/Kg-^\circ C$

D. None of these

Answer: A

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16. A calorimeter contains $0.2kg$ of water at $30^\circ C$, $0.1kg$ of water at $60^\circ C$ is added to it, the mixture is well stirred and the resulting temperature is found to be $35^\circ C$. The thermal capacity of the calorimeter is:

A. $6300J/K$

B. $1260J/K$

C. $4200J/K$

D. None of these

Answer: B

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17. Equal masses of ice and water with temperature equally below and above the melting point of ice respectively are mixed with each other. At equilibrium $40\,\%$ of the ice melted. The initial temperature of water was

A. $16^\circ C$

B. $32^\circ C$

C. $64^\circ C$

D. $96^\circ C$

Answer: C

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18. A thermal insulated vessel contains some water at $0^\circ C$. The vessel is connected to a vacuum pump to pump out

water vapour. This results in some water getting frozen. It is given latent heat of vaporization of water at $0^\circ C = 21 \times 10^5 J/kg$ and latent heat of freezing of water $= 3.36 \times 10^5 J/kg$. the maximum percentage amount of water vapour that will be solidified in this manner will be:

A. $86.2\ \%$

B. $33.6\ \%$

C. $21\ \%$

D. $24.36\ \%$

Answer: A

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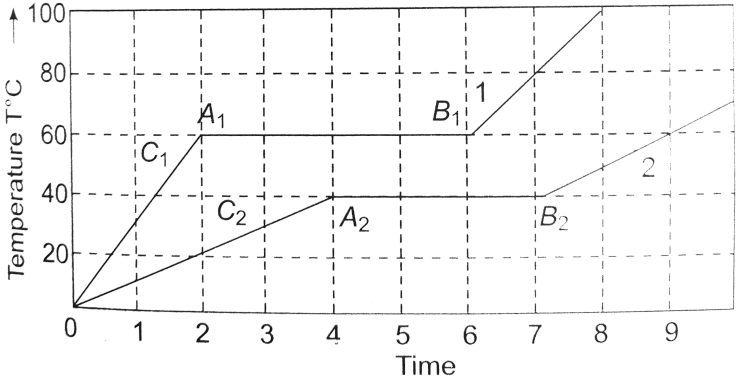
19. Two solid bodies of equal mass m initially at $T = 0^\circ C$ are heated at a uniform and same rate under identical conditions. The temperature of the first object with latent heat L_1 and specific heat capacity in solid state C_1 changes according to graph 1 on the diagram. the temperature of the second object withe latent heat L_2 and specific heat capacity in solid state C_2 changes according to graph 2 on the diagram. based on what is shown on the graph, the latent heat L_1 and L_2 and the specific heat capacities C_1 and C_2 in solid state obey which of the following relationships?



A. $L_1 > L_2, C_1 < C_2$

B. $L_1 < L_2, C_1 < C_2$

C. $L_1 > L_2, C_1 > C_2$

D. $L_1 < L_2, C_1 > C_2$

Answer: A

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20. A solid ball of mass $10kg$ at $40^\circ C$ is gently placed in a liquid of mass $20kg$ at $20^\circ C$ and of specific heat capacity $1cal/gm-^\circ C$. When the thermal equilibrium is attained, temperature of the system is $35^\circ C$. The specific heat capacity of solid ball is. Neglect heat capacity of the vessel.

A. $1cal/gm-^\circ C$

B. $2cal/gm-^{\circ}C$

C. $3cal/gm-^{\circ}C$

D. $6cal/gm-^{\circ}C$

Answer: D

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21. An ice block at $0^{\circ}C$ is dropped from height $'h'$ above the ground. What should be the value of $'h'$ so that it melts completely by the time it reaches the bottom assuming the loss of whole gravitational potential energy is used as heat by the ice? $[Given: L_f = 80cal/gm]$

A. $33.6m$

B. $33.6km$

C. $8m$

D. $8km$

Answer: B

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22. The mass, specific heat capacity and the temperature of a solid are $1000g$, $\frac{1}{2}\frac{cal}{g^\circ C}$ and $80^\circ C$ respectively. The mass of the liquid and the calorimeter are $900g$ and $200g$. Initially,both are at room temperature $20^\circ C$ Both calorimeter and the solid are made of same material. In the steady state, temperature of mixture is $40^\circ C$, then specific heat capacity of the unknown liquid.

A. $0.25cal/gm^\circ C$

B. $0.5cal/gm^\circ C$

C. $1cal/gm^\circ C$

D. $1.5cal/gm^\circ C$

Answer: C

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23. Four cubes of ice at $-10^\circ C$ each one gm is taken out from the refrigerator and are put in $150gm$ of water at $20^\circ C$. The temperature of water when thermal equilibrium is attained. Assuming that no heat is lost to the outside and water equivalent of container is $46gm$. (Specific heat capacity of water $= 1cal/gm-^\circ C$, Specific heat capacity of ice

$= 0.5cal/gm - ^\circ C$, Latent heat of fusion of ice $= 80cal/gm - ^\circ C$)

A. $0^\circ C$

B. $-10^\circ C$

C. $17.9^\circ C$

D. None of these

Answer: C

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24. $20gm$ ice at $-10^\circ C$ is mixed with m gm steam at $100^\circ C$. The minimum value of m so that finally all ice and steam converts into water is:

(Use $s_{\text{ice}} = 0.5\text{cal gm}^{\circ}C$, $S_{\text{water}} = 1cal/gm^{\circ}C$, L)

(melting) $= 80cal/gm$ and $L(\text{vaporization}) = 540cal/gm$)

A. $\frac{185}{27}gm$

B. $\frac{135}{17}gm$

C. $\frac{85}{32}gm$

D. $\frac{113}{17}gm$

Answer: C

Watch Video Solution

25. The amount of heat supplied to decrease the volume of an ice water mixture by $1cm^3$ without any change in temperature, is equal to: $(\rho_{\text{ice}} = 0.9, \rho_{\text{water}} = 80cal/gm)$

A. $360cal$

B. $500cal$

C. $720cal$

D. None

Answer: C

Watch Video Solution

26. Water of mass $m_2 = 1kg$ is contained in a copper calorimeter of mass $m_1 = 1kg$. Their common temperature $t = 10^\circ C$. Now a piece of ice of mass $m_2 = 2kg$ and temperature is $-11^\circ C$ dropped into the calorimeter. Neglecting any heat loss, the final temperature of system is. [specific heat of copper $= 0.1Kcal/kg^\circ C$, specific heat of

water $= 1Kcal/kg^\circ C$, specific heat of ice $= 0.5Kcal/kg^\circ C$, latent heat of fusion of ice $= 78.7Kcal/kg$]

A. $0^\circ C$

B. $4^\circ C$

C. $-4^\circ C$

D. $-2^\circ C$

Answer: A

Watch Video Solution

27. An ice block at $0^\circ C$ and of mass m is dropped from height $'h'$ such that the loss in gravitational potential energy of block is exactly equal to the heat required to just

completely melt the ice. Taking latent heat of fusion of ice $= 80cal/gm$, acceleration due to gravity $= 10m/s^2$ and mechanical equivalent of heat $= 4.2J/Cal.$ the value of $'h'$ is

A. $8m$

B. $8km$

C. $33.6m$

D. $33.6km$

Answer: D

Watch Video Solution

28. $4gm$ of steam at $100^\circ C$ is added to $20gm$ of water at $46^\circ C$ in a container of negligible mass. Assuming no heat is

lost to surrounding, the mass of water in container at thermal equilibrium is. Latent heat of vaporization $= 540 cal / gm$. Specific heat of water $= 1 cal / gm - ^{\circ} C$.

A. $18 gm$

B. $20 gm$

C. $22 gm$

D. $24 gm$

Answer: C

Watch Video Solution

29. What is the change in potential energy (in calories) of a $10 kg$ mass after $41.8 m$ fall?

A. $1000cal$

B. $800cal$

C. $1500cal$

D. $2000cal$

Answer: A

Watch Video Solution

30. $1kg$ ice at $-20^\circ C$ is mixed with $1kg$ steam at $200^\circ C$. The equilibrium temperature and mixture content is

A. $80^\circ C$, and mixture content $2kg$

B. $110^\circ C$, and mixture content $2kg$ steam

C. $100^\circ C$, and mixture content $\frac{10}{17} kg$ steam and $\frac{24}{17} kg$ water

D. $100^\circ C$, and mixture content $\frac{20}{27} kg$ steam and $\frac{34}{27} kg$

Answer: D

Watch Video Solution

31. The ratio of the densities of the two bodies is $3:4$ and the ratio of specific heats is $4:3$ Find the ratio of their thermal capacities for unit volume?

A. $1:1$

B. $1:2$

C. $2:3$

D. $2:7$

Answer: A

Watch Video Solution

32. A $10kW$ drilling machine is used to drill a bore in a small aluminium block of mass $8.0kg$. How much is the rise in temperature of the block in 2.5 minutes, assuming $50\,\%$ of power is used up in heating the machine itself or lost to the surrounding? Specific heat of aluminium $= 0.91J/g^{\circ}C$.

A. $83^{\circ}C$

B. $103^{\circ}C$

C. $150^{\circ}C$

D. $123^{\circ}C$

Answer: B

Watch Video Solution

33. A geyser heats water flowing at the rate of 3.0 liter per minute from $27^\circ C$ to $77^\circ C$. If the geyser operates on a gas burner and its heat of combustion is $4.0 \times 10^4 J/g$, then what is the rate of combustion of fuel (approx.)?

A. $24 g/\ \min$

B. $12 g/\ \min$

C. $32 g/\ \min$

D. $16 g/\ \min$

Answer: D

Watch Video Solution

34. When $0.400kg$ of water at $30^\circ C$ is mixed with $0.150kg$ of water at $25^\circ C$ contained in a calorimeter, the final temperature is found to be $27^\circ C$, find the water equivalent of the calorimeter.

A. $0.450kg$

B. $1kg$

C. $0.50kg$

D. $1.5kg$

Answer: A

Watch Video Solution

35. A copper calorimeter of mass $1.5kg$ has $200g$ of water at $25^\circ C$. How much water (approx.) at $50^\circ C$ is required to be poured in the calorimeter, so that the equilibrium temperature attained is $40^\circ C$? (Sp. Heat capacity of copper $= 390J/kg-^\circ C$)

A. $510g$

B. $450g$

C. $370g$

D. $610g$

Answer: A

Watch Video Solution

36. A copper block of mass $2.5kg$ is heated in a furnace to a temperature of $500^\circ C$ and then placed on a large ice block. What is the maximum amount (approx.) of ice that can melt? (Specific heat copper $= 0.39J/g^\circ C$ heat of fusion of water $= 335J/g$).

A. $2kg$

B. $1.5kg$

C. $2.5kg$

D. $0.5kg$

Answer: B

Watch Video Solution

37. A child running a temperature of $101^\circ F$ is given an antipyrine (i.e. a medicine that lowers fever) which causes an increase in the rate of evaporation of sweat from his body. If the fever is brought down to $98^\circ F$ in $20\ \min$, what is the average rate of extra evaporation caused by the drug? Assume the evaporation mechanism to be the only way by which heat is lost. the mass of the child is $30kg$. the specific heat of human body is approximately the same as that of water, and latent heat of water at that temperature is about $580cal\,/\,g$.

A. $4.3g\,/\ \min$

B. $6.2g\,/\ \min$

C. $3.6g\,/\ \min$

D. $2.4g\,/\ \min$

Answer: A

Watch Video Solution

38. A piece of ice of mass $50g$ exists at a temperature of $-20^{\circ}C$. Determine the total heart required to covert it completely to steam at $100^{\circ}C$. (Specific heat capacity of ice $= 0.5cal/g-^{\circ}C$, specific latent heat of fusion for ice $= 80cal/g$ and specific latent heat of vaporization for water $= 540cal/g$).

A. $26500cal$

B. $12400cal$

C. $36500cal$

D. $46500cal$

Answer: C

Watch Video Solution

39. A metal piece weighing $15g$ is heated to $100^\circ C$ and then immersed in a mixture of ice and water at the thermal equilibrium. The volume of the mixture is found to be reduced by $0.15cm^3$ with the temperature of mixture remaining constant. Find the specific heat of the metal. Given specific gravity of ice $= 0.92$, specific gravity of water at $0^\circ C = 1.0$, latent heat of fusion of ice $= 80cal - g^{-1}$.

A. $0.092cal/gm^\circ C$

B. $0.124cal/gm^\circ C$

C. $0.162cal/gm^\circ C$

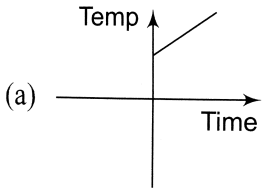
D. $0.242 cal / gm^{\circ} C$

Answer: A

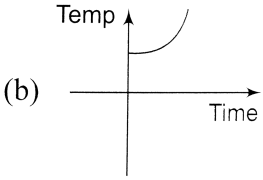
Watch Video Solution

40. If liquefied oxygen at 1 atmospheric pressure is heated from 50K to 300k by supplying heat at constant rate. The graph of temperature vs time will be

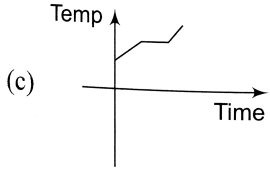
A.



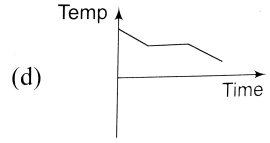
B.



C.



D.



