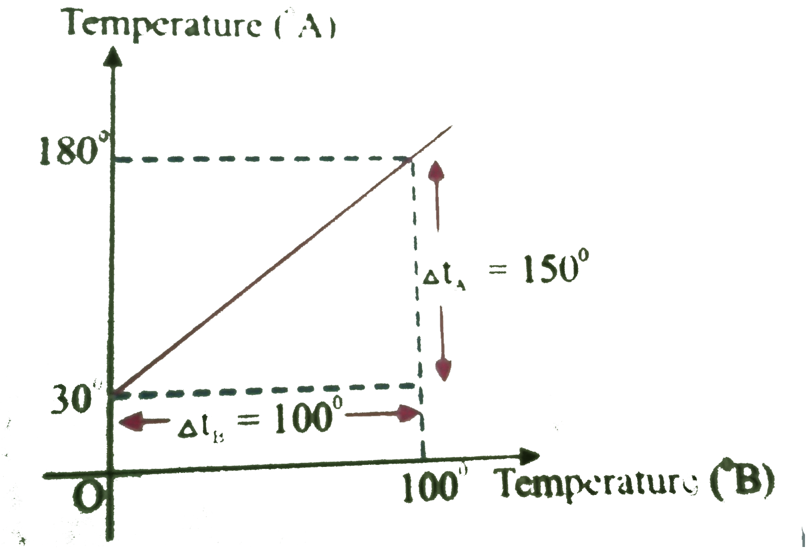
PHYSICS

AIMED AT STUDENTS PREPARING FOR IIT JEE EXAMS

THERMAL PROPERTIES OF MATTER

Examples

1. 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_



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

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3. At what temperature is the Fahrenheit scale reading equal to

(a) twice (b) half of Celsius ?

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4. An accurate Celsius rhwemometer and a faulty Fahrenheit thermometer register 60° and 141° respectively when placed in the same constant temperature enclosure. What is the error in the Fahrenheit thermometer ?

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5. Two absolute scale X and Y have triple points of water defined to be $300X$ and $450Y$. How are T_X and T_Y related to each other ?

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6. The readings corresponding to the ice point and steam point for a constant pressure gas thermometer are 500, and 545. If the reading corresponding to room temperature be 510, find the room temperature ?

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7. A constant volume gas thermometer shows pressure readings of $50cm$ and $90cm$ of mercury at 0^0C and 100^0C respectively. What is the temperature on gas scale when the pressure reading is $60cm$ of mercury ?

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8. The resistance of a platinum wire is 15Ω at $20^\circ C$. This wire is put in hot furnace and lthe resistance of the wire is found to be 40Ω.

Find the temperature of the hot furnace if temperature coefficient of resistance of platinum is $3.6 \times 10^{-3} \hat{} (0)C^{-1}$

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9. The resistance of a platinum resistance thermomter is found to be $11.0ohm$ when dipped in a triple point cell. When it is dipped in a both,resistance is found to be $28.887ohm$. Find the temperature of the bath in $.^{0}C$ on platinum scale.

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10. Graph shows the relation between Centigrade and Fahrenheit scales of temperature. Find the slope in each graph?

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11. What length of brass and iron at 0^0C must be used if the difference between their lengths is always $0.2m$? The values of α for brass and iron and $18 \times 10^{-6} / 0C$ and $12 \times 10^{-6} / 0C$ respectively,

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12. A blacksmith fixes iron ring on the rim of the wooden wheel of a bullock cart. The diameter of the rim and the ring are $5.243m$ and $5.231m$ respectively at $27^\circ C$. To what temperature should the ring be heated so as to fit the rim of the wheel ? Coefficient of linear expansion of iron =$1.20 \times 10^{-5} K^{-1}$

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13. An aluminium measuring rod, which is correct at $5^\circ C$ measures the length of a line as 80 cm at $45^\circ C$ If thermal coefficient of linear expansion of aluminium is $2.50 \times 10^{-4} / {}^{\circ} C$, the correct length of the line is:

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14. An iron of length $50cm$ is joined at an end to copper rod to length $100cm$ at $20^{0}C$. Find the length of the system at $100^{0}C$ and average coefficient of linear expansion of the systeam.

$\left(\cdot_{iron} = 12 \times 10^{-6/0}C \text{ and } \cdot_{copper} = 17 \times 10^{-6/0}C. \right)$

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15. Density of gold is $19.30g/cm^{3}$ at $20^{0}C$. Computer the density of gold at $90^{0}C$ by adding steam to it. $\left(\alpha = 14.2 \times 10^{-6/0}C\right)$

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

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17. The balance wheel of a mechanical wriest watch has a frequency of oscillation given by $f = \left(\frac{1}{2}\pi\right)\sqrt{C/I}$, where I is the moment of inertia of the wheel and C is the torisonal rigidity of its spring. The wrist watch keeps accurate time at $25^{0}C$, How many seconds would it gain a day at . $-25^{0}C$ if the balance wheel made of aluminium ?

(Given, $\alpha_{Al} = 25.5 \times 10^{-6/0}C$)

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18. A clock with a metallic pendulum gains 5 s each day at a temperature of $15^\circ C$ and loses 10 s each day at a temperature of $30^\circ C$. Find the coefficient of thermal expansion of the pendulum metal.

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19. A steel bar of cross sectional area $1cm^2$ and $50cm$ long at 30^0C fits into the space between two fixed supports.. If the bar s now heated to 280^0C, what force will it exert against the supports ? ($\cdot$ for steel $= 11 \times 10^{6/0}C$ and Young's modulus for steel $= 2 \times 10^{11} N/m^2$)

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20. A mass of $2Kg$ is suspended from a fixed point by a wire of length $3m$ and diameter $0.5mm$. Initially the wire is just unstretched, the mass resting on a fixed support. By how much must the temperature fall if the mass is to be entirely supported by the wire (Given Y for wire $= 206GPa, \alpha = 11 \times 10^{-6/ \circ} C$)

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21. A metallic rod of length lcm and cross-sectional area Acm^2 is heated through $t^\circ C$. After expansion if a mechanical force is applied normal to its length on both sides of the rod and restore its original length, what is the value of force? The young's modulus of elasticity of the metal is E and mean coefficient of linear expansion is α per degree Celsius.

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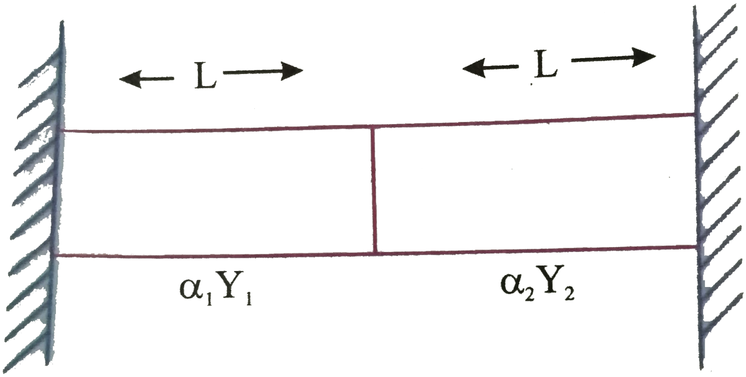
22. Two metal rods are fixed end to end between two rigid supports as shown in figure. Each rod is of length l and area of cross-section is

A. When the systeam is heated up,datermine the condition when the juncation between rods does not shift ? (Y_1 and Y_2 are Young's modulus of materials of rods, α_1 and α_2 are coefficients of linear expansion)



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23. A bimetallic strip of thickness $2cm$ consists of zinc and silver rivetted together. The approximate radium of curvature of the strip when heated through $50^0 C$ will be : (linear expansivity of zinc and silver are $32 \times 10^{-6 / \circ} C$ and $19 \times 10^{-6 / \circ} C$ respectively)

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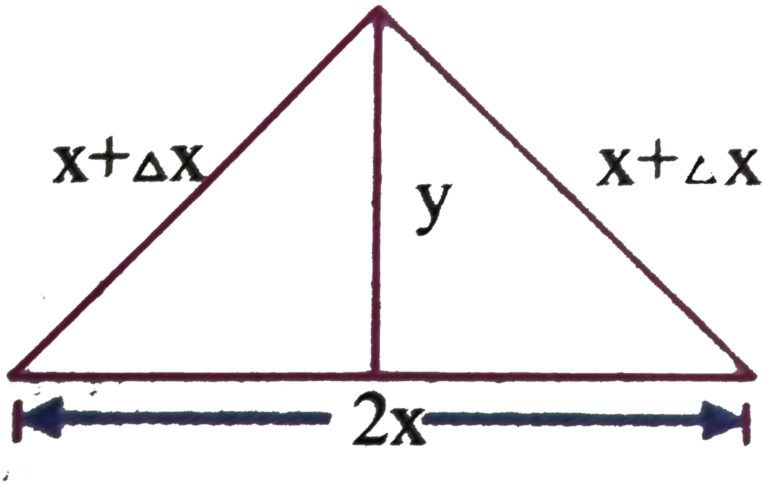
24. A steel rail $30m$ long is firmly attached to the road be only at its ends. The sun raises the temperature of the rail by 50^0C, causing the rail to buckle. Assuming that the buckled rail consitst of two straight parts metting in the centre, calculate how much the centre of the rail rise? Given, `alpha_(steel) = 12 xx 10^(-6//@)C.



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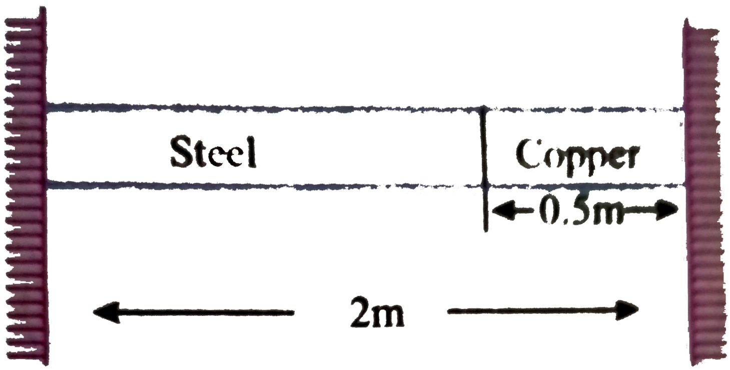
25. When composite rod is free, composite rod is free, compositive length increase to $2.002m$ from temprature $20^\circ C$ to $120^\circ C$. When composite rod is fixed between the support. There is no change in component length. Find Y and α of steel if

$Y_{cu} = 1.5 \times 10^{13N/m^2\alpha_{cu} = 1.6 \times 10^{-5/^\circ C}}$



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26. A metal rod of Young's modulas F and coefficient of thermal expansion α is held at its two ends such that its length remians invariant. If its temperature is raised by $t^\circ c$, then the linear stress developed in it is

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27. An aluminium sphere of $20cm$ diameter is headed from $0^{\circ} C$ to $100^{\circ} c$. Its volume changes by (given that the coefficient of linear expanison for aluminium $\left(\alpha_{Al} = 23 \times 10^{-6/0} C\right)$

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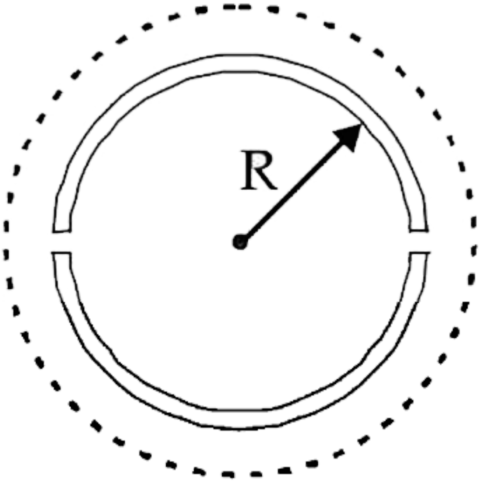
28. A wooden wheel of radius R is made of two semicircular part . The two parts are held together by a ring made of a metal strip of cross sectional area S and length L. L is slightly less than $2\pi R$. To fit the ring on the wheel, it is heated so that its temperature rises by ΔT and it just steps over the wheel. As it cools down to surrounding temperature, it process the semicircle parts together. If the coefficient of linear expansion of the metal is α, and it Young's modulus is Y, the force that one part of the wheel applies on the other part is :



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29. Volume of the bulb of a mercury thermometer at $0^{\circ} C$ is $V_{\circ}$ and area of cross section of the capillary tube is A_0, coefficient of linear expansion of glass is α_g, and the cubical expansion of mercury is γ_m. If the mercury fills the bulb at $0^{\circ} C$, find the length of mercury column in thermometer at $T^{\circ} C$

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30. A block flats in water at 4^0C so that 0.984 of its height is under water. At what temperature of water will the block just sink in water? Negleact expansion of block.

$\left(\gamma_R \text{for water } = 2.1 \times 10^{-4} / ^0 C\right)$

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31. A sphete of deamrter 7.0 cm and mass 266.5 g float in a bath of liquid. As the temperature is raised, the sphere begins to sink at a temperature of $35^\circ C$. If the density of liqued is $1.527gcm^{-3}$ at$0^\circ C$, find the coeffiecient of cubical expamsion of the liquid. Neglect the expansion of the sphere.

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32. A long cylindrical metal vessel, having a linear coefficient (α), is filled with a liquuid upto a certain level. On heating it, it is found that the level of liquid in the cylinder reamains the same. What is the cylinder reamains the same. What is the volume coefficient of expansion of the liquid?

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33. A $250 cm^3$ glass bottle is completely filled with water at $50^\circ C$. The bottle and water are heated to $60^\circ C$. How much water runs over if:

a. the expansion of the bottle is neglected:

b. the expansion of the bottle is included? Given the coefficient of areal expansion of glass $\beta = 1.2 \times 10^{-5} / K$ and $\gamma_{\text{water}} = 60 \times 10^{-5} /^\circ C$.

A. `

B.

C.

D.

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34. A cube of coefficient of linear expansion $alpah$ is floating in a bath containing a liquid of coefficeient of volume expansion γ_l. When the temperature is raised by ΔT, the depth upto which the cube is submerged in the liquid remains the same. Find relation between α and γ_l

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35. The loss of weight of a solid when immersed in a liquid at 0^0C is ΔW_0. If α and β are the volume coefficients of expansion of the solid and the liquid respectively, then the loss of weight at $t^\circ C$ is approxumately

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36. 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

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37. A peiece of metal weight $45g$ in air and $25g$ $30^\circ C$. When the temperature of the liquide raised to 40°

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38. A Barometer with brass scale, which is correct at $0^\circ C$, reads $75cm$ on a day when the air temperature is $20^\circ C$. Calculate correct reading at $0^\circ C$. (Coefficient of real expansion of mercury

$= 0.00018 / ^\circ C$ and coefficient of linear expansion of brass $= 0.000189 / ^\circ C$.)

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39. A given mass of ideal gas has volume V at pressure P and room temperature T. Its pressure is first increased by 50% and then decreased by 50% (both at constant temperature). The volume becomes

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40. The volume of an air bubble increases by $x\%$ as it raises from the bottom of a water lake to its surface. If the water barometer reads H, the depth of the lake is

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41. The density of an air bubble decrease by $x\%$ as it raises from the bottom of a lake to tis surface. The water berometer reads H. The depth of lake is

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42. An ideal gas is trapped between a mercury column and the closed-end of a narrow vertical tube of uniform base containing the column. The upper end of the tube is open to the atmosphere. The atmospheric pressure equals $76cm$ of mercury. The lenghts of the mercury column and the trapped air column are $20cm$ and $43cm$ respectively. What will be the length of the air column when the tube is tilted slowly in a vertical plane through an angle of 60°? Assume the temperature to remain constant.

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43. A column of mercury of 10cm length is contained in the middle of a narrow horizontal 1m long tube which is closed at both the ends. Both the halves of the tube contain air at a pressure of 76 cm of mercury. By what distance will the column of mercury be displaced if the tube is held vertically?

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44. A vertical cylinder of height $100cm$ contains air at a constant temperature. The top is closed by a frictionless light piston. The atmospheric pressure is equal to $75cm$ of mercury. Mercury is slowly poured over the piston.Find the maximum height of the mercury column that can be put on the piston.

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45. A gas is enclosed in a vessel of volume V at a pressure P. It is being pumped out of the vessel by mean of a piston-pump with a stroke volume. v. What is the final pressure in the vessel after $'n'$ strokes of the pump ? Assume temperature reamains constant.

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46. Two cylinder having m_1g and m_2g of a gas at pressure P_1 and P_2 respectively are put in cummunication with each other, temperature remaining constant. The common pressure reached will be

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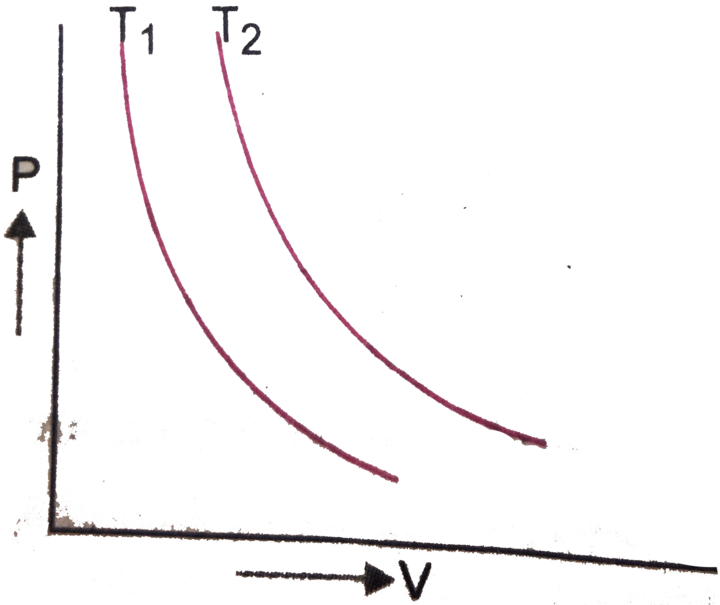
47. Isothermal curves for a given mass of gas are shown at two different temperture $T_1 \text{ and } T_2$ in Fig. State whether

$T_1 > T_2$ or $T_2 > T_1$. Justify your answer.



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48. $4g$ hydrogen is mixed with 11.2 litre of He at (STP) in a container of volume 20 litre. If the final temperature is $300K$, find the pressure.

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49. An air bubble starts rising from the bottom of a lake. Its diameter is $3.6mm$ at the bottom and $4mm$ at the surface. The depth of the lake is $250cm$ and the temperature at the surface is $40^\circ C$. What is the temperature at the bottom of the lake? Given atmospheric pressure = $76cmofHg$ and $g = 980cm/s^2$.

