PHYSICS

BOOKS - SAI PHYSICS (TELUGU ENGLISH)

THERMAL CONDUCTIVITY

Problems

1. The specific heat of helium at constant volume is $12.6 Jmol^{-1}K^{-1}$. The specific heat

of helium at constant pressure in $Jmol^{-1}K^{-1}$ is about

(Assume the temperature of the gas is moderate, universal gas constant, $R = 8.314Jmol^{-1}K^{-1}$

A. 12.6

B. 16.8

C. 18.9

D. 21

Answer: D

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2. A gas does 4.5 J of external work during adiabatic expansion. If its temperature falls by 2 K, then its internal energy will be

A. Increased by $4.5J$

B. Decreased by $4.5J$

C. Decreased by $2.25J$

D. Increased by $9.0J$

Answer: B

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3. The relation between efficiency $'\eta'$ of a heat engine and the co-efficient of performance $'\alpha$ of a refrigerator is

A. $\eta = \frac{1}{1-a}$

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

C. $\eta = 1 + a$

D. $\eta = 1 - a$

Answer: B

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4. A flask contains argon and chlorine in the ratio of$2:1$ by mass. The temperature of the mixture is $27^\circ C$. The ratio of average kinetic energies of two gases per molecule is

A. $1:1$

B. $2:1$

C. $3:1$

D. $6:1$

Answer: B

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5. A thermos flask contains 250 g coffee at $90^\circ C$. To this 20 g of milk at $5^\circ C$ is added. After equilibrium is established, the temperature of the liquid is

(Assume no heat loss to the thermos bottle . Take specific heat of coffee and milk as $1.00 cal / g^\circ C$)

A. $3.23^\circ C$

B. $3.17^\circ C$

C. $83.7^\circ C$

D. $37.8^\circ C$

Answer: C

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6. A copper rod of length 75 cm and an iron rod of length 125cm are joined together end to end . Both are of circular cross section with

diameter 2 cm . The free ends of the copper and iron are maintained at $100^\circ C$ and$0^\circ C$ respectively . The surface of the bars are insulated thermally . The temperature of the copper -iron junction is [Thermal conductivity of the copper is $386.4W/m-K$ and that of iron is $48.46W/m-K$].

A. $100^\circ C$

B. $0^\circ C$

C. $93^\circ C$

D. $50^\circ C$

Answer: C

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7. 1 g of water at $100^\circ C$ is completely converted into steam at $100^\circ C$. 1 g of steam occupies a volume of 1650 cc . (Neglect the volume of 1 g of water at $100^\circ C$). At the pressure of $10^5 N/m^2$, latent heat of steam is $540 cals/g$ (1 Calorie= 4.2 Joules).The increase in the internal energy in Joules is

A. 2310

B. 2103

C. 1650

D. 2150

Answer: B

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8. A steam at $100^\circ C$ is passed into 1 kg of water contained in a calorimeter of water equivalent 0.2 kg at $9^\circ C$ till the temperature

of the calorimeter and water in it is increased to $90^{\circ}C$. The mass of steam condensed in kg is nearly (specific heat of water $=1cal/g^{\circ}C$,latent heat of vaporisation= 540 cal / g)

A. 0.81

B. 0.18

C. 0.27

D. 0.54

Answer: B

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9. A very small hole in an electric furnance is used for heating metals . The hole nearly acts as a black body . The area of the hole is $200mm^2$. To keep a metal at $727^\circ C$, heat energy flowing through this hole per sec, in joules is ($\sigma = 5.67 \times 10^{-8} Wm^{-2} K^{-4}$)

A. 22.68

B. 2.268

C. 1.134

D. 11.34

Answer: D

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10. Five moles of hydrogen initially at STP is compressed adiabatically so that its temperature becomes 673 K. The increase in internal energy of the gas , in kilo joule is (R= 8.3 J / mol-K, γ= 1.4 for diatomic gas)

A. 80.5

B. 21.55

C. 41.5

D. 65.55

Answer: C

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11. On a temperature scale Y, water freezes at -160° Y and boils at -50° Y . On this Y scale , a temperature of 340 K is