Answer: C

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41. 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. $0.224kg$

C. $0.336kg$

D. $0.621kg$

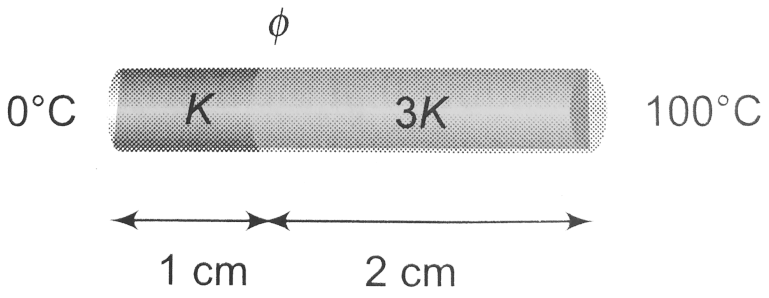
Answer: A

Watch Video Solution

Transmission Of Heat : Conduction

1. Two bars of thermal conductivities K and $3K$ and lengths $1cm$ and $2cm$ respectively have equal cross-sectional area,

they are joined lengths wise as shown in the figure. If the temperature at the ends of this composite bar is $0^\circ C$ and K^2/l respectively (see figure), then the temperature ϕ of the interface is



A. $50^\circ C$

B. $\frac{100}{3}.^\circ C$

C. $60^\circ C$

D. $\frac{200}{3}.^\circ C$

Answer: C

Watch Video Solution

2. A compound slab is made of two parallel plates of copper and brass of the same thickness and having thermal conductivities in the ratio $4:1$. The free face of copper is at $0^\circ C$. The temperature of the internal is $20^\circ C$. What is the temperature of the free face of brass?

A. $0^\circ C$

B. $20^\circ C$

C. $40^\circ C$

D. $100^\circ C$

Answer: D

Watch Video Solution

3. Two identical vessels are filled with equal amounts of ice. The vessels are made from different materials. If the ice melts in the two vessels in times t_1 and t_2 respectively, then their thermal conductivities are in the ratio

A. $\frac{t_1}{t_2}$

B. $\frac{t_2}{t_1}$

C. $t_2^2 : t_1^2$

D. $t_1^2 : t_2^2$

Answer: B

Watch Video Solution

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

A. $1:1$

B. $2:1$

C. $1:4$

D. $1:8$

Answer: D

Watch Video Solution

5. The temperature gradient in a rod of $0.5m$ length is $80^\circ C/m$. It the temperature of hotter end of the rod is $30^\circ C$, then the temperature of the cooler end is

A. $40^\circ C$

B. $-10^\circ C$

C. $10^\circ C$

D. $0^\circ C$

Answer: B

Watch Video Solution

6. If the coefficient of conductivity of aluminium is $0.5calcm^{-1}s^{-1}.^\circ C^{-1}$, then the other to conductor

$10 cals^{-1} cm^{-2}$ in the steady state, the temperature gradient in aluminium must be

A. $5^\circ C/cm$

B. $10^\circ C/cm$

C. $20^\circ C/cm$

D. $10.5^\circ C/cm$

Answer: C

Watch Video Solution

7. The coefficient of thermal conductivity of copper, mercury and glass are respectively K_c, K_m and K_g that $K_c > K_m > K_g$. If the same quantity of heat is to flow per

second per unit of each and corresponding temperature gradients are X_c, X_m and X_g, then

A. $X_c = X_m = X_g$

B. $X_c > X_m > X_g$

C. $X_c < X_m < X_g$

D. $X_m < X_c < X_g$

Answer: C

Watch Video Solution

8. Ice has formed on a shallow pond, and a steady state has been reached, with the air above the ice at $-5.0^\circ C$ and the bottom of the pond at $40^\circ C$. If the total depth of ice + water is $1.4m$, (Assume that the thermal conductivities of ice and

water are 0.40 and $0.12 cal / mC^{\circ} s$, respectively.)

The thickness of ice layer is

A. $1.1m$

B. $0.4m$

C. $2.1m$

D. $3.6m$

Answer: A

Watch Video Solution

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

A. $\frac{Kl}{A}$

B. $\frac{l}{KA}$

C. $\frac{AK}{l}$

D. $\frac{A}{Kl}$

Answer: B

Watch Video Solution

10. A wall has two layers A and B each made of different materials. The layer A is 10cm thick and B is 20 cm thick. The thermal conductivity of A is thrice that of B. Under thermal equilibrium temperature difference across the wall is $35^\circ C$. The difference of temperature across the layer A is

A. $28^\circ C$

B. $14^{\circ} C$

C. $7^{\circ} C$

D. $5^{\circ} C$

Answer: D

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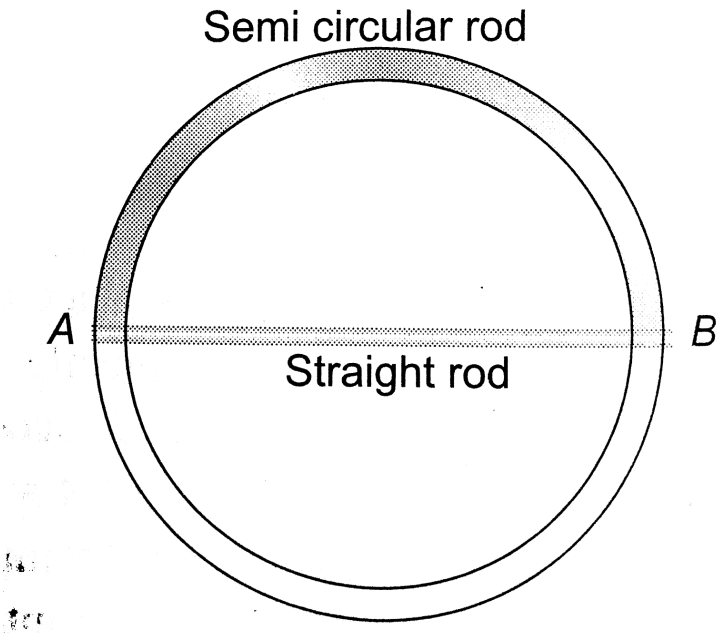
11. Two rods (one semi-circular and other straight) of same material and of same cross-sectional area are joined as shown in the figure. The point A and B are maintained at different temperature. Find the ratio of the heat transferred through a cross-section of a semi-circular rod to the heat transferred through a cross section of the straight rod in a

given time.



A. $\frac{2}{\pi}$

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

C. π

D. $\frac{\pi}{2}$

Answer: A

Watch Video Solution

12. Two spheres of different materials one with double the radius and one-fourth wall thickness of the other are filled with ice. If the time taken for complete melting of ice in the larger sphere is 25 minutes and for smaller one is 16 minutes, the ratio of thermal conductivities of the materials of larger sphere to that of smaller sphere is:

A. $4:5$

B. $5:4$

C. $25:8$

D. $8:25$

Answer: D

Watch Video Solution

13. A wall has two layers A and B each made of different materials. The thickness of both the layers is the same. The thermal conductivity of A, $K_A = 3K_B$. The temperature different across the wall is $20^\circ C$ in thermal equilibrium

A. The temperature difference across A is $15^\circ C$.

B. Rate of heat transfer across A is more than across B

C. Rate of heat transfer across both is same.

D. Temperature difference aross A is $5^\circ C$

Answer: D

Watch Video Solution

14. A cylinder of radius R made of a material of thermal conductivity K_1 is surrounded by a cylindrical shell of inner radius R and outer radius $2R$ made of a material of thermal conductivity K_2. The two ends of the combined system are maintained at two different temperatures. There is no loss of heat across the cylindrical surface and the system is in steady state. The effective thermal conductivity of the system is

A. $K_1 + K_2$

B. $\frac{K_1 + 3K_2}{4}$

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

D. $\frac{3K_1 + K_2}{4}$

Answer: B

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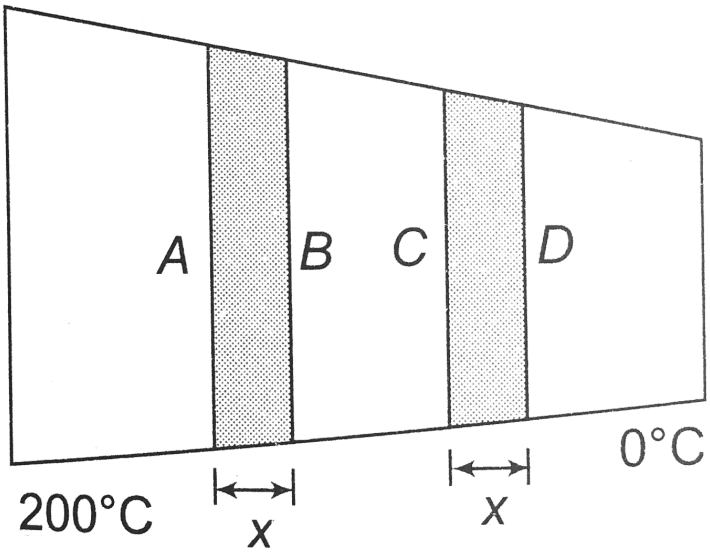
15. Two ends of a conducting rod of varying cross-section are maintained at $200^\circ C$ and $0^\circ C$ respectively. In steady state:



A. temperature differences across AB and CD are equal

B. temperature difference aross AB is greater than that across CD

C. temperature difference aross AB is less than that across CD

D. temperature difference may be equal or different depending upon thermal conductivity of the rod.

Answer: C

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16. One end of conducting rod is maintained at temperature $50^\circ C$ and at the other end ice is melting at $0^\circ C$. The rate of melting of ice is doubled if:

A. the temperature is made $200^\circ C$ and the area of cross-section of the rod is doubled

B. the temperature is made $100^\circ C$ and the length of the rod is made four time

C. area of cross-section of the rod is halved and length is doubled.

D. the temperature is made $100^\circ C$ and area of cross-section of rod and length both are doubled.

Answer: D

Watch Video Solution

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

A. $6^\circ C$

B. $12^\circ C$

C. $18^\circ C$

D. $24^\circ C$

Answer: B

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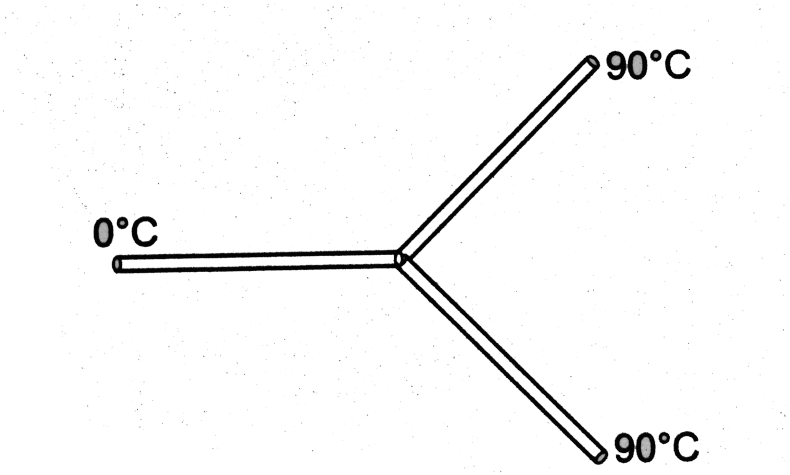
18. Three rods made of the same material and having the same cross-section have been joined as shown in the figure. Each rod is of the same length. The left and right ends are kept at $0^\circ C$ and $90^\circ C$, respectively. The temperature of

junction of the three rods will be



A. $45^\circ C$

B. $60^\circ C$

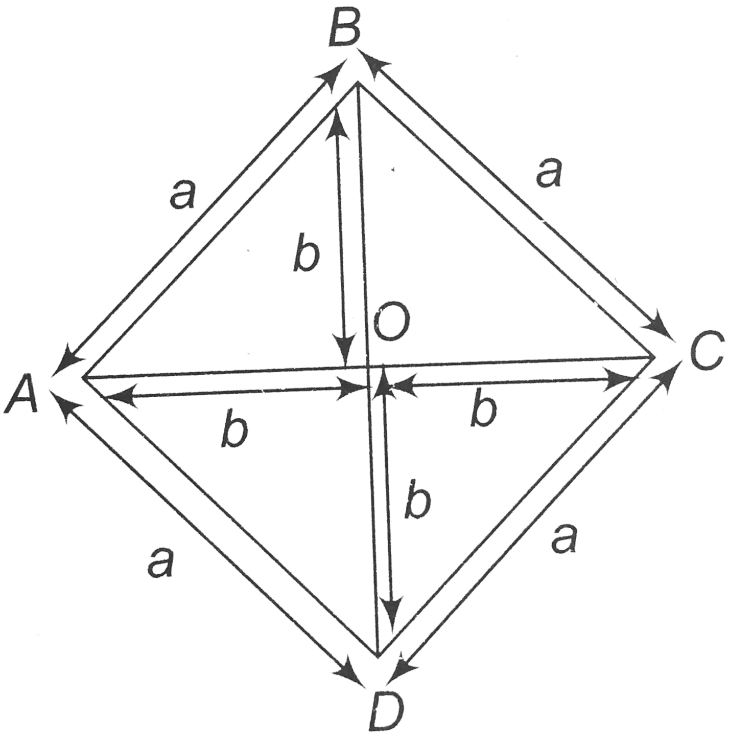
C. $30^\circ C$

D. $20^\circ C$

Answer: B

Watch Video Solution

19. All the rods have same conductance $'K'$ and same area of cross section $'A'$. If ends A and C are maintained at temperature $2T_0$ and T_0 respectively then which of the following is / are correct?