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50. A faulty barometer tube is $90cm$ long and its contains some air above mercury. The reading is cm when the true atmospheric pressure $76cm$. What will be the true atmospheric pressure if the reading on this barometer is 74 cm? (H = 10cm of water column)

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C.U.Q

1. Temperature of gas is a measure of

A. (a) the average translational kinetic energy of the gas molecules

B. (b) the averge potential energy of the gas molecules

C. (c) the average distance of the gas molecules

D. (c) the size of the molecules of the gas

Answer: A

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2. Celsius is the unit of

A. (a) Temperature

B. (b) Heat

C. (c) Specific heat

D. (d) Latent heat

Answer: A

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3. On the Celsius scale the absolute zero of temperature is at

A. (a) $0^{\circ} C$

B. (b) $-32^{\circ} C$

C. (c) $100^{\circ} C$

D. (d) . $-273.15^{\circ} C$

Answer: D

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4. The correct value of $0^{\circ} C$ on the Kelvin scale is

A. (a) $273.15K$

B. (b) $273.16K$

C. (c) $273K$

D. (d) $273.2K$

Answer: A

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5. The standard scale of temperature is

A. the mercury scale

B. the gas scale

C. the platinum resistance scale

D. liquid scale

Answer: B

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6. Melting and Boiling point of water on Fahrenheit scale of temperature respectively

A. (a) $212^0 F, 32^0 F$

B. (b) $32^0 F, 212^0 F$

C. (c) $0^0 F, 100^0 F$

D. (d) $32^0 F, 132^0 F$

Answer: B

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7. For meaurements of very high temperature say around $5000^\circ C$(of sun), one can use:

A. Gas thermometer

B. Platinum resistance thermometer

C. Vapour pressure thermometer

D. Pyrometer (Radiation thermometer)

Answer: D

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

A. maintaning vacuum above the mercury column in the steam of the thermometer

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

C. filling Nitrogen gas at low pressure above the mercury column

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

Answer: B

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9. For measuring temperature near absolute zero, the thermometer used is

A. thermoelectric termometer

B. radiation thermometer

C. magnetic thermometer

D. resistance thermometer

Answer: C

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10. Which of the following scales of temperature has only positive degrees of tempreature has only positive degress of temperature?

A. (a) Centigrade

B. (b) Fahrenheit scale

C. (c) Reaumur scale

D. (d) Kelvin scale

Answer: D

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11. Which of the following is the smallest rise in temperature?

A. (a) $1^{\circ}F$

B. (b) $1^{\circ}R$

C. (c) $1K$

D. (d) $1^{\circ}C$

Answer: A

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12. The temperature at which two bodies appear equally hot or cold when touched by a person is

A. (a) $0^{0}C$

B. (b) $37^{0}C$

C. (c) $25^{0}C$

D. (d) $4^{0}C$

Answer: B

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13. The range of clinical thermometer is

A. $37^{\circ}C$ to $42^{\circ}C$

B. $95^{\circ}F$ to $110^{\circ}F$

C. $90^{\circ}F$ to $112^{0}F$

D. $95^{0}C$ to $104^{\circ}C$

Answer: B

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14. Which of the following is the largest rise in temperature?

A. $1^\circ F$

B. $1^\circ R$

C. $1 K$

D. $1^\circ C$

Answer: B

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15. Solids expand on heating because

A. the $K. E.$ of the atoms increases.

B. the P.E. of the atom increases

C. total energy of the atoms increases.

D. the $K. E.$ of the atoms decreases.

Answer: A

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16. Expansion during heating

A. occurs only in solids.

B. decreases the density of the material

C. occurs at same rate for all liquids and gases.

D. increases the weight of the material.

Answer: B

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17. When a metal bar is cooled, then which one of these staments is correct.

A. Length, density and mass remain same.

B. Length decreases, density increases but mass remains same

C. Length and mass decrease but density remains the same.

D. Length and density decrease but mass reamains the same.

Answer: B

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18. When a metal bar is heated, the increase in length is greater, if

A. the bar has large diameter

B. The bar is long.

C. the temperature rise small

D. Small diameter

Answer: B

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19. A ring shaped piece of a metal is heated, if the material expands, the hole will

A. contract

B. expand

C. remain same

D. expand or contract depending on the width

Answer: B

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20. A solid ball of metal has a spherical cavity inside it. The ball is cooled. The volume of the cavity will

A. decrease

B. increase

C. reamain same

D. have its shape changed

Answer: A

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21. The substance which ha negative coefficient of linear expension is

A. lead

B. aluminum

C. iron

D. invar steel

Answer: A

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22. Two substance of same size are made of same material but one is hollow and the other is solid. They are heated to same temperature, then

A. both spheres will expand equally

B. hollow sphere will expand more than solid one

C. solid sphere will expand more than hollow one

D. hollow sphere will expand double that of solid one

Answer: A

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23. If temeratre of two shpheres of same size but made of different materials changes by ΔT then

A. both expands equally

B. Sphere with greater α expands or contracts more than other.

C. sphere with greater α expands or conteats less than other.

D. both contracts equally.

Answer: B

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24. The linear expansion of a solid depends on

A. its original mass

B. nature of the material and temperature difference.

C. the nature of the material only

D. pressures

Answer: B

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25. The coefficient of linear expansion of a solid depends upon

A. the unit of pressure

B. the nature of the material only

C. the nature of the material and temperature

D. unit of mass

Answer: B

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26. if α_c and α_f denote the numerical values of coefficient of linear expansions of the solid, expressed per ^(0)C` and per Kelvin respectibely, then.

A. $\alpha_c > \alpha_k$

B. $\alpha_c < \alpha_k$

C. $\alpha_c = \alpha_k$

D. $\alpha_c = 2\alpha_k$

Answer: C

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27. If α_c and α_f denote the numerical values of coefficient of linear expansion of a solid, expressed per $.^0 C$ and per $.^0 F$ respectively, then

A. $\alpha_c > \alpha_f$

B. $\alpha_f > \alpha_c$

C. $\alpha_f = \alpha_c$

D. $\alpha_f + \alpha_f = 0$

Answer: A

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28. The coefficient of linear expansion of a metal rod is $12 \times 10^{-6/0}C$, its value in per ^(0)F`

A. $\frac{20}{3} \times 10^{-6/0}F$

B. $\frac{15}{4} \times 10^{-6/0}F$

C. $21.6 \times 10^{-6/0}F$

D. $12 \times 10^{-6/0}F$

Answer: A

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29. the coefficient of volume expansion is

A. equal to the coefficient of linear expansion

B. twice the coefficien of linear expansion

C. equal to the sum of coefficient of linear and superficial expansions.

D. Twice the coefficient of areal expansion.

Answer: C

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30. Always platinum is fused into glass, because

A. Plaltinum is good conductor of heat

B. melting point of platinum is very high

C. they have equal specific heats

D. their coefficients of linear expansion are equal

Answer: D

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31. Two metal strips that constitute a bimetallic strip must necessarily differ in their.

A. length

B. mass

C. coefficient of linear expansion

D. resistivity

Answer: C

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32. Thermpstat is based on the principle of

A. equal expansion of two rods of different lengths.

B. different expansion of two rods of different lengths

C. different expansion of two rods of same length

D. equal expansion of two rods of same length.

Answer: C

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33. A pendulum clock shows correct time at $0^{\circ} C$. At a higher temperature the clock.

A. looses time

B. gains time

C. neither looses nor gains time

D. will not operate

Answer: A

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34. To keep constant time, watches are fitted with balance whell made of

A. steel

B. Platinum resistance thermometer

C. invar

D. tungsten

Answer: C

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35. A brass dise fits into a hole in an iron plate. To remove the disc.

A. the system must be cooled

B. the system must be heated

C. the plate may be heated (or) cooled

D. the disc must be heated

Answer: A

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36. When hot water is poured on a glass plate, it breaks because of

A. unequal expansion of glass

B. equal contraction of glass

C. unequal contraction of glass

D. glass is delicate

Answer: A

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37. When the temperature of a body increases

A. density and moment of inertia increase

B. density and moment of inertia decrease

C. density decreases and moment of inertia increase

D. density increases and moment of inertia decreases.

Answer: C

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38. In balance wheel of watch, the factors that make its oscillations uniform are

A. tension in string

B. moment of inertia of balance wheel

C. temperature

D. pressures

Answer: B

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39. When a metal ring is heated

A. the inner radius decreases and outer radius increases

B. the outer radius decreases and inner radius increases

C. both inner and outer radii increases

D.

Answer: C

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40. A cube of ice is placed on bimetallic strip at room temperature as shown in the figure. What will happen if the upper strip of iron and the lower strip of copper?

A. Ice moves downward

B. Ice moves upward

C. Ice remains in rest

D. None of the above

Answer: A

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41. To withstand the shapes of concave mirrors against temperature variations used in high resolution telescope, they are made of

A. quartz

B. flint glass

C. crown glass

D. combination of flint and silica

Answer: A

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42. The holes through which the fist plates are fitted to join the rails are ovalin shape because

A. bolts are in oval shape

B. to allow the movement of rails in the direaction of length due to change in temperature.

C. to make the fitting easy and tight

D. only oval shape holes are possible

Answer: B

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43. A semicircular metal ring subtends an angles of 180^0 at the centre of the circle. When it is heated, this angle

A. remains constant

B. increase slightly

C. decrease slightly

D. become 360°

Answer: A

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44. The diameter of a metal ring is D and the coefficient of linear expansion is α. If the temperature of the ring is increased by $1^0 C$, the circumference and the area of the ring will increases by

A. $\pi D\alpha, 2\pi D\alpha$

B. $2\pi D\alpha, \pi D^2\alpha$

C. $\pi D\alpha, \frac{\pi D\alpha}{2}$

D. $\pi D\alpha, \frac{\pi D^2\alpha}{2}$

Answer: D

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45. The moment of ineratia of a uniform thin rod about its perpendicular bisector is I. If the temperature of the rod is increased by Δt , the moment of inertia about perpendicular bisector increases by (coefficient of linear expansion of material of the rod is α).

A. Zero

B. $I\alpha\Delta t$

C. $2I\alpha\Delta t$

D. $I\alpha\Delta t$

Answer: C

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46. A bimetal made of copper and iron strips welded together is straight at room temprature. It is held vertically so that the iorn strip is towards the left hand and coper strip is then heated. The bimetal strip will

A. remain straight

B. bend towards right

C. bend towards left

D. have no change

Answer: C

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47. If L_1 and L_2 are the lengths of two rods of coefficients of linear expansion α_1 and α_2 respectively the condition for the difference in lengths to be constant at all temperatures is

A. $L_1\alpha_1 = L_2\alpha_2$

B. $L_1\alpha_2 = L_2\alpha_1$

C. $L_1\alpha_1 = L_2\alpha_2$

D. $L_1\alpha_2 = L_2\alpha_1$

Answer: A

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48. When a copper ball is coolled llthe largest percentage increase will occur in its

A. diameter

B. area

C. volume

D. density

Answer: D

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49. The coefficient of linear expansion of P and Q are α_1 and α_2 respectively. If the coefficient of cubical expansion $'Q'$ is three times the coefficient of superficial expansion of P, them which of the following is true ?

A. $\alpha_2 = 2\alpha_1$

B. $\alpha_1 = 2\alpha_2$

C. $\alpha_2 = 3\alpha_1$

D. $\alpha_1 = 3\alpha_2$

Answer: A

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50. The substance which contracts on heating is

A. silica glass

B. iron

C. inva steel

D. aluminum

Answer: A

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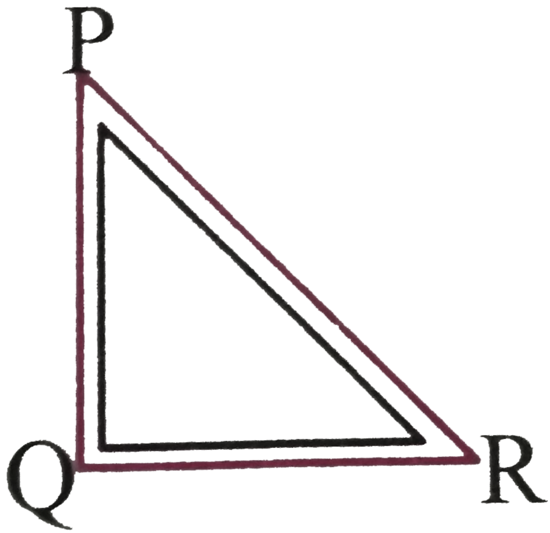
51. PQR is a right angled triangle made of brass rod bent as shown. If it is heated to a high temperature the angle PQR.



A. increases

B. decreases the density of the material

C. remain same

D. become 135°

Answer: C

Watch Video Solution

52. A brass scale gives correct length at $0^{\circ} C$. If the temperature by $25^{\circ} C$ and the length read by the scale is $10 cm$. Then the actual length will be

A. more than $10 cm$

B. less than $10 cm$

C. equal to $10 cm$

D. we can not say

Answer: A

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53. the coefficient of volume expansion is

A. twice the coefficient of linear expansion.

B. twice the coefficient of real expansion.

C. thrice the coefficient of real expansion.

D. thrice the coefficient of linear expansion.

Answer: D

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54. When a metasl sphere is heated maximum percentage increase occurs in its

A. density and moment of inertia increase

B. surface area

C. radius

D. volume

Answer: D

Watch Video Solution

55. A solid sphere and a hollow sphere of same material have same mass. When they are heated by$50^\circ C$, increase in volume of solide sphere is $5c. c.$ the expansion of hollow sphere is

A. $5c. c$

B. more than $5c. c.$

C. Less than $5c. c.$

D. None

Answer: B

Watch Video Solution

56. When a rod is heated, its linear expansions depends on

(a) initial length

(b) area of cross section

(c) mass

(d) temperature rise

A. only a is correct

B. a & d are correct

C. b & c are correct

D. a & c are correct

Answer: B

Watch Video Solution

57. The numerical value of coefficient of linear expansion is independent of units of

(a) length

(b) temperature

(c) area

mass

A. Only (a) is correct

B. (a) & (b) are correct

C. (a), (b) & (c) are correct

D. (a), (c) & (d) are correct

Answer: D

Watch Video Solution

58. Expansion during heating

(a) occurs in solids only

b) causes decrease of interatomic spacing

(c) is due to increase of interatomic spacing

A. only (a) is wrong

B. (a),(b) & (c) are wrong

C. (a) & (b) are wrong

D. (a) ,(b) & (c) are correct

Answer: C

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59. When a copper solid shpere is heated, its

(a) moment of inertia increases

(b) Elasticity decreases

© The weight of a body in a liquid increases

A. Only (b) is true

B. (a) & (b) are correct

C. (a), (b) & (c) are true

D. all the true

Answer: C

Watch Video Solution

Watch Video Solution

60. Due to thermal ecpansion with rise in temperature

(a) Metallic scale reading becomes lesser than true value

(b) A floating body sinks a little more

(c) The weight of a body in a liquid increases

A. Only (a) is correct

B. (a) & (b) are correct

C. (a), (b) & (d) are correct

D. (a), (b) & (c) are correct

Answer: D

Watch Video Solution

61. Which of the following statement are true

(a) Rubber contracts on heating

(b) Water expands on freezing

(c) Waterr expands on heating from $4^\circ C$ to $40^\circ C$

A. (a) is correct

B. (b) and (c) are correct

C. (a) & (c) correct

D. all are correct

Answer: D

Watch Video Solution

62. When a metal ring having some gap is heated

(a) length of gap increases

(b) radius of the ring decreases

(c) the angle substanded by the gap at the centre remains same

(d) length of gap decreases

A. Only d is correct

B. a and b are correct

C. a & c are correct

D. all are correct

Answer: C

Watch Video Solution

63. Expansion of liquids on heating is different from that solids, since the expansion of liquids is `

A. much of than solids because molecular spacing in them is less

B. much more than solids because molecular spacing in them is more

C. much less than solids because molecular spacing in them is more.

D. much less than solids because molecular spacing in them is less

Answer: B

Watch Video Solution

64. A liquid with coefficient of volume expansion γ is filled in a container of a material having coefficient of linear expansion α . If the liquid overflows on heating, then

A. $\gamma = 3\alpha$

B. $\gamma > 3\alpha$

C. $\gamma < 3\alpha$

D. $\gamma = \alpha$

Answer: B

Watch Video Solution

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

A. rise

B. fall

C. reamain same

D. over flows

Answer: C

Watch Video Solution

66. A long cylindrical metal vessel of volume V and coefficient of linear expansion α contains a liquid. The level of liquid has not changed on heating. The coefficient of real expansion of the liquid is.

A. $\frac{V-\alpha}{V}$

B. $\frac{V+\alpha}{V}$

C. $\frac{V}{V-\alpha}$

D. 3α

Answer: D

Watch Video Solution

67. The liquid whose coeffcient of real expansion is equal to 1.5 times the coefficient of areal expansion of container and heated then the

level of the liquid taken in the container

A. rises

B. falls

C. remain same

D. first rises and then falls

Answer: C

Watch Video Solution

68. A metal ball suspended from the hook of a spring balance is kept immesed in a liquid other than water. On increassing the temperature of this liquid, the reading in the spring balance.

A. increases

B. Decreases

C. Remains same

D. May increase or decreases.

Answer: A

Watch Video Solution

69. A metal ball immersed in alcohol weights W_1 at $0^\circ C$ and W_2 at $50^\circ C$. The coefficient of expansion of cubical the metal is less than that of the alcohol. Assuming that the density of the metal is large compared to that of alcohol, it can be shown that

A. $W_1 = W_2$

B. $W_1 > W_2$

C. $W_1 < W_2$

D. $W_1 \geq W_2$

Answer: C

Watch Video Solution

70. A block of wood is floating on water at $0^\circ C$ with a certain volume V above water level. The temperature of water is slowly raised to $20^\circ C$. How does the volume V change with the rise of temperature ?

A. increases

B. decreases

C. Remains same

D. first decreases and then increases.

Answer: B

Watch Video Solution

71. A glass is full of water at $4^\circ C$ when it is (a) cooleed (b) heated then, which one of the following is correct

A. water level decreases, increases

B. water level increases, decreases

C. water level, decreases, decreases

D. water over flow in both the cases

Answer: D

Watch Video Solution

72. The top of a lake is frozen when the air in contact with the lake surface is at $-5^\circ C$ the temperature of water in contact with the bottom of the lake will be

A. $-5^\circ C$

B. $4^{\circ} C$

C. $0^{\circ} C$

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

Answer: B

Watch Video Solution

73. A metal sphere is suspended in water at $0^{\circ} C$ by a thread when water is heated to $4^{\circ} C$ the tansion in the thread

A. decreases

B. increases

C. reamain same

D. first increases and then decreases

Answer: A

View Text Solution

74. Water has maximum density at

A. $0^{\circ} C$

B. $4^{\circ} C$

C. $25^{\circ} C$

D. $37^{\circ} C$

Answer: B

Watch Video Solution

75. A vessel is completely filled with water at $32.2^{\circ} F$. Now it is cooled then

A. Water spills out

B. Level of water remains sames

C. level of water decreases

D. none

Answer: A

Watch Video Solution

76. A Sealed glass jar is full of water. When it is kept in a freezing mixture, it is broken because

A. water expands from $4^\circ C$ to $0^\circ C$

B. ice expands while melting

C. water expands due to freezing

D. ice expands since its temperature falls below $0^\circ C$

Answer: A

Watch Video Solution

77. Certain volume of a liquid is taken in a long glass tube and its temperature is increased at a uniform rate, the rate of increase in the length of the liquid depends on

a) length of the liquid

b) area of cross section of the glass tube

c) coefficient of expansion of glass

A. Only (a) is correct

B. (a) & (b) are correct

C. (b) & (c) are correct

D. (a), (b) & (c) are correct

Answer: D

Watch Video Solution

78. A metal ball suspended from a spring balance is immersed in water at $4^{\circ} C$. If the temperaute of water is changed the reading in the balance

(a) any decreases

(b) increases

(c) may reamains same

A. only (c) is true

B. (b) is true

C. (a) & (c) is true

D. (b) & (c) are true

Answer: B

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79. Identify the correct statements from the following:

(a) The apparent expansion of liquid depends the expansion of material of the container

(b) The real expansion of the liquids depends on the density of the liquid.