A. $-160.3^\circ Y$

B. $-96.3^\circ Y$

C. $-86.3^\circ Y$

D. $-76.3^\circ Y$

Answer: C

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12. Three moles of an ideal monoatomic gas undergoes a cyclic process as shown in the figure. The temperature of the gas in different states marked as 1,2,3and 4 are 400 K,700 K,

2500 K and 1100 K respectivelty .The work done by the gas during the process 1-2-3-4-1 is (universal gas constant is R)

A. 1650 R

B. 550 R

C. 1100 R

D. 2200 R

Answer: A

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13. Efficiency of a heat engine whose sink is at temperature of 300 K is 40% . To increase the efficiency to 60 % keeping the sink temperature same, the source temperature must be increased by

A. 750 K

B. 500 K

C. 250 K

D. 1000 K

Answer: C

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14. Two bodies Aand B of equal surface area have thermal emissivities of 0.01 and 0.81 respectively . The two bodies are radiating energy at the same rate. Maximum energy is radiated from the two bodies A and B at wavelength λ_A and $\lambda_B$respectively . Difference in these two wavelengths is $1\mu m$. If

the temperature of the body A is 5802 K, then value of λ_B is

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

B. $1\mu m$

C. $2\mu m$

D. $\frac{3}{2}\mu m$

Answer: D

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15. When the temperature of a body increases from $T \rightarrow T + \Delta T$, its moment of inertia increases from $I \rightarrow I + \Delta I$. If α is the coefficient of linear expansion of the material of the body, the $\frac{\Delta I}{I}$ is (neglect higher order of α)

A. $\alpha \Delta T$

B. $2\alpha \Delta T$

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

D. $\frac{2a}{\Delta T}$

Answer: B

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16. A sound wave passing through an ideal gas at NTP produces a pressure change of 0.001 $dyne/cm^2$) during adiabatic compression. The corresponding change in temperature ($\gamma = 1.5$ for the gas and atmospheric pressure is $1.013 \times 10^6 dyne/cm^2$) is

A. $8.97 \times 10^{-4} K$

B. 8.97×10^{-6}K

C. $8.97 \times 10^{-8}k$

D. $8.97 \times 10^{-9}K$

Answer: C

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17. Work done to increase the temperature of one mole of an odeal gas by $30^{\circ}C$, if it is expanding under the condition $V \propto T^{2/3}$ is , $(R = 8.314J/mol/K)$

A. 116.2 J

B. 136.2 J

C. 166.2 J

D. 186.2 j

Answer: C

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18. Power radiated by a black body at temperature T_1 is P and it radiates maximum energy at a wavelength λ_1. If the temperature

of the black body is changed from T_1 to T_2 , itradiates maximum energy at a wavelength $\lambda_1 / 2$.The power radiated at T_2 is

A. $2P$

B. $4p$

C. $8P$

D. $16P$

Answer: D

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19. Total emf produd in a thermocouple does not depend on

A. The metals in the thermocouple

B. Thomson coefficients of the metals in the thermocouple

C. Temperature of the junctions

D. The duration of time for which the current is passed through thermocouple

Answer: D

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20. An insulated cylinderical vessel filled with an insulated piston of negligible weight and negligible thickness at the mid point of the vessel . The cylinder contains a gas at $0^\circ C$ .When the gas is heated to $100^\circ C$, the piston moves through a length of 5 cm . Length of the cylindrical vessel in cm is

A. 13.65

B. 27.3

C. 38.6

D. 64.6

Answer: B

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21. A reversible engine converts one - sixth of the heat suplied into work . When the temperature of the sink is reduced by $62^{\circ}C$, the efficiency of the engine is doubled . The temperatures of the source and sink are

A. $99^\circ C, 37^\circ C$

B. $80^\circ C, 37^\circ C$

C. $95^\circ C, 37^\circ C$

D. $90^\circ C, 37^\circ C$

Answer: A

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22. During an adiabatic process , the pressure of a gas is proportional to the cube of its

temperature . The value of C_I / C_v for that gas is

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

B. $\frac{4}{5}$

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

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

Answer: D

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23. Two slabs A and B of different materials but of the same thickness are joined end to end to form a composite slab . The thermal conductivities of A and B are K_1 and K_2 respectively . A steady temperature difference of $12^\circ C$ is maintained across the composite slab . If $K_1 = \frac{K_2}{2}$, the temperature difference across slab A is

