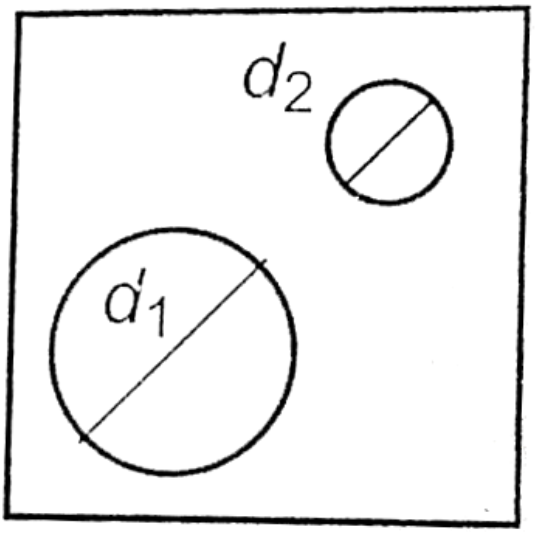
PHYSICS

BOOKS - D MUKHERJEE PHYSICS (HINGLISH)

HEAT AND THERMODYNAMICS

Others

1. Two holes of unequal diameters d_1 and $d_2(d_1 > d_2)$ are cut in metal sheet is heated



A. both d_1 and d_2 will decrease

B. both d_1 and d_2 will increase

C. d_1 will increase d_2 will decrease

D. d_1 will decrease d_2 will increase

Answer:

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2. In the previous question, the distance between the hole will

A. increase

B. decrease

C. remain constant

D. may either or decrease depending on the positions of the holes on the sheet and on the ratio d_1 / d_2

Answer:

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3. A metal wire of length jl and area of cross - section A is fixed between rigid supports negligible tension . If this is cooled. The tension in the wire will be

A. proportional to l

B. inversely proportional to l

C. independent of l

D. independent of A

Answer:

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4. Two metal rods of the same length and area of cross-section are fixed end to end between rigid supports. The materials of the rods have Young module Y_1 and Y_2 , and coefficient of linear expansion α_1 and α_2 . The junction

between the rod does not shift and the rods are cooled

A. $y_1 \propto_1$ and $y_2 \propto_2$

B. $y_1 \propto_2$ and $y_2 \propto_1$

C. $y_1 \propto_1^2$ and $y_2 \propto_2^2$

D. $y_1^2 \propto_1$ and $y_2^2 \propto_2$

Answer:

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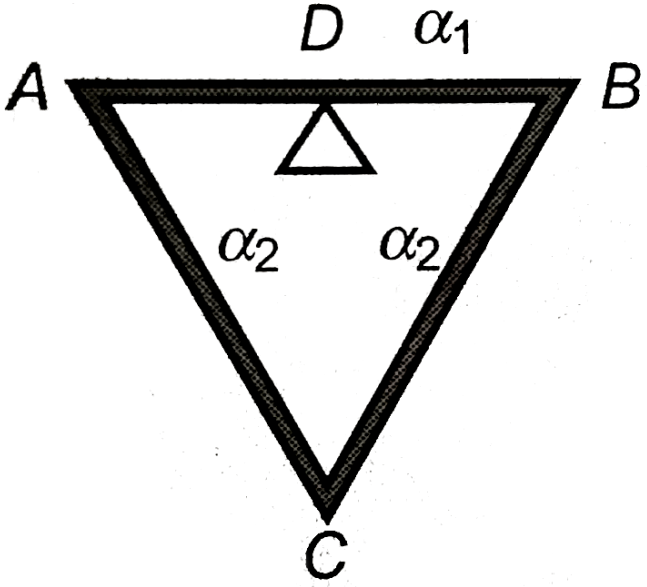
5. Three rods of equal of length are joined to from an equilateral triangle ABC. D is the midpoint of AB. The coefficient of linear expansion is α_1 for AB and α_2 for AC and BC . If the distance DC remains constant for small changes in temperature,



A. $\alpha_1 = \alpha_2$

B. $\alpha_1 = 2\,\alpha_2$

C. $\alpha_1 = 4\,\alpha_2$

D. $\alpha_1 = \frac{1}{2}\,\alpha_2$

Answer:

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6. when the temperature of a body increses from t to $t + \Delta t$,its moment of inertia increases form I to $I + \Delta I$. The coefficient of

linear expanison of the body is $\propto$. The ratio $\frac{\Delta I}{I}$ is equal to

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

B. $\frac{2\Delta t}{t}$

C. $\propto \Delta t$

D. $2 \propto \Delta t$

Answer:

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7. A horizontal tube, open at both ends, contains a column of liquid. The length of this liquid column does not change with temperature. Let γ : coefficient of volume expansion of the liquid and α : coefficient of linear expansion of the material of the tube

A. $\gamma = \propto$

B. $\gamma = 2 \propto$

C. $\gamma = 3 \propto$

D. $\gamma = 0$

Answer:

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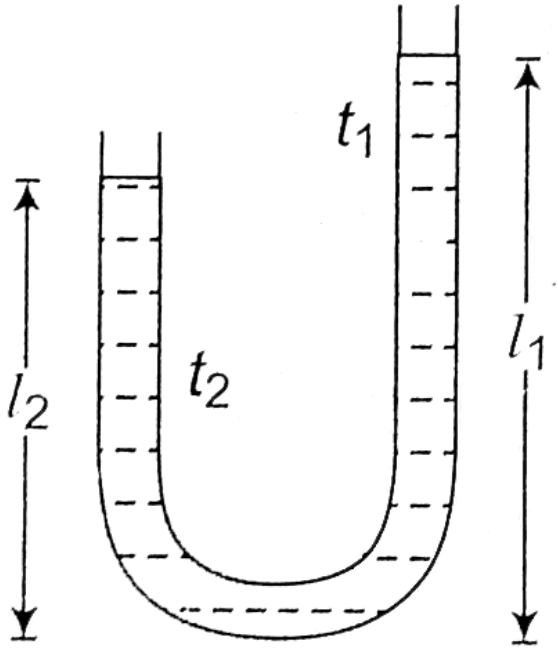
8. In a vertical U-tube containing a luquid, the two arms are maintained at different temperatures, t_1 and t_2 . The liquid coplumns in the two arms have heights l_1 and l_2 respectively. The coefficient of volume

expansion of the liquid is equal to



A. $\dfrac{l_1 - l_2}{l_2 t_1 - l_1 t_2}$

B. $\dfrac{l_1 - l_2}{l_1 t_1 - l_2 t_2}$

C. $\dfrac{l_1 + l_2}{l_2 t_1 + l_1 t_2}$

D. $\frac{l_1 + l_2}{l_1 t_1 + l_2 t_2}$

Answer:

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9. A solid whose volume does not change with temperature floats in a liquid. For two different temperatures t_1 and t_2 of the liqiud, fraction f_1 and f_2 of the volume of the solid remain submerged in the liquid. The

coefficient of volume expansion of the liquid is

equal to

A. $\frac{f_1 - f_2}{f_2 t_1 - f_1 t_2}$

B. $\frac{f_1 - f_2}{f_1 t_1 - f_2 t_2}$

C. $\frac{f_1 + f_2}{f_2 t_1 + f_1 t_2}$

D. $\frac{f_1 + f_2}{f_1 t_1 + f_2 t_2}$

Answer:

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10. A solid with coefficient of linear expansion $aplha$ just floats in a liquid whose coefficient of volume expansion is γ . If the system is heated, the solid will

A. sink in all cases

B. continue to float in all cases

C. sink if $\gamma > 3 \propto$

D. $\gamma < 3 \propto$

Answer:

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11. A gas at 300 K has pressure $4 \times 10^{-10} N/m^2$. IF $k = 1.38 \times 10^{-23} J/K$, the number of $\text{molecule}/cm^3$ is of the order of

A. 100

B. 10^5

C. 10^8

D. 10^{11}

Answer:

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12. The root mean square (r.m.s) speed of oxygen molecules (O_2) at a certain temperature T (degree absolute) is V. If the temperature is doubled and oxygen gas dissociates into atomic oxygen, the r.m.s speed remains unchanged.

A. ν

B. $\sqrt{2}\nu$

C. 2ν

D. $2\sqrt{2}\nu$

Answer:

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13. The average translational kinetic energy of O_2 (molar mass 32) molecules at a particular temperature is $0.048eV$. The translational kinetic energy of N_2 (molar mass 28)

molecules in (eV) at the same temperature is

(JEE 1997)

(a) 0.0015 (b) 0.003 (c) 0.048 (d) 0.768

A. 0.0015

B. 0.003

C. 0.048

D. 0.768

Answer:

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14. A gas has volume V and pressure p. The total translational kinetic energy of all the molecules of the gas is

A. $\frac{3}{2}pV$ only if the gas is monoatomic

B. $\frac{3}{2}pV$ only if the gas is diatomic

C. $> \frac{3}{2}pV$ if the gas is diatomic

D. $\frac{3}{2}pV$ in all cases

Answer:

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15. A closed vessel is maintained at a constant temperture. It is first evacuated and then vapour is injected it continuously. The pressure of the vapour in the vessel

A. increase continuously

B. first increases and then reamians contant

C. first increases and then decrease

D. none of the above'

Answer:

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16. when an air bubble rises from the bottom to the surface of a lake, its radius becomes double . Find the depth of the lake , given that the atmospheric pressure is equal to the pressure due to a column of water 10 m high. Assume constant temperature and disreged surface tension .

A. 30m

B. 40 m

C. 70 m

D. 80 m

Answer:

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17. Two containers of equal volume contain the same gas at pressure P_1 and P_2 and absolute temperature T_1 and T_2, respectively. On joining the vessels, the gas reaches a common

pressure P and common temperature T. The ratio P/T is equal to

A. $\frac{P_1}{T_1} + \frac{P_2}{T_2}$

B. $\frac{1}{2}\left[\frac{p_1}{T_1} + \frac{P_2}{T_2}\right]$

C. $\frac{p_1 T_2 + p_2 T_2}{T_1 + T_2}$

D. $\frac{p_1 T_2 - p_2 T_2}{T_1 - T_2}$

Answer:

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18. Two idential container joined by a small pipe initially contain the same gas at pressure p_0 and absolute temperature T_0. One container is now maintained at the same temperature while the other is heated to $2T_0$. The common pressure of the gas

A. $\frac{3}{2}p_0$

B. $\frac{4}{3}p_0$

C. $\frac{5}{3}p_0$

D. $2p_0$

Answer:

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19. In the previous question let V_0 be the volume of each container. All other details remain the same. The number of moles of gas in the container at temperature $2T_0$ will be

A. $\frac{p_0 V_0}{2RT_0}$

B. $\frac{p_0 V_0}{RT_0}$

C. $\frac{2p_0 V_0}{3RT_0}$

D. $\frac{p_0 V_0}{3RT_0}$

Answer:

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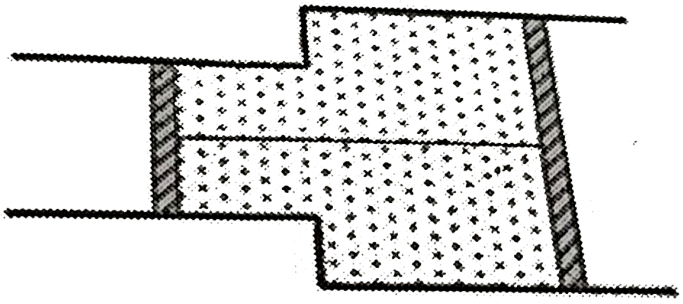
20. A horizontal cylinder has two sections of unequal cross - sections, in which two pistons can move freely. The pistons are joined by a string, Some gas is trapped between the

pistons. If this gas is heated the pistons will



A. move to the left

B. move to the right

C. remain stationary

D. either(a) or (b) depding on the initial pressure of the gas

Answer:

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21. A gas expands from 1 litre to 3 litres at atmospheric pressure. The work done by the gas is about

A. 2J

B. 200 J

C. 300 J

D. 2×10^5 j

Answer:

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22. During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its absolute temperature. The ratio C_P / C_V for the gas is