(c) The expansion of liquid with respect to the container is called the apparent expansion

A. Only a & b are ture

B. Only b & c are ture

C. a, b & c are ture

D. Only a & c are true

Answer: C

Watch Video Solution

80. A liquid with coefficient of real volume expansion (γ) is filled in vessel of coefficient of linear expansion $\frac{\gamma}{3}$. When the systeam is heated then.

a) The volume of spece above liquid remains same.

b) The level of liquid relative to vessel reamins same.

c) The fraction of volume of liquid in vessel reamains same.

A. Only (a) is correct

B. Only b & c are correct

C. Only (c) is true

D. All are true

Answer: D

Watch Video Solution

81. When the volumn of a gas is decreased at constant temperature the pressure increases because the molecules

A. strike the unit area of the walls of the container more often.

B. strike the unit area of the walls of the container with higher speed

C. strike the unit area of the wall of the container with lesser speed.

D. move with more kinetic energy

Answer: A

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82. Boyle's law is represented by the equation $PV = K$ (K is not constant), K dependds on

A. pressure of the gas

B. volume of the gas

C. mass of the gas

D. all the above

Answer: C

Watch Video Solution

83. A gas is enclosed in a closed pot. On keeping this pot in a train moving with high speed , the temperature of the gas

A. will increase

B. will decrease

C. will remain unchanged.

D. increases or decrease depending on the chemical composition of gas

Answer: C

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84. At constant pressure density of a gas is

A. directly proportional to absoulte temperature

B. inversely proportional to absolute temperature

C. independent of temperature

D. directly proportional to square root of absolute temperature

Answer: B

Watch Video Solution

85. The slope of $T - P$ graph for a given mass of a gas increases, the volumn of the gas

A. increases

B. decreases

C. does not change

D. May increase or decreases.

Answer: B

Watch Video Solution

86. Which of the following methods will enable the volume of an ideal gas to be made four times

A. double the absolute temperature and pressure

B. halve the absolute temperature and double the pressure.

C. quadruple the absolute temperature at constant pressure

D. quarter the absolute temperature at constant pressure

Answer: C

Watch Video Solution

87. An ideal gas is that which

A. cannot be liquefied

B. can be easily liqefied

C. has strong inter molecular forces

D. has a large size of molecules.

Answer: A

Watch Video Solution

88. In a gas equation, $PV = RT$, V refers to the volume of

A. any amount of a gas

B. 1 gram mass of a gas

C. 1 gram mole of a gas

D. 1 litre of a gas

Answer: C

Watch Video Solution

89. 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 tempreature and low pressure

D. low temperature and high pressure

Answer: B

Watch Video Solution

90. The molar gas constant is the same for all gases because at the same temperature and pressure, equal volumes of gases have the same

A. number of molecules

B. average potential energy

C. ratio of specific heats

D. density

Answer: A

Watch Video Solution

91. A box contains x molecules of a gas. How will the pressure of the gas be effected if the number of molecules is made $2x$?

A. Pressure will decrease.

B. Pressure will remain unchanged.

C. Pressure will be doubled.

D. Pressure will become three times

Answer: C

Watch Video Solution

92. According to Charles's law,

A. at constant pressure, volume of gas is proportional to its absolute temperature.

B. at constant pressure, the volume of a gas is not propotional to its absolute temperature.

C. at constant gauge pressure, the molecular volume of a gas is proportional to its absolute temperature.

D. at constant volume, the absolute pressure is proportional to absolute temperature

Answer: A

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93. The density of an ideal gas

A. is directly proportional to its pressure and absolute temperature

B. is directly propotional to its pressure and inversely propotional to its absolute temperature

C. is inversely propotional to its pressure and directly propotional to its absolute temperature

D. is inversely propotional to both its pressure and absolute temperature of the gas

Answer: B

Watch Video Solution

94. The relation between volume V, pressure P and absolute temperature T of an ideal gas is $PV = xT$, where x is a constant. The value of x depend upon

A. the mass of the gas molecule

B. the average kinetic energy of the gas molecules

C. P, V and T

the number of gas molecules in volume V.

D.

Answer: D

View Text Solution

95. The air of the atmosphere becomes cool at higher altitudes due to

A. decrease in density

B. variation in pressure

C. expansion of the air

D. height above the surface of the earth

Answer: C

Watch Video Solution

96. If pressure and temperature of an ideal gas are doubled and volume is halved, the number of molecules of the gas

A. becomes half

B. becomes two times

C. becomes 4 times

D. remains constant

Answer: B

Watch Video Solution

97. If gas molecules undergo, inelastic collision with the walls of the container

A. temperature of the gas will increase

B. temperature of the gas will fall

C. pressure of the gas will increase

D. both temperature and the pressure change

Answer: D

Watch Video Solution

98. A gas in an airtight container is heated from $25^{\circ}C$ to $90^{\circ}C$. The density of gas will

A. increase slightly

B. increase considerably

C. reamain the same

D. Decrease slightly

Answer: C

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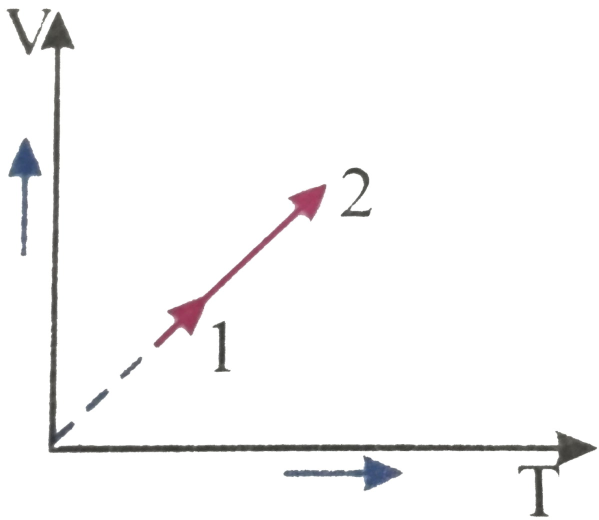
99. A volume V absolute temperature T diagram was obtained when a given mass of gas was heated. During the heating process from state 1 to 2, the pressure



A. increased

B. decreased

C. remains constant

D. changed erratically

Answer: A

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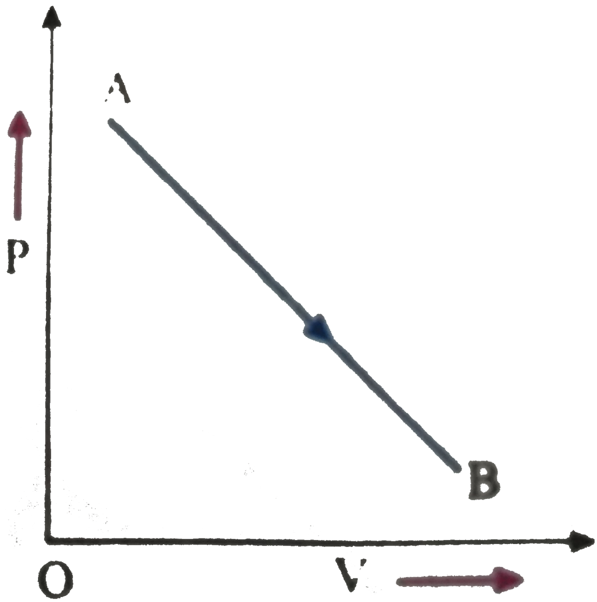
100. A $P-V$ diagram is obtained by changing the temeprature of the gas as shown. During the proces the gas is



A. heated continuously

B. cooled continuously

C. heated in the beginning but cooled towards the end

D. cooled in the beginning but heated towards the end

Answer: C

Watch Video Solution

101. The critical temperature of the gas is the temperature

A. at which Charles's law is obeyed

B. at which Boyle's law is obeyed

C. above which the gas connot be liquefied

D. at which all molecular motion ceases

Answer: A

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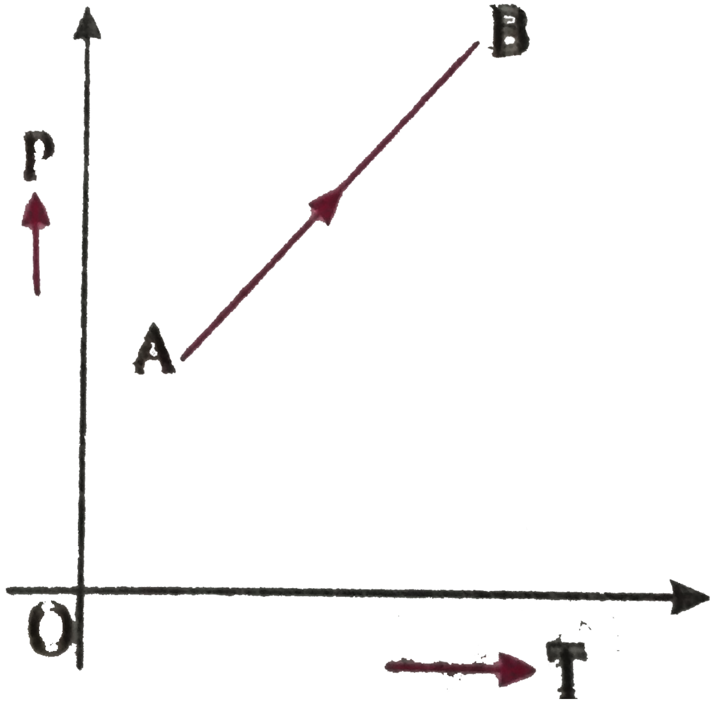
102. The $P-T$ graph for the given mass of an ideal gas is shown in figure. Then the volume



A. increases

B. decreases

C. remains constant

D. data insuficient

Answer: A

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103. According to Boyles's law $PV = C$ the value of C depends on.

A) Mass of the gas

b) Type of gas

c) Temperature

A. A, B

B. B, C

C. A, C

D. A, B, C

Answer: C

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Watch Video Solution

104. Select the correct graphs

A) the $P - 1/V$ graph at constant temperature is a rectangular hyperbola.

B) the $PV - V$ graph is a straight line parallel to the $Y -$ axis.

C) $V - T$ graph at constant pressure is a straight line passing through the origin.

A. A

B. B

C. C

D. A, B, C

Answer: B

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105. Following operation are carried out on a sample of ideal gas initially at pressure P volume V and Kelvin temperature T.

A) At constant volume, the pressure is increased fourfold.

B) at constant pressure, the volume is doubled

C) The volume is doubled and pressure halved.

D) If heated in a vessel open to atmosphere, one-fourth of the gs escapes from the vessel. Arrange the above operations in the increasing order of final temperature

A. A, B, C, D

B. C, B, A, D

C. B, A, D, C

D. C, D, B, A

Answer: D

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106. Real gases approches ideal gas at high temperature and low pressure because

A) interatomic separation is large

size of the molecule is negligible when compareed to inter atomic separation

A. A & B are true

B. only A is true

C. only B is true

D. A & B are false

Answer: A

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107. The parameter that datermine the pysical state of gas are:

A) Pressure

B) Volume

C) Number of moles

D) Temperature

A. A & B

B. A, B & C

C. A, B & D

D. A, C & D

Answer: C

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108. In the equation $PV = cons\tan t$, the numerical value to constant depends upon

A) Temperature

B) mass of the gas

C) systeam of units used

D) nature of the gas

A. A & B

B. B & C

C. C & D

D. All

Answer: D

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109. $PV = nRT$ holds good for

A) Isobaric process

B) Isochoric process

C) Isothermal process

D) Adiabatic process

A. A & B

B. A, B & C

C. A, B & D

D. All

Answer: D

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LEVEL - I (C.W.)

1. If the temperature of a patient is $40^{\circ}C$ his temperature in the Fahrenheit scale will be

A. $72^{\circ}F$

B. $96^{\circ}F$

C. $100^{\circ}F$

D. $104^{\circ} F$

Answer: D

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2. The freezing point on a thermometer is marked as $20(0)$ and the boliling point as 150°. A temperature of $60^{\circ} C$ on this thermomemter will be read as

A. 40°

B. 65°

C. 98°

D. 110°

Answer: C

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3. A Celsius theromemter and a Fahrenheit thermometer are put ina hot bath. The reading on Fahrenheit thermometer is just 3 times the reading on Celsium thermometer. The temperature of the hot bath is

A. $26.67^{\circ} C$

B. $36.67^{\circ} C$

C. $46.67^{\circ} C$

D. $56.67^{\circ} C$

Answer: A

Watch Video Solution

4. Oxygen boils at $-183^{\circ} C$. This temperature is approximately

A. $215^{\circ} F$

B. $-297^{\circ} F$

C. $329^{\circ} F$

D. $361^{\circ} F$

Answer: B

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5. A mercury thermomeeter is transferred from melting ice to a hot liquid. The mercury rises to $9/10$ of the distance between the two fixed points. Find the temperature of the liquid in Fahrenheit scale

A. $194^{\circ} F$

B. $162^{\circ} F$

C. $112^{\circ} F$

D. $113^{\circ} F$

Answer: A

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6. A Centigreade scales A and B have triple points of water defined to be $200A$ and $300B$ (given triple point of water is $= 276.16K$). The relation between T_A and T_B is

A. 30^0

B. 40^0

C. 60^0

D. 80^0

Answer: B

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7. Two absolute scale X and Y have triple points of water defined to be $300X$ and $450Y$. How are T_X and T_Y related to each other ?

A. $T_A = T_B$

B. $T_B = \frac{3}{2}T_A$

C. $T_B = \frac{2}{3}T_A$

D. $T_B = \frac{3}{4}T_A$

Answer: B

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8. The temperature coefficient of resistant of wire is $12.5 \times 10^{-4} / C^{\circ}$. At $300K$ the resistance of the wire is $1 ohm$. The temperature at which resistance will be $2 ohm$ is

A. $1154K$

B. $1100K$

C. $1400K$

D. $1127K$

Answer: C

Watch Video Solution

9. The reading of Centigrade thermometer coincides with that of Fahrenheit thermometer in a liquid. The temperature of the liquid is

A. $-40^{\circ} C$

B. $0^{\circ} C$

C. $100^{\circ} C$

D. $300^{\circ} C$

Answer: A

Watch Video Solution

10. The pressure of a gas filled in the bulb of constant volume gas thermometer at $0^\circ C$ and $100^\circ C$ are $28.6cm$ and $36.6cm$ of mercury respectively. The temperature of bulb at which pressure will be $35.0cm$ of mercury will be

A. 80^0C

B. 70^0C

C. 55^0C

D. 40^0C

Answer: A

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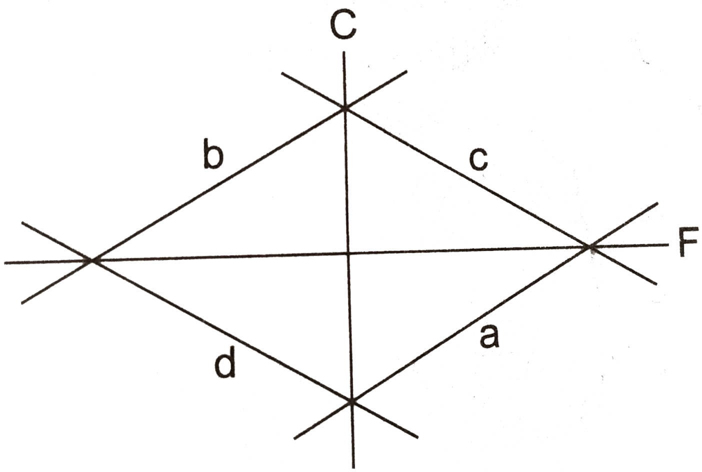
11. Which of the curves in figure represents the telation between Celsius and Fahrenheit temperatures?



A. a

B. b

C. c

D. d

Answer: A

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12. if two tempratures differ by 25 degress on cesisus scale, the difference of temperature on Fahrenhelt scale is

A. 65°

B. 45°

C. 38°

D. 25°

Answer: B

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13. If a graph is plotted taking the temperature in Fahrenheit along the Y-axis and the corresponding temperature in Celsius along the X-axis, it will be a straight line

A. $5/9$

B. $9/5$

C. $4/5$

D. $5/4$

Answer: B

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14. The coefficient of linear exopansion of a metal is $1 \times 10^{-5/0}C$. The percentage increase in area of a square plate of that metal when it is heated through 100^0C is

A. 0.02%

B. 0.1%

C. 0.001%

D. 0.2%

Answer: D

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15. The length of each steel rail is $10m$ in winter. The coefficient of linear expansion of steel in $0.000012 / ^\circ C$ in summer. The gap to be left between the rails

A. $0.0018m$

B. $0.00120m$

C. $0.0022m$

D. $0.05m$

Answer: A

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16. A clock while keeps correct time at $30^{\circ} C$ has a pendulum rod made of brass. The number of seconds it gains (or) looses per second when the temperature falls to $10^{\circ} C$ is [α of brass $= 18 \times 10^{-6 / \circ} C$]

A. 18×10^{-6} sec

B. 18×10^{-5} sec

C. 0.0018 sec

D. 0.018 sec

Answer: B

Watch Video Solution

17. A metal plate of area $1.2 m^2$ increases its area by $2.4 \times 10^{-4} m^2$ when it is heated from $0^{\circ} C$ to $100^{\circ} C$. The coefficient of cubical excpansion of the metal expressed in per $.^{\circ} C$ is

A. 2×10^{-6}

B. 4×10^{-6}

C. 6×10^{-6}

D. 3×10^{-6}

Answer: D

Watch Video Solution

18. The length of a metal rod at $0^{\circ} C$ is $0.5m$ When it sis heated, its length incerases by $2.7mm$. The final temperature of rod is (coeff. Of linear excpansion of metal $= 90 \times 10^{-6/ \circ} C$)

A. $20^{\circ} C$

B. $30^{\circ} C$

C. $40^{\circ} C$

D. $60^{\circ} C$

Answer: D

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19. The density of a substance at $0^{\circ} C$ is $10 g / c.c.$ and at $100^{0} C$ its density os $9.7 g / c.c.$ The coefficient of linear expansion of the sunstance is.

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

B. $3 \times 10^{-4 / \circ} c$

C. $6 \times 10^{-4 / \circ} c$

D. $9 \times 10^{-4 / \circ} C$

Answer: A

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20. What force should be applied to the ends of steel rod of cross sectional area $10cm^2$ to prevent it form elongation when heated form 273 K to 303 k ?