A. $4^\circ C$

B. $6^\circ C$

C. $8^\circ C$

D. $10^\circ C$

Answer: C

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24. An ideal gas expands isothermally from volume V_1 to volume V_2. It is then compressed to original volume V_1 adiabatically . If p_1, p_2 and W represent the initial pressure , final pressure and the net work done by the gas respectively during the entrie process, then

A. $p_1 > p_2, W = 0$

B. $P_1 > P_2, W > 0$

C. $P_2 > P_1, W > 0$

D. $P_2 > P_1, W < 0$

Answer: D

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25. 3 moles of an ideal monoatomic gas performs ABCDA cyclic process as shown in figure below. The gas temperatures are

$T_A = 400K$, $T_B = 800K$, $T_C = 2400K$ and $T = 1200K$. The work done by the gas is (approximately) $(R = 8.314J/molK)$

A. 10KJ

B. 20KJ

C. 40KJ

D. 100KJ

Answer: B

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26. Three rods AB,BC and BD made of the same material and having the same corss-section have been joined as shown in the figure. The ends A,C and D are held at temperatures of $20^\circ C,\ 80^\circ C$ representatively. If each rod is of same length, then the temperature at the junction B of the three rod is

A. 90°

B. $60^\circ C$

C. $40^\circ C$

D. $30^\circ C$

Answer: B

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27. A clock pendulum made of invar has a period of 0.5s, at $20^\circ C$. If the clock is used in a climate where the temperature averages to $30^\circ C$, how much time does the clock lose in

each oscillation? (For invar

$\alpha = 9 \times 10^{-7} / ^{\circ} C,$ g= Constant)

A. $2.25 \times 10^{-6} s$

B. $2.5 \times 10^{-7} s$

C. $5 \times 10^{-7} s$

D. $1.125 \times 10^{-6} s$

Answer: A

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28. A piece of metal weight 45 g is air and 25 g in a liquid of density $1.5 \times 10^3 kg - m^{-3}$ Kept at 30°. When the temperature of the liquid is raised to $40^\circ C$, the metal piece weight 27g. The density of liquid at $40^\circ C$ is $1.25 \times 10^3 kg - m^{-3}$. The coefficient of linear expansion of metal is

A. $1.3 \times 10^{-3} /^\circ C$

B. $5.2 \times 10^{-3} /^\circ C$

C. $2.6 \times 10^{-3} /^\circ C$

D. $0.26 \times 10^{-3} / ^{\circ} C$

Answer: C

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29. An ideal gas is subjected to a cyclic process ABCD as depicted in the p-V diagram given below

Which of the following curves represents the equivalent cyclic process?

A. 

B. 

C. 

D. 

Answer: C

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30. An ideal gas is subjected to cyclic process involving four thermodynamic states, the amounts of heat (Q) and work (W) involved in

each of these states are

$Q_1 = 6000J$,$Q_2 = -5500J$,

$Q_3 = -3000J, Q_4 = 3500J$

$W_1 = 2500J, W_2 = -1000J,$

$W_3 = -1200J : W_4 = xJ$

The ratio of the net work done by the gas to the total heat absorbed the gas is η. The values of x and η respectively are

A. 500 , 7.5 %

B. 700 , 10.5 %

C. 1000 , 21 %

D. 1500 , 15 %

Answer: B

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31. Two cylinder A and B fitted with pistons contain equal number of moles of an ideal monoatomic gas at 400 K . The piston of A is free to move while that of B is held fixed . Same amount of heat energy is given to the gas in each cylinder . If the rise in temperature

of the gas in A is 42 K, the rise in temperature of the gas in B is

A. 21 K

B. 35 K

C. 42 K

D. 70 K

Answer: C

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32. Three rods of same dimentional have thermal coductivity 3 K,2 K, and K. They are arrenged as shown in the figure below

Then , the temperature of the junction in steady state is

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

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

C. $75^{\circ}C$

D. $\frac{50}{3}^{\circ}C$

Answer: A

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33. In the adiabatic compression, the decrease in volume is associated with

A. Increase in temperature and decrease in pressure

B. Decrease in temperature and increase in pressure

C. Decrease in temperature and decrease in pressure

D. Increase in temperature and increase in pressure

Answer: D

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34. Which of the following is the case of an adiabatic process, where $\gamma = C_p / C_v$?