A. Rate of heat flow through ABC, AOC and ADC is same

B. Rate of heat flow through BO and OD is not same

C. Total rate of heat flow from A to C is $\frac{3KAT_0}{2a}$

D. Temperature at junctions B, O and D are same

Answer: D

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20. Two identical long, solid cylinders are used to conduct heat from temp T_1 to Temp T_2. Originally the cylinders are connected in series and the rate of heat transfer is H. If the cylinders are connected in parallel then the rate of heat transfer would be:

A. $H/4$

B. $2H$

C. $4H$

D. $8H$

Answer: C

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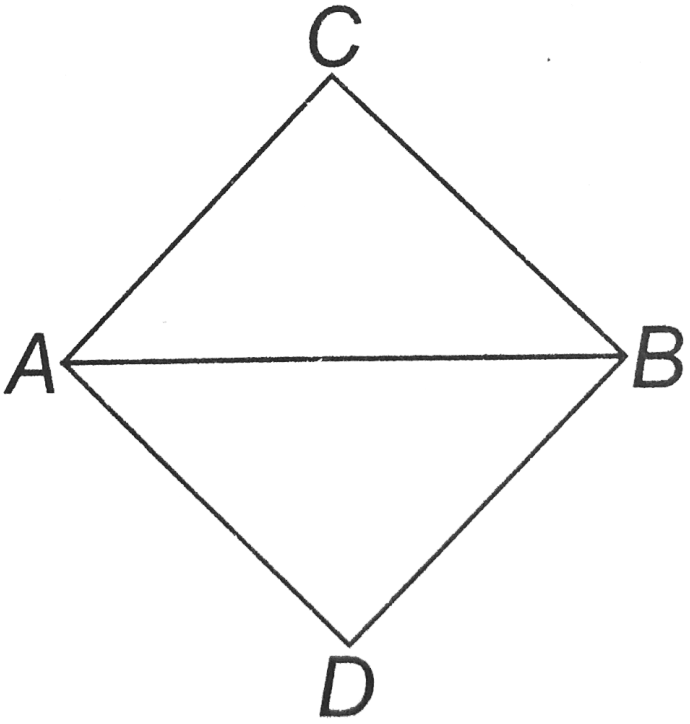
21. Two identical rectangular rods of metal are welded end to end in series between temperature $0^\circ C$ and $100^\circ C$ and $10J$ of heat is conducted (in steady state process) through the rod in $2.00\ \min$. if 5 such rods are taken and joined as shown in figure maintaining the same temperature difference between A and B, then the time in

which $20J$ heat will flow through the rods is



A. 30 sec

B. 2 min

C. 1 min

D. 20 sec

Answer: C

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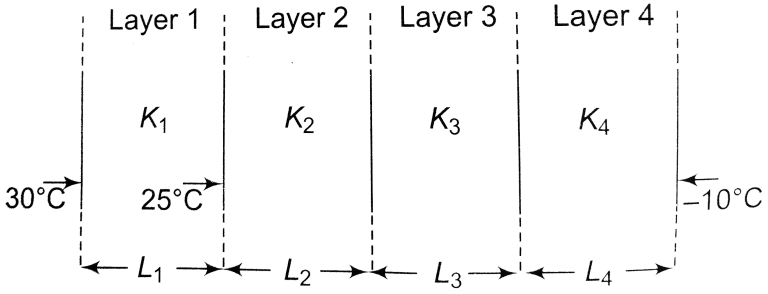
22. Figure shows in cross section a wall consisting of four layers with thermal conductivities $K_1 = 0.06W/mK, K_3 = 0.04W/mK$ and $K_4 = 0.10W/mK$. The layer thickness are $L_1 = 1.5cm, L_3 = 2.8cm$ and $L_4 = 3.5cm.$ The temperature of interfaces is as shown in figure. energy transfer through the wall is in steady state. the temperature of the interface between layer 3 and 4 is:



A. $-1^{\circ} C$

B. $-3^{\circ} C$

C. $2^{\circ} C$

D. $0^{\circ} C$

Answer: B

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23. The temperature of the interface between layer 2 and 3 is:

A. $11^{\circ} C$

B. $8^{\circ} C$

C. $7.2^{\circ} C$

D. $5.4^\circ C$

Answer: A

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24. If layer thickness L_2 is $1.4cm$, then its thermal conductivity K_2 will have value $(\text{in } W/mK)$

A. 2×10^{-2}

B. 2×10^{-3}

C. 4×10^{-2}

D. 4×10^{-3}

Answer: A

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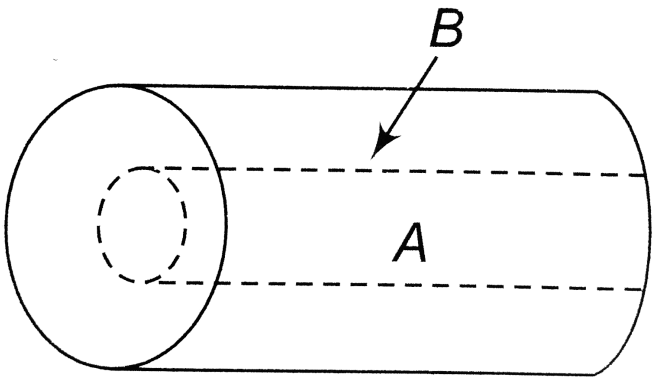
25. A cylinder A of a material of thermal conductivity K_1 is surrounded by a cylindrical shell of inner radius equal to the cylinder. The shell is made of a material of thermal conductivity K_2. The two ends of the combined system are maintained at two different temperature. if the effective thermal conductivity of the system is $\frac{4K_1 + 5K_2}{9}$, find the rate of outer radius of the shell to the radius of the cylinder.



A. 2.0

B. $5/2$

C. $5/3$

D. $3/2$

Answer: D

Watch Video Solution

26. Ice starts forming in lake with water at $0^\circ C$ and when the atmospheric temperature is $-10^\circ C$. If the time taken for $1cm$ of ice be 7 hours. Find the time taken for the thickness of ice to change from $1cm$ to $2cm$

A. $11hours$

B. $6hours$

C. $16 hours$

D. $21 hours$

Answer: D

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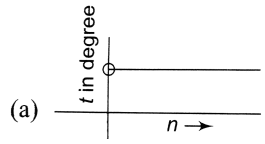
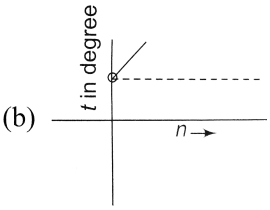
27. A slab X of thickness $'t'$, thermal conductivity $'K'$ and area of cross-section $'A'$ is placed in thermal contact with another slab Y which is $2n^2$ times thicker, $4n$ times conductive and having n times larger cross-section area. If the outside face of X is maintained at $100^\circ C$, the outside face of Y at $0^\circ C$, then the temperature of the junction is represented by the graph $(n > 0)$

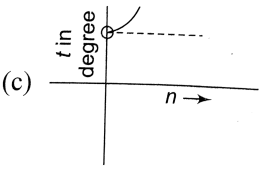
A.



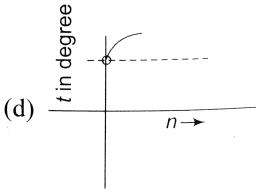
B.



C.



D.



Answer: A

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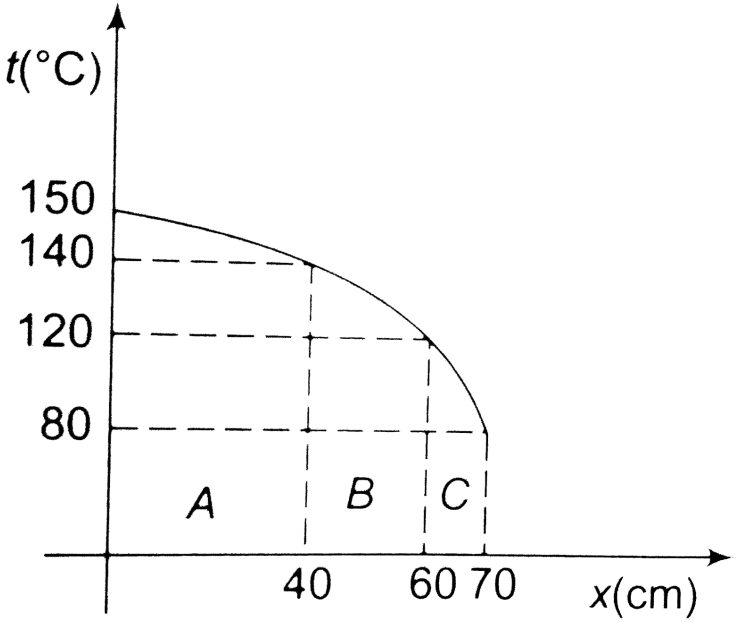
28. The graph shown gives the temperature along an X axis that extends directly through a wall consisting of three layers

A, B and C. The air temperature on one side of the wall is $150^\circ C$ and on the other side is $80^\circ C$. Thermal conduction through the wall is steady. Out of the three layers A B and C , thermal conductivity is greatest of the layer



A. A

B. B

C. C

D. Thermal conductivity of A = Thermal conductivity of B

Answer: A

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Transmission Of Heat : Radiation

1. The rectangular surface of area $8cm \times 4cm$ of a black body at temperature $127^\circ C$ emits energy E per section if length and breadth are reduced to half of the initial value and the temperature is raised to $327^\circ C$, the ratio of emission of energy becomes

A. $\frac{3}{8}E$

B. $\frac{81}{16}E$

C. $\frac{9}{16}E$

D. $\frac{81}{64}E$

Answer: D

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2. Two spheres of the same material have radii $1m$ and $4m$ and temperatures $4000K$ and $2000K$ respectively. The ratio of the energy radiated per second by the first sphere to that by the second 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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3. A black body at high temperature $T\ K$ radiates energy at the rate of EW/m^2. When the temperature falls to $(T/2)K$, the radiated energy will be

A. $E/4$

B. $E/2$

C. $2E$

D. $E/16$

Answer: D

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4. The rate of dissipation of heat by a black body at temperature T is Q. What will be the the rate of dissipation of heat by another body at temperature $2T$ and emissivity 0.25?

A. $16Q$

B. $4Q$

C. $8Q$

D. $4.5Q$

Answer: B

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5. The wavelength of maximum intensity of emission of solar radiation is $\lambda_m = 4753\text{Å}$ and from moon it is $14mm$. The surface temperature of sun and moon are: (Given $b = 2.898 \times 10^{-3}\text{metre/Kelvin}$)

A. $6097K, 207K$

B. $8097K, 307K$

C. $10000K, 400K$

D. $3000K, 100K$

Answer: B

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6. A black body is heated from $7^{\circ}C$ to $287^{\circ}C$. The ratio of radiation emitted is:

A. $1:256$

B. $1:27$

C. $1:16$

D. $1:64$

Answer: C

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7. The temperature of a body is increased by $50\,\%$. The amount of radiation emitted by it would be nearly

A. $50\ \%$

B. $225\ \%$

C. $250\ \%$

D. $400\ \%$

Answer: D

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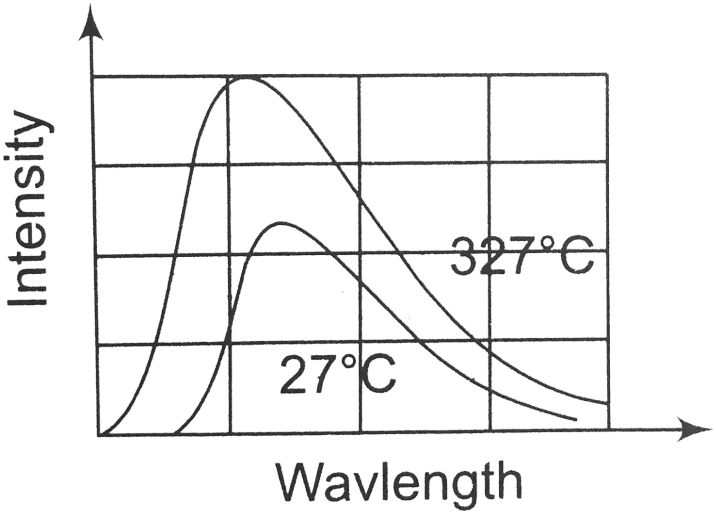
8. The spectrum of a black body at two temperatures $27^\circ C$ and $327^\circ C$ is shown in the figure. Let A_1 and A_2 be the areas

under the two curves respectively. Find the value of $\frac{A_2}{A_1}$



A. $16:1$

B. $8:1$

C. $9:4$

D. $16:9$

Answer: A

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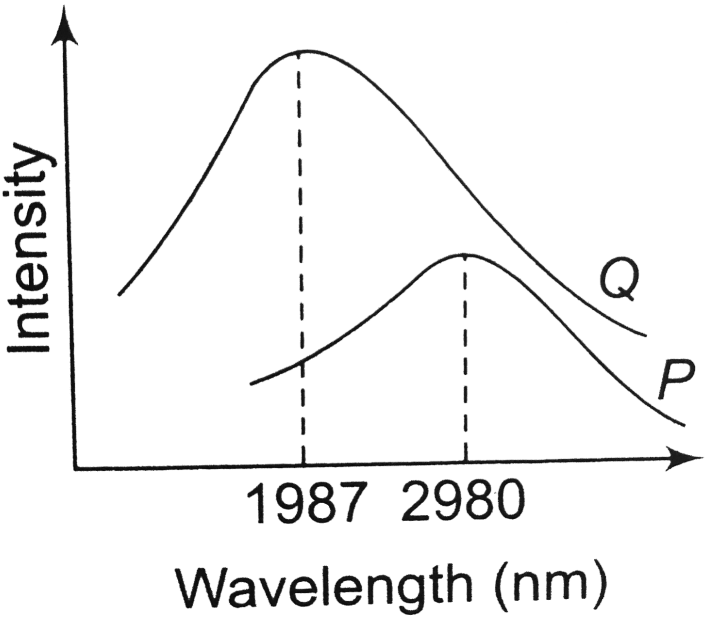
9. The emission spectrum of a black body at two different temperatures are shown by curves P and Q (as shown in figure). The ratio of the areas under the two curves P and Q will be



A. $1:16$

B. $4:9$

C. $81:256$

D. $16:81$

Answer: D

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10. By virtue of some internal mechanism, temperature of spherical shell is maintained in steady state which emits radiation like black body while kept in vaccum and isolated from all radiation. If this shell is enveloped by another shell B of same radius, still emitted like a black body, find the ratio of temperatures of shell B and shell A when it was alone:

A. $(2)^{1/4}$

B. $(3)^{1/4}$

C. $(4)^{1/4}$

D. None of these

Answer: A

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11. A calorimeter of mass $0.2kg$ and specific heat $900J/kg-K$. Containing $0.5kg$ of a liquid of specific heat $2400J/kg-K$. Its temperature falls from $60^\circ C$ to $55^\circ C$ in one minute. Find the rate of cooling.