A. 2

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

C. $\frac{5}{3}$

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

Answer:

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23. In the previous question, the gas may be

A. monoatomic

B. diatomic

C. a mixture of monoatomic and diatomic gases

D. a mixture of diatomic and triatomic gases

Answer:

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24. Each molecule of a gas has F degrees of freedom . The ratio $\frac{C_p}{C_V} = \gamma$ for the gas is

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

B. $1 + \frac{1}{f}$

C. $\left(1+\frac{2}{f}\right)$

D. $1+\frac{(f-1)}{3}$

Answer:

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25. A mixture of n_1 moles of monoatomic gas and n_2 moles of diatomic gas has $\frac{C_p}{C_V}=\gamma=1.5$

A. $n_1=n_2$

B. $2n_1 = n_2$

C. $n_1 = 2n_2$

D. $2n_1 = 3n_2$

Answer:

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26. The pressure p for a gas is plotted against its absolute temperature T for two different volumes V_1 and V_2. If p is plotted on $y-$ axis and T on $x-$ axis, then

A. The curve for V_1 has greater slope than the curve for V_2 .

B. The cureve for V_2 has greater slope than the curve for V_1

C. The curves must intersect at some point other than T=0

D. The curves hace the same slope and do not intersect

Answer:

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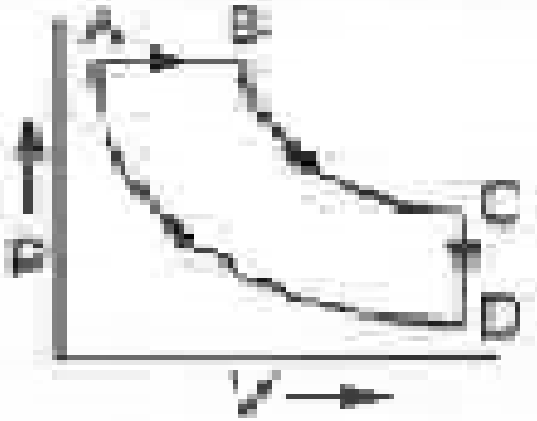
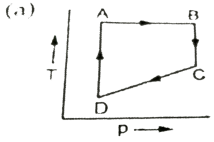
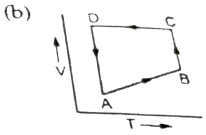
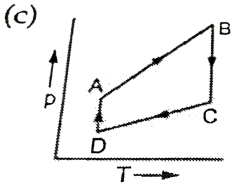


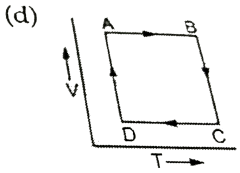
27.

A cyclic process ABCD is shown in the p-V diagram. Which of the following curves represent the same process?

A. 

B. 

C. 

D. 

Answer:

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28. The ratio $\frac{C_p}{C_v} = \gamma$ for a gas. Its molecular weight is M. Its specific heat capacity at constant pressure is

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

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

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

D. $\frac{\gamma RM}{(\gamma - 1)}$

Answer:

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29. When an ideal gas undergoes an adiabatic change causing a temperature change ΔT

(i) there is no heat ganied or lost by the gas

(ii) the work done by the gas is equal to change in internal eenrgy

(iii) the change in internal energy per mole of the gas is $C_V \Delta T$, where C_V is the molar heat capacity at constant volume.

A. only if the change of temperature occurs at constant volume

B. only if the change of temperature occurs at constant pressure

C. in any process which in not adiabatic

D. in any process

Answer:

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30. When an ideal diatomic gas is heated at constant pressure, the fraction of the heat

energy supplied, which increases the internal energy of the gas, is

A. $\frac{2}{5}$

B. $\frac{3}{5}$

C. $\frac{3}{7}$

D. $\frac{5}{7}$

Answer:

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31. The average degrees of freedom per molecule for a gas are 6. The gas performs $25J$ of work when it expands at constant pressure. The heat absorbed by gas is

A. 75 J

B. 100 J

C. 150 J

D. 125 J

Answer:

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32. Two cylinders A and B fitted with pistons contain equal amounts of an ideal diatomic gas at 300K. The piston of A is free to move, while that B is held fixed. The same amount of heat is given to the gas in each cylinder. If the rise in temperature of the gas in A is 30K, then the rise in temperature of the gas in B is

A. 30 K

B. 18 K

C. 50 K

D. 42 K

Answer:

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33. A system is taken from state A to state B along two different paths 1 and 2 . The heat absorbed and work done by the system along these two paths are Q_1 and W_1 and W_2 respectively.

A. $Q_1 = Q_2$

B. $W_1 = W_2$

C. $Q_1 - W_1 = Q_2 - W_2$

D. $Q_1 + W_1 = Q_2 + W_2$

Answer:

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34. Equal masses of three liquids A, B and C have temperature $10^\circ C, 25^\circ C$ and $40^\circ c$ respectively. If A and B are mixed, the mixture

has a temperature of $15^\circ C$. If B and C are mixed, the mixture has a temperature of $30^\circ C$, if A and C are mixed will have a temperature of

A. 16°

B. 20°

C. 25°

D. 29°

Answer:

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35. If water at $0^{\circ}C$ kept in a container with an open top, is placed a large evacuated chamber,

A. all the water will baporize

B. all the water will freeze

C. part of the water will vaporize and the rest will freeze

D. ice, water and water vapour will be formed and reach equilibrium at the triple point

Answer:

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36. In the previous question, if the specific latent heat of vaporization of water at $0^\circ C$ is η times the specific latent heat of freezing of water at $0^\circ C$, the fraction of water that will ultimately freeze is

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

B. $\frac{\eta}{\eta+1}$

C. $\frac{\eta - 1}{\eta}$

D. $\frac{\eta - 1}{\eta + 1}$

Answer:

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37. 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. Pt

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

C. PtM

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

Answer:

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

A. $\left(\frac{\theta_{1_+\theta_2}}{2}\right)$

B. $\frac{k_1\theta_1 + k_2\theta_2}{k_1 + k_2}$

C. $\frac{k_1\theta_2 + k_2\theta_1}{k_1 + k_2}$

D. $\frac{|k_1\theta_1 + k_2\theta_2|}{|k_1 \_ k_2|}$

Answer:

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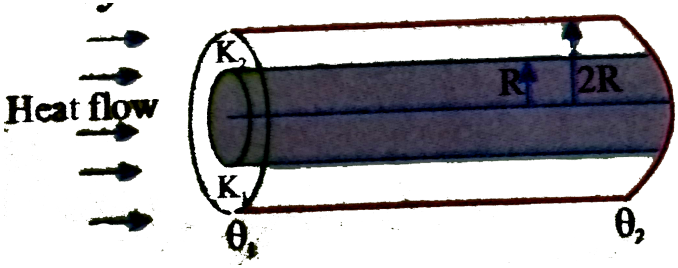
39. A cylinder of radius R made of a material of thermal conductivity K_1 is surrounded by cylindrical shell of inner radius R and outer radius $2R$ made of a material of thermal conductivity K_2 The two ends of the combined system are maintained at two differnet tem-

peratures There is no loss of heat across the cylindrical surface and system is in steady state What is the effective thermal conductivity of the system



A. $k_1 + k_2$

B. $\dfrac{k_1 k_2}{k_1 + k_2}$

C. $\dfrac{k_1 + 3k_2}{4}$

D. $\dfrac{3k_1 + k_2}{4}$

Answer:

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

A. 225

B. 450

C. 900

D. 1800

Answer:

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41. Two spherical black bodies of radii R_1 and R_2 and with surface temperature T_1 and T_2 respectively radiate the same power. R_1 / R_2 must be equal to

A. $(T_1 / T_2)^2$

B. $(T_2/T_1)^2$

C. $(T_1/T_2)^4$

D. $(T_2/T_1)^4$

Answer:

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42. A body cools from $50^\circ C$ to $40^\circ C$ in 5 min. The surroundings temperature is $20^\circ C$. In what further times (in minutes) will it cool to $30^\circ C$?

A. 5

B. $\frac{15}{2}$

C. $\frac{25}{3}$

D. 10

Answer:

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43. In the previous question will be its temperature 5 min after reaching $40^\circ C$?

A. 35° C

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

C. 32° C

D. 30° C

Answer:

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44. A metal rod is shaped into a ring with a small gap. If this is heated,

(i) the length of the rod will increase

(ii) the gap will decrease

(iii) the gap will increase

(iv) the diameter gof the ring will increase in the same ratio as the length of the rod

A. the length of the rad will increase

B. the gap will decrease

C. the gap will increase

D. the diameter of the ring will increase in the same ratio as the length of the rod

Answer:

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45. The average translational energy and the rms speed of molecules in a sample of oxygen gas at $300K$ are $6.21 \times 10^{-21} J$ and $484m/s$, respectively. The corresponding values at $600K$ are nearly (assuming ideal gas behaviour)

A. $12.42 \times 10^{-21} J, 968m/s$

B. $8.78 \times 10^{-21} J, 644m/s$

C. $6.21 \times 10^{-21} J, 968m/s$

D. $12.42 \times 10^{-21} J, 684 m / s$

Answer:

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46. Let $\bar{v}, v_{rms}$ and v_p respectively denote the mean speed. Root mean square speed, and most probable speed of the molecules in an ideal monoatomic gas at absolute temperature T. The mass of a molecule is m. Then

A. No molecules can have speed greater than v_{rms}

B. No molecules can have speed less than $\frac{v_p}{\sqrt{2}}$.

C. $v_p < \overrightarrow{v} < v_{rms}$

D. The average kinetic energy of a molecles is $\frac{3}{4}mv_p^2$.

Answer:

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47. Two identical containers A and B have frictionaless pistons. They contain the same volume of an ideal gas at the same temperature. The mass of the gs in A is m_A and that B is m_B . The gas in each cylinder is now allowed to expand isothermally to double the intial volume. The chages in the pressure in A and B are fopund to be Δ and $1.5\Delta p$ respectively.

A. $4m_A = 9m_B$

B. $2M_a = 3M_b$

C. $3m_A = 2m_B$

D. p^n

Answer:

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48. A gas undergoes a process in which its pressure P and volume V are related as $VP^n =$ constant. The bulk modulus of the gas in the process is:

A. np

B. $p\frac{1}{n}$

C. $\frac{p}{n}$

D. p^n

Answer:

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49. A gas with $\frac{c_p}{c_V} = \gamma$ goes from an intial state (p_1, V_1, T_1) to a final state (p_2, V_2, T_2)

through an adiabatic process. The work done by the gas is

A. $\frac{nR(T_1 - T_2)}{\gamma - 1}$

B. $\frac{p_1V_1 - p_2V_2}{\gamma - 1}$

C. $\frac{p_1V_1 + p_2V_2}{\gamma + 1}$

D. $n\gamma R(T_1 - T_2)$

Answer:

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50. A gas may expand either adiabatically or isothermally. A number of $p - V$ curves are drawn for the two processes over different ranges of pressure and volume, it will be found that

(i) Two adiabatic curves do not intersect

(ii) two isothermal curves do not intersect

(iii) an adiabatic curve and an isothermal curve may intersect.

(iv) the magnitude of the slope of an adiabatic curve is greater than the magnitude of the slope of an isothermal curve

A. two adiabatic curves do not intersect

B. two isothermal curves do not intersect

C. an adiabatic curve and an isothermal curve may intersect

D. the magnitude of the slope of an isothermal curve for the same values of pressure and volume

Answer:

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51. A gas expands such that its initial and final temperatures are equal. Also the process followed by the gas traces a straight line on the $P - V$ diagram

(i) The temperature of the gas remains constant throughout

(ii) The temperature of the gas first increases and then decreases

(iii) The temperature of the gas first decreases and then increases

(iv) The straight line has negative slope

A. The temperature of the gas remains constant throughout

B. The temperature of the gas first increases and then decreases.

C. The temperature of the gas first decreases and then increases.

D. The straight line has a negative slope

Answer:

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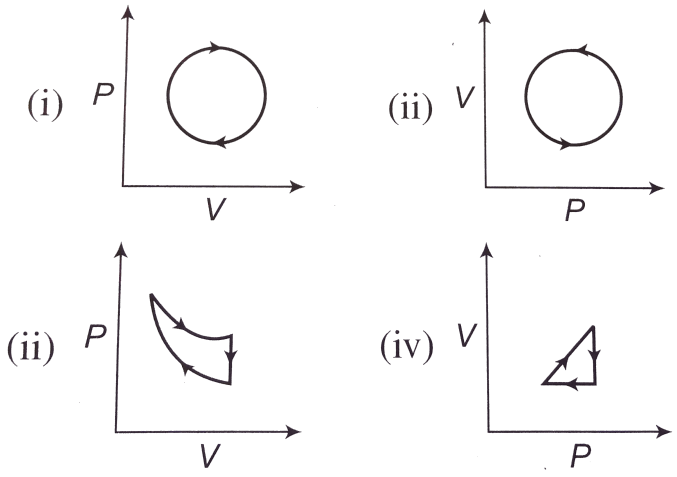
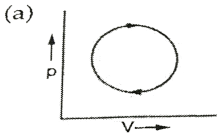


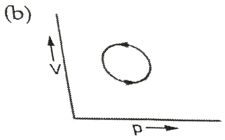
52.

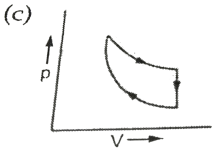
The following are the $P-V$ diagrams for cyclic processes for a gas. In which of these processes is heat absorbed by the gas?

A.



B.



C. 

D. 

Answer:

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53. Two gases have the same initial pressure, volume and temperature. They expand to the same final volume, one adiabatically and the other isothermally

A. The fina temperature is greater for the isothermal process.

B. The final pressure is greater for the isothermal process.

C. The work done by the gas is greater for the isothermal process.

D. All the above options are incorrect.

Answer:

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54. In the previous question, if the two gases are compressed to the same final volume,

A. the final temperature is greater for the adiabatic process

B. the final pressure is greater for the adiabatic process

C. the work doen on the gas is greater for the adiabatic process

D. All the above options are incorrect.

Answer:

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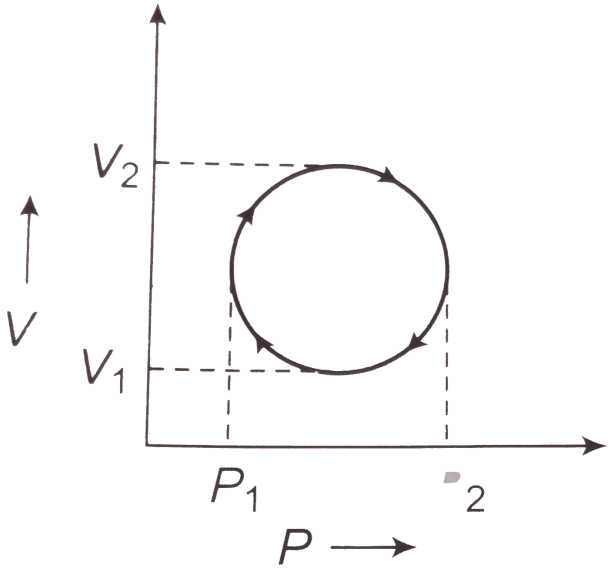

55.

In the cyclic process shown in the $V - P$ diagram the magnitude of the work is done is

A. $\pi\left(\frac{p_2 - p_1}{2}\right)^2$

B. $\pi\left(\frac{V_2 - V_1}{2}\right)^2$

C. $\frac{\pi}{4}(p_2 - p_1)(V_2 - V_1)$

D. $\pi(p_2V_2 - p_1V_1)$

Answer:

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56. In the previous question,

A. work is done by the gas

B. work is done on the gas

C. heat is absorbed by the gas

D. heat is given out by the gas

Answer:

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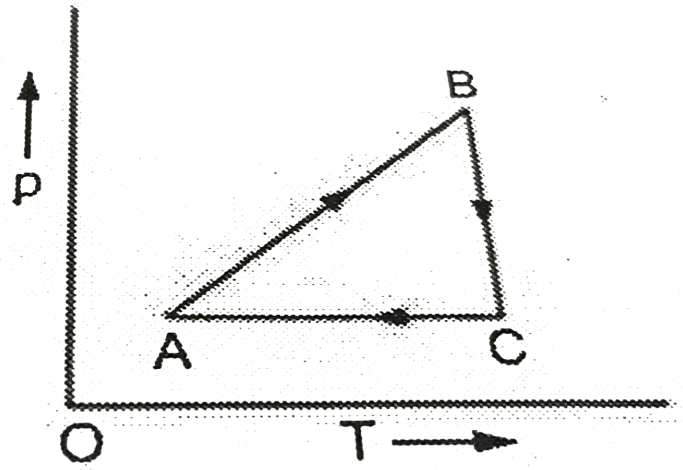
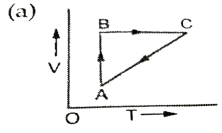


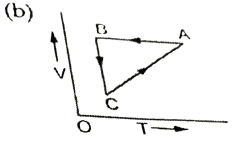
57.

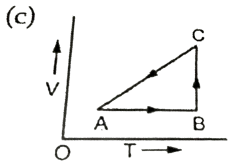
A cyclic process is shown in the p-T diagram. Which of the curves show the same process on a V-T diagram?

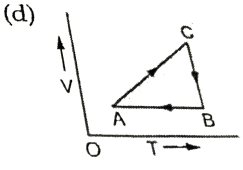
A.



B.



C. 

D. 

