PHYSICS

BOOKS - BITSAT GUIDE PHYSICS (HINGLISH)

HEAT, TEMPERATURE AND CALORIMETRY

Practice Exercies

1. The temperature of an iron piece is heated from $30^{\circ}C \text{to} 90^{\circ}C$. What is the change in its temperature on the fahrenheit scale and on the kelvin scale?

A. 108°, 60K

B. 100° F, 55 K

C. 100° F, 65K

D. 60° F, 108 K

Answer:

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2. At 30°C, the hole in a steel plate has diameter of 0.99970 cm. A cylinder of diameter exactly 1 cm at 30°C is to be slide into the hole. To what temperature the plate must be heated?

(Given $\alpha_{Steel} = 1.1 \times 10^{-5^{\circ}} C^{-1}$

A. 58°C

B. 55°C

C. 57.3°C

D. 60° C

Answer:

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3. A monoatomic ideal gas, initially at temperature T_1, is enclosed in a cylinder fitted with a friction less piston. The gas is allowed to expand adiabatically to a temperature T_2 by releasing the piston suddenly. If L_1 and L_2 are the length of the

gas column before expansion respectively, then $\frac{T_1}{T_2}$ is given by

A. $\left(\frac{L_1}{L_2}\right)^{\frac{2}{3}}$

B. $\left(\frac{L_1}{L_2}\right)$

C. $\left(\frac{L_2}{L_1}\right)$

D. $\left(\frac{L_2}{L_1}\right)^{\frac{2}{3}}$

Answer:

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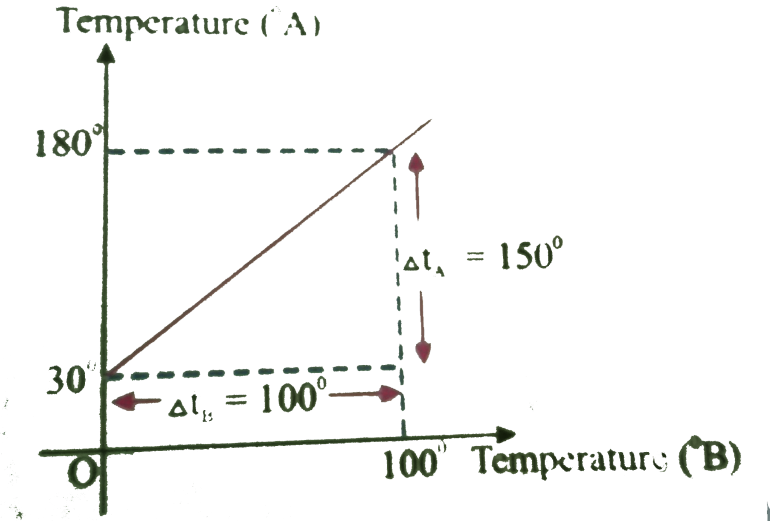
4. The graph between two temperature scales A and B is shown in Fig. Between upper fixed point and lower fixed point there are 150 equal divisions on scales A and 100 on scale B . The relation between the temperature in two scales is given by_



A. $\frac{t_A - 180}{100} = \frac{t_B}{150}$

B. $\frac{t_A - 30}{150} = \frac{t_B}{100}$

C. $\frac{t_B - 180}{150} = \frac{t_A}{100}$

D. $\frac{t_A - 40}{100} = \frac{t_B}{180}$

Answer:

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5. Heat given to a system can be associated with

A. Kinetic energy of random motion of molecules

B. Kinetic energy of orderly motion of molecules

C. Total kinetic energy of random and orderly motion of molecules

D. kinetic energy of random motion in some cases and kinetic energy of orderly motion in other

Answer:

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6. At what temperature (in $\hat{}(\circ)C$, the fahrenheit and celsius scale gives same reading?

A. 40

B. -40

C. 8

D. -8

Answer:

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7. Which one of the following would reaise the temperature of 40 g of water at 20°C most when mixed with?