A. $p^{1-\gamma}T^{\gamma} = Cons\tan t$

B. $p^{\gamma}T^{1-\gamma} = Cons\tan t$

C. $pT^{\gamma} = Con\tan t$

D. $p^{\gamma}T = Cons\tan t$

Answer: A

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35. Two slabs A and B of equal surface area are placed one over the other such that their surface are completely in contact. The

thickness of slab A is twice that of B. The coefficient of thermal conductivity of slab A is twice that of B. The first surface of slab a is maintained at $100^\circ C$, while the second surface of slab B is maintained at $25^\circ C$. The temperature at the contact of their surface is

A. $62.5^\circ C$

B. $45^\circ C$

C. $55^\circ C$

D. $85^\circ C$

Answer: A

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36. A clock which keeps correct time at $20^\circ C$, is subjected to $40^\circ C$. If coefficient of linear expension of the pendulum is $12 \times 10^{-6/\circ C}$. How much will it gain or lose time?

A. $10.3s/day$

B. $20.6s/day$

C. $5s/day$

D. $20 \text{ min } /day$

Answer: A

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37. The temperature of the system decraeses in the process of

A. Free expansion

B. Adiabatic expansion

C. Isothermal expansion

D. Isothermal compression

Answer: B

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38. Two cylinder A and B fitted with pistons contain equal number of moles of an ideal monoatomic gas at 400 K . The piston of A is free to move while that of B is held fixed . Same amount of heat energy is given to the gas in each cylinder . If the rise in temperature of the gas in A is 42 K, the rise in temperature of the gas in B is

A. 25.2 K

B. 35 K

C. 42 K

D. 70 K

Answer: A

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39. A black body radiates energy at the rate of EW/m^2 at a high temperature T K. When the

temperature is reduced to $\left(\frac{T}{2}\right)$ K, the radiant energy is

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

B. 2 E

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

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

Answer: D

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40. The temperature of a thin uniform ciruclar disc ,of 1 m diameter is increased by $10^{\circ} C$. The percenrtage increase in moment of the disc about an axis passing through its centre and perpendicular to the circular face (linear coefficient of expansion = `11xx10^(-6//@C)

A. 0.0055

B. 0.011

C. 0.022

D. 0.044

Answer: C

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41. A given mass of a gas is compressed isothermally untill its pressure is doubled. It is then allowed to expand adiabatically until its original volume is restored and its pressure is then found to be 0.75 of its initial pressure . The ratio of the specific heats of the gas is approximately .

A. 1.20

B. 1.41

C. 1.67

D. 1.83

Answer: B

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42. Two solid spheres A and B made of the same material have radii r_A and r_B respectively . Both the spheres are cooled

from the same temperature under the conditions valid for Newton's law of cooling . The ratio of the rate of change of temperature of A and B is

A. $\frac{r_A}{r_B}$

B. $\frac{r_B}{r_A}$

C. $\frac{r_A^2}{r_B^2}$

D. $\frac{r_B^2}{r_A^2}$

Answer: B

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43. A cyclic process ABCD is down below in the given p-V diagram. In the following answers the one that represents the same process as in p-V diagram.

A. 

B. 

C. 

D. 

Answer: A

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44. The ratio of specific heats of a gas is γ. The change in internal energy of one mole of the gas, when the volume change from V to 2V at constant pressure p is

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

B. pV

C. $\frac{pV}{\gamma - 1}$

D. $\frac{pV}{\gamma}$

Answer: C

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45. Two identical bodies have temperatures $277^\circ C$ and $67^\circ C$. If the surrounding temperature is $27^\circ C$, the ratio of loss pf heats of the two bodies during the same interval of time is (apporximately).