$\left(\alpha \text{ of steel} 10^{-5} . ^{\circ} C^{-1}, Y = 2 \times 10^{11} NH^{-2}\right)$

A. $2 \times 10^4 N$

B. $3 \times 10^4 N$

C. $6 \times 10^4 N$

D. $12 \times 10^4 N$

Answer: C

Watch Video Solution

21. The inner diameter of a breass ring $273K$ is $5cm$. To what temperature should it be heated for it to accommodate a ball $5.01cm$ in diameter. $\left(\alpha = 10^{-5 / ^{\circ}} C\right)$

A. $273K$

B. $372K$

C. $437K$

D. $173K$

Answer: C

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22. A metal sheet having size of $0.6 \times 0.5m^2$ is heated from $293K$ to $520^\circ C$. The final area of the hot shee is $\{\alpha$ of metal $= 2 \times 10^{-5/\circ}C]$

A. $0.306m^2$

B. $0.0306m^2$

C. $3.06m^2$

D. $1.02m^2$

Answer: A

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23. A crystal has linear coefficients $0.00004 / {}^{\circ}C, 0.00005 / {}^{\circ}C, 0.00006 / 6^{\circ}C$. Coefficient of cubical expansion of the crystal is

A. $0.000015 / {}^{\circ}C$

B. $0.00015 / {}^{\circ}C$

C. $0.00012 / {}^{\circ}C$

D. $0.00018 / {}^{\circ}C$

Answer: B

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24. A wire of length $60cm$ is bent to into a circle with a gap of $1cm$. At its ends, on heating it by 100^0C, the length of the gap increases to $1.02cm$. `alpha of materials of wire is

A. $2 \times 10^{-4/\circ}C$

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

C. $6 \times 10^{-4/\circ}C$

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

Answer: A

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LEVEL - II (C.W.)

1. The resistance of a certain paltinum resistance thermomter is found to be 2.56Ω at $0^\circ C$ and 3.56Ω at $100^\circ C$. When the thermometer is immersed in a given liquid, its resistance is observed to be 5.06Ω. The temperature of the liquid

A. $45^0 C$

B. $250^0 C$

C. $225^0 C$

D. $120^0 C$

Answer: B

Watch Video Solution

2. A constant volume gas thermometer shows pressure readings of $50cm$ and $90cm$ of mercury at $0^\circ C$ and $100^\circ C$ respectively, The temprature of the bath when pressure reading is $60cm$ of mercury.

A. $45^0 C$

B. $30^0 C$

C. $25^0 C$

D. $20^\circ C$

Answer: C

Watch Video Solution

3. On a hypothetical scale A the ice point is 42° and the steam points is 182° For another scale B. The ice points is -10° and steam point in 90°. If B reads 60°. The reading of A is.

A. 160°

B. 140°

C. 120°

D. 11°

Answer: B

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4. The upper and lower fixed points of a faulty mercury thermometer are $210^{\circ} F$ and $34^{\circ} F$ respectively. The correct temperature read by this thermometer is

A. $22^{0} F$

B. $80^{0} F$

C. $100^{0} F$

D. $122^{0} F$

Answer: D

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5. A Fahrenheit thermometer registers $100^{\circ} F$ while a faulty Celsius thermometer registers $44^{\circ} C$. Find the error in the later

A. 0.37°

B. 0.87°

C. 0.67°

D. 0.48°

Answer: C

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6. When a rod is heated from $25^{\circ}C$ to $75^{\circ}C$, it expands by $1mm$. When a rod of same materlal but with 4 times the length is heated from $25^{\circ}C$ to $50^{\circ}C$. The increase in length is

A. $1mm$

B. $1.5mm$

C. $1.6mm$

D. $2mm$

Answer: D

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7. An iron metal rod is to maintain an accuracy of one part per million. The coefficient of linear expansion of iron is $1 \times 10^{-5/\circ}C$ respectively. The difference in lengths is $10cm$ at all temperatures. Their initital lengths must be respectively.

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8. Two metal rods have coefficients of linear exapansion $1.1 \times 10^{-5/}C$ and $1.65 \times 10^{-5/\circ}C$ respectively. The difference in lengths is $10cm$ at all temperatures. Their initial lengths must be respectively.

A. $40cm$ and $50cm$

B. $40cm$ and $30cm$

C. $50cm$ and $60cm$

D. $30cm$ and $20cm$

Answer: D

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9. Two rods of same length and same diametel are drawn from equal masses and same quantity of heat is supplied to the two rods. Find the rationof expansions if specific heats of the material is $2/3$ and that of coefficient of linear expansion is $1/2$

A. $4/3$

B. $1/2$

C. $3/4$

D. $1/3$

Answer: C

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10. Two rods of different materials having coefficient of thermal expansion α_1, α_2 and young's modulii Y_1, Y_2 respectively are fixed between two rigid massive walls. The rods are heated such that they undergo the same increase in temperature. There is no bending of rods. If $\alpha_1 : \alpha_2 = 2 : 3$, the thermal stresses developed in the two rods are equal provided $Y_1 : Y_2$ is equal to

A. $2 : 3$

B. $1 : 1$

C. $3 : 2$

D. $4 : 9$

Answer: C

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11. Two uniform metal rods one of aluminium of length l_1 and another made of steel of length l_2 and linear coefficients of expansion α_a and α_s respectively are connected to form a single rod of length $(l_1 + l_2)$, When the temperature of the combined rod is raised by $t^\circ C$, the length of each rod increases by the same amount then $\frac{l_l}{l_1 + l_2}$ is

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

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

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

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

Answer: A

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12. When the temperature of a rod increases from t to $r + \Delta t$, its moment of inertia increases from I to $I + \Delta I$. If α is the value of $\Delta I / I$ is

A. $\Delta t / t$

B. $\Delta t / t$

C. $\alpha \Delta t$

D. $2\alpha \Delta t$

Answer: D

Watch Video Solution

13. 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 of elongation 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. $20^{\circ} C$

B. $15^{\circ} C$

C. $10^{\circ} C$

D. $0^{\circ} C$

Answer: C

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14. Brass scale of a Barometer gives correct reading at $0^{\circ} C$. Coefficient of linear expansion of brass is $18 \times 10^{-6 \times {\circ}} C$. If the barometer reads $76 cm$ at $20^{\circ} C$, the correct reading is $\left(\gamma_{Hg} = 18 \times 10^{-5 / {\circ}} C\right)$

A. $76.426 cm$

B. $75.7 cm$

C. $76.642 cm$

D. $76.264 cm$

Answer: B

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15. A thin brass sheet at $10^{\circ} C$ and a thin steel sheet at $20^{\circ} C$ have the same surface area. The common temperature at which both would have the same area is (Coefficient of linear expansion for brass and steel are respectively, $19 \times 10^{-6 / {}^{\circ}} C$ are $11 \times 10^{-6 / {}^{\circ}} C \big)$

A. $-3.75 \circ C$

B. $-2.75^{\circ} C$

C. $2.75^{\circ} C$

D. $3.75^{\circ} C$

Answer: A

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16. A pendulum clock gives correct time at $20^{\circ} C$ at a place where $g = 10 m / s^{2}$. The pendulum consists of a light steel rod connected to a heavy ball. If it is taken to a different place where $g = 10.01 m / s^{2}$ at what temperature the pendulum gives correct time (α of steel of $10^{-5 / {}^{\circ} C}$)

A. $30^{\circ} C$

B. $60^{\circ} C$

C. $100^{\circ} C$

D. $120^{\circ} C$

Answer: D

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17. Two rods of lengths L_1 and L_2 are welded together to make a composite rod of length $(L_1 + L_2)$. If the coefficient of linear expansion of the materials of the rod are α_1 and α_2 respectively. The effective coefficient of linear expansion of the composite rod is

A. $\dfrac{L_1\alpha_1 - L_2\alpha_2}{L_1 + L_2}$

B. $\dfrac{L_1\alpha_1 + L_2\alpha_2}{L_1 + L_2}$

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

D. $\dfrac{\alpha_1 + \alpha_2}{2}$

Answer: B

Watch Video Solution

18. A clock pendulum made of invar has a period of $0.5\,\text{sec}$ at $20^\circ C$. If the clock is used in a climate where the temperature average to

$30^\circ C$, how much time does the clock loose in each oscilliation. For innar $\alpha = 9 \times 10^{-7}$ ^ $(\circ) C^{-1}$

A. 2.25×10^{-6} sec

B. 2.5×10^{-7} sec

C. 5×10^{-7} sec

D. 1.125×10^{-6} sec

Answer: A

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19. A steel scale is correct at $0^\circ C$. The length of a brass tube measured by it at $40^\circ C$ is 4.5 m. The correct length of the tube at $0^\circ C$ is (Coefficients of linear expansion of steel and brass are $11 \times 10^{-6} / {}^\circ C$ and $19 \times 10^{-6} / {}^\circ C$ respectively.)

A. $4.001 m$

B. $5.001m$

C. $4.999m$

D. $4.501m$

Answer: D

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20. The ratio of lengths of two rods is $1:2$ and the ratio of coefficient of expansions is $2:3$. The first rod is heated through $60^\circ C$. Find the temperautre through $60^\circ C$. Find the temperature through $60^\circ C$. Find the temperature through which the second rod is to be heated so that its expansion is twice that of first is

A. $60^\circ C$

B. $40^\circ C$

C. $30^\circ C$

D. $10^{\circ} C$

Answer: B

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LEVEL - III

1. Two rods of the same length, have radii in the ratio $3:4$ Their densities are respectively 8000 and $9000 kg/m^3$. Their specific heats are in the ratio of $2:3$. When the same amount of heat is supplied to both, the changes in their lengths are in the ratio. (If their linear coefficients are in the ratio $5:6$)

A. $1:1$

B. $5:2$

C. $5:12$

D. $12:5$

Answer: B

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2. A solid sphere of radius r and mass m is spining about a diameter as axis with a speed ω_0. The temperature of the sphere increases by $100^0 C$ without any other disturbance. If the coefficient of linear expansion of material of sphere is $2 \times 10^{-4/0}C$, the ratio of angular speed at $100^0 C$ and ω_0 is

A. $1:1$

B. $1:1.04$

C. $1.04:1$

D. $1:1.02$

Answer: B

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3. Two rods of different materials and identical cross sectional area, are joined face to face at one end their free ends are fixed to the rigid walls. If the temperature of the surroundings is increased by $30^\circ C$, the magnitude of the displacement of the joint of the rod is (length of rods $l_1 = l_2 = 1unit$, ratio of their young's moduli, $Y_1 / Y_2 = 2$, coefficients of linear expansion are α_1 and α_2)

A. $5(\alpha_2 - \alpha_1)$

B. $10(\alpha_1 - \alpha_2)$

C. $10(\alpha_2 - 2\alpha_1)$

D. $5(2\alpha_1 - \alpha_2)$

Answer: C

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4. A wire of length L_0 is supplied heat to raise its temperature by T. if γ is the coefficient of volume expansion of the wire and Y is Young's modulus of the wire then the energy density stored in the wire is

A. $\frac{1}{2}\gamma^2 T^2 Y$

B. $\frac{1}{3}\gamma^2 T^2 Y^3$

C. $\frac{1}{18}\frac{\gamma^2 T^2}{Y}$

D. $\frac{1}{18}\gamma^2 T^2 Y$

Answer: D

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5. A uniform solid brass cylinder of mass $M = 0.5Kg$ and radius $R = 0.03m$ is placed in frictionless bearings and set to rotate about its geometrical axis with an angular velocity of $60ra\frac{d}{s}$. After the cylinder has reached the specified state of rotation, it is heated (without any mechanical contact) from room temperature $20^0 C$ to $100^0 C$. The fractional change in angular velocity of the cylinder is $\left(\alpha = 2 \times 10^{-5/0} C\right)$sss

A. -3.2×10^{-3}

B. 3.2×10^{-3}

C. 2.3×10^{-3}

D. -2.3×10^{-3}

Answer: A

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6. Calculate the compressional force required to prevent the metallic rod length lcm and cross-sectional area Acm^2 when heated through $t^\circ C$, from expanding along length wise. The Young's modulus of elasticity of the metal is E and mean coefficient of linear expansion is α per degree Celsiuss

A. $EA\alpha t$

B. $\dfrac{EA\alpha t}{l+\alpha t}$

C. $\dfrac{EA\alpha t}{l-\alpha t}$

D. $El\alpha t$

Answer: B

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7. An iron rod of length $50cm$ is joined at an end to an aluminium rod of length $100cm$. All measurements refer to $20^\circ C$. Find the length of the composite system at $100^\circ C$ and its average coefficient of linear expansion. The coefficient of linear expansion of iron and aluminium are $12 \times 10^{-6} /^\circ C$ and $24 \times 10^{-6} /^\circ C$ respectively.

A. $36 \times 10^{-6/\circ}C$

B. $12 \times 10^{-6/\circ}C$

C. $20 \times 10^{-6} / {}^{\circ}C$

D. $48 \times 10^{-6} / {}^{\circ}C$

Answer: C

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8. A rod of length $20cm$ is made of metal. It expands by $0.075cm$ when its temperature is raised from $0^{\circ}C$ to $100^{\circ}C$. Another rod of different metal B having the same length expands by $0.045cm$ for the same change in temperature. A third rod of the same length is composed of two parts, one of metal A and the oher of metal B. This rod expandss by $0.060cm$ for the same change in temperature. The portion made of metal A has the length :

A. $20cm$

B. $10cm$

C. $15cm$

D. $18cm$sss

Answer: B

Watch Video Solution

9. A thin circular metal disc of radius 500.0 mm is set rotating about a central axis normal to its plane. Upon raising its temperature gradually, the radius increases to 507.5 mm. The percentage change in the rotational kinetic energy will be

A. 1.5%

B. -1.5%

C. 3%

D. -3%

Answer: D

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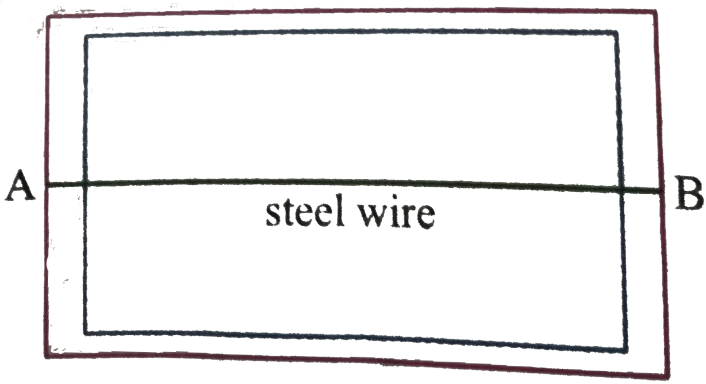
10. A steel wire AB of length $100cm$ is fixed rigidly at points A and B in an aluminium frame as shown in the figure. If the temperature of the system increases through $100^{\circ}C$, then the excess stress produced in the steel wire relative to the aluminium?

$\alpha_{Al} = 22 \times 10^{-6/0}C$ and $\alpha_{steel} = 11 \times 10^{-6/0}C$

young's Modulus of steel is $2 \times 10^{11} Nm^{-2}$.



A. $2.2 \times 10^{8} Pa$

B. $22 \times 10^8 Pa$

C. $0.2 \times 10^8 Pa$

D. $220 \times 10^8 Pa$

Answer: A

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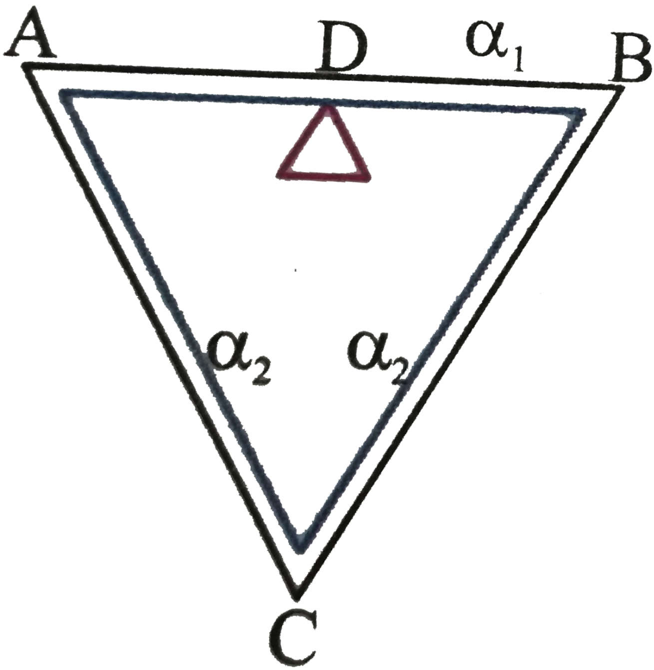
11. An equilateral triangle ABC is formed by joining three rods of equal length and D is the mid-point of AB. The coefficient of linear expansion for AB is α_1 and for AC and BC is α_2. The relation between α_1 and α_2, if distance DC remains constant for small changes in temperture is



A. $\alpha_1 = \alpha_2$

B. $\alpha_1 = 4\alpha_2$

C. $\alpha_2 = 4\alpha_1$

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

Answer: B

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12. A cube of edge (L) and coefficient of linear expansion (α) is heated by $1^0 C$. Its surface area increases by

A. $6\alpha L^2$

B. $8\alpha L^2$

C. $12\alpha L^2$

D. $2\alpha L^2$

Answer: C

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13. An iron ball of diameter $6cm$ and is $0.01mm$ too large to pass through a hole in a brass plate when the ball and plate are at a temperature of $20^0 C$. The temperature at which (both for ball and plate) the ball just passes through the hole is

$\left(\alpha_{iron} = 12 \times 10^{-6/0}C, \alpha_{brass} = 18 \times 10^{-6/0}C\right)$

A. $68^0 C$

B. $48^0 C$

C. $28^0 C$

D. $40^0 C$

Answer: B

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14. A rod of length 2 m is at a temperature of 20° C. find the free expansion of the rod, if the temperature is increased to 50°C, then find stress produced when the rod is (i) fully prevented to expand, (ii) permitted to expand by 0.4mm. $Y = 2 \times 10^{11} N/m^2, \alpha = 15 \times 10^{-6/\circ} C.$

A. $9 \times 10^7 N/m^2$

B. $4.5 \times 10^7 N/m^2$

C. $5 \times 10^7 N/m^2$

D. $3 \times 10^7 N/m^2$

Answer: A

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15. The coefficient of linear expansion for a certain metal varies with temperature as $\alpha(T)$. If L_0 is the initial length of the metal and the temperature of metal is changed from T_0 to $T(T_0 > T)$, then

A. $L = L_0 \int_{T_0}^{T} \alpha(T) dT$

B. $L = L_0 \left[1 + \int_{T_0}^{T} \alpha(T)\right] dT$

C. $L = L_0 \left[1 + \int\limits_{T_0}^{T} \alpha(T) dT\right]$

D. $L > L_0$

Answer: C

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16. A steel teape is placed around the earth at the equator. When the temperature is $0^0 C$ neglecting the expansion of the earth, the neglecting between the tape and the ground if the temperature of the tape rises to $30^0 C$, is nearly $\left(\alpha_{steel} = 11 \times 10^{-6} / K\right)$

A. $1.1 km$

B. $0.5 km$

C. $6400 km$

D. $2.1 km$

Answer: D

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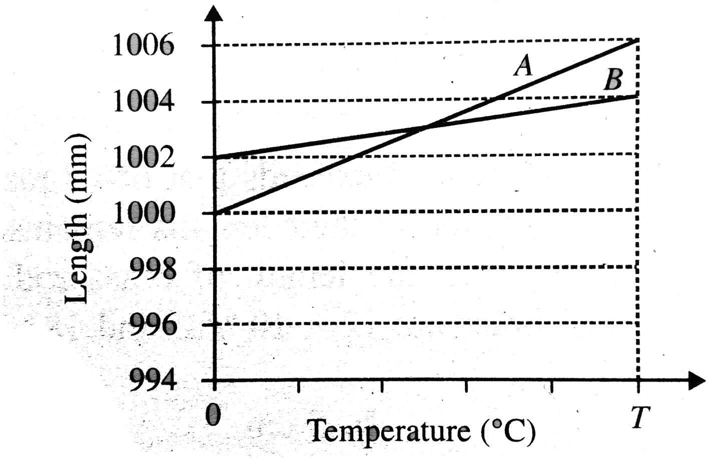

17.