A. 20g of water at 40°C

B. 30 g of water at 30°C

C. 10 g of water at 60°C

D. 4 g of water at 100°C

Answer:

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8. If same amount of heat is supplied to two identical spheres (one is hollow and other is solid), then

A. the expansion in hollow is greater than the solid

B. the expansion in hollow is same as that in solid

C. The expansion in hollow is lesser than the solid

D. the temperature of both must be same to each other.

Answer:

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9. At 30°C, a lead bullet of 50 g, is fired verticaly upwards with a speed of 840 m/s. The specific heat of leasd is 0.02 cal/g°C. On

returning to the starting level, it strikes to a cake of ice at 0° C. Calcualte the amount of ice melted (Assume all the energy is spent in melting only)

A. 62.7 g

B. 55g

C. 52.875 g

D. 52.875 g

Answer:

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10. A second's pendulum clock havig steeel wire is calibrated at 20°C. When temperature is increased to 30°C, then calculate how much time does the clock

$[\alpha_{Steel}$=$1.2 \times 10^{-6^\circ} C^{-1}$

A. 0.3628 s

B. 3.626 s

C. 362.8 s

D. 36.23 s

Answer:

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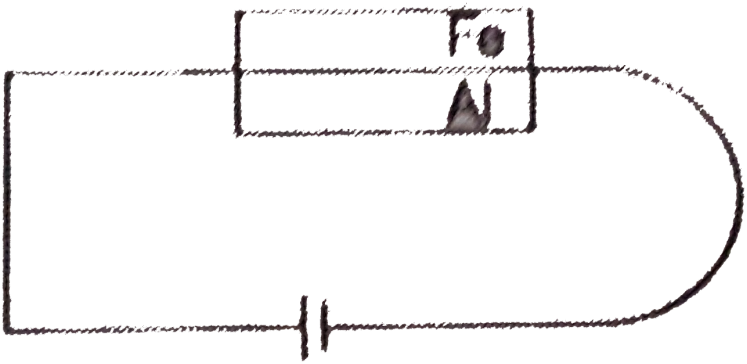
11. A plate composed of welded sheets of aluminium and iron is connected to an electrical circuit as shown in figure. What will happen if a fairly strong current to be passed

through the circuit?



A. Stip bends upward

B. Strip bends downward

C. Strip remains in its initial condition

D. None of the above

Answer:

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12. A copper rod of length l_0 at 0°C is placed on smooth surface. Now, the rod is heated upto 100°C. Find the longtidudinal strain developed.

(α=coefficient of linear expansion)

A. $a = \dfrac{100 l_0 \alpha}{l_o + 100 l_0 \alpha}$

B. 100α

C. Zero

D. None of the these

Answer:

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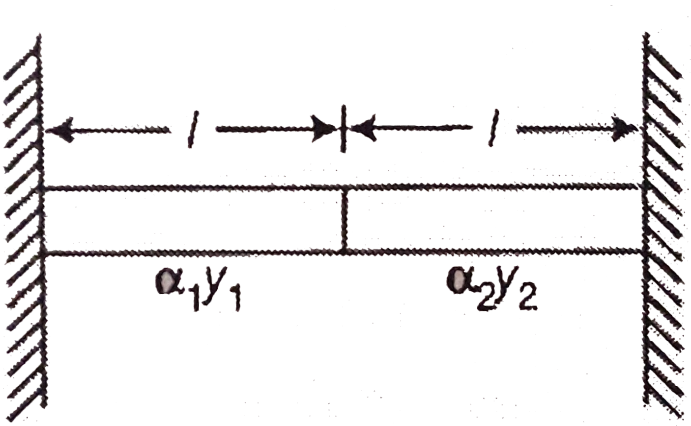
13. Two metal rods are fixed end to end between two rigid supports, as shown in figure. Each rod is of length 'l' and area of cross-section is A. When the system is heated up, determine the conditioin whenthe juction between rods does not shift.

[Given, Y_1 and Y_2 are Young's modulus of materials of the rods, α_1 and α_2 are coefficient

at linear expansion.



A. $(\alpha_1 Y_2$

B. $\alpha_1 Y_1 = \alpha_2 Y_2$

C. $\alpha_1 = \alpha_2$

D. $Y_1 = Y_2$

Answer:

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14. A steel rod with a cross-sectional area of $150mm^2$ is stretched between two fixed points. The tensile load at $20^\circ C$ is $5000N$.

(a) What will be the stress at $-20^\circ C$?

(b) At what temperature will the stress be zero ?

(Assume $\alpha = 11.7\mu m/m^\circ C$ and $Y = 200GN/m^2$)

A. $12.7 \times 10^6 N/m^2$

B. $1.27 \times 10^6 N/m^2$

C. $127 \times 10^6 N/m^2$

D. $0.127 \times 10^6 N/m^2$

Answer:

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15. In an anisotropic medium the coefficients of linear expansion of a solid are α_1, α_2, and α_3. In three mutually perpendicualr directions.