Answer:

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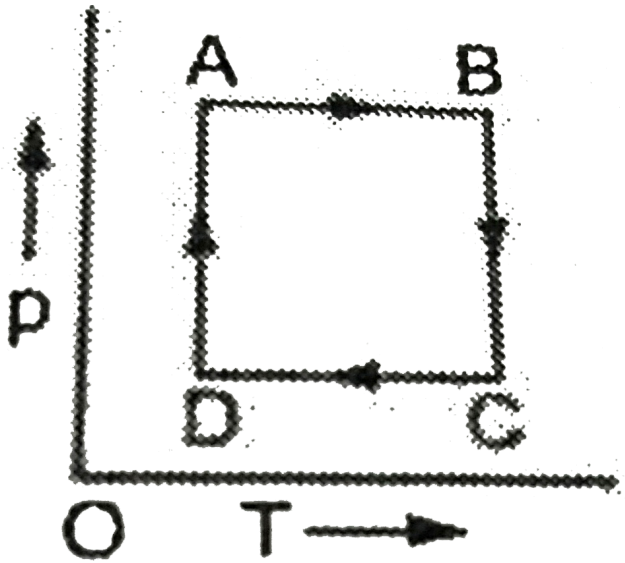
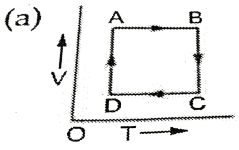


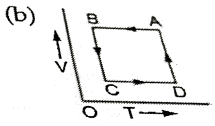
58.

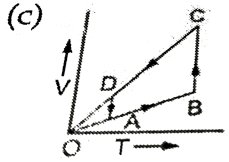
A cyclic process is shown on the p-T diagram .

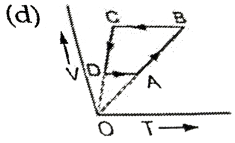
Which of the curves show the same process on

a V-T diagram?

A. 

B. 

C. 

D. 

Answer:

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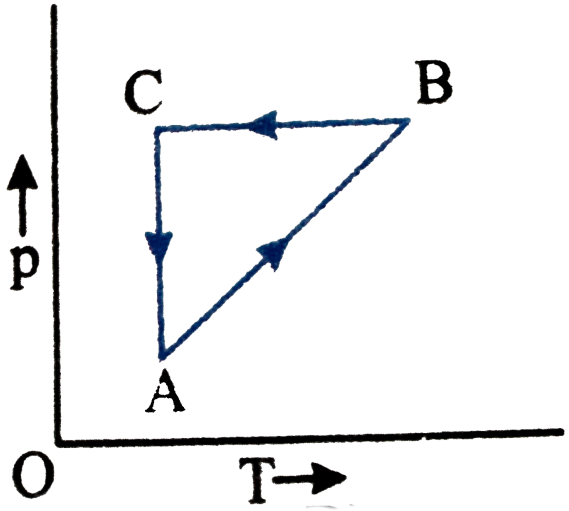
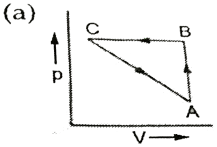
59. A cyclic process is shown in the $P-T$ siagram. Whech of the curves show the same

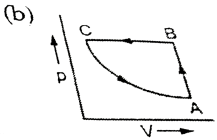
process on a $P - V$ diagram ?



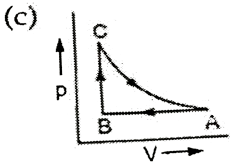
A.

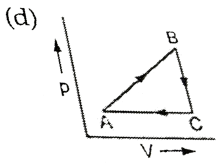


B.



C.



D. 

Answer:

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60. The first law of thermodynamics incorporates are concept of

(i) conservation of energy

(ii) convervation of heat

(iii) conservation of work

(iv) equivalence of heat and work

A. conservation of energy

B. conservation of heat

C. conservation of work

D. equivalence of heat and work

Answer:

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61. Statement-I: it is possible for both the pressure and volume of a monoatomic ideal gas of a given amount to change

simultaneously without causing the internal energy of the gas to change.

Statement-2: The internal energy of an ideal gas of a given amount remains constant it temperature does not change. it is possible to have a process in which pressure and volume are changed such that temperature remains constant.

A. a cyclic process

B. an isothermal process

C. an adiabatic process

D. any process in which the heat given out the system is equal to the work done on the system

Answer:

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62. For a ideal gas,

A. the change in internal energy in a constant -pressure process from

temperature T_1 to T_2 is equal to $nV_v(T_2 - T_1)$, where C_v is the molar heat capacity at constant volume and n is the number of moles of the gas

B. the change in internal energy of the gas and the work done by the gas are equal in magnitude in an adiabatic process

C. the internal energy does not change in an isothermal process

D. no heat is added or removed in an adiabatic process

Answer:

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63. The molar heat capacity for an ideal gas cannot

A. cannot be negative

B. must be equal to either C_V or C_p

C. must be lie in the range $C_V \leq C \leq C_p$

D. may have any value between $-\infty$ and $+\infty$

Answer:

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64. The molar heat capacity for an ideal gas

A. is zero for an adiabatice process

B. is infinite for an isothermal process

C. depends only on the nature of the gas for a process in which either volume or pressure is constant

D. is equal to the product of the molecular weight and specific heat capacity for any process

Answer:

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65. C_p is always greater than C_v for a gas, which of the following statements provide, partly or wholly, the reason for this?

(i) No work is done by a gas at constant volume

(ii) When a gas absorbs heat at constant pressure, its volume must change

(iii) For the same change in temperature, the internal energy of a gas changes by a smaller amount at constant volume that at constant pressure

(iv) The internal energy of an ideal gas is a function only of its temperature

A. No work is done by a gas at constant volume.

B. When a gas absorbs heat at constant pressure, its volume must change

C. For the same change in temperature, the internal energy of a gas changes by a smaller amount at constant volume than at constant pressure.

D. The internal energy of an ideal gas is a function only of its temperature.

Answer:

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66. A system undergoes a cyclic process in which it absorbs Q_1 heat and gives out Q_2 heat. The efficiency of the process is η and work done is W. Select correct statement:

A. $W = Q_1 - Q_2$

B. $\eta = \frac{W}{Q_1}$

C. $\eta = \frac{Q_2}{Q_1}$

D. $\eta = 1 - \frac{Q_2}{Q_1}$

Answer:

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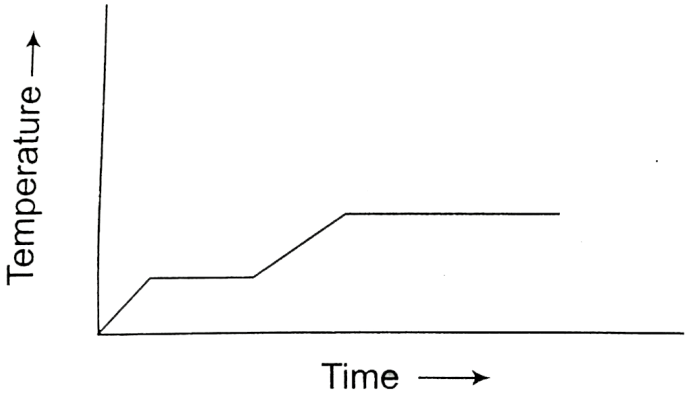

67.