The variation of length of two metal rods A and B with change in temperature is shown in Fig. the coefficient of linear expansion α_A for the metal A and the temperature T will be? (alpha_(A)=3x10^(-6)/ C)

A. $\alpha_A = 3 \times 10^{-6} / {}^\circ C, 500^\circ C$

B. $\alpha_A = 3 \times 10^{-6} / {}^\circ C, 222.22^\circ C$

C. $\alpha_A = 27 \times 10^{-6} / {}^\circ C, 500^\circ C$

D. $\alpha_A = 27 \times 10^{-6} / {}^\circ C, 222.22^\circ C$

Answer: D

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18. The coefficient of linear expansion of an in homogeneous rod change linearly from α_1 to α_2 from one end to the other end of the rod. The effective coefficient of linear expansion of rod is

A. $\alpha_1 + \alpha_2$

B. $\dfrac{\alpha_1 + \alpha_2}{2}$

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

D. $\alpha_1 - \alpha_2$

Answer: B

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19. A rod of steel is $5m$ long and $3cm$ diameter at a tempearatyre if $20^{\circ} C$. Find the free expansion of the rod when the temperature us raused ti $65^{\circ} C$. Find the respective pulls exerted if (i) the ends do not yield and (ii) the ends yield by $0.12cm$. $Y = 2 \times 10^5 MN / m^2$ and $\alpha = 12 \times 10^6$ per $\hat{} (\circ) C$

A. $0.27cm, 42.41KN, 76.34KN$

B. $0.27cm, 76.30KN, 42.39KN$

C. $0.27cm, 38.63KN, 78.23KN$

D. $0.27cm, 78.23KN, 38.63KN$

Answer: B

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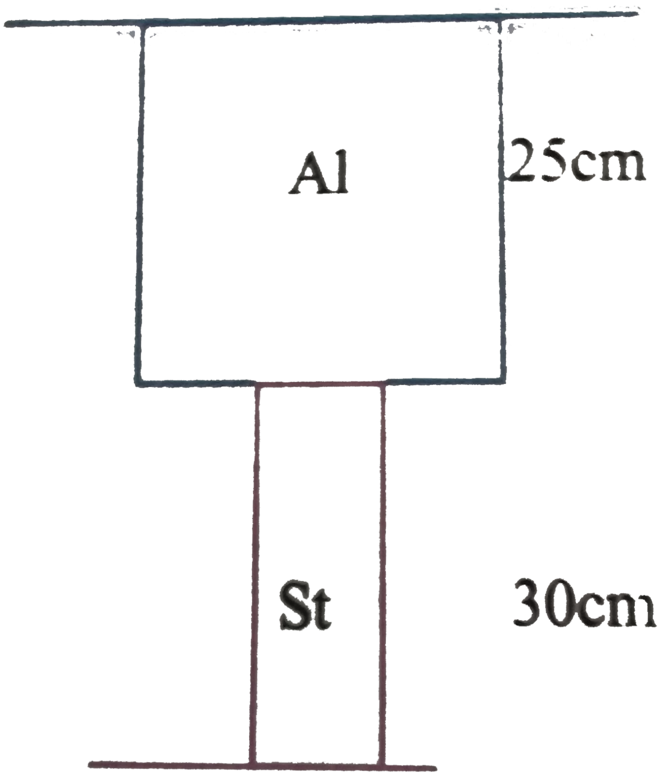
20. Two bars are untressed and have lengths of $25cm$ and $30cm$ at $20^{\circ} C$ as shown in Figure. Bar(1) is of aluminium and bar (2) is of steel. The croos-sectional area of bars are $20 cm^2$ for aluminium and $10 cm^2$ for steel. Assuming that the top and bottom supports are rigid, stress in $\frac{N}{mm^2}$ when the temperature is $70^0 C$. (Nearly)

(

$Y_a = 0.70 \times 10^5 N / mm^2 Y_s = 2.1 \times 10^5 N / mm^2 . \alpha_a = 24 \times 10^{-6 / 0} C$

and $\alpha_s = 12. \times 10^{-6 / 0} C$)



A. $75, 150$

B. $25, 50$

C. $50, 100$

D. $100, 200$

Answer: A

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21. A pendulum clock loses 12 s a day if be the temperature is $40^{\circ}C$ and gains 4 s a day if the temperature is $20^{\circ}C$. The temperature at which the clock will show correct time and the coefficient of linear expansion α of the pendulum shaft are, respectively

A. $25^{0}C, \alpha = 1.85 \times 10^{-5} / ^{0}C$

B. $60^{0}C, \alpha = 1.85 \times 10^{-4} / ^{0}C$

C. $30^{0}C, \alpha = 1.85 \times 10^{-3} / ^{0}C$

D. $55^{0}C, \alpha = 1.85 \times 10^{-2} / ^{0}C$

Answer: A

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22. A simple pendulum made of bob of mass m and a metallic wire of negligible mass has time period $2s$ at $T = 0^{\circ}C$. If the temperature of the wire is increased and the corresponding change in its time period is plotted against its temperature, the resulting graph is a line of slope S. If the coefficient of linear expansion of metal is α then value of S is :

A. α

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

C. 2α

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

Answer: A

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23. A rod has been laid by using alternate rails of steel and aluminium each $12m$ long in a winter season when temperature is . $-2^{\circ}C$. The maximum temprature which can must be left be-tween advance rules of they are just to touch on a summer day

$(\alpha_{\text{steel}} = 1.2 \times 10^{-5} \hat{} (0) C^{-1} \alpha_{Al} = 2.4 \times 10^{-5} \hat{} (0) C^{-1}$

A. $0.6cm$

B. $1.2cm$

C. $0.95cm$

D. $0.86cm$

Answer: C

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NCERT BASED QUESTIONS

1. A birmetallic strip made of aluminium and steel $(\alpha_{Al} > \alpha_{steel})$ on heating the strip will

A. remain straight

B. get twisted

C. will bend with aluminium on concave side.

D. will bend with steel on concave side

Answer: D

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

A. its speed of rotation increases

B. its speed of ratation decreases

C. its speed of rotation decreases

D. its speed increases because its moment of inertai increases

Answer: B

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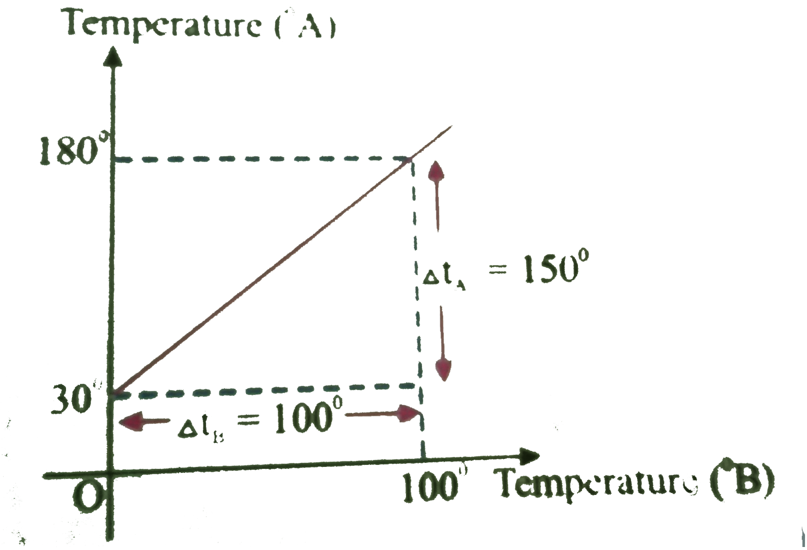
3. The graph between two temperature scales A and B is shown in Fig. Between upper fixed point and lower fixed point there are 150 equal divisions on scales A and 100 on scale B. The relation between the temperature in two scales is given by_



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

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

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

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

Answer: B

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4. As the temperature is increased, the period of a pendulum

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

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

C. increases as its effective length increases due to shifting to centre of mass bellow the centre of the bob

D. decreases as its effective length remain same but the centre of mass shifts above the centre of the bob

Answer: A

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5. The radius of a 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 ΔT so that its new temperature is $T + \Delta T$. The increase in the volume of the sphere is approximately

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

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

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

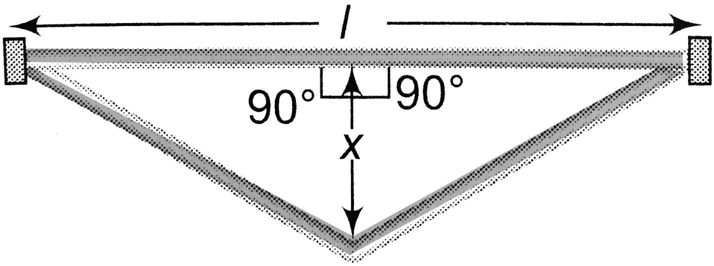
D. $4\pi R^3\alpha\Delta T$

Answer: D

Watch Video Solution

6. A rail track made of steel having length $10m$ is clamped on a railway line at its two end (figure). On a summer day due to rise in temperatue by $20^\circ C$. It is deformed as shown in figure. Find x

(displacement of the centre) if $\alpha_{\text{steel}} = 1.2 \times 10^{-5} /{}^{\circ} C$



A. $5cm$

B. $20cm$

C. $15cm$

D. $11cm$

Answer: D

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7. The resistance of a resistance thermometer has values 2.70Ω and 3.70Ω at $0^{\circ} C$ and $100^{\circ} C$ respectively. The temperature at which the resistance is 3.10Ω is

A. $30^\circ C$

B. $40^\circ C$

C. $60^\circ C$

D. $70^\circ C$

Answer: B

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8. A gas thermometer measures the temperature from the variation of pressure of a sample of gas. If the pressure measured at the melting point of lead is 2.20 times the pressure measured at the triple point of water, find the melting point of lead.

A. $600K$

B. $420K$

C. $790K$

D. $510K$

Answer: A

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9. On a hypothetical scale X, the ice point is 40° and the steam point is 120°. For another scale Y the ice point and steam points are -30° and 130° respectively. If X-reads 50° The reading of Y is

A. -5°

B. -8°

C. -10°

D. -12°

Answer: C

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10. A steel taps is calibrated at $20^{0}C$. When the temperature of the day is $-10^{0}C$, the percentage error in the measurement with the tap is $\left(\alpha = 12 \times 10^{-6/0}C\right)$

A. $3.6\,\%$

B. $0.36\,\%$

C. $0.18\,\%$

D. $0.036\,\%$

Answer: D

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11. The temperature coefficient of resistant of wire is $12.5 \times 10^{-4}/C^{\circ}$. At $300K$ the resistance of the wire is $1ohm$. The temperature at which resistance will be $2ohm$ is

A. $827K$

B. $854K$

C. $527K$

D. $1127K$

Answer: D

Watch Video Solution

12. The diameter of iron wheel is $1cm$. If its temprature is increased by 700^0C What is the increase in circumference of the wheel?

$$\left(\alpha = 12 \times 10^{-6/^0}C\right)$$

A. $0.0264cm$

B. $0.264cm$

C. $2.64cm$

D. $26.4cm$

Answer: A

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13. If a cylinder of diameter $1.0cm$ at $30^{\circ}C$ is to be slid into a hole of diameter $0.9997cm$ in a steel plate at the same temperature, the minimum required rise in the temperature of the plate is: (Coefficient of linear expansion of steel $= 12 \times 10^{-6/\circ}C$)

A. $25^{\circ}C$

B. $35^{\circ}C$

C. $45^{\circ}C$

D. $55^{\circ}C$

Answer: A

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14. The initial lengths of two rods A and B are in the ratio $3:5$ and coefficients of linear expansion are in the ration $5:3$. If the rods are heated from $34^{\circ}C$ to $65^{\circ}C$, the raito of their expansion will be

A. $1:1$

B. $3:5$

C. $1:2$

D. $2:3$

Answer: A

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15. When a thin rod of length $'l'$ is heated from $t_1^0 C$ to $t_2^0 C$ length increases by 1% . If plate of length $2l$ and breadth $'l'$ made of same material is heated form $t_1^0 C$ to $t_2^0 C$, percentage increase in area is

A. 1%

B. 3%

C. 2%

D. 4%

Answer: C

Watch Video Solution

16. The brass scale of a barometer gives correct reading at $10^\circ C$. The baometer reads $75cm$ at $30^\circ C$. What is the a atmoshpheric pressure at $o^\circ C(\text{in cm} \quad Hg)$

$(\alpha_{\text{brass}} = 20 \times 10^{-6} /^0 C, \lambda_{Hg} = 175 \times 10^{-6} /^\circ C)$

A. 74.8

B. 75.03

C. 70

D. 60

Answer: A

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17. Two marks on a glass rod $10cm$ apart are found to increase their distance by $0.06mm$ when the rod is heated from 0^0C to 10^0C. A flask made of the same glass as that rod measiures a volume of $1000c.c$ at 0^0C. The volume it measures at 100^0C in $c.c.$ is

A. 1018

B. 918

C. 818

D. 718

Answer: A

Watch Video Solution

18. A pendulum clock runs fast by 5 seconds per day at $20^{0}c$ and goes slow by 10 seconds per day at $35^{0}C$. It shows correct time at a temperature of

A. $27.5^{0}C$

B. $25.^{0}\ C$

C. $30.^{0}\ C$

D. $33.^{0}\ C$

Answer: B

Watch Video Solution

19. A second's pendulum clock has a steel wire. The clock is calibrated at $20^{\circ} C$. How much time does the clock lose or gain in one week when the temperature is increased to $30^{\circ} C$? $\alpha_{steel} = 1.2 \times 10^{-5} \left(\hat{} \circ C\right)^{-1}$.

A. $0.3628s$

B. $3.626s$

C. $362.8s$

D. $36.28s$

Answer: D

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20. A meter scale made of steel is calibrated at $20^{\circ} C$ to give correct reading. Find the distance between 50 cm mark and 51 cm mark if the scale is used at $10^\circ C$. Coefficient of linear expansion of steel is $1.1 \times 10^{-5} {}^\circ C^{-1}$

A. $1.00011 cm$

B. $1.0011 cm$

C. $1.011 cm$

D. $1.000011 cm$

Answer: A

Watch Video Solution

21. A thin brass sheet at $20^\circ C$ and a thin steel sheet at $30^\circ C$ have the same surface area. The common tempreture at which both would have the same area is (Coefficient of linear expansion for brass and steel are respectively, $19 \times 10^{-6} / {}^\circ C$ are $11 \times 10^{-6} / {}^\circ C$)

A. $-6.25^0 C$

B. $+6.25^0 C$

C. $-3.25^0 C$

D. $+3.25^0 C$

Answer: B

Watch Video Solution

22. Distance between two places is $200 km$. α of metal is $2.5 \times 10^{-5/ \circ} C$. Total space that must be left between steel rails to allow a change of temperature from $36^0 F$ to $117^0 F$ is

A. 1.08

B. 0.108

C. 0.8

D. 0.0108

Answer: B

Watch Video Solution

23. Two thin metal strips, one of brass and the other of iron are fastended together parallel to each other. Thickness of each strip is $2mm$. If the strips are of equal length at $0^{\circ} C$. The radius of the are formed by the bimetaalic strip when heated to $80^{\circ} C$ is (Coefficient of linear expansion of brass $= 19 \times 10^{-6} / ^{\circ} C \&$

of iron=$12 \times 10^{-6} / ^{\circ} C)$.

A. $3.57m$

B. $2.67m$

C. $3.12m$

D. $4.56m$

Answer: A

Watch Video Solution

24. A brass wire $1.8m$ long at $27^{\circ} C$ is held taut with little tension between two rigid supports. If the wire cooled to a temperature of $-39^{\circ} C$, what is the tension developed in the wire, if its diameter is $2.0mm$? Coefficient of linear expansion of brass $= 2.0 \times 10^{-5} / ^{\circ} C$, Young's modulus of brass $= 0.91 \times 10^{11} Pa$.

A. $3.8 \times 10^2 N$

B. $5.8 \times 10^2 N$

C. $7.8 \times 10^2 N$

D. $6.8 \times 10^2 N$

Answer: A

Watch Video Solution

25. The pressure that has to be applied to the ends of a steel wire of length 10cm to keep its length constant when its temperature is raised by $100^{\circ}C$ is : (For steel Young's modulus is $2 \times 10^{11} Nm^{-2}$ and coefficient of thermal expansion is $1.1 \times 10^{-5} K - 1$)

A. $2.2 \times 10^{7} Pa$

B. $2.2 \times 10^{6} Pa$

C. $2.2 \times 10^{8} Pa$

D. $2.2 \times 10^{9} Pa$

Answer: C

Watch Video Solution

LEVEL-I(H.W.)

1. What is the temperature on Fahrenheit scale corresponding to $30^\circ C$

A. $86^\circ F$

B. $52^\circ F$

C. $62^\circ F$

D. $72^\circ F$

Answer: A

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2. A faulty thermometer has its fixed point marked at 6° and 96°. What is the correct temperature on the Centrigrade scale when this themometer reads 87°

A. $83^\circ C$

B. $93^\circ C$

C. $90^\circ C$

D. $85^\circ C$

Answer: C

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3. At what temperature is the Fahrenheit scale reading equal to

(a) twice (b) half of Celsius ?

A. $40^\circ C$

B. $20^\circ C$

C. $160^\circ C$

D. $80^\circ C$

Answer: C

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4. The normal boiling point of liquid hydrogen is $253^\circ C$. What is the corresponding temperature on absolute scale

A. $22K$

B. $20K$

C. $274K$

D. $-20K$

Answer: B

Watch Video Solution

5. A faulty thermometer has $90.5^\circ C$ and $0.5^\circ C$ as upper and lower fixed points respectively. What is the correct temperature if this faulty thermometer reads $15.5^\circ C$

A. $16.67^{\circ} C$

B. $16^{\circ} C$

C. $15^{\circ} C$

D. $15.5^{\circ} C$

Answer: A

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6. The temperature of a substance increases by $27^{\circ} C$. On the Kelvin scale this increase is equal to

A. $300 K$

B. $2.46 K$

C. $27 K$

D. $7 K$

Answer: C

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7. A Fahrenheit thermometer registers 107° while a faulty Celsius thermometer registers 42°. Find the error in Celsisus Scale.

A. $0.33^{\circ}C$

B. $0.72^{\circ}C$

C. $1.2^{\circ}C$

D. $7.2^{\circ}C$

Answer: A

Watch Video Solution

8. A platinum wire has a resistance of 2.62Ω at $15^0 C$ and 3.29Ω at $80^\circ C$. Find the temperature coefficient of the resistance of platinum wire.