A. $5J/s$

B. $15J/s$

C. $100J/s$

D. $115 J / s$

Answer: D

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12. It takes 10 min to cool a liquid from $61^\circ C$ to $59^\circ C$. If room temperature is $30^\circ C$ then find the time taken in cooling from $51^\circ C$ to $49^\circ C$.

A. 15 min

B. 12 min

C. 18 min

D. 20 min

Answer: A

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13. The initial temperature of a body is $80^\circ C$. If its temperature falls to $64^\circ C$ in 5 minute and in 10 minute to 52°. Find the temperature of surrounding.

A. $26^\circ C$

B. $60^\circ C$

C. $36^\circ C$

D. $49^\circ C$

Answer: D

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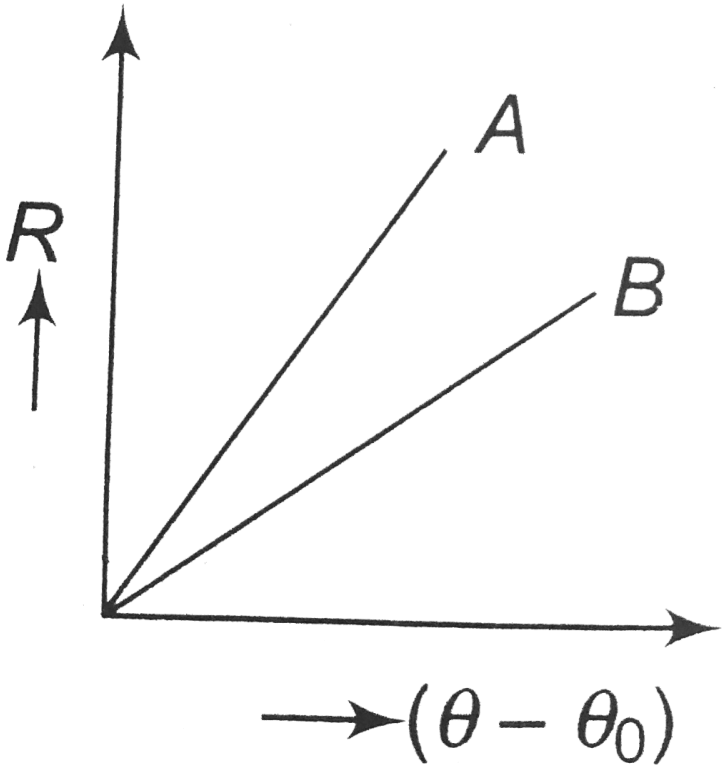
14. Two circular disc A and B with equal radii are blackened. They are heated to same temperature and are cooled under identical conditions. What inference do your draw from their cooling curves?



A. A and B specific heat

B. Specific heat of A is less

C. Specific heat of B is less

D. Nothing can be said

Answer: B

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15. A blackbody is at a temperature of 2880K. The energy of radiation emitted by this object with wavelength between 499nm and 500nm is U_1, between 999nm and 1000nm is U_2 and between 1499 nm and 1500 nm is U_3. The Wien constant $b = 2.88 \times 10^6 nmK$. Then

A. $U_1 = 0$

B. $U_2 = 0$

C. $U_1 = U_2$

D. $U_2 > U_1$

Answer: D

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16. The radiation emitted by a star A is 1000 times that of the sun. If the surface temperature of the sun and star A are $6000K$ and $2000K$ respectively. The ratio of the radii of the star A and the sun is:

A. $300:1$

B. $600:1$

C. $900:1$

D. $1200:1$

Answer: C

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17. A planet radiates heat at a rate proportional to the fourth power of its surface temperature T. If such a steady temperature of the planet is due to an exactly equal amount of heat received from the sun then which of the following statement is true?

A. The planet's surface temperature varies inversely as the distance of the sun

B. The planet's surface temperature varies directly as the square of its distance of the sun

C. The planets's surface temperature varies inversely as the square root of its distance from the sun.

D. The planet's surface temperature is proportional to the fourth power is distance from the sun.

Answer: C

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18. When the temperature of a black body increases, it is observed that the wavelength corresponding to maximum energy changes from $0.26\mu m$. The ratio of the emissive powers of the body at the respective temperature is:

A. $\frac{16}{1}$

B. $\frac{4}{1}$

C. $\frac{1}{4}$

D. $\frac{1}{16}$

Answer: D

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19. The maximum energy is the thermal radiation from a hot source occurs at a wavelength of $11 \times 10^{-5} cm$. According to Wien's law, the temperature of this source (on Kelvin scale) will be n times the temperature of another source (on Kelvin scale) for which the wavelength at maximum energy is 5.5×10^{-5} cm. The value of n is:

A. 2

B. 4

C. $1/2$

D. 1

Answer: C

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20. A body cools from $50^\circ C$ to $49^\circ C$ in 5 s. How long will it take to cool from $40^\circ C$ to $39.5^\circ C$? Assume the temperature of surroundings to be $30^\circ C$ and Newton's law of cooling to be valid:

A. $2.5s$

B. $10s$

C. $20s$

D. $5s$

Answer: D

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21. 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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22. A rectangular body has maximum wavelength λ_m at $2000K$. Its corresponding wavelength at $3000K$ 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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23. A black body radiated maximum energy around a particular wavelength at a given temperature. If the temperature of the black body is now changed so that it radiates maximum energy around a wavelength n time the original wavelength $(n < 1)$ then power radiate by it will increases by a factor of:

A. $\frac{1}{n^2}$

B. n^2

C. $\frac{1}{n^4}$

D. n^4

Answer: C

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24. A sphere of $3cm$ radius acts like a black body. If it is in equilibrium with its surrounding and absorb $30K$ watt of energy radiated to it from the surrounding. Then the temperature of the sphere will be:

A. 816

B. 916

C. 1616

D. 2616

Answer: D

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25. The thermal emissivitites of two bodies A and B are in the ratio of $1/e$. The outer surface area of the bodies are

same and they radiate the energy at the same rate. Find the ratio of the wavelength corresponding to the maximum spherical radiance in the radiation from A to maximum spectral radiance in the radiation from B.

A. $e^{1/4}$

B. $\frac{1}{e^{1/4}}$

C. $(1+e)^{1/4}$

D. $\frac{1}{(1+e)^{1/4}}$

Answer: B

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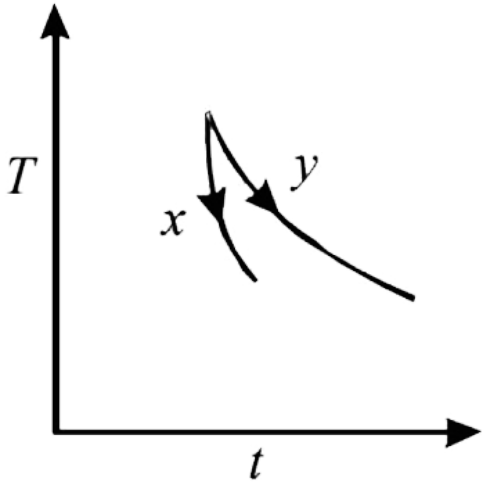
26. The graph, shown in the adjacent diagram, represents the variation of temperature (T) of two bodies, x and y having

same surface area, with time (t) due to the emission of radiation. Find the correct relation between the emissivity and absorptivity power of the two bodies



A. $e_x > e_y$ and $a_x < a_y$

B. $e_x < e_y$ and $a_x > a_y$

C. $e_x > e_y$ and $a_x > a_y$

D. $e_x < e_y$ and $a_x < a_y$

Answer: C

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27. Three discs, A, B and C having radii 2m, 4m and6m respectively are coated with carbon black on their outer surfaces. The wavelengths corresponding to maximum intensity are $300nm, 400nm$ and $500nm$, respectively. The power radiated by them are Q_A, Q_B and Q_C respectively

(a) Q_A is maximum (b) Q_B is maximum (c) Q_C is maximum (d) $Q_A = Q_B = Q_C$

A. Q_a is maximum

B. Q_b is maximum

C. Q_c is maximum

D. $Q_a = Q_b = Q_c$

Answer: B

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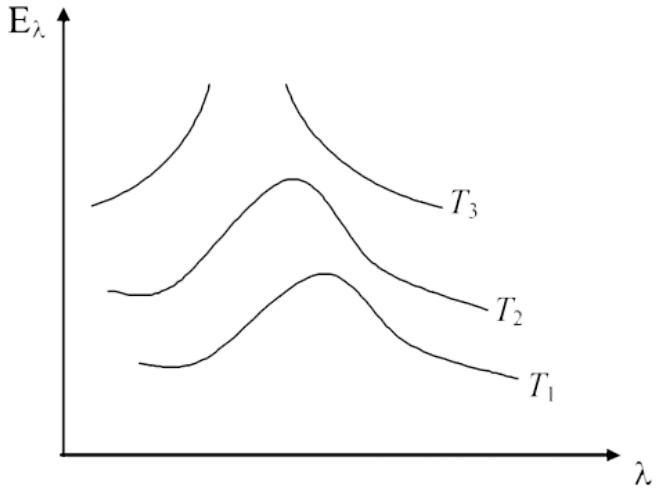
28. Variation of radiant energy emitted by sun, filament of tungsten lamp and welding arc as a function of its wavelength is shown in figure. Which of the following option is the correct match?



A. Sun - T_1, tungsten filament - T_2, welding arc - T_3

B. Sun - T_2, tungsten filament - T_1, welding arc - T_3

C. Sun - T_3, tungsten filament - T_2, welding arc - T_1

D. Sun - T_1, tungsten filament - T_1, welding arc - T_2

Answer: C

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Problems Baesd On Mixed Concepts

1. Two wires A and B of the same cross sectional areas. Young's moduli Y_1 and Y_2 and coefficients of linear expansion α_1 and α_2 respectively are joined together and fixed between rigid supports at either ends. The tension in the compound wire when wire A is heated and wire B is cooled at different temperature is same when wire A alone is cooled at the

same temperature as wire B earlier.

Find correct oprtion.

A. $\frac{\alpha_1}{\alpha_2} > \frac{Y_2}{2Y_1}$

B. $\frac{\alpha_1}{\alpha_2} < \frac{Y_2}{2Y_1}$

C. $\frac{\alpha_1}{\alpha_2} > \frac{2Y_2}{Y_1}$

D. $\frac{\alpha_1}{\alpha_2} > \frac{Y_2}{Y_1}$

Answer: B

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2. A piece of metal weighs 46 g in air and 30 g in lipuid of density $1.24 \times 10^3 kgm^{-3}$ kept at 27^0C. When the temperature of the liquid is raised to 42^0C the metal piece weights 30.5 g . The density of the liqued at 42^0C is

$1.20 \times 10^3 kgm^{-3}$. Calculate the coefficient of linear expandsion of the metal.