Tjhe coefficient of volume expansion for the solid is

A. $\alpha_1 - \alpha_2 - \alpha_3$

B. $\frac{\alpha_1 + \alpha_2 + \alpha_3}{3}$

C. $\alpha_1+\alpha_2+\alpha_3$

D. None of these

Answer:

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16. A liquid when heated in a copper vessel and when heated in a silver vessel, the apparent coefficient of expansion is C and S, repsctively. If coefficients of linear expansion of copper is A, then coefficient of linear expansion of silver is

A. $\frac{C+S-3A}{3}$

B. $\frac{C+3a-S}{3}$

C. $\frac{3A-S-C}{3}$

D. `(C+S+3A)/3

Answer:

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17. Using the following data, calculate at what temperature will the wood just sink in benzene

Density of wood at 0°C = $8.8 \times 10^2 kg/m^3$

Density of benzene at 0°C = $9 \times 10^{-4} K^{-1}$

Cubical expansivity of wood = $1.5 \times 10^{-4} K^{-1}$

Cubical expansivity of benzene = $1.2 \times 10^{-3} K^{-1}$

A. $27^\circ C$

B. $21.7^\circ C$

C. $31^\circ C$

D. $31.7^\circ C$

Answer:

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18. The radius of metal sphere at room temperature T is R and the coefficient of linear expansion of the metal is α. The sphere is

heated a little by a temperature T, so that new temperature is $T + \Delta T$. The increase in volume of sphere is approximately

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

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

C. $4\pi R^3\alpha\Delta\frac{T}{3}$

D. $4\pi R^2\alpha\Delta T$

Answer:

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19. A copper rod and steel rod having length L_c and L_s respectively at certain temperature. It is observed that difference between their length remains constant at all temperature. If α_c and α_s ar their respective coefficient of linear expansions. Then, ratio of $\frac{L_s}{L_c}$ is `

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

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

C. $\left(1+\frac{\alpha_s}{\alpha_c}\right)$

D. $\left(1+\frac{\alpha_c}{\alpha_s}\right)$

Answer:

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20. One mole of an ideal monoatomic gas is heated at a constant pressure of 1 atmosphere from 0° C to $100^{\circ 0}$C. Work done by the gas is

A. 8.31×10^3J

B. 8.31×10^{-3}J

C. 8.31×10^{-2}J

D. 8.31×10^2J

Answer:

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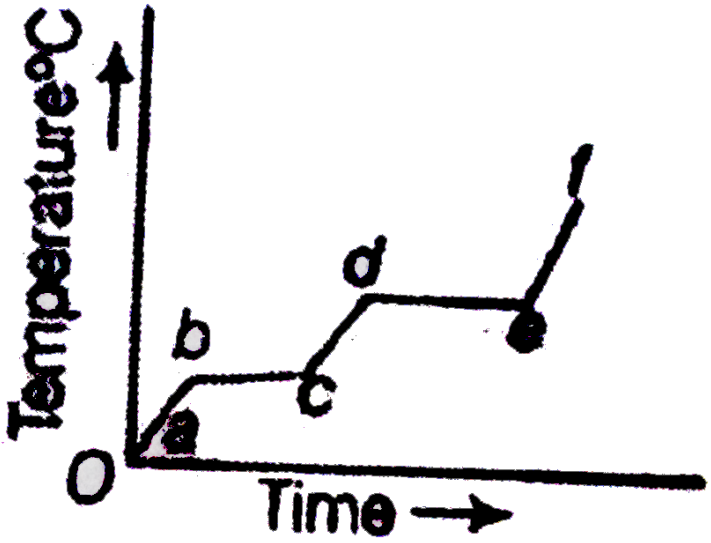
21. The following figure represents the temperature versus time plot for a given amount of a substance when heat energy is supplied to it at a fixed rate and at a constant pressure. Which part of plot represent a phase

change?



A. a to b and e to f

B. b to c and c to d

C. a to e and e tof

D. b to c and d to e

Answer:

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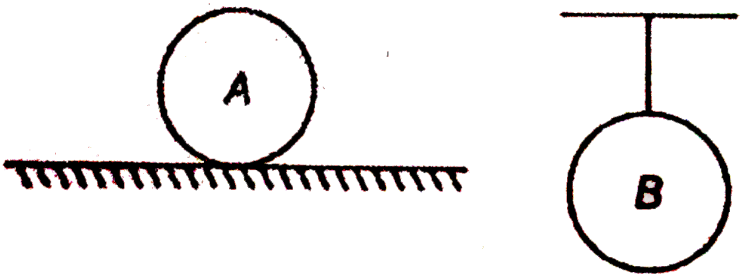
22. A sphere A is placed at smooth table. An another sphere B is suspended as shown in figure. Both spheres are identical in all respects. Equal quantity of heat is supplied to both spheres. All kiinds of heat loss are neglected. The final temperatures of A and B

are T_A and T_B respectively, then



A. $T_A = T_B$

B. $T_A > T_B$

C. $T_A < T_B$

D. None of these

Answer:

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23. Calcualte the resulting temperatures when 20 g of boiling water is poured into an ice-cold brass vesel (specific heat=0.1 cal/g°C) of mass 100 g.