Heat is supplied to a certain homogeneous sample of matter, at a uniform rate. Its temperature is plotted against time, as shown Which of the following conclusions can be drawn?

(i) Its specific heat capacity is greater in the solid state than the liquid state.

(ii) Its specific heat capacity is greater in the

liquid state than in the solid state.

(iii) Its latent heat of vaporization is greater than its latent heat of fusion.

(iv) Its latent heat of vaporization is smaller than its latent heat of fusion

A. Its specific heat capacity is greater in the solid state than in liquid state.

B. Its specific heat capacity is greater in the liquid state than in liquid state.

C. The latent heat of vaporization is greater than its latent heat of fusion.

D. The latent heat of vaporization is smaller than its latent heat of fusion.

Answer:

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68. Three rods of the same dimension have thermal conductivities 3K, 2K and K. They are arranged as shown in fig. with their ends at $100^\circ\,\mathrm{C}, 50^\circ\,\mathrm{C}$ and $20^\circ\,\mathrm{C}$. The temperature of

their junction is

- $75^{\circ} C$
- $\left(\frac{200}{3}\right)^{\circ} C$
- $40^{\circ} C$
- $\left(\frac{100}{3}\right)^{\circ} C$

Answer:

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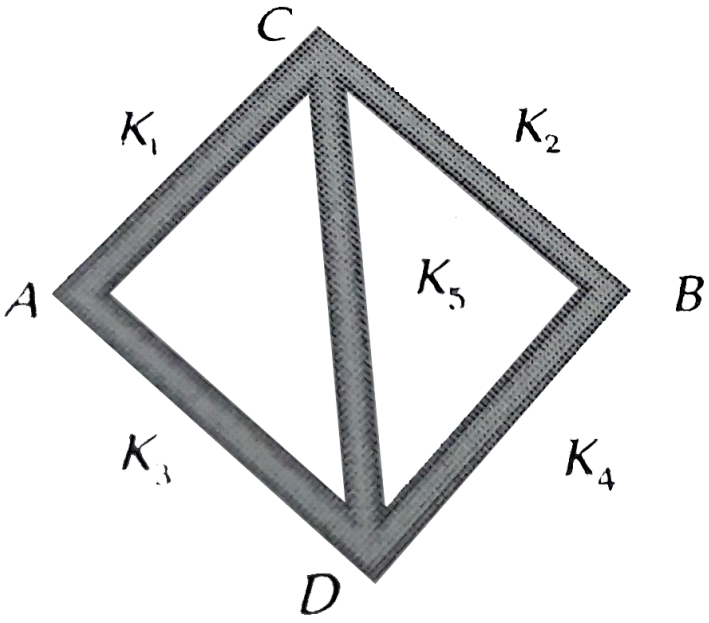
69. Five rods of same dimensions are arranged as shown in the figure. They have thermal

conductivities K_1, K_2, K_3, K_4 and K_5 . When points A and B are maintained at different temperatures, no heat flows through the central rod if



A. $k_1 = k_4$ and $k_2 = k_3$

B. $k_1 / k_4 = k_2 / k_3$

C. $k_1 k_4 = k_2 k_3$

D. $k_1 k_2 = k_3 k_4$

Answer:

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70. Three rods A, B and C have the same dimensions Their conductivities are K_A K and K_C respectively A and B are placed end to end with their free ends kept at certain temperature difference C is placed separately

with its ends kept at same temperature difference The two arrangements conduct heat at the same rate K_c must be equal to .

A. $k_A + k_B$

B. $\frac{k_A k_B}{k_A + k_B}$

C. $\frac{1}{2}(k_A + k_B)$

D. $2.\left(\frac{k_A k_B}{k_A + k_B}\right)$

Answer:

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71. Three rods A, B and C have the same dimensions Their conductivities are K_A K and K_C respectively A and B are placed end to end with their free ends kept at certain temperature difference C is placed separately with its ends kept at same temperature difference The two arrangements conduct heat at the same rate K_c must be equal to .

A. $k_A + k_B$

B. $\dfrac{k_A k_B}{k_A + k_B}$

C. $\dfrac{1}{2}(k_A + k_B)$

D. 2. $\left(\frac{k_A k_B}{k_A + k_B}\right)$

Answer:

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72. One end of a uniform rod of length 10m is placed in boiling water while its other end is placed in melting ice. A point P on the rod is maintained at a constant temperature of $450^\circ C$. The mass of steam produced per second is equal to the mass of ice melted per

second. If specific latent heat of steam is 7 times the specific latent heat of ice, the distance of P from the steam chamber must be_____(in m)

A. $\frac{1}{7}$m

B. $\frac{1}{8}$m

C. $\frac{1}{9}$m

D. $\frac{1}{10}$m

Answer:

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73. A and B are two points on uniform metal ring whose centre is O The angle $AOB = \theta$ A and B are maintaind at two different constant temperatures When $\theta = 180^\circ$ the rate of total heat flow from A to B is $1.2W$ When $\theta = 90^\circ$ this rate will be .

A. 0.6W

B. 0.9W

C. 1.6W

D. 1.8W

Answer:

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74. In a 10 m deep lake, the bottom is at a constant temperature of $4^\circ C$. The air temperature is constant at $-4^\circ C$. $K_{ice} = 3K_\omega$. Neglecting the expansion of water on freezing, the maximum thickness of ice will be

A. 7.5m

B. 6m

C. 5m

D. 2.5m

Answer:

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75. A point source of heat of power P is placed at the centre of a spherical shell of mean radius R. The material of the shell has thermal conductivity K. If the temperature difference

between the outer and inner surface of the shell in not to exceed T, the thickness of the shell should not be less than .....