A. $4:1$

B. $8:1$

C. $12:1$

D. $19:1$

Answer: D

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46. A metallic solid sphere is rotating about its diameter as axis of rotation. If the temperature is increased by $200^{\circ}C$ the percentage increase in its moment of inertia is

(Coefficient of linear expansion of the metal $= 10^{-5} / ^{\circ} C$).

A. 0.1%

B. 0.2%

C. 0.3%

D. 0.4%

Answer: D

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47. The pressure and density of a given mass of a diatomic gas $\left(\gamma = \frac{7}{5}\right)$ change adiabatically from (p, d) to (p', d'). If $\frac{d'}{d} = 32$, then $\frac{p'}{p}$ is (γ = ration of specific heat).

A. $1/28$

B. $1/64$

C. 64

D. 128

Answer: D

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48. If 4 moles of an ideal monoatomic gas at temperature 400 K is mixed with 2 mole of another ideal monoatomic gas at temperature 700 K, the temperature of the mixture is

A. $550^\circ C$

B. $500^\circ C$

C. $550K$

D. $500K$

Answer: D

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49. A black body of mass 34.38 g and surface area $19.2cm^2$ is at an intial temperature of 400 K. It is allowed to cool inside an evacuated enclosure kept at constant temperature 300 K. The rate of cooling is $0.04^\circ C/s$. The sepcific heat of the body $Jkg^{-1}K^{-1}$ is

(Stefan's constant, $\sigma = 5.73 \times 10^{-8} Wm^{-2}K^{-4}$)

A. 2800

B. 2100

C. 1400

D. 1200

Answer: C

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50. The temperature of 5 moles of a gas at constant volume is changed from $100^{\circ}C$ to $120^{\circ}C$. The change in internal energy is 80 J.

The total heat capacity of the gas at constant volume will be in $\frac{J}{K}$.

A. 8

B. 4

C. 0.8

D. 0.4

Answer: B

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51. The radiation emitted by a star A is 10,000 times that of the sun. If the surface temperatures of the sun and the star A are 6000 K and 2000 K 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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52. The densities of a liquid at $0^\circ C$ and $100^\circ C$ are respectively 1.0127 and 1. A specific gravity bottle is filled with 300 g of the liquid at $0^\circ C$ upto the brim and it is heated to $100^\circ C$. Then, the mass of the liquid expelled in gram is Coefficient of linear expansion of glass $= 9 \times 10^{-6} / ^\circ C$)

A. $\frac{3}{10.1}$

B. $\frac{3}{1.01}$

C. $\frac{3.81}{1.0127}$

D. $\frac{3.81}{0.0127}$

Answer: B

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53. The coefficients of apparent expansion of a liquid when determined using two different vessels A and B are y_1 and y_2 respectively. If the coefficient of liner expansion of the vessel

A is α, the coefficient of linear expansion of the vessel B is

A. $\frac{\alpha\gamma_1\gamma_2}{\gamma_1+\gamma_2}$

B. $\frac{\gamma_1-\gamma_2}{2\alpha}$

C. $\frac{\gamma_1-\gamma_2+\alpha}{3}$

D. $\frac{\gamma_1-\gamma_2}{3}+\alpha$

Answer: D

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54. A metal sphere of radius r and specific heat s is rotated about an axis passing through its centre at a speed of n rotation/s. It is suddenly stopped and $50\,\%$ of its energy is used in increasing its temperature. Then, the rise in temperature of the sphere is

A. $\frac{2\pi^2 n^2 r^2}{5s}$

B. $\frac{1\pi^2 n^2}{10 r^2 s}$

C. $\frac{7}{8}\pi r^2 n^2 s$

D. $\frac{5(\pi r n)^2}{14 s}$

Answer: A

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55. 5 moles of Hydrogen $\left(\gamma = \frac{7}{5}\right)$ initially at STP are compressed adiabatically so that its temperature becomes $400^{\circ}C$. The increase in the internal energy of the gas in kilo-joule is $\left[R = 8.30 Jmol^{-1}K^{-1}\right]$

A. 21.56

B. 41.55

C. 65.55

D. 80.55

Answer: B

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56. When the temperature of a black body increases, it is observed that the wavelenght corresponding to maximum energy changes from $0.26\ \mu m$ to $0.13 \mu m$. The ration of the

emissive power 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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57. The wavelenght of maximum intensity of radiation emitted by a star is 289.8 nm. The radiation intensity of the star is