A. 66.66°C

B. 6.66°C

C. 0.66°C

D. 50°C

Answer:

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24. In similar calorimeters, equal volume of water and alcohol, when poured take 100 s and 74 s respectivel to cool from 50°C to 40° C. If the thermal capacity of each calorimeter is numerically equal to volume of either liquid, then calculatethe specific heat capacity of alcohol.

(Given, the relative density of alcohol as 0.8 and specific heat capacity of water as 1 $ca\frac{l}{g}/^{\circ}C\Big)$

A. 0.8 cal/g°C

B. 0.6 cal/g°C

C. 0.9 cal/g°C

D. 1 cal/g°C

Answer:

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25. 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:

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26. The motor heat capacity of rock salt at low temperatures varies with temperatures according to Debye's T_3 law.

Thus, C = $k\frac{T^3}{\theta^3}$, where k = 1940 $Jmol^{-1}Ko^{-1}$, θ = 281 K)

Calculate how much heat is required to raise the tempratures of 2 moles of rock salt from 10 K to 50 K?

A. 800 J

B. 373 J

C. 273 J

D. None of these

Answer:

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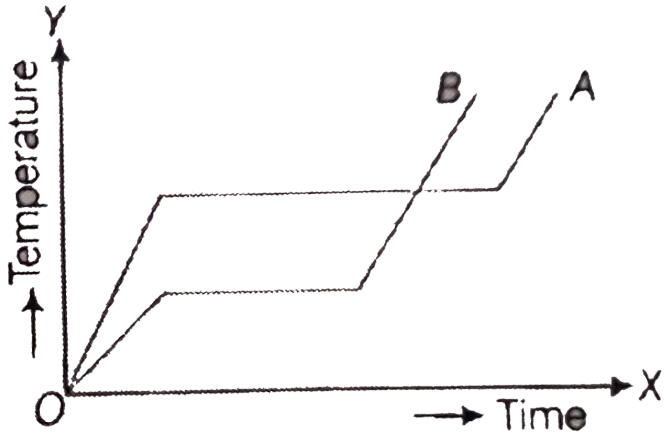
27. Equal masses of two liquids A and B contained in vessels of negligible heat capacity are supplied heat at the same rate. The temperature-time graphs for the liquids are shown in the figure. If S represents specific heat and L represents latent heat of liquid,

then



A. $S_A > S_B, L_A < L_B$

B. $S_A > S_B, L_A > L_B$

C. $S_A < S_B, L_A < L_B$

D. $S_A < S_B, L_A > L_B$

Answer:

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28. The specific heat of a substance at temperature at t°c is $s = at^2 + bt + c$. Calculate the amount of heat required to raise the temperature of m g of the substance from 0°C to t_0°C

A. $\frac{mt_0^3 a}{3} + \frac{bt_0^2}{2} + ct_0$

B. $\frac{mt_0^3 a}{3} + \frac{mbt_0^2}{2} + mct_0$

C. $\frac{mt_0^3 a}{3} + \frac{mbt_0^2}{2}$

D. None of these

Answer:

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29. In Q29. find the average value of specific heat.

A. $\frac{at_0^3}{3} + \frac{bt_0^2}{2} + ct_0$

B. $\frac{at_0}{3} + \left(bt_0^2\right.$

C. $at_0^2 + bt_0 + c$

D. zero

Answer:

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30. 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. 103° C

B. 130° C

C. 105° C

D. 30° C

Answer:

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31. A thermally insulated piece of metal is heated under atmosphere by an electric current so that it receives electric energy at a

constant power P. This leads to an increase of the absoulute temperature T of the metal with time t as follows $T = a^{\frac{1}{4}}$. then the heat capacity C_p is

A. $\frac{4PT^3}{a^4}$

B. $4PT^2\frac{)}{a^3}$

C. $4PT^2$

D. None of these

Answer:

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32. 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. 0.131

B. 0.065

C. 0.26

D. 0.135

Answer:

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33. 5 g of water at 30° C and 5 g of ice at -20° C are mixed together in a caloritmeter. The water equivalent of calorimeter is negliglible and specific heat and latent heat of ice are 0.5 cal/g°C and 80 cal/g repsectively. The final temperature of the mixture is

A. 0°C

B. $-8^{\circ}C$

C. $-4^{\circ}C$

D. $2^{\circ}C$

Answer:

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34. Water at $10^{\circ}C$ is present in a thermally insulated container. Calculate the ratio of mass of ice formed and initial mass of water, if a small crystal of ice is thrown into it.