A. $4.18 \times 10^{-3\circ} C^{-1}$

B. $9.34 \times 10^{-3\circ} C^{-1}$

C. $1.934 \times 10^{-3\circ} C^{-1}$

D. $934 \times 10^{-3\circ} C^{-1}$

Answer: A

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

A. -40

B. 313

C. 574.25

D. 732.75

Answer: C

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10. The pressure of hydrogen gas in a constant volume gas thermometer is $80.0cm$ at $0^{\circ} C$, $110cm$ at $100^{\circ} C$ and $95.0cm$ at unknown temoerature t. Then t is equal to

A. $50^{\circ} C$

B. $75^{\circ} C$

C. $95^{\circ} C$

D. $150^{\circ} C$

Answer: A

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11. A brass sheet is $25cm$ long and $8cm$ breath at $0^{\circ}C$. Its area at $100^{\circ}C$ is $\left(\alpha = 18 \times 10^{-6/^{\circ}}C\right)$

A. $207.2cm^2$

B. $200.72cm^2$

C. $272cm^2$

D. $2000.72cm^2$

Answer: B

Watch Video Solution

12. A metal rod having a linear coefficient of expansion $2 \times 10^{-5/ \circ} C$ has a length $1m$ at $25^\circ C$, the temperature at which it is shortened by $1mm$ is `

A. $50^\circ C$

B. $-50^\circ C$

C. $-25^\circ C$

D. $-12.5^\circ C$

Answer: C

Watch Video Solution

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

A. $2.5 \sec$

B. $2.6 \sec$

C. $2.4 \sec$

D. $2.2 \sec$

Answer: B

Watch Video Solution

14. A steel rod of length $0.5km$ is used in the construction of a bridge. It has to withstand a temperature change of $40^0 C$. The gap that is allowed for its expansion is $\left[\alpha = 10^{-6 / \circ} C\right]$

A. $0.02cm$

B. $0.02cm$

C. $2m$

D. $20mm$

Answer: D

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15. A wire of length $100cm$ increases in length by $10^{-2}m$ when it is heated through $100^{\circ}C$. The coefficient of linear expansion of the material of the wire exprassed in $/K$ units is

A. 1×10^{-6}

B. 1×10^{4}

C. 1×10^{-4}

D. 10^{-2}

Answer: C

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16. The variation of density of a solid with temperature is give by the formula

A. $d_2 = \dfrac{d_1}{1 + \gamma(t_2 - t_1)}$

B. $d_2 = \dfrac{d_1}{1 - \gamma(t_2 - t_1)}$

C. $d_2 = \dfrac{d_1}{1 - 2\gamma(t_2 - t_1)}$

D. $d_2 = \dfrac{d_1}{1 + 2\gamma(t_2 - t_1)}$

Answer: A

Watch Video Solution

17. An iron bar whose cross sectional area is $4cm^2$ is heated from $0^\circ C$ and $10^\circ C$. The force required to prevent the expansion of the rod is [Y of Iron $= 2 \times 10^{12} \text{dyne} / cm^2$

α of Iron $= 12 \times 10^{-6 / \circ} C$]

A. $0.96 \times 10^{8} N$

B. $0.96 \times 10^{7} N$

C. $9.6 \times 10^{7} N$

D. $96 \times 10^{2} N$

Answer: D

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18. A hole is drilled in a copper sheet. The diameter of the hole is $4.24 cm$ at $27.0^{\circ} C$. What is the change in the diameter of the hole when the sheet is heated to $227^{0} C$? α for copper $= 1.70 \times 10^{-5} K^{-1}$

A. $1.44 \times 10^{-2} cm$

B. $14.4 \times 10^{-2} cm$

C. $144 \times 10^{-2} cm$

D. $0.144 \times 10^{-2} cm$

Answer: A

Watch Video Solution

19. Distance between two places is $200km$. α of metal is $2.5 \times 10^{-5/\circ} C$. Total spece that must be left between steel rails to allow a change of temperature from $36^0 F$ to $117^0 F$ is

A. $2.25km$

B. $0.225km$

C. $22.5km$

D. $0.0225km$

Answer: B

Watch Video Solution

20. A crystal has a coefficient of linear expansion $12 \times 10^{-6 / \circ} C$ in one direaction and $244 \times 10^{-6 / \circ} C$ in every direaction at right angles to it. Then the coefficient of cubical expansion of crystal is

A. $450 \times 10^{-6 / \circ} C$

B. $500 \times 10^{-6 / \circ} C$

C. $244 \times 10^{-6 / \circ} C$

D. $36 \times 10^{-6 / \circ} C$

Answer: B

Watch Video Solution

21. When a thin rod of length $'l'$ is heated from $t_1^0 C$ to $t_2^0 C$ length increases by 1% . If plate of length $2l$ and breadth $'l'$ made of same material is heated form $t_1^0 C$ to $t_2^0 C$, percentage increase in area is

A. 1

B. 2

C. 3

D. 4

Answer: B

Watch Video Solution

LEVEL-I (C.W.)

1. The coefficient of real expansion of liquid is γ_R and the coefficient of appareent expansion of the liquid is γ_A. The coefficient of cubical expansion of the vessel is γ. If $\gamma_R : \gamma_A = 4 : 1$ then $\gamma_A : \gamma$ is

A. $3 : 1$

B. $1 : 3$

C. $4:1$

D. $1:4$

Answer: B

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2. γ_A of liquid is $7/8$ of γ_R of liquid. α_g is vessel is

A. $\frac{\gamma_R}{8}$

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

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

D. $\frac{\gamma_R}{36}$

Answer: C

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3. The apparent coefficient of expansion of liquid, when heated a copper vessel is C and when heated in a silver vessel is S. If A is the linear coefficient of expansion of Copper, linear expansion coefficient of silver is

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

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

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

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

Answer: B

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4. The density of a liquid at $100^{\circ}C$ is $8.0g/cm^{3}$ and at $0^{\circ}C$ is $8.4g/cm^{3}$, the coefficient of cubical expansion of the liquid is

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

B. $5 \times 10^{-4} / {}^{\circ}C$

C. $8 \times 10^{-4} / {}^{\circ}C$

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

Answer: B

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5. If γ is the cofficient of a real expansion of a liquid then the temperature at which density of a liquid is 1% of its density at $0^{\circ}C$ is

A. $\frac{99}{\gamma}$

B. $\frac{1}{99\gamma}$

C. $\frac{100}{\gamma}$

D. $\frac{1}{100\gamma}$

Answer: A

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6. A 1-L flask contains some mercury. It is found that at different temperature, the volume of air inside the flask remains the same. What is the volume of mercury in the flask, given that the coefficient of linear expansion of glass $= 9 \times 10^{-6} / ^{\circ} C$ and the coefficient of volume expansion of $Hg = 1.8 \times 10^{-4} / ^{\circ} C$?

A. $150ml$

B. $750ml$

C. $1000ml$

D. $700ml$

Answer: A

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7. A liquid occupies half of a vessel at a perticular temperature. The volume of the unoccupied part remains constant at all temperatures. If α and γ are the coefficients of linear and real expansions of a vessel and liquid, then γ is

A. 3α

B. $3\alpha/2$

C. 6α

D. 9α

Answer: C

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8. A glass bulb of volume $250cc$ is filled with mercury at $20^\circ C$ and the temperature is raised to $100^\circ C$. If the coefficient of linear expansion of glass is $9 \times 10^{-6/\circ} C$). Coefficient of absolute expansion of mercury is $18 \times 10^{-5/\circ} C$). The volume of mercury overflows

A. 3.06

B. 2.94

C. 6.12

D. 7.73

Answer: A

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9. If on heating a liquid through $80^0 C$, the mass explled is $\frac{1}{100}$th of mass till remaining, the coefficient of apparent expansion of the liquid is

A. $12.6 \times 10^{-4} /^\circ C$

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

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

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

Answer: D

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10. A weight thermometer contains $52g$ of liquid at $10^{0}C$. When it is heated to $110^{0}C$, $2g$ of the liquid is expelled. The coefficient of real expansion of the liquid is $\left[\alpha_{gI} is 9 \times 10^{-6/0}C\right]$

A. $27 \times 10^{-6/0}C$

B. $427 \times 10^{-6/0}C$

C. $373 \times 10^{-6/0}C$

D. $473 \times 10^{-6/0}C$

Answer: B

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11. A vessel contaning 10 litre of air under a pressure of $1MPa$ is connected to a 4 litre empty vessel. The final air pressure in the vessel assuming that the process is isothermal.

A. $7/5MPa$

B. $5/7MPa$

C. $1MPa$

D. $10MPa$

Answer: B

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12. Two vessels of volume 10 and 5 litres contain air at 5 atmospheres and x (Unknown) atmospheres. When they are connected together with a small tube the resultant pressure is $'6'$ atmospheres find the value of $'x'$

A. $8atm$

B. $16atm$

C. $4atm$

D. $2atm$

Answer: A

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13. An air bubble starts rising from the bottom of a lake and its radius is doubled on reaching the surface. If the temperature is costant the depth of the lake is. (1 atmospheric pressure $= 10m$ height of water column)

A. $7m$

B. $70m$

C. $10m$

D. $0.7m$

Answer: B

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14. If an air bubbles rises from the bottom of a mercury tank to the top its volume becomes $1\frac{1}{2}$ times. When normal pressure is $76cm$ of Hg then the depth of the Hg tank is

A. $38cm$

B. $123cm$

C. $76cm$

D. $49cm$

Answer: A

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15. A quill tube contains a mercury column of length $19cm$. The length of air column is $24cm$ when it is held veritcally. On inverting it with its open end downwards the length of air column will be (atmospheric pressure $= 76cm$ of Hg)

A. $20cm$

B. $30cm$

C. $40cm$

D. $35cm$

Answer: C

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16. At what temperature will the volume of a gas be twice the volume at 27^0C at a given pressure.

A. 327^0C

B. 54^0C

C. 127^0C

D. 100^0C

Answer: A

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17. If the temperature of a gas is increased by $1K$ at constant pressure its volume increase by 0.0035 of the initial volume. The temperature of the gas is

A. $100K$

B. $150K$

C. $300K$

D. $285.7K$

Answer: D

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18. A cylinder contains a gas at temperature of 27^0C and a pressure $1MPa$. If the temperature of the gas is lowered to -23^0C, the change in pressure is

A. $1MPa$

B. $5/6MPa$

C. $1/6MPa$

D. $5MPa$

Answer: C

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19. A gas is kept at $13^{0}C$ in a vessel, if the volume of the gas is kept constant and is heated, the pressure will be doubled to its initial pressure at a temperature

A. $572K$

B. $286K$

C. $143K$

D. $73K$

Answer: A

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20. State the equation corresponding to $8g$ of O_2 is

A. $PV = 8RT$

B. $PV = RT/4$

C. $PV = RT$

D. $PV = RT/2$

Answer: B

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21. A given amoount of gas is heated until both its pressure and volume are doubled. If initial temperature is $27^0 C$, its final temperature is

A. $300K$

B. $600K$

C. $1200K$

D. $900K$

Answer: C

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22. At. N.T.P. $28g$ Nitrogen occupies 22.4 litres. Nitrogen at $38cm$ of Hg pressure and $273^\circ C$ temperature

A. $7g$

B. $48g$

C. $1.75g$

D. $1.5g$

Answer: C

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23. A vessel of volume 4 litres contains a mixture of $8g$ of O_2, $14g$ of N_2 and $22g$ of CO_2 at $27^0 C$. The pressure exerted by the mixture is

A. $10N/m^2$

B. $5 \times 10^6 N/m^2$

C. $7.69 \times 10^5 N/m^2$

D. $6 \times 10^5 N/m^2$

Answer: C

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LEVEL-II (C.W.)

1. Coefficient of apparent expansions of a liquid in two different vessels are a and b. Then the real coefficient of expansions of liquids, if the ratio of volume expansion of vessel of $x : y$

A. $\dfrac{bx - ay}{x - y}$

B. $\dfrac{ay - bx}{x + y}$

C. $\dfrac{ay - bx}{x - y}$

D. $\dfrac{ay + bx}{x - y}$

Answer: A

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2. A flask cotaines $100c.c$ of a liquid at $10^{\circ}C$. When it is heated to $110^{0}C$ increase in volume of the liquid appers to be 2 c.c. Find the coefficient of real expansion of the liquid.

(α of flask is $11 \times 10^{-6 / \circ} C$)

A. $2.33 \times 10^{-4} /^{\circ} C$

B. $3.33 \times 10^{-4} /^{\circ} C$

C. $23.3 \times 10^{-4} /^{\circ} C$

D. $33.3 \times 10^{-4} /^{0} C$

Answer: A

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3. At $0.^{0} C$ the densities of a cork and a liquid in which the cork floats are d_1 and d_2 respectively. The coefficient of expansion for the material of the cork and the liquid are γ and 100γ respectively. If the cork sinks when the temperature of the liquid is $'t^{0}C'$ then the ratio $\frac{d_2}{d_1}$ is

A. $\dfrac{1+100\gamma t}{1+\gamma t}$

B. $\dfrac{1+\gamma t}{1+100\gamma t}$

C. $\dfrac{100+\gamma t}{1+\gamma t}$

D. $\dfrac{1+\gamma t}{100+\gamma t}$

Answer: A

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4. A wooden block of density $860kg/m^3$ at $0^\circ C$ is floating on bezene liquid of density $900k\dfrac{g}{m^3}$ at $0^\circ C$. The temperature at which the block just submerge in benzene is

$\left[\gamma_{wood} = 8\times10^{-5/\circ}c, \gamma_{\text{benzene}} = 12\times10^{-4/\circ}c\right]$

A. $24^\circ c$

B. $42^\circ c$

C. $16^\circ c$

D. $32^{\circ} c$

Answer: B

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5. A sphere of mass $180g$ and diameter $6cm$ floats on the surface of a liquid. When the liquid is heated to $35^{0}C$, the sphere sinks in the liquids. If the density of liquid at $0^{0}C$ is $2gcm^{-5}$. The coefficient of real expansion of liquid is

A. $71.4 \times 10^{-4} / ^{\circ} C$

B. $81.4 \times 10^{-4} / ^{\circ} C$

C. $91.4 \times 10^{-4} / ^{\circ} C$

D. $61.4 \times 10^{-4} / ^{\circ} C$

Answer: A

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6. A vessel contains a liquid filled with $1/10$th of its volume. Another vessel contains same liquid upto $1/8$th its volume. In both cases the volume in empty space remains constant at all temperatures. Then the ratio of coefficient of linear expansions of the two vessels is

A. $2:5$

B. $5:2$

C. $4:5$

D. $5:4$

Answer: C

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7. The co-efficient of linear expansion of iron is $11/180$ of volume coefficient of expansion of mercury which is $18 \times 10^{-5} /^{0} C$. An iron rod is $10m$ long at $27^{\circ} C$. The length of the rod will be decreased by $1.1mm$ then the termperature the rod changes by

A. $0^{\circ} C$

B. $10^{\circ} C$

C. $20^{\circ} C$

D. $170^{\circ} C$

Answer: B

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8. A barometer with a brass scale correct at $0^{\circ} C$ reads $70cm$ of mercury on a day when the air temperature is $40^{\circ} C$. The correct reading at $0^{\circ} C$ is (Coefficient of real exapansion of mercury is

$0.00018/^{\circ}C$ and coefficient of linear expansion of brass is $0.00018/^{\circ}C)$

A. $60.5cm$

B. $69.97cm$

C. $20.5cm$

D. $50.00cm$

Answer: B

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9. A solid floats in a liquid at 20°C with 75 % of it immersed. When the liquid is heeated to 100°C, the same solid floats with 80% of it immersed in the liquid. Calculate the coefficient of expansion of the liquid. Assume the volume of the solid to be constant.

A. $8.33\times10^{-4}/^{\circ}C$

B. $83.3 \times 10^{-4} / {}^{\circ} C$

C. $833 \times 10^{-4} / {}^{\circ} C$

D. $0.833 \times 10^{-4} / {}^{\circ} C$

Answer: A

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10. The volume of mercury in the bulb of thermometer is $10^{-6} m^3$. The area of cross-section of the capillary tube is $2 \times 10^{-7} m^2$. If the temperature is raised by $100^0 C$, the increase in the length of the mercury column is $\left(\gamma_{Hg} = 18 \times 10^{-5 / {}^{\circ}} C\right)$

A. $18 cm$

B. $9 cm$

C. $4 cm$

D. $1.8 cm$

Answer: B

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11. A non-conducting body floats in a liquid at $20^\circ C$. with $2/3$ of its volume immersed in the liquid When liquid temperature is increased to $100^\circ C$, $3/4$ of body volume is immersed in the liquid. Then the coefficient of real expansion of the liquid is... (neglecting the expansion of container of the liquid)

A. $1.56 \times 10^{-4/\circ} C$

B. $15.6 \times 10^{-4/\circ} C$

C. $1.56 \times 10^{-5/\circ} C$

D. $15.6 \times 10^{-5/\circ} C$

Answer: B

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

A. 21.2c c

B. 15.2c c

C. 2.12 c c

D. 18.2c c

Answer: B

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13. A vessel contains a gas under a pressure of $5 \times 10^5 pa$. If $3/5$ of the mass of the gas is flown out, What will be the gas pressure if the temperature being maintained constant,

A. $50MPa$

B. $2MPa$

C. $0.2MPa$

D. $0.5MPa$

Answer: C

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14. When an air bubble of radius $'r'$ rises from the bottom to the surface of a lake, its radius becomes $5r/4$ (the pressure of the atmosphere is equal to the $10m$ height of water column). If the temperature is constant and the surface tension is neglected, the depth of the lake is

A. $3.53m$

B. $6.53m$

C. $9.53m$

D. $12.53m$

Answer: C

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15. How much should the pressure of 1 atmosphere and 2 litre of nitrogen at a pressence of 0.5 atmosphere are introduced in a vessel of 1 litre capacity without any change in temperature The total pressure in atmosphere is

A. 10%

B. 9.5%

C. 11.111%

D. 5.11%

Answer: C

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16. One litre of oxygen at a pressure of 1 atm and two litres of nitrogen at a pressure of 0.5 atm are introduced into a vessel of volume 1 litre. If there is no change in temperature, the final pressure of the mixture of gas (in atm) is

A. 1

B. 2

C. 3

D. 4

Answer: B

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17. Two closed vessels of equal volume contain air at $105kPa$, $300K$ and are connected through a narrow tube. If one of the vessels is now maintained at $300K$ and the other at $400K$, what will be the pressure in the vessels?

A. $120kPa$

B. $105kPa$

C. $150kPa$

D. $300kPa$

Answer: A

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18. A vessel is filled with an ideal gas at a pressure of 10 atmospheres and temp 27^0C. Half of the mass of the gas is removed from the vessel the temperature of the remaining gas is increased to 87^0C. Then the pressure of the gas in the vessel will be

A. $5atm$

B. $18atm$

C. $7atm$

D. $8atm$

Answer: B

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19. Two identical containers connected by a fine caillary tube contain air at $N.T.P$ if one of those containers is immersed in pure water, boiling under noramal pressure then new pressure is

A. $76cm$ of Hg

B. $152cm$ of Hg

C. $57cm$ of Hg

D. $87.76cm$ of Hg

Answer: D

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20. At the top of a mountain a thermometer and 7^0C and barometer reads $70cm$ of Hg. At the bottom of the mountain the barometer reads $76cm$ of Hg and termometer reads 27^0C. The density of air at the top of mountain is "_" times the density at the bottom.