(Stefan's constant $= 5.67 \times 10^{-8} Wm^{-2} K^{-4}$, constant $b = 2898 \mu mK$)

A. $5.67 \times 10^{8} W/m^{2}$

B. $5.67 \times 10^{12} W/m^{2}$

C. $10.67 \times 10^{7} W/m^{2}$

D. $10.67 \times 10^{14} W/m^{2}$

Answer: A

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58. A lead bullet of mass 10 g travelling at $300m/s$ strikes against a block of wood and comes to rest. Assuming 50% of heat is absorbed by the bullet, the increase in its temperature is

(Specific heat of lead $= 150J/kg^{\circ}C$)

A. $100^{\circ}C$

B. $125^\circ C$

C. $150^\circ C$

D. $200^\circ C$

Answer: C

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59. Thomson coefficient of a conductor is $10\mu VK$. The two ends of its are kept at $50^\circ C$ and $60^\circ C$ respectively. Amount of heat

absorbed by the conductor when a charge of a 10 C flows through it, is

A. 1000 J

B. 100 J

C. 100 mJ

D. 1 mJ

Answer: D

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60. During an adiabatic process , the pressure of a gas is proportional to the cube of its temperature . The value of C_I / C_v for that gas is

A. $\frac{1}{5}$

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

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

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

Answer: D

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61. An ideal gas at a pressure of 1 atm and temperature of $27^\circ C$ is compressed adiabatically until its pressure becomes 8 times the initial pressure , then final temperature is $\left(\gamma = \frac{3}{2}\right)$

A. $627^\circ C$

B. $527^\circ C$

C. $427^\circ C$

D. $327^\circ C$

Answer: D

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62. The liquids at temperature $60^\circ C$ and $30^\circ C$ respectively have masses in the ratio 3:4 and their specific heats in the ratio 4:5. The the two liquids are mixed , the resultant temperature is

A. $70^\circ C$

B. $50^\circ C$

C. $40^\circ C$

D. $41.25^\circ C$

Answer: D

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63. Two metal rods A and B of equal lengths and equal cross- sectional areas are joined end to end. The coefficients of thermal conductivities of A and B are in ratio 2 : 3 , when the free end of A is maintained at

$100^\circ C$, free end of B at $0^\circ C$, the temperature of the junction is

A. $30^\circ C$

B. $40^\circ C$

C. $50^\circ C$

D. $60^\circ C$

Answer: B

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64. 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. $126.5 \times 10^{-4/\circ C}$

B. $0.8 \times 10^{-4/\circ C}$

C. $1.25 \times 10^{-6/\circ C}$

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

Answer: D

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65. When heat energy of 1500 J is supplied to a gas at constant pressure , $2.1 \times 10^5 Nm^{-2}$, there was an increase in its volume equal to $2.5 \times 10^{-3} m^3$. The increase in its internal energy in joule is

A. 450

B. 525

C. 975

D. 2025

Answer: C

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66. A liquid of mass M and specific heat s is at temperature 2t . If another liquid of same mass, specific heat 1.5 times s at a temperature of $\frac{t}{3}$ is added to it, the resultant temperature will be

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

B. t

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

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

Answer: B

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67. The relation between melting point of ice and pressure is shown by ice line , which will be

A. With a positive slope

B. With a negative slope

C. Parallel to pressure axis

D. Parallel to temperature axis

Answer: B

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68. A steel bridge in a town is 200 m long . Where minimum temperature in winter is $10^{\circ} C$ and maximum in summer is $40^{\circ} C$. The

change in length of bridge from winter to summer is [for steel $\alpha = 11 \times 10^{-6}/^{\circ}C$]

A. 3.3 cm

B. 6.6 cm

C. 6.6 m

D. 8.3 m

Answer: B

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69. A glass flask of volume $200cm^3$ is completely filled with mercury at $20^\circ C$. The amount of mercury that split over when the flask is heated to $80^\circ C$ is (coefficient of volume expension for glass $27 \times 10^{-8/\circ C}$)