A. $\frac{1}{15}$

B. $\frac{1}{17}$

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

D. $\frac{1}{8}$

Answer:

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35. It takes 20 minutes to melt 10 g of ice, when ray from the sun are focused by a lens of diameter 5 cm on to a block of ice. Calcualate

the heat received from the sun of $1cm^2$ per minute.

(Given, L = 80 kcal/kg)

A. R=2.04 cal/cm^2-min

B. R= 3.04 cal / cm^2-min

C. R=0.204 cal/cm^2-min

D. R= 204 cal/cm^2-min

Answer:

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36. In an energy recycling process, X g of steam at 100°C becomes water at 100°C which converts Y g of ice at 0°C into water at 100°C. The ratio of X/Y will be

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

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

C. 3

D. 2

Answer:

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Bitsat Archives

1. In an experiment on the specific heat of a metal a 0.20 kg block of the metal at 150°C is dropped in a copper calorimeter (of water equivalent 0.025 kg) containing 150 cc of water at 27°C. The final temperature is 40°C. Calcualte the specific heat of the metal. If heat losses to the surroundings are not negligible, is our answer greater or smaller than the actual value of specific heat of the metal?

A. 0.02

B. 0.2

C. 0.01

D. 0.1

Answer:

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2. A partition wall has two layers of different materials A and B in contact with each other. They have the same thickness but the thermal

conductivity of layer A is twice that of layer B. At steady state the temperature difference across the layer B is 50 K, then the corresponding difference across the layer A is

A. 50 K

B. 12.5 K

C. 25 K

D. 60 K

Answer:

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3. A monoatomic gas $(\gamma = 5/3)$ is suddenly compressed to $(1/8)$ of its volume adiabatically then the pressure of the gas will change to

A. 32

B. $\frac{40}{3}$

C. $\frac{24}{5}$

D. 8

Answer:

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4. 1 g of water (volume 1 cm^3 becomes 1671 cm^3 of steam when boiled at a pressure of 1atm. The latent heat of vaporisation is 540 cal/g, then the external work done is (1 atm $= 1.013 \times 10^5$ N/m^2)

A. 499.7 J

B. 40.3 J

C. 169.2 J

D. 128.57 J

Answer:

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5. The end A of rod AB of length 1 m is maintained at 80° C and the end B at 0° C. The temperature at a distance of 60 cm from the end A is

A. 16° C

B. 32° C

C. 48° C

D. 64° C

Answer:

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6. One junction of a certain thermoelectric couple is at a fixed temperature r T and the other junction is at temperature T . The thermo electromotive force for this is expressed by $E = K(T - T_r)\left[T_0 - \frac{1}{2}(T + T_r)\right]$. At

temperature $T = \frac{1}{2}T_0$, the thermoelectric power is

A. $\frac{1}{2}kT_0$

B. kT_0

C. $\frac{1}{2}kT_0^2$

D. $\frac{1}{2}k(T_0 - T_r)^2$

Answer:

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7. 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. 7.5 m

B. 6 m

C. 6 m

D. 2.5 m

Answer:

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8. A metal string is fixed between rigid supports. It is initially at negligible tensin. Its Young modulus is Y, density ρ and coefficient of thermal expansion is α. If it is now cooled through a temperature $= t$, transverse waves will move along it with speed

A. $Y\frac{\sqrt{\alpha t}}{\rho}$

B. $\alpha t\sqrt{\frac{Y}{\rho}}$

C. $\sqrt{\frac{Y\alpha t}{\rho}}$

D. $t\sqrt{\frac{Y\alpha}{\rho}}$

Answer:

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9. There is some change in length when a $33000N$ tensile force is applied on a steel rod of area of cross-section $10^{-3}m^2$. The change

in temperature of the steel rod when heated is

$\left(Y = 3 \times 10^{11} N/m^2, \alpha = 1.1 \times 10^{-5/\circ} C\right)$

A. 20° C

B. 15° C

C. 10° C

D. 0° C

Answer:

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