A. $\frac{1}{36200}/^\circ C$

B. $\frac{1}{43200}/^\circ C$

C. $\frac{1}{54100}/^\circ C$

D. $\frac{1}{23200}/^\circ C$

Answer: B

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3. A small ball of mass m is dropped from an aeroplane moving at $50m$ height above the ground with a speed of $25\sqrt{2}\text{metre}/\sec$ if half of the mechanical energy of ball with respect to ground is lost as a thermal energy due to air

friction. The change in the temperature of the ball as it lands on the ground is. specific heat capacity of ball is $56.25J/kg.$ $(g = 10m/\sec^2)$

A. $5^\circ C$

B. $10^\circ C$

C. $20^\circ C$

D. $500/56.25^\circ C$

Answer: B

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4. A current of 2.50 A passing through a heating coil immersed in $180g$ of paraffin (specific heat capacity $2.00Jg^{-1}K^{-1}$) contained in a $100g$ calorimeter (specific heat

capacity $0.400 Jg^{-1}K^{-1}$) raise the temperature from $5^{\circ}C$ below room temperature to $5^{\circ}C$ above room temperature in $100s$. the reading of the voltmeter connected across the heating coil is

A. $8.0V$

B. $16.0V$

C. $24.0V$

D. $32.0V$

Answer: B

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5. A simple seconds pendulum is constructed out of a very thin string of thermal coefficient of linear expansion

$\alpha = 20 \times 10^{-4} / ^{\circ} C$ and a heavy particle attached to one end. The free end of the string is suspended from the ceiling of an elevator at rest. the pendulum keeps correct time at $0^{\circ} C$. when the temperature rises to $50^{\circ} C$, the elevator operator of mass $60kg$ being a student of Physics accelerates the elevator vertically, to have the pendulum correct time. the apparent weight of the operator when the pendulum keeps correct time at $50^{\circ} C$ is $\left(\text{Take } \ g = 10m / s^2\right)$

A. $660N$

B. $440N$

C. $520N$

D. $340N$

Answer: A

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6. An insulated chamber at a height h above the earth's surface and maintained at $30^\circ C$ has a clock fitted with an uncompensated pendulum. The maker of the clock for the chamber mistakenly design it to maintain correct time at $20^\circ C$ at that height. it is found that if the chamber were brought to earth's surface the clock in it would click correct time at $30^\circ C$. the coefficient of linear expansion of the material of pendulum is (earth's radius is R)

A. $\frac{h}{19R}$

B. $\frac{5R}{h}$

C. $\frac{h}{5R}$

D. $\frac{h}{20R}$

Answer: C

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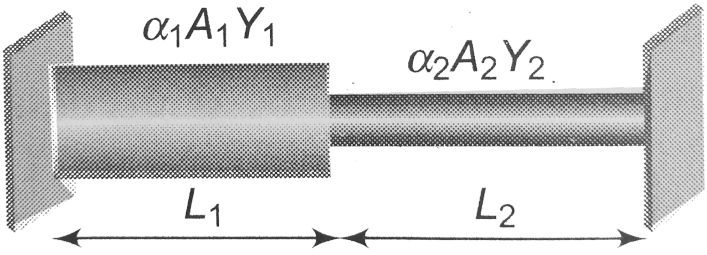
7. Two rods are joined between fixed supports as shown in the figure. Condition for no change in the length of individual rods with the increase of temperature will be

$(\alpha_1, \alpha_2 =$ linear expansion coefficient

$A_1, A_2 =$ Area of rods

$Y_1, Y_2 =$ Young modulus $)$



A. $\frac{A_1}{A_2} = \frac{\alpha_1 Y_1}{\alpha_2 Y_2}$

B. $\frac{A_1}{A_2} = \frac{L_1\alpha_1 Y_1}{L_2\alpha_2 Y_2}$

C. $\frac{A_1}{A_2} = \frac{L_2\alpha_2 Y_2}{L_1\alpha_1 Y_1}$

D. $\frac{A_1}{A_2} = \frac{\alpha_2 Y_2}{\alpha_1 Y_1}$

Answer: D

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8. If accidently the calorimeter remained open to atmosphere for some time during the experiment, due to which the steady state temperature comes out to be $30^\circ C$, then total heat loss to surrounding during the experiment, is (Use the specific heat capacity of the liquid from previous questions).

A. $20kcal$

B. $15kcal$

C. $10kcal$

D. $8kcal$

Answer: B

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9. Four spheres A, B, C and D have their radii in arithmetic progression and the specific heat capacities of their substances are geometric progression. If the ratios of heat capacities of D and B to that of C and A are as $8:27$. The ratio of masses of B and A is: (assume same density for all spheres)

A. $8:1$

B. $4:1$

C. $1:8$

D. $1:4$

Answer: A

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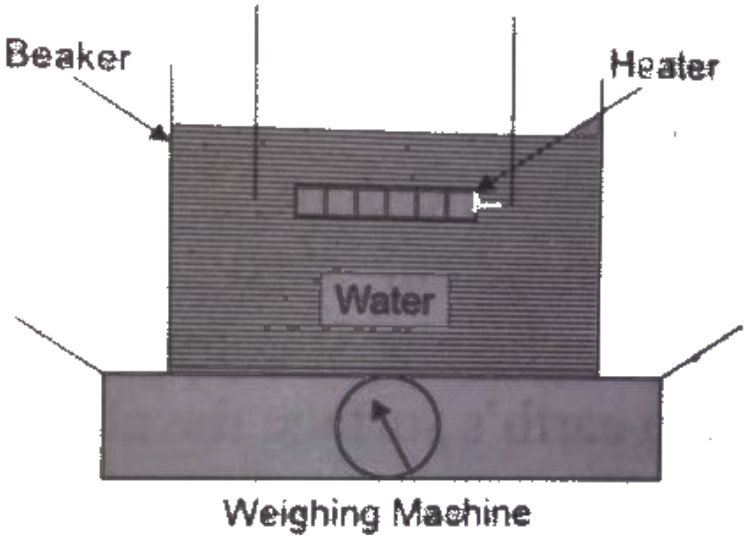
10. As part of an experiment to determine the latent heat of vaporisation of water, a student boils some water in a beaker using an electric heater as shown below. The student notes two sources of error.



Error-1: thermal energy is lost from the sides of the beaker

Error -2: As the water is boling water splashes out of the beaker

Which of the following gives the correct effect of these two errors on the calculated value for the specific lalent heat?

A. Error-1 = increases , Error-2 = Decrease

B. Error-1 = increases , Error-2 = increase

C. Error-1 = Decreases , Error-2 = increase

D. Error-1 = Decreases , Error-2 = Decrease

Answer: A

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11. Two identical conducting rods are first connected independently to two vessels, one containing water at $100^\circ C$ and the other containing ice at $0^\circ C$. In the second case, the rods are joined end to end and connected to the same vessels. Let q_1 and q_2 gram per second be the rate of melting of ice in the two cases respectively. The ratio $\frac{q_1}{q_2}$ is

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

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

C. $\frac{4}{1}$

D. $\frac{1}{4}$

Answer: C

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12. The opposite faces of a cubical block of iron of cross-section 4 square cm are kept in contact with steam and melting ice. Calculate the quantity of ice melted at the end of 10 minutes. k for iron $= 0.2CGS$ units.

A. $300g$

B. $150g$

C. $75g$

D. $450g$

Answer: A

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13. A solid cube and a solid sphere of the same material have equal surface area. Both are at the same temperature $120^\circ C$, then

A. Both the cube and the sphere cool down at the same rate

B. The cube cools down faster than the sphere

C. The sphere cools down faster than the cube

D. Whichever is having mor mass will cool down faster

Answer: B

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14. A system S receives heat continuously from an electric heater of power $10W$. The temperature of S becomes constant at $50^\circ C$ when the surrounding temperature is $20^\circ C$. After the heater is switched off, S cools from $35.1^\circ C$ to $34.9^\circ C$ in $1\ \min\ ute$. the heat capacity of S is

A. $100J/^\circ C$

B. $300J/^\circ C$

C. $750J/^\circ C$

D. $1500J/^\circ C$

Answer: D

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15. Equal volumes of water and alcohol when put in similar calorimeters take $100\,\sec$ and $74\,\sec$ respecively to cool from $50^\circ C$ to $40^\circ C$. The thermal capacity of each calorimeter in numerically equal to the volume of either liquid. The specific gravity of alcohol is 0.8 if the specific heat capacity of water is $1 cal/gm$, the specific heat capcity of alcohol will

A. $0.6 cal/gm -^\circ C$

B. $0.8 cal/gm -^\circ C$

C. $1.6 cal/gm -^\circ C$

D. $1.8 cal/gm -^\circ C$

Answer: A

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16. A sphere and a cube of same material and same total surface area are placed in the same evaculated space turn by turn after they are heated to the same temperature. Find the ratio of their initial rates of cooling in the enclosure.

A. $\sqrt{\frac{\pi}{6}}:1$

B. $\sqrt{\frac{\pi}{3}}:1$

C. $\frac{\pi}{\sqrt{6}}:1$

D. $\frac{\pi}{\sqrt{3}}:1$

Answer: A

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17. The surface temperature of the sun is T_0 and it is at average distance d from a planet. The radius of the sun is R. The temperature at which planet radiates the energy is

A. $T_0\sqrt{\frac{R}{2d}}$

B. $T_0\sqrt{\frac{2R}{d}}$

C. $T_0\sqrt{\frac{R}{d}}$

D. $T_0\left(\frac{R}{d}\right)^{1/4}$

Answer: A

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18. A sysem is supplied power of $10W$. Temperature of the system becomes constant at $50^\circ C$. With temperature of

surrounding at $20^{\circ}C$. When power is switched off system cools from $t^{\circ}C$ to $(t/m)^{\circ}C$ in one minute. The heat capacity of the system is $1200J/^{\circ}C$. find the limiting value of n.

A. $n \geq 75$

B. $n \geq 55$

C. $n \geq 60$

D. $n \geq 100$

Answer: C

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Assertion Reasoning

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

B. If the 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.

Answer: C

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2. 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 the 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.

Answer: D

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3. 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 the 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.

Answer: C

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4. 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 the 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.

Answer: A

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5. 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 the 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.

Answer: D

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6. 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 the 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.

Answer: C

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7. Assertion : Coefficient of absorption of radiation of an ideal black body is 1.

Reason : An ideal black body emits radiation of all wavelengths.

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

B. If the 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.

Answer: B

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8. Assertion : The coefficient of real expansion of the liquid is independent of nature of container.

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

B. If the 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.

Answer: A

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9. Assertion : If one gram of ice is mixed with $1g$ of water at $80^\circ C$, then the final temperature of mixture is zero.

Reason : Latent heat of ice $80^\circ cal/g$

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

B. If the 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.

Answer: B

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10. Assertion : Water expands both when heated or cooled from $4^{\circ}C$

Reason : Density of water is minimum at $4^{\circ}C$.

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

B. If the 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.

Answer: C

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11. Assertion : While measuring the thermal conductivity of liquid experimentally, the upper layer is kept hot and the lower layer kept cold.

Reason : This avoids heating of liquid by convection.

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

B. If the 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.

Answer: A

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12. Assertion : If thermal conductivity of a rod is 5, then its thermal resistively is 0.2

Reason : Thermal conductivity $= \frac{1}{\text{thermal resistivity}}$

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

B. If the 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.

Answer: A

Watch Video Solution

13. Assertion : Water can be made to boil without heating.

Reason : Boiling point is lowered by increasing pressure.

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

B. If the 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.

Answer: C

 Watch Video Solution

14. Assertion : A solid sphere of copper of radius R and a hollow sphere of the same material of inner radius r and outer radius R are heated to the same temperature and allowed to cool in the same environment. The hollow sphere cools faster.

Reason : Rate of cooling is according to Stefan's law which is $E\alpha T^4$

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

B. If the 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.

Answer: C

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15. Assertion : A solid and hollow sphere of same diameter and same material when heated through the same temperature will expand by the same amount.

Reason : The change in volume us independent of the original mass but depends on original volume.

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

B. If the 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.

Answer: A

Watch Video Solution

16. Assertion : If the temperature of a star is doubled then the rate loss of heat from it becomes 16 times.

Reason : Specific heat varies with temperature.

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

B. If the 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.

Answer: C

Watch Video Solution

17. Assertion : A hollow metallic closed container maintained at a uniform temperature cab act as a source of black body radiation.

Reason : All metals act as a black body.

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

B. If the 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.

Answer: C

Watch Video Solution

18. Assertion : A body that is a good radiator is also a good absorber of radiation at a given wavelength.

Reason : According to Kirchhoff's law the absorptivity of a body is equal to its emissivity at a given wavelength

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

B. If the 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.

Answer: A

 Watch Video Solution

19. Assertion : Temperature near the sea-coast are moderate.

Reason : Water has a high thermal conductivity.

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

B. If the 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.

Answer: B

 Watch Video Solution

20. Assertion : It is hotter over the top of a fire than at the same distacne of the side.

Reason : Air surrounding the fire conducts more heat upward

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

B. If the 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.

Answer: A

21. Assertion : Woollen clothes keep the body warm in winter

Reason : Air is a bad conductor of heat.