A. Zero

B. $0.3cm^3$

C. $1.84cm^3$

D. $2.40cm^3$

Answer: A

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70. The first law of thermodynamics states that

A. System can do the work

B. System has temperature

C. System has pressure

D. Heat is a form of energy

Answer: D

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71. A lead bullet of mass 21 g travelling at a speed of $100m/s$ comes to rest in a wooden block . If no heat is taken away by the wood , the rise in temperature of the bullet in the wood nearly is (specified heat of lead = $30cal/kg^\circ C$)

A. $25^\circ C$

B. $28^\circ C$

C. $33^\circ C$

D. $39^\circ C$

Answer: D

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72. In order that heat is conducted from one part of a solid to another part , what is required is ?

A. Uniform density

B. Uniform temperature

C. Temperature gradient

D. Density gradient

Answer: C

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73. The coefficient of real expension of mercury is $18 \times 10^{-5/\circ}C$.The thermometer bulb has a volume of $10^{-6}m^3$ and cross-section of the steam is $0.002cm^2$. Assuming that the bulb is filled with mercury at $0^\circ C$,

the length of the mercury column at $100^\circ C$ will be

A. 9 cm

B. 18 cm

C. 9 mm

D. 18 mm

Answer: A

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74. A clock with an iron pendulum keeps correct time at $15^{\circ}C$. If th room temperature rises to $20^{\circ}C$, the error in second per day will be (coefficient of linear expansion of iron is $0.000012^{\circ}C$)

A. 2.5 s

B. 2.6 s

C. 2.4 s

D. 2.2 s

Answer: B

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75. Certain amount of heat supplied to an ideal gas under isothermal conditions will result in

A. A rise in temperature

B. Doing external work and a change in temperature

C. Doing external work

D. An increase in the internal energy of the gas

Answer: C

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76. 30 g of water at $300^\circ C$ is in a beaker . Which of the following when added to water , will have greater cooling effect ?(specific heat of copper =$0.1 cal / g^\circ C$)

A. 100 g of water at $10^{\circ} C$

B. 15 g of water at $0^{\circ} C$

C. 3 g of ice at $0^{\circ} C$

D. 18 g of copper at $0^{\circ} C$

Answer: A

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77. Two cylindrical conductors A and b of same metallic material have their diameters in the ratio 1 : 2 and lengths in the ratio 2 : 1 . If the

temperature difference between their ends is same , the ratio of heats conducted respectivelty by A and B per sec is

A. $1:2$

B. $1:4$

C. $1:16$

D. $1:8$

Answer: D

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78. For a constant volume gas thermometer one should fill the gas at

A. High temperature and high pressure

B. High temperature and low pressure

C. Low temperature and low pressure

D. Low temperature and high pressure

Answer: B

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79. A body does not emit heat energy at

A. $0^\circ C$

B. 0 K

C. $273^\circ C$

D. $373^\circ C$

Answer: A

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80. A piece of lead falls from a height of 100 m on a fixed non - conducting slab which brings it to rest . The temperature of the piece immediately after collision increase by (specific heat of lead is $30.6 cal kg^{-10} C^{-1}$ and $g = 9.8 m s^{-2}$)

A. 0 K

B. $27^{\circ} C$

C. $7.63^{\circ} C$

D. 4.2 K

Answer: C

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81. An amount of water of mass 20 g at $0^\circ C$ is mixed with 40 g of water at $10^\circ C$. Final temperature of mixture is

A. $20^\circ C$

B. $6.67^\circ C$

C. $5^\circ C$

D. $0^\circ C$

Answer: B

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82. Coefficient of real expension of mercury is $0.18 \times 10^{-3/\circ}C$. If the density of mercury at $0^\circ C$ is $13.6g/CC$, its density at 473 K will be

A. $13.11gCC^{-1}$

B. $13.65gCC^{-1}$

C. $13.51gCC(-1)$

D. $13.22gCC^{-1}$

Answer: A

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83. A glass vessel just hold 50g of a liquid at $0^\circ C$. If the coefficient of linear expension of glass is $8 \times 10^{-4/\circ} C$. The mass of the liquid , it holds at $50^\circ C$ is