A. $\frac{4\pi k R_2 T}{P}$

B. $\frac{4\pi k R_2}{TP}$

C. $\frac{4\pi R_2 T}{kP}$

D. $\frac{4\pi R_2 P}{kT}$

Answer:

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76. A spherical black body of radius r radiates power P, and its rate of cooling is R

(i)$P \propto r$

(ii)$P \propto r^2$

(iii)$R \propto r^2$

(iv)$R \propto \frac{1}{r}$

A. $P \propto r$

B. $P \propto r^2$

C. $R \propto r^2$

D. $R \propto \frac{1}{r}$

Answer:

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77. The temperature of an spherical isolated black body falls from T_1 and T_2 in time t them time t is

A. $t = c\left[\frac{1}{T_2} - \frac{1}{T_1}\right]$

B. $t = c\left[\frac{1}{T_2^2} - \frac{1}{T_1^2}\right]$

C. $t = c\left[\frac{1}{T_2^3} - \frac{1}{T_1^3}\right]$

D. $t = c\left[\frac{1}{T_2^4} - \frac{1}{T_1^4}\right]$

Answer:

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78. A planet is at an average distance d from the sun and its average surface temeperature is T. Assume that the planet receives energy only from the sun and loses energy only through radiation from the surface. Neglect

atmospheric effects. If $T \propto d^{-n}$, the value of n is

A. 2

B. 1

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

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

Answer:

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79. The solar constant for a planet is S. The surface temperature of the sun is TK. The sun subtends an angle θ at the planet:

A. $\sum \propto T^4$

B. $\sum \propto T^2$

C. $\sum \propto \theta^2$

D. $\sum \propto \theta$

Answer:

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80. The power radiated by a black body is P, and it radiates maximum energy around the wavelength λ_0. If the temperature of the black body is now changed so that it radiates maximum energy around a wavelength $3\lambda_0/4$, the power radiated by it will increase by a factor of

A. $4/3$

B. $16/9$

C. $64/27$

D. $256/81$

Answer:

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81. Two bodies A and B have thermal emissivities of 0.01 and 0.81 respectively. The outer surface areas of the two bodies are same. The two bodies emit total radiant power at the same rate. The wavelength λ_B corresponding to maximum spectral radiancy

from B is shifted from the wavelength corresponding to maximum spectral radiancy in the radiation from A by 1.0 μm. If the temperature of A is 5802 K, calculate (a) the temperature of B, (b) wavelength λ_B.

A. the temperature of B is 1934 K

B. $\lambda_B = 0.5 \mu m$

C. the temperature of B is 11604 K

D. the temperature of B is 29.1 K

Answer:

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82. A black body is at a temperature of 2880 K. The energy of radiation emitted by this object with wavelength between 499 nm and 500 nm isU_1, between 999 nm and 1000 nm is U_2 and between 1499 nm and 1500 nm is U_3. The Wein's constant $b = 2.88 \times 10^6 \text{nm K}$. Then

A. $U_1 = 0$

B. $U_3 = 0$

C. $U_1 > U_2$

D. $U_2 > U_1$

Answer:

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83. A body with an initial temperature θ_1 is allowed to cool in a surrounding which is at a constant temperature of $\theta_0(\theta < \theta_1)$ Assume that Newton's law of cooling is obeyed Let $k =$ constant The temperature of the body after time t is best experssed by .

A. $(\theta_i - \theta_0)e^{-kt}$

B. $(\theta_i - \theta_0)\text{In}\,(\text{kt})$

C. $\theta_0 + (\theta_i - \theta_0)e^{-kt}$

D. $\left(\theta_i e^{-kt} - \theta_0\right)$

Answer:

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84. 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 $1\ \text{min}\ ute$. the heat capacity of S is

A. $100 J/^\circ C$

B. $300 J/^\circ C$

C. $750 J/^\circ C$

D. $1500 J/^\circ C$

Answer:

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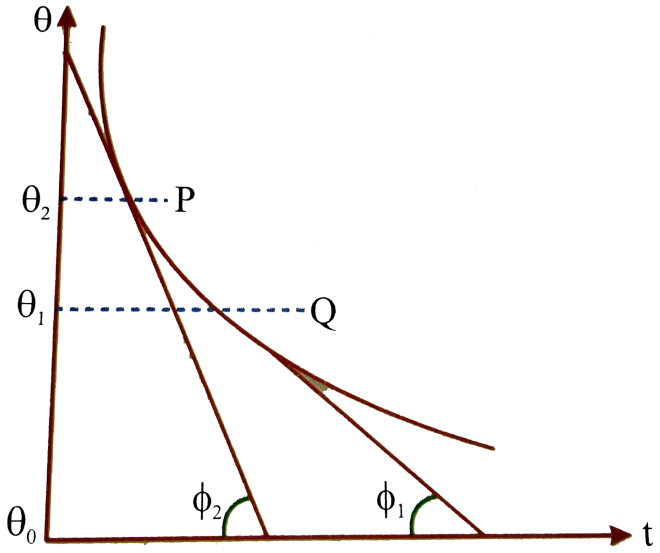
85. A body cools in a surrounding which is at constant temperature of θ_0. Assume that it obeys Newton's law of colling. Its temperature θ is plotted against time t. Tangents are drawn to the curve at the points $P(\theta = \theta_t)$ and $Q(\theta = \theta_2)$. These tangents meet the time axis

at angles of ϕ_2 and ϕ_1, as shown



A. $\dfrac{\tan\phi}{\tan\phi} = \dfrac{\theta_1 - \theta_0}{\theta_2 - \theta_0}$

B. $\dfrac{\tan\phi}{\tan\phi} = \dfrac{\theta_2 - \theta_0}{\theta_1 - \theta_0}$

C. $\dfrac{\tan\phi}{\tan\phi} = \dfrac{\theta_1}{\theta_2}$

D. $\dfrac{\tan\phi}{\tan\phi} = \dfrac{\theta_2}{\theta_1}$

Answer:

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