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

B. If the 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.

Answer: A

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NEET Questions

1. A cylindrical rod having temperature T_1 and T_2 at its ends. The rate of flow of heat is $Q_1 cal/\sec$. If all the linear dimensions are doubled keeping temperature constant, then rate of flow of heat Q_2 will be

A. $4Q_1$

B. $2Q_1$

C. $\frac{Q_1}{4}$

D. $\frac{Q_1}{2}$

Answer: B

Watch Video Solution

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

A. $20^\circ C$

B. $40^\circ C$

C. $80^\circ C$

D. $100^\circ C$

Answer: B

Watch Video Solution

3. The energy supply being cut-off, an electric heater element cools down to the temperature of its surrounding, but it will not cool further because

A. supply is cut off

B. it is made of metal

C. surroundings are radiating

D. element and surroundings have the same temperature.

Answer: D

Watch Video Solution

4. A rectangular body has maximum wavelength λ_m at $2000K$. Its corresponding wavelength at $3000K$ will be

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

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

C. $\frac{4}{9}\lambda_m$

D. $\frac{9}{4}\lambda_m$

Answer: B

Watch Video Solution

5. The temperature of the body is increased from $-73^\circ C$ to $357^\circ C$, the ratio of energy emitted per second is

A. $1:3$

B. $1:81$

C. $1:27$

D. $1:9$

Answer: B

Watch Video Solution

6. Triple point of water is

A. $273.16^\circ F$

B. $273.16K$

C. $273.16^{\circ}C$

D. $273.16R$

Answer: B

Watch Video Solution

7. Which of the following is the example of ideal black body?

A. Kajal

B. Black board

C. A pin hole in a box

D. None of these

Answer: C

Watch Video Solution

8. Two identical metal balls at temperature $200^\circ C$ and $400^\circ C$ kept in air at $27^\circ C$. The ratio of net heat loss by these bodies is

A. $1/4$

B. $1/2$

C. $1/16$

D. $\frac{473^4 - 300^4}{673^4 - 300^4}$

Answer: D

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9. A black body at a temperature of $227^\circ C$ radiates heat at a rate of $20calm^{-2}s^{-1}$. When its temperature is raised to $727^\circ C$ the radiated by it in cal $m^{-2}s^{-1}$ will be closet to

A. $120W$

B. $240W$

C. $320W$

D. $360W$

Answer: C

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10. Newton's law of cooling is used in laboratory for the determination of the

A. specific heat of the gases

B. the latent heat of gases

C. specific heat of liquids

D. latent heat of liquids

Answer: C

Watch Video Solution

11. 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. $\sqrt{2K}$

B. $3K$

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

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

Answer: C

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12. Heat travels through vaccum by

A. Conduction

B. Convection

C. Radiation

D. Both (a) and (b)

Answer: C

Watch Video Solution

13. We consider the radition emitted by the human body which of the following statements is true?

A. The radiation is emiited only during the day

B. The radiation is emitted during the summers and absorbed during the winters

C. The radiation emitted lies in the ultraviolet region and hence is not visible

D. The radiation emitted is in the infrared region

Answer: D

Watch Video Solution

14. Mercury boils at $367^\circ C$. However, mercury thermometers are made such that they can measure temperature up to $500^\circ C$. This is done by

A. maintaining vacuum above mercury column in the stem of the thermometer

B. filling nitrogen gas at high pressure above the mercury column

C. filling nitrogen gas at low pressure above the mercury level

D. filling oxygen gas at high pressure above the mercury column

Answer: B

15. A steel scale measures the length of a copper wire as $80.0cm$ when both area at $20^\circ C$ (the calibration temperature for scale). What would be the scale read for the length of the wire when both are at $40^\circ C$? (Given $\alpha_{\text{steel}} = 11 \times 10^{-6} per^\circ C$ and $\alpha_{\text{copper}} = 17 \times 10^{-6} per^\circ C$)

A. $80.0096cm$

B. $80.0272cm$

C. $1cm$

D. $25.2cm$

Answer: A

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16. If the temperature of the sun (black body) is doubled, the rate of energy received on earth will be increase by a factor of

A. 2

B. 4

C. 8

D. 16

Answer: D

Watch Video Solution

17. If λ_m denotes the wavelength at which the radiative emission from a black body at a temperature TK is maximum, then

A. $\lambda_m \propto T^4$

B. λ_m is independent of T

C. $\lambda_m \propto T$

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

Answer: D

Watch Video Solution

18. Which of the following circular rods (given radius r and length l) each made of the same material and whose ends are maintained at the same temperature will conduct most heat?

A. $r = 2r_0, l = 2l_0$

B. $r = 2r_0, l = l_0$

C. $r = r_0, l = l_0$

D. $r = r_0, l = 2l_0$

Answer: B

Watch Video Solution

19. The temperature of inversion of a thermocouple is $620^\circ C$ and the neutral temperature is $300^\circ C$. What is the temperature of cold junction?

A. $20^\circ C$

B. $320^\circ C$

C. $-20^\circ C$

D. $40^\circ C$

Answer: C

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20. A black body at $1227^\circ C$ emits radiations with maximum intensity at a wavelength of 5000Å. If the temperature of the

body is increased by 1000°, the maximum intensity will be observed at

A. 4000Å

B. 5000Å

C. 6000Å

D. 3000Å

Answer: D

Watch Video Solution

21. A black body is at $727^{\circ} C$. It emits energy at a rate which is proportional to

A. $(727)^2$

B. $(1000)^4$

C. $(1000)^2$

D. $(727)^4$

Answer: B

Watch Video Solution

22. If the cold junction of thermocouple is kept at $0^\circ C$ and the hot junction is kept at $T^\circ C$, then the relation between neutral temperature (T_n) and temperature of inversion (T_i) is

A. $T_n = \frac{T_i}{2}$

B. $T_n = 2T_i$

C. $T_n = T_i - T$

D. $T_n = T_i + T$

Answer: A

Watch Video Solution

23. Assuming the sun to have a spherical outer surface of radius r radiating like a black body at temperature $t^\circ C$. The power received by a unit surface (normal to the incident rays) at a distance R from the centre of the sun is

where σ is the Stefan's constant.

A. $\frac{4\pi r^2 \sigma t^4}{R^2}$

B. $\frac{r^2 \sigma (t+273)^4}{4\pi R^2}$

C. $\frac{16\pi^2 r^2 \sigma t^4}{R^2}$

D. $\frac{r^2 \sigma (t+273)^4}{R^2}$

Answer: D

Watch Video Solution

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

A. $78^\circ W$

B. $117^\circ W$

C. $200^\circ W$

D. $139^\circ W$

Answer: B

Watch Video Solution

25. An electric kettle takes $4A$ current at $220V$. How much time will it take to boil $1kg$ of wate from temperature $20^\circ C$? The temperature of boiling water is $100^\circ C$

A. $6.3\ \min$

B. $8.4\ \min$

C. $12.6\ \min$

D. $4.2\ \min$

Answer: A

Watch Video Solution

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

A. $\frac{dQ}{dt} = \frac{KL(T_1 - T_2)}{A}$

B. $\frac{dQ}{dt} = \frac{KL(T_1 - T_2)}{LA}$

C. $\frac{dQ}{dt} = KLA(T_1 - T_2)$

D. $\frac{dQ}{dt} = \frac{KA(T_1 - T_2)}{L}$

Answer: D

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27. A black body at $227^\circ C$ radiates heat at the rate of cal $cm^{-2}s^{-1}$. At a temperature of $727^\circ C$, the rate of heat radiated in the same unit will be

A. 60

B. 50

C. 112

D. 80

Answer: C

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28. A cylindrical metallic rod in thermal contact with two reservation of heat at its two ends conducts an amount of heat Q in time t. The metallic rod is melted and the material is formed into a rod of half the radius of the original rod. What is the amount of heat conducted by the new rod when placed in thermal contact with the two reservation in time t?

A. $Q/4$

B. $Q/16$

C. $2Q$

D. $Q/2$

Answer: B

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29. The total radiant energy per unit area, normal to the direction of incidence, received at a distance R from the centre of a star of radius r whose outer surface radiates as a black body at a temperature TK is given by

(where σ is Stefan's constant)

A. $\sigma r^2 T^4 / R^2$

B. $\sigma r^2 T^4 / 4\pi r^2$

C. $\sigma r^4 T^4 / r^4$

D. $4\pi\sigma r^2 T^4 / R^2$

Answer: A

Watch Video Solution

30. If the radius of a star is R and it acts as a black body, what would b the temperature of the star, in which the rate of energy production is Q?

A. $\left(\frac{Q}{4\pi R^2\sigma}\right)^{1/4}$

B. $\frac{Q}{4\pi R^2\sigma}$

C. $\left(\frac{Q}{4\pi R^2\sigma}\right)$

D. $\left(4\pi R^2 Q/\sigma\right)^{1/4}$

Answer: A

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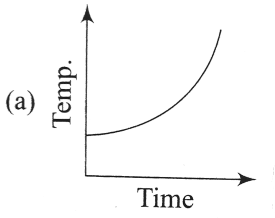
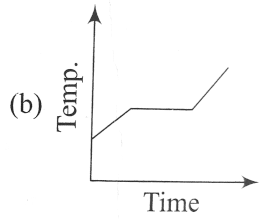
31. Liquid oxygen at $50K$ is heated to $300K$ at constant pressure of $1atm$. The rate of heating is constant. Which of

the following graphs represents the variation of temperature with time?

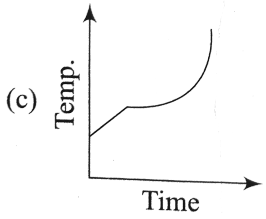
A.



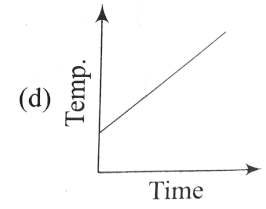
B.



C.



D.



Answer: B

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32. A slab of stone of area of $0.36m^2$ and thickness $0.1m$ is exposed on the lower surface to steam at $100^\circ C$. A block of ice at $0^\circ C$ rests on the upper surface of the slab. In one hour $4.8kg$ of ice is melted. The thermal conductivity of slab is (Given latent heat of fusion of ice $= 3.63 \times 10^5 Jkg^{-1}$)

A. $1.24J/m/s/^\circ C$

B. $1.29J/m/s/^\circ C$

C. $2.05J/m/s/^\circ C$

D. $1.02J/m/s/^\circ C$

Answer: A

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33. A piece of iron is heated in a flame. It first becomes dull red then becomes reddish yellow and finally turns to white hot. The correct explanation for the above observation is possible by using.

A. Stephen's law

B. Wien's displacement law

C. Kirchoff's law

D. Newton's law of cooling

Answer: B

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34. The molar specific heats of an ideal gas at constant pressure and volume are denotes by C_P and C_v respectively. If $\gamma = \frac{C_P}{C_v}$ and R is the universal gas constant, then C_v is equal to

A. $\frac{1+\gamma}{1-\gamma}$

B. $\frac{R}{(\gamma-1)}$

C. $\frac{(\gamma-1)}{R}$

D. γR

Answer: B

Watch Video Solution

35. Steam at $100^\circ C$ is passed into $20g$ of water at $10^\circ C$ when water acquire a temperature of $80^\circ C$, the mass of water present will be

[Take specific heat of water $= 1calg^{-1}.^\circ C^{-1}$ and latent heat of steam $= 540calg^{-1}$]

A. $24g$

B. $31.5g$

C. $42.5g$

D. $22.5g$

Answer: D

Watch Video Solution

36. Certain quantity of water cools from $70^\circ C$ to $60^\circ C$ in the first 5 minutes and to $54^\circ C$ in the next 5 minutes. The temperature of the surrounding is

A. $45^\circ C$

B. $20^\circ C$

C. $42^\circ C$

D. $10^\circ C$

Answer: A

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37. On observing light from three different stars P, Q and R, it was found that intensity of violet colour is maximum in the

spectrum of P, the intensity of green colour is maximum in the spectrum of R and the intensity of red colour is maximum in the spectrum of Q. if T_P, T_Q and T_R are respective absolute temperature of P, Q and R. then it can be concluded from the above observation that

A. $T_P > T_Q > T_R$

B. $T_P > T_R > T_Q$

C. $T_P < T_R < T_Q$

D. $T_P < T_Q < T_R$

Answer: B

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38. The two ends of a metal rod are maintained at temperature $100^\circ C$ and $110^\circ C$. The rate of heat flow in the rod is found to be $4.0 J/s$. If the ends are maintained at temperature s $200^\circ C$ and $210^\circ C$. The rate of heat flow will be

A. $44.0 J/s$

B. $16.8 J/s$

C. $8.0 J/s$

D. $4.0 J/s$

Answer: D

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39. The value of coefficient of volume expansion of glycerin is $5 \times 10^{-4} K^{-1}$. The fractional change in the density of glycerin for a rise of $40^{\circ} C$ in its temperature is

A. 0.010

B. 0.015

C. 0.020

D. 0.025

Answer: C

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40. A black body is at a temperature of $5760 K$. The energy of radiation emitted by the body at wavelength $250 nm$ is U_1 at

wavelength $500nm$ is U_2 and that at $1000nm$ is U_3. Wien's consant, $b = 2.88 \times 10^6 nmK$. Which of the following is correct?

A. $U_1 = 0$

B. $U_3 = 0$

C. $U_1 > U_2$

D. $U_2 > U_1$

Answer: D

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41. Coefficient of linear expansion of brass and steel rods are α_1 and α_2. Length of brass and steel rods are l_1 and l_2 respectively. If $(l_2 - l_1)$ is maintained same at all

temperature, which one of the following relations holds good?