A. 46 g

B. 48 g

C. 56 g

D. 42 g

Answer: C

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84. A iron ball of mass $0.2kg$ is heated to $100^\circ C$ and put into a block of ice at $0^\circ C$.25 g of ice melts , then specific heat of iron (in cal $kg^{-10}C^{-1}$) is [Latent heat of fusion of ice = $80calg^{-1}$]

A. 1

B. 0.1

C. 0.8

D. 0.08

Answer: B

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85. Work done by 0.1 mole of gas at $27^{\circ}C$ when it expands to double its volme at constant pressure is (assume $R = 2cal/mol - K$)

A. 600 cal

B. 42 cal

C. 60 cal

D. 546 cal

Answer: B

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86. A pyknometer weight 40 g when empty and 1040g when filled with mercury at $0^{\circ}C$. On heating to $100^{\circ}C$, 10 g of mercury overflows. If

the coefficient of real expansion of mercury is $0.0002/^{\circ}C$, the coefficient of expansion of glass is

A. $0.00001/^{\circ}C$

B. $0.0002/^{\circ}C$

C. $0.0002/^{\circ}C$

D. $0.0001/^{\circ}C$

Answer: D

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87. In an isothermal change, an ideal gas obeys

A. Boyle's law

B. charle's law

C. Gay-Lusac law

D. None of these

Answer: A

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88. A compound slab is made with two different materials A and B with coefficient of thermal conductivity $K_A = 2K_B$ and thickness $x_A = \frac{1}{2}x_B$.

If the face of the A surface is at $100^\circ c$ and that of the B surface is at $25^\circ C$ the temperature of the common surface will be

A. $85^\circ C$

B. $45^\circ C$

C. $40^\circ C$

D. $15^{\circ} C$

Answer: A

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89. Boiling point of a liquid can be defined as that temperature at which___ the liquid becomes equal to atmospheric pressure.

A. Due point

B. Surface vapour pressure

C. Internal energy of liquid

D. None of the above

Answer: B

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90. When a liquid is taken in a long cylindrical vessel of material, with linear coeffcient of expansion α, is heated, the level of liquid did not change. The volume coefficient of expansion of liquid is

A. α

B. 2α

C. 3α

D. 1.5α

Answer: C

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91. A liuid of mass m and specific heat s is heated to a temperature T. Another liquid of mass $m/2$ and specific heat 2s is heated to

temperature 2 T. If these two liquids are mixed, the resultant temperature of the nixture will be

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

B. $\frac{8}{5}T$

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

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

Answer: D

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92. When an ice cube melts and becomes water , the ice water system undergoes

A. The entropy of the system increases and the internal energy increases

B. The entropy of the system decreases and the internal energy decreases

C. The entropy of the system decreases and the internal energy increases

D. The entropy of the system increases and the internal energy decreases

Answer: A

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93. A 2 m long Al pipe at $27^\circ C$ is heated until it is 2.0024 m , at $77^\circ C$. The coefficient of linear expension of Al is

A. $2.4 \times 10^{-5/\circ} C$

B. $1.4 \times 10^{-5/\circ} C$

C. $2.4 \times 10^{-3/\circ} C$

D. $1.4 \times 10^{-3/\circ} C$

Answer: A

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94. Assume that heat capacity of H_2O to be $4.2 \times 10^3 Jkg^{-1}K^{-1}$ and the latent heat of vapourisation of H_2O to be $22.5 \times 10^5 Jkg^{-1}$. The amount of heat in joule required to heat 1 kg of water from $50^\circ C$ to $100^\circ C$ and then to convert into steam at $100^\circ C$ is

A. $12.3 \times 10^5 J$

B. $24.6 \times 10^5 J$

C. $20.0 \times 10^5 J$

D. $18.6 \times 10^5 J$

Answer: B

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95. The hollow 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 large radius one is 25 min and that for smaller one is 16 min , the ratio of thermal conductivities of materials of larger sphere to smaller sphere is

A. $4:5$

B. $5:4$

C. $25:8$

D. $1:25$

Answer: B

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96. Ice contract on melting when subjected to pressure and the pressure is increased the melting point

A. Increase

B. Decrease

C. Remains same

D. First increase than decrease

Answer: A

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