A. 0.99

B. 0.9

C. 0.89

D. 0.95

Answer: A

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21. During an experiment an idea gas is found to obey an additional gas law VT = constant. The gas is initially at temperature T and pressure P. When it is heated to the temperature $2T$, the resulting pressure is

A. $2P$

B. $P/2$

C. $4P$

D. $P/4$

Answer: C

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22. During an experiment, an ideal gas is found to obey an additional law $VP^2 = cons\tan t,$ The gas is initially at a temperature T, and volume V. When it expands to a volume $2V,$ the temperature becomes.......

A. T

B. $2T$

C. $\sqrt{2}T$

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

Answer: C

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23. At the bottom of a lake where temperature is 7^0C the pressure is 2.8 atmosphere. An air bubble of radius $1cm$ at the bottom rises to the surface. Where the temperature is 27^0C. Radius of air bubble at the surface is

A. $3^{1/3}$

B. $4^{1/3}$

C. $5^{1/3}$

D. $6^{1/3}$

Answer: A

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24. The gas in a vessel is subjected to a pressure of 20 atmosphere at a temperature $27^\circ C$. The pressure of the gas in the vessel after one half of the gas is released from the vessel and the temperature of the remainder is raised by $50^{\circ} C$ is

A. $8.5 atm$

B. $11.7 atm$

C. $17 atm$

D. $10.8 atm$

Answer: B

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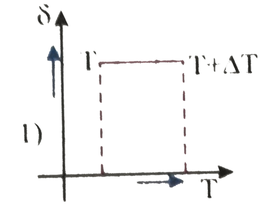
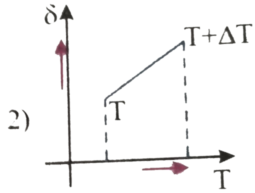
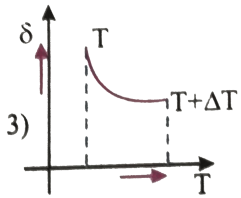
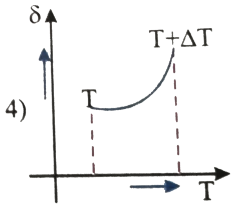
25. An ideal gas is initially at temperature T and volume V. Its volume is increased by ΔV due to an increase in temperature ΔT, pressure remaining constant. The quantity $\delta = \frac{\Delta V}{V \Delta T}$ varies with temperature as

A. 

B. 

C. 

D. 

Answer: C

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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 that for V_2

B. the curve for V_2 has greater slope than that for V_1

C. both curves have same slope

D. the curves intersect at some point other than $T=0$

Answer: A

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27. Two gases A and B having the same temperature T, same pressure P and same volume V are mixed. If the mixture is at the same temperature and occupies a volume V. The pressure of the mixture is

A. $2P$

B. P

C. $P/2$

D. $4P$

Answer: A

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LEVEL-III

1. A mercury thermomeeter contains $2c.c.$ of $Hg.$ at $0^{\circ}C$. Distance between $0^{\circ}C$ and $100^{\circ}C$ marks on the stem is $35cm$ and diameter of the bore is $0.02cm$ then γ_A of liquid is

A. $0.000055/^{0}C$

B. $0.000066/^{0}C$

C. $0.00055/^{0}C$

D. $0.000058 /{ }^{0} C$

Answer: A

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

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

B. $3.4 \times 10^{-5 \circ} C$

C. $2.9 \times 10^{-5 \circ} C$

D. $24 \times 10^{-5 \circ} C$

Answer: A

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3. A piece of metal floats on mercury. The coefficients of volume expansion of the metal and mercury are γ_1 and γ_2 respectively. If the temperatures of both mercury and the metal are increased by an amount ΔT, the fraction of the volume of the metal submerged in mercury changes by the factor............

A. $\dfrac{1}{(\gamma_2 - \gamma_1)\Delta t}$

B. $\dfrac{1}{(\gamma_1 - \gamma_2)\Delta t}$

C. $(\gamma_1 - \gamma_2)$

D. $(\gamma_2 - \gamma_1)\Delta t$

Answer: D

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4. The loss of weight of a solid when immersed in a liquid at $0^\circ C$ is W_0 and at $t^\circ C$ is $'W'$. If cubical coefficient of expansion of the solid and the liquid are γ_s and γ_1 then $W =$

A. $W_0[1 + (\gamma_s - \gamma_l)t]$

B. $W_0[1 - (\gamma_s - \gamma_l)t]$

C. $W_0[1 + (\gamma_l - \gamma_s)t]$

D. $W_0[1 - (\gamma_l - \gamma_s)t]$

Answer: A::D

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5. The density of a liquid of coefficient of cubical expansion γ is ρ at $0^\circ C$ when the liquid is heated to a temp T, the change in density will be

A. $\dfrac{-\rho\gamma T}{1+\gamma T}$

B. $\dfrac{\rho\gamma T}{1+\gamma T}$

C. $-\dfrac{1+\gamma T}{\gamma T}$

D. $\gamma\dfrac{1+\gamma T}{\gamma T}$

Answer: A

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

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

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

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

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

Answer: B

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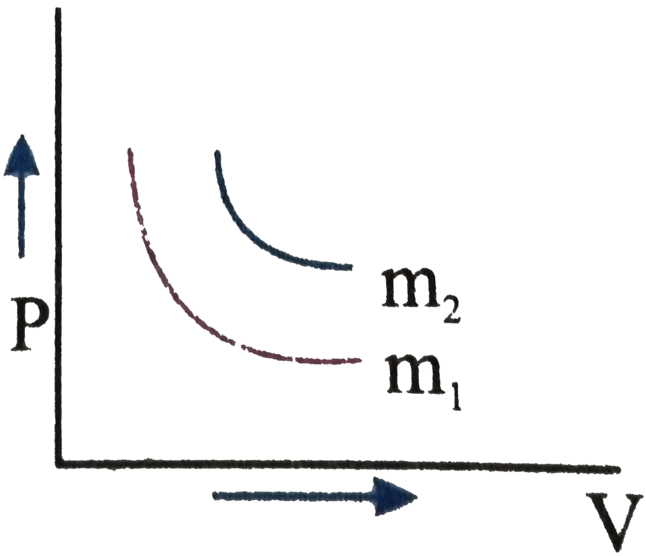
7. The graph drawn between pressure and volume lin Boyles law experiment is shown in figure for different masses of same gas at same temperature then



A. $M_2 < M_2$

B. $M_1 < M_2$

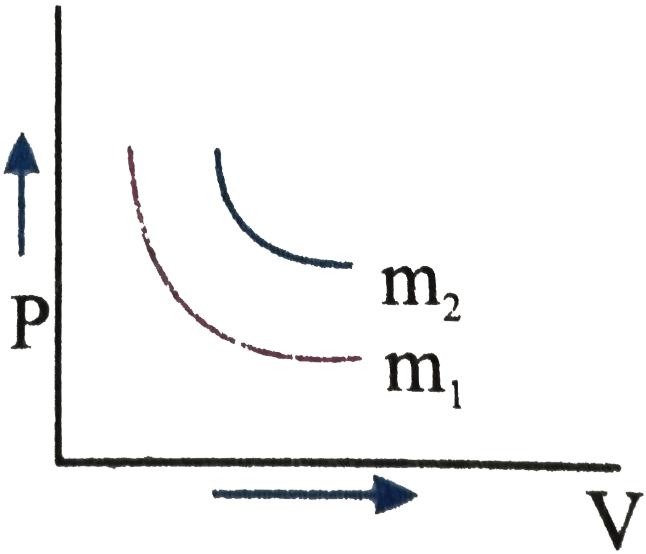
C. $M_1 = M_2$

D. $M_1^3 = M_2$

Answer: A

Watch Video Solution

8. The graph drawn between pressure and volume lin Boyles law experiment is shown in figure for different masses of same gas at same temperature then



A. $m_2 > m_1$

B. $m_1 < m_2$

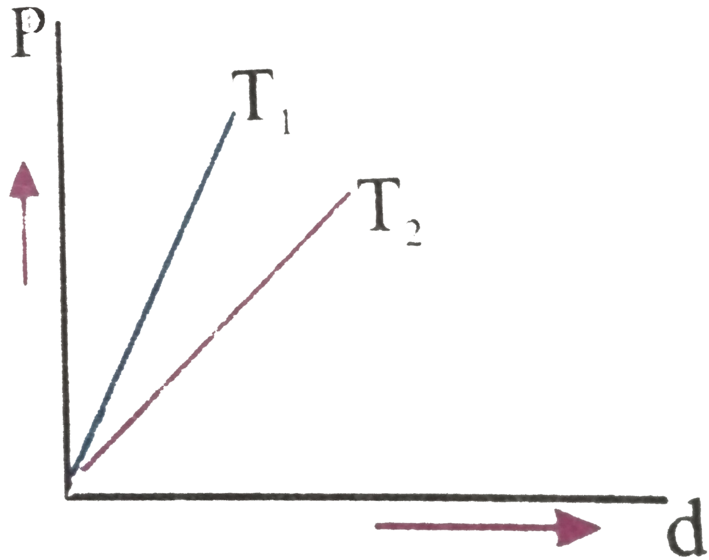
C. $m_1 = m_2$

D. $m_1^3 = m_2$

Answer: A

Watch Video Solution

9. In Boyles experiment for a given gas at different temperature the graph drawn between pressure and density are straight lines as shown then



A. $T_1 > T_2$

B. $T_2 > T_1$

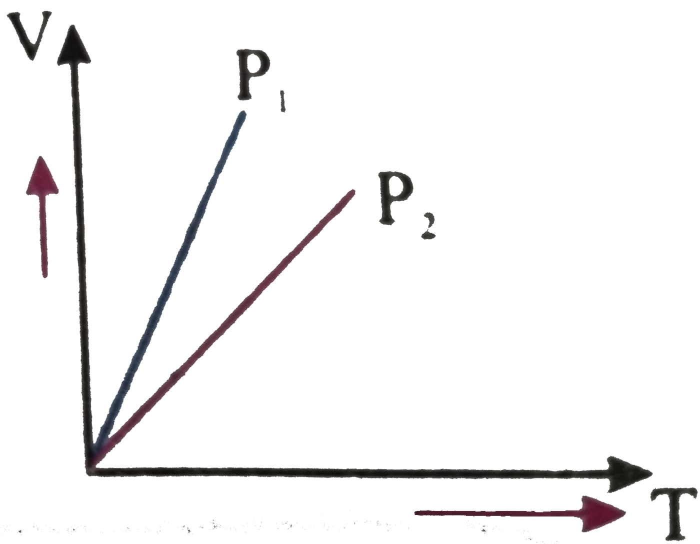
C. $T_1 = T_2$

D. $T_1^3 = T_2$

Answer: A

Watch Video Solution

10. For an ideal gas $V - T$ curves at constant pressure P_1 & P_2 are shown in figure, from the figure



A. $P_1 > P_2$

B. $P_1 < P_2$

C. $P_1 = P_2$

D. $P_1 \leq P_2$

Answer: B

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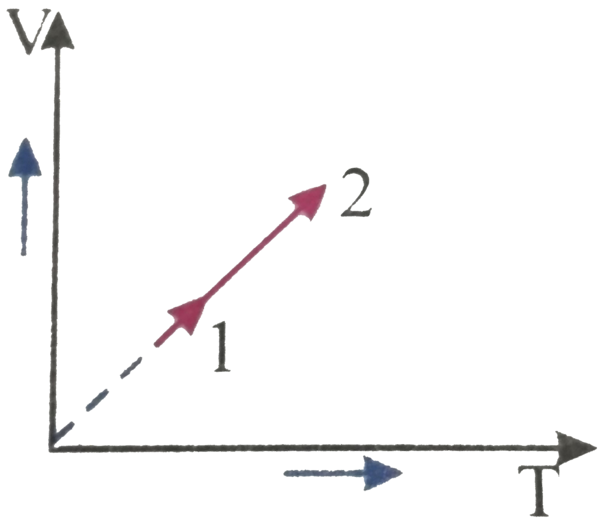
11. A volume V absolute temperature T diagram was obtained when a given mass of gas was heated. During the heating process from state 1 to 2, the pressure



A. Remain constant

B. Decreased

C. Changed erratically

D. Increased

Answer: A

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12. Two identical container each of volume V_0 are joined by a small pipe. The containers contain identical gases at temperature T_0 and pressure P_0. One container is heated to temperature $2T_0$ while maintaining the other at the same temperature. The common pressure of the gas is P and n is the number of moles of gas in container at temperature $2T_0$.

A. $P = 2P_0$

B. $P = \frac{4}{3}P_0$

C. $n = \frac{2P_0V_0}{3RT_0}$

D. $n = \frac{2P_0V_0}{2RT_0}$

Answer: C

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13. A cycle tube has volume $2000cm^3$. Initially the tube is filled to $\left(\frac{3}{4}\right)^{th}$ of its colume by air at pressure of $10^5 N/m^2$ under isothermal conditions. The number of strokes of pump, which gives $500cm^3$ air in each stroke, to infalte the tube is

A. 21

B. 12

C. 42

D. 11

Answer: A

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14. A horizontal uniform glass tube of $100cm$ length is sealed at both ends contains $10cm$ mercury column in the middle , the temperature and pressure of air on either side of mercury column are repectively $31^{\circ}C$ and $76cm$ of mercury, if the air column at one end is kept at $0^{\circ}C$ and the other end at $273^{\circ}C$ then pressure if air which is $0^{\circ}C$ is (in cm of Hg)

A. 76

B. 88.2

C. 102.4

D. 122

Answer: C

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15. A closed hollow insulated cylinder is filled with gas at $0^{\circ}C$ and also contains an insulated piston of negligible weight and negligible thickness at the middle point. The gas on one side of the piston is heated to $100^{\circ}C$. If the piston moves $5cm$ the length of the hollow cylinder is

A. $13.65cm$

B. $27.3cm$

C. $38.6cm$

D. $64.6cm$

Answer: D

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16. Two thermally insulated vessel 1 and 2 are filled with air at temperature $(T_1T_2), volume(V_1V_2)$ and pressure (P_1P_2)

respectively. If the valve joining the two vessels is opened, the temperature inside the vessel at equilibrium will be

A. $T_1 + T_2$

B. $T_1T_2(P_1V_1 + P_2V_2)/(P_1V_1T_1 + P_2V_2T_2)$

C. $T_1T_2(P_1V_1 + P_2V_2)/(P_1V_1T_2 + P_2V_2T_1)$

D. $(T_1 + T_2)/2$

Answer: C

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17. Two identical containers A and B with frictionless pistons contain the same ideal gas at the same temperature and the same velocity V. The mass of the gas in A is m_A, and that in B is m_B. The gas in each cylinder is now allowed to expand isothermally to the same final volume 2V. The changes in the pressure in A and B are found to be ΔP and $1.5\Delta P$ respectively. Then

A. $9m_A = 4m_B$

B. $3m_A = 2m_B$

C. $2m_A = 3m_B$

D. $4m_A = 9m_B$

Answer: B

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18. A closed container of volume $0.02m^3$contains a mixture of neon and argon gases, at a temperature of $27^\circ C$ and pressure of $1 \times 10^5 Nm^{-2}$. The total mass of the mixture is 28g. If the molar masses of neon and argon are 20 and $40gmol^{-1}$ respectively, find the masses of the individual gasses in the container assuming them to be ideal (Universal gas constant $R = 8.314J/mol - K$).

A. $m_1 = 4g, m_2 = 24g$

B. $m_1 = 8g, m_2 = 20g$

C. $m_1 = 16g, m_2 = 12g$

D. $m_1 = 12g, m_2 = 16g$

Answer: A

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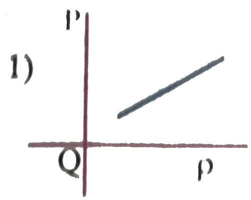
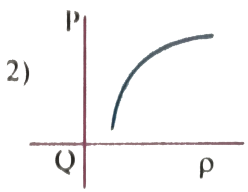
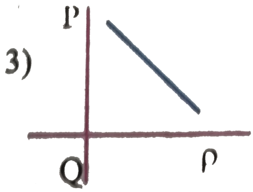
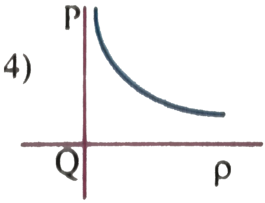
19. Which of the following shown the correct relationship between the pressure $'P'$ and density ρ of an idealgas at constant tem pera ture?

A. 

B. 

C. 

D. 

Answer: A

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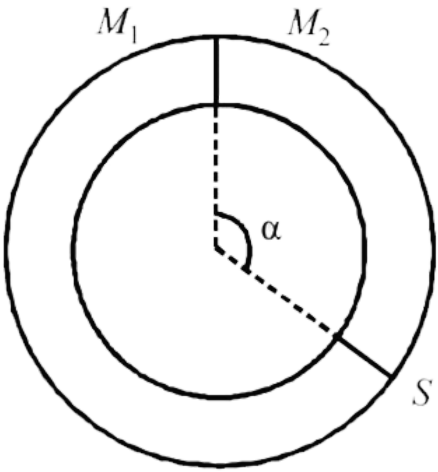
20. A ring shaped tube contain two ideal gases with equal masses and relative molar masses $M_1 = 32$ and $M_2 = 28.$

The gases are separated by one fixed partiotin and another movable stopper S which can move freely without friction inside the ring. The angle α as shown in the figure is ...... degrees.