A. $\alpha_1 l_2 = \alpha_2 l_1$

B. $\alpha_1 l_2^2 = \alpha_2 l_1^2$

C. $\alpha_1^2 l_2 = \alpha_2 l_1$

D. $\alpha_1 l_1 = \alpha_2 l_2$

Answer: D

Watch Video Solution

42. A piece of ice falls from a height h so that it melts completely. Only one-quarter of the heat produced is absobed by the ice and all energy of ice gets converted into

heat during its fall. The value of h is

[Latent heat of ice is $3.4 \times 10^5 J/kg$ and $g = 10N/kg$]

A. $34km$

B. $544km$

C. $136km$

D. $68km$

Answer: C

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43. Two identical bodies are made of a material for which the heat capacity increases with temperature. One of these is at $100^\circ C$. While the other one is at $0^\circ C$. If the two bodies are

brought into contact, then assuming no heat loss, the final common temperature is

A. less than $50^\circ C$ but greater than $0^\circ C$

B. $0^\circ C$

C. $50^\circ C$

D. more than $50^\circ C$

Answer: D

Watch Video Solution

44. A body cools from a temperature $3T$ to $2T$ in 10 minutes. The room temperature is T. Assume that Newton's law of cooling is applicable. The temperature of the body at the end of next 10 minutes will be

A. $\frac{4}{3}T$

B. T

C. $\frac{7}{4}T$

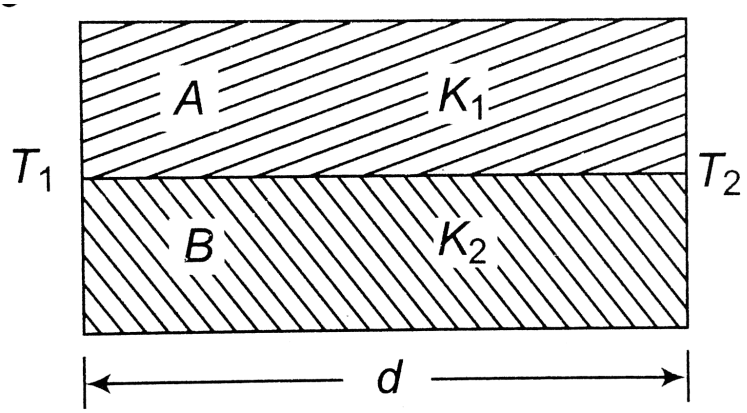
D. $\frac{3}{2}T$

Answer: D

Watch Video Solution

45. Two rods A and B of different materials are welded together as shown in figure. Their thermal conductivities are K_1 and K_2. The thermal conductivity of the composite rod

will be



A. $\frac{3(K_1 + K_2)}{2}$

B. $K_1 + K_2$

C. $2(K_1 + K_2)$

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

Answer: D

Watch Video Solution

46. A spherical black body with a radius of 12 cm radiates 450 W power at 500 K. If the radius were halved and the temperature doubled, the power radiated in watt would be

(a)225 (b)450

(c) 900 (d)1800

A. 450

B. 1000

C. 1800

D. 225

Answer: C

Watch Video Solution

47. The energy spectrum f a black body exhibits a maximum around a wavelength λ_0. The temperature of the black body is now changed such that the energy is maximum around a wavelength $3\lambda_0/4$. The power radiated by the black body will now increase by a factor of

A. $\frac{81}{256}$

B. $\frac{3}{4}$

C. $\frac{256}{81}$

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

Answer: C

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AIIMS Questions

1. The colour of a star indicates its

A. temperature

B. velocity

C. size

D. length

Answer: A

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2. Fraunhofer line of the solar system is an example of

A. line emission spectrum

B. emission of band spectrum

C. line absorption spectrum

D. none of the above

Answer: C

Watch Video Solution

3. A black body is heated from $27^\circ C$ to $127^\circ C$. The ratio of their energies of radiation emitted will be

A. $81:256$

B. $27:64$

C. $9:16$

D. $3:4$

Answer: A

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4. A metallic ball and highly stretched spring are made of the same material and have the same mass. They are heated so that they melt. The latent heat required

A. are the same for both

B. is greater for the ball

C. is greater for the spring

D. for the two may or may not be the same depending upon the metal

Answer: A

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

A. $(300)^4$

B. $(300)^3$

C. 300

D. $(300)^2$

Answer: C

Watch Video Solution

6. The density of a substance at $0^\circ C$ is $10g/cc$ and at $100^\circ C$, its density is $9.7g/cc$. The coefficient of linear expansion of the substance is

A. 10^2

B. 10^{-2}

C. 10^{-3}

D. 10^{-4}

Answer: D

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7. A black body at a temperature of $227^\circ C$ radiates heat at a rate of $20calm^{-2}s^{-1}$. When its temperature is raised to

$727^\circ C$ the radiated by it in cal $m^{-2}s^{-1}$ will be closet to

A. 320

B. 160

C. 40

D. 640

Answer: A

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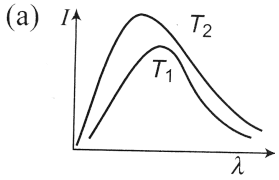
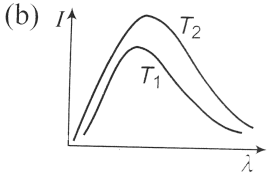
8. Shown below are the black body radiation curves at temperature T_1 and $T_2(T_2 > T_1)$. Which of the following plots is correct?

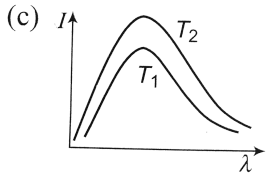
A.



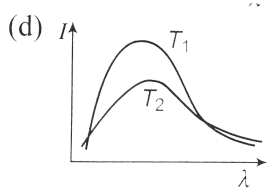
B.



C.



D.



Answer: A

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9. Suppose the sun expands so that its radius becomes 100 times its present radius and its surface temperature becomes half of its present value. The total energy emited by it then will increase by a factor of :

A. 625

B. 10^4

C. 256

D. 16

Answer: A

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10. Three objects coloured black, gray and white can withstand hostile conditions upto $2800^\circ C$. These objects are thrown into a furance where each of them attains a temperature of $2000^\circ C$. Which object will glow brightest?

A. The white object

B. All glow with equal brigtness

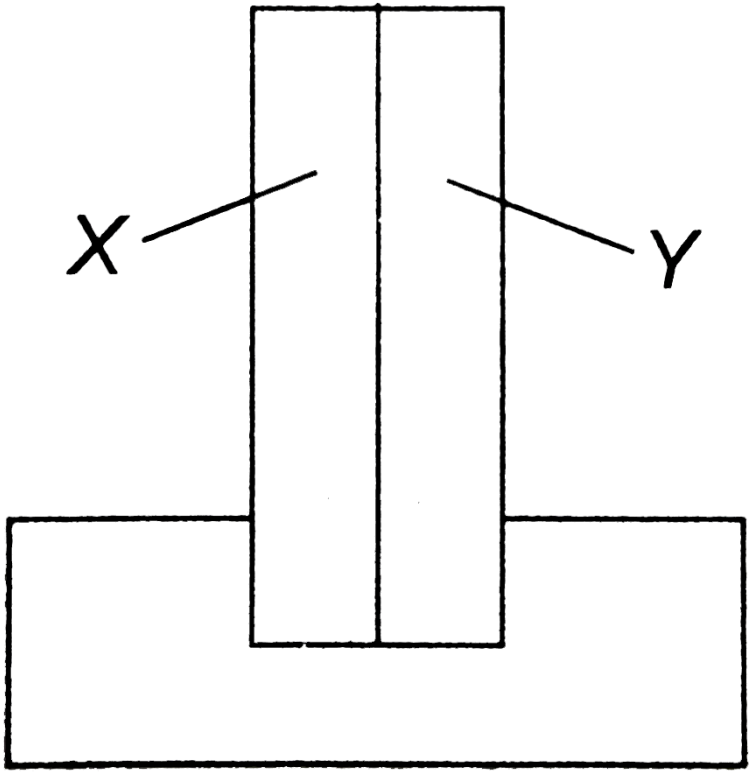
C. Gray object

D. The black object

Answer: D

Watch Video Solution

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



A. it will bend towards the right

B. it will not bend but shrink

C. it will bend towards the left

D. it will neither bend nor shrink

Answer: C

Watch Video Solution

12. A brass disc fits snugly in a hole in a steel plate. Should you heat or cool this system to losen the disc from the hole ? given that $\alpha_b > \alpha_F e$.

A. first heated then cooled

B. first cooled then heated

C. is heated

D. is cooled

Answer: D

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

A. rise

B. fall

C. will remain almost stationary

D. it is difficult to say

Answer: C

Watch Video Solution

14. The coefficient of thermal conductivity of copper, mercury and glass are respectively K_c, K_m and K_g that $K_c > K_m > K_g$. If the same quantity of heat is to flow per second per unit of each and corresponding temperature gradients are X_c, X_m and X_g, then

A. $X_c = X_m = X_g$

B. $X_c < X_m > X_g$

C. $X_c < X_m < X_g$

D. $X_m < X_c < X_g$

Answer: C

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15. The initial temperature of a body is $80^\circ C$. If its temperature falls to $64^\circ C$ in 5 minute and in 10 minute to 52°. Find the temperature of surrounding.

A. $16^\circ C$

B. $26^\circ C$

C. $36^\circ C$

D. $40^\circ C$

Answer: A

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16. At 1 atmospheric pressure, 1.000 g of water having a volume of $1.000 cm^3$ becomes 1671 cm^3 of steam when boiled. The heat of vaporization of water at 1 atmosphere is $539 cal / g$. What is the change in internal energy during the process ?

A. $204 cal$

B. $167 cal$

C. $540 cal$

D. $373 cal$

Answer: D

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17. Assertion : Woolen clothes keep the body warm in winter

Reason : Air is a bad conductor of heat.

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

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

C. If the assertion is true but the reason is false

D. If the both the assertion and reason are false.

Answer: A

Watch Video Solution

18. Assertion : Blue star is at high temperature than red star.

Reason : Wein's displacement law states that $T \propto (1/\lambda_m)$.

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

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

C. If the assertion is true but the reason is false

D. If the both the assertion and reason are false.

Answer: A

Watch Video Solution

19. Assertion : Temperature near the sea-coast are moderate.

Reason : Water has a high thermal conductivity.

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

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

C. If the assertion is true but the reason is false

D. If the both the assertion and reason are false.

Answer: B

 Watch Video Solution

20. Assertion : It is hotter over the top of a fire than at the same distacne of the side.

Reason : Air surrounding the fire conducts more heat upward

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

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

C. If the assertion is true but the reason is false

D. If the both the assertion and reason are false.

Answer: C

Watch Video Solution

21. Assertion : The melting point of ice decreases with increase of pressure

Reason : Ice contract on melting.

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

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

C. If the assertion is true but the reason is false

D. If the both the assertion and reason are false.

Answer: A

 Watch Video Solution

22. Assertion : A body that is a good radiator is also a good absorber of radiation at a given wavelength.

Reason : According to Kirchhoff's law the absorptivity of a body is equal to its emissivity at a given wavelength

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

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

C. If the assertion is true but the reason is false

D. If the both the assertion and reason are false.

Answer: A

Watch Video Solution

23. Assertion : For higher temperature, the peak emission wavelength of a black body shifts to lower wavelengths.

Reason : Peak emission wavelength of a black body is proportional to the fourth power of temperature.

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

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

C. If the assertion is true but the reason is false

D. If the both the assertion and reason are false.

Answer: C

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24. Assertion : Perspiration from human body helps in cooling the body.

Reason : A thin layer of water on the skin enhances its emissivity.

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

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

C. If the assertion is true but the reason is false

D. If the both the assertion and reason are false.

Answer: C

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25. Assertion : The equivalent thermal conductivity of two plates of same thickness in contact (series) is less than the smaller value of thermal conductivity.

Reason : For two plates of equal thickness in contact (series) the equivalent thermal conductivity is given by

$$\frac{1}{K} = \frac{1}{K_1} + \frac{1}{K_2}$$

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

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

C. If the assertion is true but the reason is false

D. If the both the assertion and reason are false.

Answer: D

Watch Video Solution

26. Assertion : If the temperature of a star is doubled then the rate loss of heat from it becomes $16\times$.

Reason : Specific heat varies with temperature.

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

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

C. If the assertion is true but the reason is false

D. If the both the assertion and reason are false.

Answer: B

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27. Assertion : Two bodies at different temperatures if brought in thermal contact do not necessary settle to the mean temperature

Reason : The two bodies may have different thermal capacities.

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

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

C. If the assertion is true but the reason is false

D. If the both the assertion and reason are false.

Answer: A

Watch Video Solution

28. Assertion : Water kept in an open vessel will quickly evaporate on the surface of the moon.

Reason : The temperature at the surface of the moon is much higher than boiling point of the water.

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

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

C. If the assertion is true but the reason is false

D. If the both the assertion and reason are false.

Answer: A

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Chapter Test

1. If mass-energy equivalence is taken into account, when water is cooled to from ice, the mass of water should

A. Increase

B. Remain unchanged

C. Decrease

D. First increase then decrease

Answer: B

Watch Video Solution

2. Amount of heat required to raise the temperature of a body through $1K$ is called its.

A. Water equivalent

B. Thermal capacity

C. Entropy

D. Specific heat

Answer: B

Watch Video Solution

3. A lead bullet just melts when stopped by an obstacle. Assuming that 25 per cent of the heat is absorbed by the obstacle, find the velocity of the bullet if its initial temperature is $27^\circ C$. (Melting point of lead $= 327^\circ C$, specific heat of lead $= 0.03 cal/g.^\circ C$, latent heat of fusion of lead $= 6 cal/g$, $J = 4.2 J/cal$).

A. $410 m/\sec$

B. $1230 m/\sec$

C. $307.5 m/\sec$

D. none of the above

Answer: A

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4. Two metal strips that constitue a thermostat must necessarily differ in their

A. Mass

B. Length

C. Resistivity

D. Coefficient of linear expansion

Answer: D

Watch Video Solution

5. A substance of mass M kg requires a power input of P wants to remain in the molten state at its melting point. When the power source is turned off, the sample completely

solidifies in time t seconds. The latent heat of fusion of the substance is .....

A. $\frac{Pm}{t}$

B. $\frac{Pt}{m}$

C. $\frac{m}{Pt}$

D. $\frac{t}{Pm}$

Answer: B

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6. Steam at $100^\circ C$ is passed into 1.1 kg of water contained in a calorimeter of water equivalent 0.02 kg at $15^\circ C$till the temperature of the calorimeter and its contents rises to $80^\circ C$. The mass of the steam condensed in kilogram is

A. 0.130

B. 0.065

C. 0.260

D. 0.135

Answer: A

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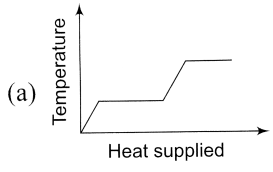
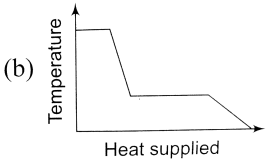
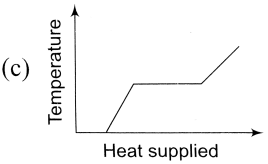
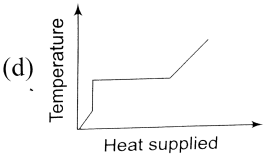
7. A block of ice at $-10^{\circ}C$ is slowly heated and converted to steam at $100^{\circ}C$. Which of the following curves represents the phenomenon qualitatively?

A.



B. 

C. 

D. 

Answer: A

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8. Two rods, one of aluminium and the other made of steel, having initial length l_1 and l_2 are connected together to from a single rod of length $l_1 + l_2$. The coefficients of linear expansion for aluminium and steel are α_a and α_s and

respectively. If the length of each rod increases by the same amount when their temperature are raised by t^0C, then find the ratio $l_1/(l_1+l_2)$

A. $\frac{\alpha_s}{\alpha_a}$

B. $\frac{\alpha_a}{\alpha_s}$

C. $\frac{\alpha_s}{(\alpha_a+\alpha_s)}$

D. $\frac{\alpha_a}{(\alpha_a+\alpha_s)}$

Answer: C

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9. 2kg of ice at $20^\circ C$ is mixed with 5kg of water at $20^\circ C$ in an insulating vessel having a negligible heat capacity. Calculate the final mass of water remaining in the container. It is given

that the specific heats of water & ice are $1kcal/kg/^{\circ}C$ and 0.5 $kcal/kg/^{\circ}C$ while the latent heat of fusion of ice is $80kcal/kg$

A. $7kg$

B. $6kg$

C. $4kg$

D. $2kg$

Answer: B

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10. Water of volume 2 litre in a container is heated with a coil of $1kWat27^{\circ}C$. The lid of the container is open and energy

dissipates at rate of $160J/s$. In how much time temperature will rise from $27^\circ C \to 77^\circ C$ Given specific heat of water is $[4.2kJ/kg]$

A. $8 \text{ min } 20s$

B. $6 \text{ min } 2s$

C. 7 min

D. 14 min

Answer: A

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11. According to Newton's law of cooling, the rate of cooling of a body is proportional to $(\Delta\theta)^n$, where $\Delta\theta$ is the

difference of the temperature of the body and the surroundings, and n is equal to

A. One

B. Two

C. Three

D. Four

Answer: A

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12. If the temperature of the sun were to increase form T to 2T and its radius from R to 2R, then the ratio of the radiant energy received on earth to what it was previously will be

A. 4

B. 16

C. 32

D. 64

Answer: D

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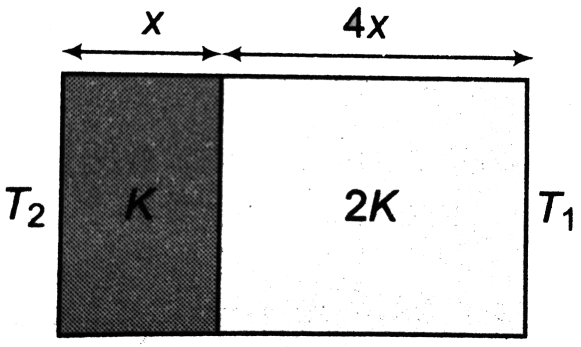
13. The temperature of the two outer surfaces of a composite slab consisting of two materials having coefficient of thermal conductivity K and 2K and thickness x and 4x respectively are T_2 and $T_1(T_2 > T_1)$. The rate of heat transfer through the slab in steady state is $\left(\frac{AK(T_2 - T_1)}{x}\right)f$. where, f is equal

to



A. 1

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

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

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

Answer: D

Watch Video Solution

14. A sphere a cube and thin circular plate, all made of the same material and having the same mass are initially heated to a temperature of $1000^{\circ}C$. Which one of these will cool first?

A. plate

B. Sphere

C. Cube

D. None of these

Answer: A

Watch Video Solution

15. A slab consists of two parallel layers of copper and brass of the time thickness and having thermal conductivities in the ratio $1:4$. If the free face of brass is at $35^\circ C$ and that of copper at $1:\sqrt{2.5}$, the temperature of interface is

A. $80^\circ C$

B. $20^\circ C$

C. $60^\circ C$

D. $40^\circ C$

Answer: A

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16. A solid copper sphere (density rho and specific heat c) of radius r at an initial temperature $200K$ is suspended inside a chamber whose walls are at almost $0K$. The time required for the temperature of the sphere to drop to 100K is .....

A. $\frac{72}{7}\frac{r\rho c}{\sigma}$

B. $\frac{7}{72}\frac{r\rho c}{\sigma}$

C. $\frac{27}{7}\frac{r\rho c}{\sigma}$

D. $\frac{7}{27}\frac{r\rho c}{\sigma}$

Answer: B

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17. Two metallic spheres S_1 and S_2 are made of the same material and have got identical surface finish. The mass of S_1 is thrice that of S_2. Both the spheres are heated to the same high temperature and placed in the same room having lower temperature but are thermally insulated from each other. the ratio of the initial rate of cooling of S_1 to that of S_2 is

$(a)\frac{1}{3}(b)\frac{1}{\sqrt{3}}(c)\frac{\sqrt{3}}{1}(d)\left(\frac{1}{3}\right)^{\frac{1}{3}}$

A. $1/3$

B. $(1/2)^{1/3}$

C. $1/\sqrt{3}$

D. $\sqrt{3}/1$

Answer: B

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18. Three rods of identical cross-sectional area and made from the same metal from the sides of an isosceles triangle ABC, right-angled at B. The point A and B are maintained at temperatures T and $\sqrt{2}$ T respectively. In the steady state, the temperature of the point C is T_c. Assuming that only heat conduction takes places, T_c/T is

A. $\frac{1}{\left(\sqrt{2}+1\right)}$

B. $\frac{3}{\left(\sqrt{2}+1\right)}$

C. $\frac{1}{2\left(\sqrt{2}-1\right)}$

D. $\frac{1}{\sqrt{3}\left(\sqrt{2}+1\right)}$

Answer: B

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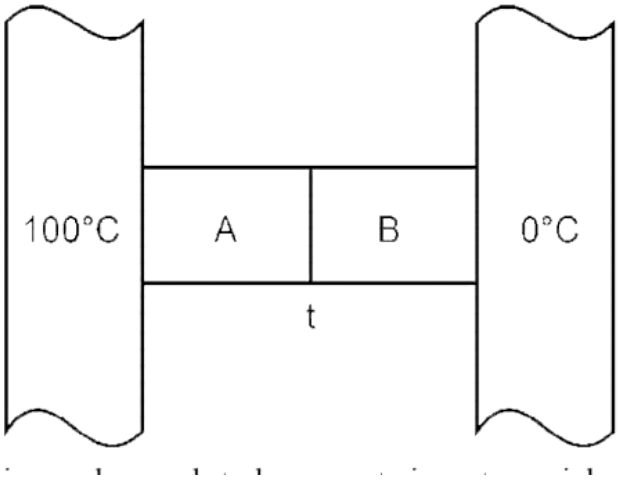
19. Two metal cubes A and B of same size are arranged as shown in Figure. The extreme ends of the combination are maintained at the indicated temperatures. The arrangement is thermally insulated. The coefficients of thermal conductivity of A and B are $300W/m^{\circ}C$ and $200W/m^{\circ}C$, respectively. After steady state is reached the temperature t of the interface will be .....



A. $45^\circ C$

B. $90^\circ C$

C. $30^\circ C$

D. $60^\circ C$

Answer: D

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

A. 1.46

B. 0.69

C. 1.21

D. 0.83

Answer: B

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21. A spherical black body with a radius of 12 cm radiates 450 W power at 500 K. If the radius were halved and the temperature doubled, the power radiated in watt would be

A. 225

B. 450

C. 900

D. 1800

Answer: D

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22. A black body is at a temperature of $5760K$. The energy of radiation emitted by the body at wavelength $250nm$ is U_1 at wavelength $500nm$ is U_2 and that at $1000nm$ is U_3. Wien's consant, $b = 2.88 \times 10^6 nmK$. Which of the following is correct?

A. $U_1 = 0$

B. $U_3 = 0$

C. $U_1 > U_2$

D. $U_2 > U_1$

Answer: D

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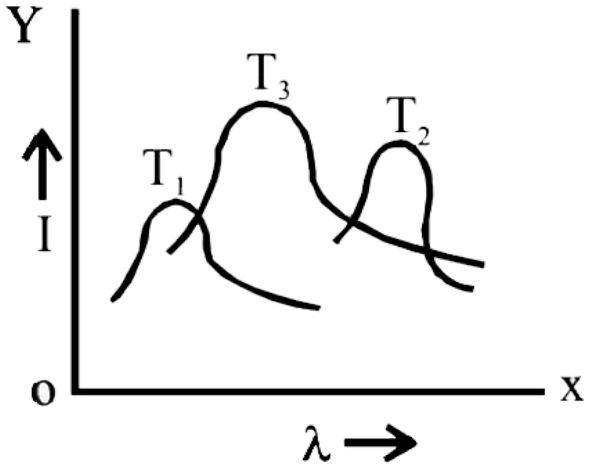
23. The plots of intensity versus wavelength for three black bodies at temperature T_1, T_2 and T_3 respectively are as shown. Their temperatures are such that



A. $T_1 > T_2 > T_3$

B. $T_1 > T_3 > T_2$

C. $T_2 > T_3 > T_1$

D. $T_3 > T_2 > T_1$

Answer: B

Watch Video Solution

24. An ideal Black-body at room temperature is thrown into a furnace. It is observed that

A. Initially it is the darkest body and at later times the brightest

B. It is the darkest body at all times

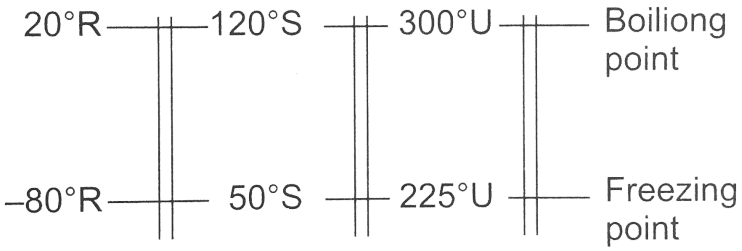
C. It cannot be distinguished at all times

D. Initially it is the darkest body and at later times it cannot be distinguished

Answer: A

Watch Video Solution

25. Figure shows three temperature scales with the freezing and boiling point of water indicated. A change of $25^\circ R, 25^\circ S$ and $25^\circ U$ is denoted by x_1, x_2, x_3 respectively. Which of the following is correct?



A. $x_1 > x_2 > x_3$

B. $x_2 < x_1 < x_3$

C. $x_3 < x_2 < x_1$

D. $x_2 > x_3 > x_1$

Answer: D

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26. A composite bar of length $L = L_1 + L_2$ is made up from a rod of material 1 and of length L_1 attached to a rod of material 2 and of length L_2 as shown. If α_1 and α_2 are their respective coefficient of linear expansion, then equivalent coefficient of linear expansion for the composite rod is

A. $\frac{\alpha_1 L_2 + \alpha_2 L_1}{L}$

B. $\frac{\alpha_1 L_2 + \alpha_2 L_2}{L}$

C. $\frac{\alpha_1 L_1 + \alpha_2 L_2}{L}$

D. $\frac{\alpha_1 \alpha_2 \left(L_1^2 + L_2\right)}{\left(\alpha_1 L_1 + \alpha_2 L_2\right)}$

Answer: C

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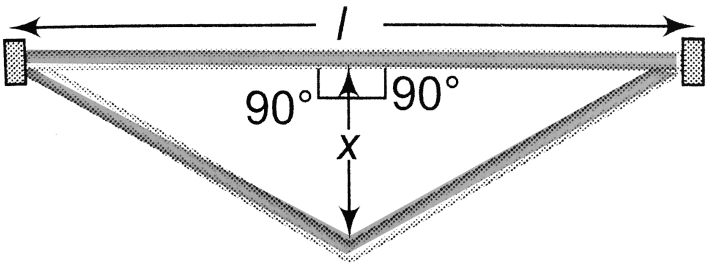
27. A rail track made of steel having length $10m$ is clamped on a railway line at its two end (figure). On a summer day due to rise in temperatue by $20^\circ C$. It is deformed as shown in figure. Find x (displacement of the centre) if $\alpha_{\text{steel}} = 1.2 \times 10^{-5} / ^\circ C$



A. $15\sqrt{30} \times 10^{-3} cm$

B. $10\sqrt{30} \times 10^{-3} cm$

C. $25\sqrt{30} \times 10^{-3} cm$

D. $20\sqrt{30} \times 10^{-3} cm$

Answer: D

Watch Video Solution

28. 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 the assertion and reason are true and reason is the correct explanation of the assertion.

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

C. If the assertion is true but the reason is false

D. If the both the assertion and reason are false.

Answer: C

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29. 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 the assertion and reason are true and reason is the correct explanation of the assertion.

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

C. If the assertion is true but the reason is false

D. If the both the assertion and reason are false.

Answer: D

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30. 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 the assertion and reason are true and reason is the correct explanation of the assertion.

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

C. If the assertion is true but the reason is false

D. If the both the assertion and reason are false.

Answer: C

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