A. 291^0

B. 219^0

C. $125^0 C$

D. $192^0 C$

Answer: D

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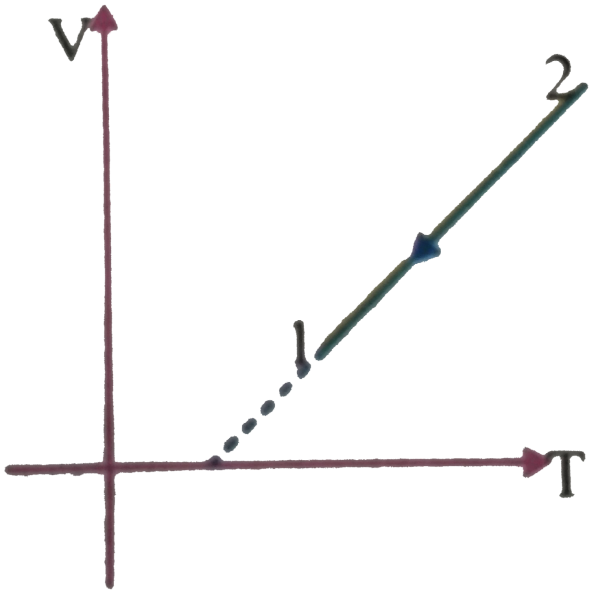
21. $V-T$ diagram for a process of given mass of ideal gas is as shown in fig. During the process pressure of the gas



A. First increases then decreases

B. First decreases then increases

C. continously decreases

D. continously increases

Answer: C

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22. Find the minimum attainabel pressure of one mole of an ideal gas. If during its expansion its temprature and volume are related as $T = T_0 + \alpha V^2$ where $T_0 \& \alpha$ are positive constants

A. $2R\sqrt{T_0\alpha}$

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

C. $R\sqrt{T_0\alpha}$

D. $\frac{R\sqrt{T_0\alpha}}{4}$

Answer: A

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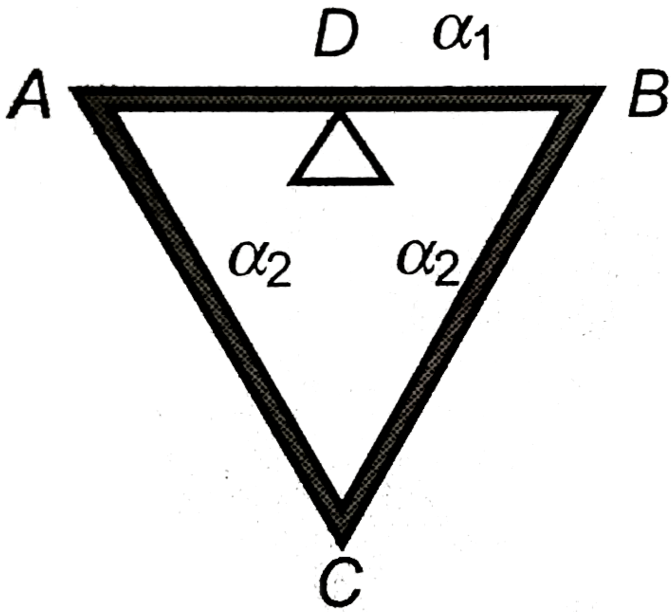
LEVEL - V

1. 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. $(\alpha_1 + \alpha_2) L \delta t$

B. $\frac{2\alpha_1 + \alpha_2}{2} L \Delta t$

C. $\frac{(\alpha_1 + 2\alpha_2) L \delta t}{2}$

D. Zero

Answer: D

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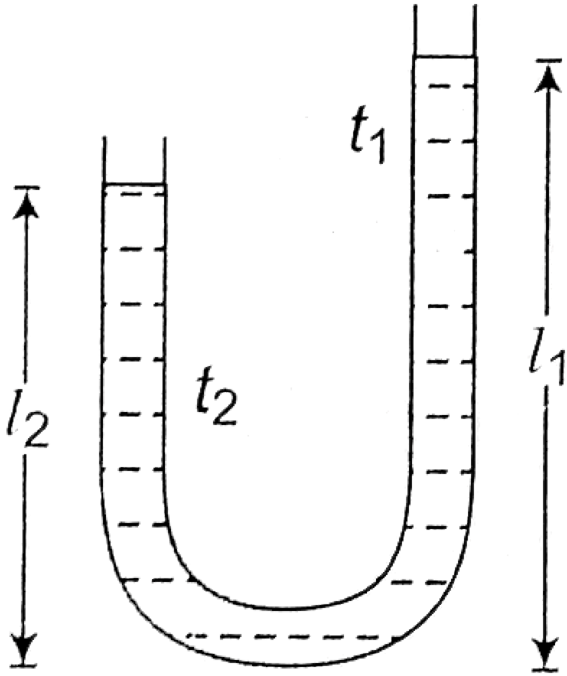
2. In a vertical U-tube containing a luquid, the two arms are maintained at different temperatures, t_1 and t_2 . The liquid coplumns in the two arms have heights l_1 and l_2 respectively. The coefficient of

volume expansion of the liquid is equal to



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

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

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

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

Answer: A

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3. A cube of coefficient of linear expansion α is floating in a bath containing a liquid of coefficient of volume expansion γ_l. When the temperature is raised by ΔT, the depth upto which the cube is submerged in the liquid remains the same. Find relation between α and γ_l

A. $\gamma = 3\alpha_s$

B. $\gamma_1 = 3\alpha_s / 2$

C. $\gamma_1 = 2\alpha_s$

D. $\gamma_1 = \alpha_s / 2$

Answer: C

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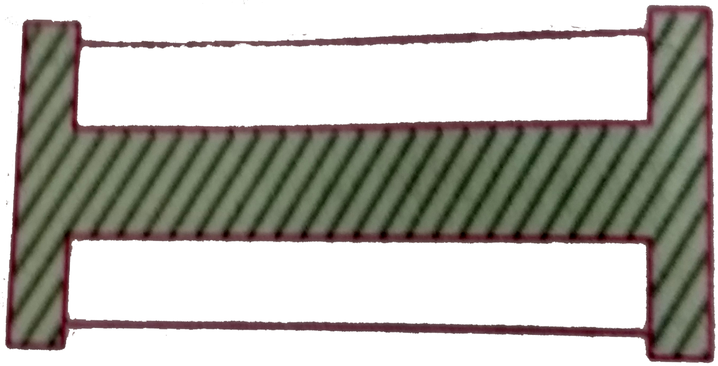
4. A heavy brass bar has projections at its ends as shown in the figure. Two find steel wires, fastened between the projections, are just taut (zero tension) when the whole systeam is at $0^0 C$. What is the tensile stress in the steel wires when the temperature of the systeam is raised to $300^0 C$?

Given that

$\alpha_{\text{brass}} = 20 \times 10^{-6^\circ} C^{-1}$

$\alpha_{\text{steel}} = 12 \times 10^{-6\circ} C^{-1} Y_{\text{steel}} = 2 \times 10^{11} Nm^{-2}$



A. $48 \times 10^7 Nm^{-2}$

B. $84 \times 10^7 Nm^{-2}$

C. $32 \times 10^4 Nm^{-2}$

D. $24 \times 10^4 Nm^{-2}$

Answer: A

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5. A metallic circular disc having a circular hole at its centre rotates about an axis passing through its centre and perpendicular to its plane. When the disc is heated:

A. its angular speed will decrease

B. its diameter will decrease

C. its moment of inertia will increase

D. its angular speed will increase

Answer: A::C

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6. A bimetallic strip is formed out of two identical strips one of copper and the other of brass. The co-efficients of linear expansion of the two metals are α_C and α_B. On heating, the the strip bends to form an are of radius of curvature R. Then R is

A. proportional to ΔT

B. inversely proportional to ΔT

C. proportional to $|\alpha_B - \alpha_C|$

D. Inversely proportional to $|\alpha_B - \alpha_C|$

Answer: D

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7. Which of the following processes will quadruple the pressure

A. Reduce V to half and double T

B. Reduce V to $1/8th$ and reduce T to half

C. Double V and half T

D. Increase both V and T to double the values.

Answer: A::B

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8. A metal rod lenth L_0 whose coefficient of linear expansion $\alpha = 10^{-3} \hat{} (0)C^{-1}$ is heated such that its temperature changes by $1000K$ assum-ing α is constant during the temperature change $(e = 2.7)$

A. Final length of the rod is greater than $2L_0$

B. Final length of the rod is greater than $2.5L_0$

C. Final length of the rod is greater than $3L_0$

D. increase in length of rod is L_0

Answer: A::B

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9. Which o of the following statements are not ture

A. Size of degree is smallest on celsius scale

B. Size of degree is smallest on Fehrenhelt scale

C. Size of degree is equal on Fahrenhelt and kelvin scale

D. Size of degree is equal on celsius and kelvin scale

Answer: A::D

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10. Reading of temperature may be same on:

A. Celsius and Kelvin scale

B. Fahrenhelt and Kelvin scale

C. celsius and fahrenhelt scale

D. All the three scales

Answer: B::C

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11. A steel rod of length $5m$ is fixed between two support. The coefficient of linear expansion of steel is $12.5 \times 10 - 6 / ^{\circ} C$. Calculate the stress (in $10^{8} N / m2$) in the rod for an increase in temperature of $40^{\circ} C$. Young's modulus for steel is $2 \times 10^{11} Nm^{-2}$

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12. A cubical block of co-efficient of linear expansion α_s is submerged partially inside a liquid of co-efficient of volume expansion γ_l. On increasing the temperature of the system by ΔT, the height of the cube inside the liquid remains unchanged. Find the relation between α_s and γ_l.

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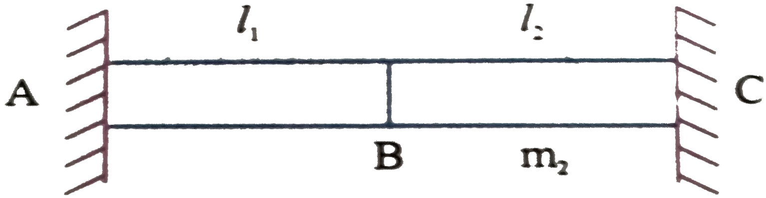
LEVEL - VI

1. Two rods AB and BC of equal cross-sectional area are joined together and clamped between two fixed supports as shown in the figure. For the rod AB and road BC lengths are l_1 and l_2 coefficient of linear expansion are α_1 and α_2, young's modulus are Y_1 and Y_2, densities are ρ_1 and ρ_2 respectively. Now the temperature of the compound rod is increased by θ. Assume of that there is no significant change in the lengths of rod due to heating. then the time taken by transverse wave pulse to travel from end A to other end C of the compound rod is directly proportional to



A. $\sqrt{l_2Y_1+l_1Y_2}$

B. $2\sqrt{l_2Y_1+l_1Y_2}$

C. $\sqrt{l_1Y_2+l_2Y_1}$

D. $\sqrt{l_2Y_1-l_1Y_2}$

Answer: C

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2. Two wire A and B of the same corss sectional area, young's modulli Y_1, Y_2 and coefficients of linear expansion α_1, α_2 respectively are joined together and fixed between rigid supports at either ends. The tension in the compound wire when the wire A is heated and Wire B is cooled at different temperature is same when wire A alone in cooled at same temperature as wire B earller. the correct option is

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

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

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

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

Answer: B

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

A. $\dfrac{h}{R_e}$

B. $\dfrac{h}{5R_e}$

C. $\dfrac{5R_e}{h}$

D. $\dfrac{R_e}{h}$

Answer: B

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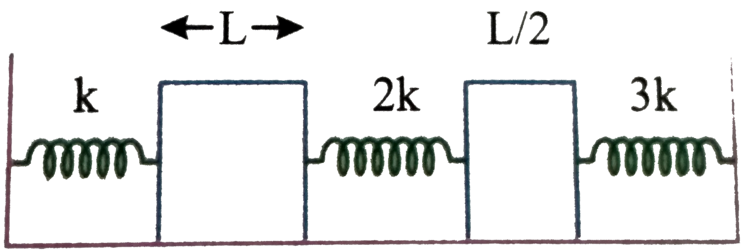
4. The systeam shown is figure consists of 3 springs and two rods. If the temperature of the rod is increased by ΔT, then the total energy stored in three springs is $\beta \times \dfrac{99}{484} kL^2\alpha^2(\Delta T)^2$. Datermine the value of β. The soring are initially relaxed and there is no frication anywhere. For rod the coefficient of linear expansion is α



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LEVEL - I (H.W.)

1. The coefficient of real expansion of liquid is $7 \times 10^{-4/0}C$. The co efficient of linear ex/pansion of the vessel is $1 \times 10^{-5} /^0 C$. The coefficient of apparent expansion of the liquid is

A. $7 \times 10^{-4} /^0 C$

B. $6 \times /^0 C$

C. $67 \times /^0 C$

D. $73 \times /^0 C$

Answer: C

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2. The coefficient of real expansion γ_R of a liquid is 5 times the coefficient of linear expansion of the material of the container in which the liquid is present. The ratio is of the cofficient of apparent expansion and real expansion of the liquid is

A. $5:2$

B. $1:5$

C. $2:5$

D. $5:1$

Answer: C

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3. When a liquid in a glass vessel is heated, its apperent expansion is $10.30 \times 10^{-4/0}C$. Same liquid when heated in a matalic vessel, its apparent expansion is $10.06 \times 10^{-4/0}C$. Same liquid when heated in a metalic vessel, its apperent expansion of metal is

$\left(\alpha_{glass} = 9 \times 10^{-6/0}C\right)$

A. $51 \times 10^{-6/0}C$

B. $25 \times 10^{-6/0}C$

C. $43 \times 10^{-6/0}C$

D. $25 \times 10^{-6/0}C$

Answer: D

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4. Coefficient of apparent expansions of mercury is $0.18 \times 10^{-3}/^0C$. If the density of mercury at 0^0C is $13.6g/cc$ its density at $473K$ will be

A. $13.12g/c.c.$

B. $13.65g/c.c.$

C. $13.51g/c.c.$

D. $13.22g/c.c.$

Answer: A

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5. If coefficient of real expansion of a liquid is $\frac{1}{5500}/^0C$. The temperature at which its density is 1% less than density at 0^0C is

A. 55.5^0C

B. 100^0C

C. 99^0C

D. $1^0 C$

Answer: A

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6. The coefficient of cubical expansion of liquid and glass are in the ratio of $8 : 1$. The volume of the liquid to be taken into 800 container so that the unoccupied portion remains costant is

A. 10

B. 100

C. 80

D. 8

Answer: B

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7. The fraction of the volume of a glass flask must be filled with mercury so that the volume of the empty space may be the same at all temperature is

$\left(\alpha_{\text{glass}} = 9 \times 10^{-6} /{}^{0}C, \gamma_{Hg} = 18.9 \times 10^{-5} /{}^{0}C\right)$

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

B. $\frac{1}{7}$

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

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

Answer: B

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8. A glass flask of volume $200 cm^3$ is completely filled with mercury at $20^0 C$. The amount of mercury that overflow when the flask is heated to $80^{0}C$ (Coefficient of volume expansion of glass is $27 \times 10^{-6/0}C$, γ of mercury $0.18 \times 10^{-3}/^{0}C$

A. $2.16 cm^{3}$

B. $0.032 cm^{3}$

C. $1.84 cm^{3}$

D. $2.40 cm^{3}$

Answer: C

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9. A glass vessel just holds $50 gm$ of a liquid at $0^{0}C$. If the coefficient of linear expansion is $8 \times 10^{-6}/^{0}C$ The mass of the liquid it holds at $80^{0}C$ is [coefficient of absolute expansion of liquid $= 5 \times 10(-4)/^{0}C$ (nearly)

A. $46 g$

B. $48g$

C. $51g$

D. $42g$

Answer: B

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10. A weight thermometer contains $51g$ of mercury at 20^0C and $50g$ of mercury at 100^0C. The coefficient of apparent expansion of mercury in glass vessel is

A. $25 \times 10^{-5} / {}^0C$

B. $2.5 \times 10^{-3} / {}^0C$

C. $2 \times 10^{-5} / {}^0C$

D. $4 \times 10^{-4} / {}^0C$

Answer: A

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11. If a given mass of a gas occupies a volume 100 at one atmospheric pressure and a temperature of $100^0 C$. What will be its volume at 4 atmospheric pressure, the temperature being the same?

A. $100cm^3$

B. $400cm^3$

C. $25cm^3$

D. $200cm^3$

Answer: C

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12. A vessel containing 9 litres of an ideal gas at $760mm$ pressure is connected to an evacuated 9 litre vessel. The resultant pressure is

A. $380mm$

B. $760mm$

C. $190mm$

D. $1140mm$

Answer: A

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13. A bubble rises from the bottom of a lake $90m$ deep on reaching the surface, its volume becomes (take atmospheric pressure equals to $10m$ of water)

A. 4 times

B. 8 times

C. 10 times

D. 3 times

Answer: C

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14. An air bubble rises from the bottom to the surface of lake and it is found that its diameter is duubled. If the height of water barometer is $11m$, the depth of the lake in maters is

A. $70m$

B. $77m$

C. $7.7m$

D. $78m$

Answer: B

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15. The temperature of a gas contain in a closed vessel increased by $2^0 C$ when the pressure is increased by 2% the intial temperature of the gas is

A. $200K$

B. $100K$

C. $200^0 C$

D. $110^0 C$

Answer: B

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16. The volume that a gas occupies at $343K$ if its volume at $-25^{0}C$ is 7.5 litre is `(The process is isobaric)

A. 10.29 lit

B. 102.9 lit

C. 1.029 lit

D. 1029 lit

Answer: A

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17. A car type has air at $1.5atm$ at $300K$. If P increases to $1.75atm$ with volume same, the termperature will be "_"

A. $350^{0}C$

B. $350K$

C. $300^0 C$

D. $300K$

Answer: B

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18. A gas at $627^0 C$ is cooled that its pressure becomes $1/3$ of its initial value at constant volume. Ifs final termperature is

A. $900K$

B. $600K$

C. $300KK$

D. $100K$

Answer: C

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19. State the equation corresponding to $4g$ of N_2 is

A. $PV = 8RT$

B. $PV = RT/7$

C. $PV = RT$

D. $PV = RT/2$

Answer: B

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20. A gas at temperature $270^0 C$ and pressure 30 atmosphere is allowed to expand to one atmospheric pressure. If the volume, the final temerpature becomes

A. $100^0 C$

B. $373^0 K$

C. $373^0 C$

D. $-173^0 C$

Answer: D

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21. $16g$ of O_2 gas and xg of H_2 occupy the same volume at the same temperature and pressure. Then $x =$

A. $2g$

B. $1g$

C. $8g$

D. $16g$

Answer: B

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22. An enclosure of volume 3 litre contains $16g$ of oxygen, $7g$ of nitrogen and $11g$ of carbon - di-oxide at $27^\circ C$. The pressure exerted by the mixture is approximately

$$\left[R = 0.0821 lit \text{atm mole}^{-1} K^{-1}\right]$$

A. 1 atmosphere

B. 3 atmosphere

C. 9 atmosphere

D. 8.3 atmosphere

Answer: D

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LEVEL - II (H.W.)

1. The ratio of coefficients of apparent expansions of the same liquid in two different vessels is $1:2$. If α_1 and α_2 are the coefficient of linear expansions then coefficient of real expansion of the liquid is

A. $2\alpha_1 - \alpha_2$

B. $3\alpha_1 - 4\alpha_2$

C. $\alpha_1 - 2\alpha_1$

D. $6\alpha_1 - 3\alpha_2$

Answer: D

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2. If the coefficient of real expansion γ_R is 1% more than coefficient of coefficientg of apparent expansion, linear expansion coefficient of the materia is a

A. $\frac{\gamma_R}{303}$

B. $\frac{100\gamma_R}{101}$

C. $\frac{101\gamma_R}{303}$

D. $\frac{101\gamma_R}{100}$

Answer: A

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3. When a block of iron in mercury at $0^\circ C$, fraction K_1 of its volume is submerged, while at the temperature $60^\circ C$, a fraction K_2 is seen to be submerged. If the coefficient of volume expansion of iron is γ_{Fe} and that of mercury is γ_{Hg}, then the ratio $(K_1)/(K_2)$ can be expressed as

A. $\frac{1+60\gamma_{Fe}}{1+60\gamma_{Hg}}$

B. $\frac{1-60\gamma_{Fe}}{1+60\gamma_{Hg}}$

C. $\dfrac{1+60\gamma_{Fe}}{1-60\gamma_{Hg}}$

D. $\dfrac{1+60\gamma_{Hg}}{1-60\gamma_{Fe}}$

Answer: A

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4. A boat is floating in water at $0^0 C$ such that $97\,\%$ of the volume of the boat is submerged in water. The temperature at which the boat will just completely sink in water is $\left(\gamma_R = 3 \times 10^4 \,/^0\,C\right)$ (nearly)

A. $10^0 C$

B. $103^0 C$

C. 60^C

D. $50^0 C$

Answer: B

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5. A sphere of diameter $8cm$ and mass $275g$ floats in a bath of liquid. As the temperature is raised, the sphere begins to sink at a temperature of 40^0C. If the density of the liquid is $1.5g/cm^3$ at 0^0C, find the coefficient of cubical expansion of the liquid. Neglect the expansion of the sphere

A. $12 \times 10^{-4/0}C$

B. $25 \times 10^{-4/0}C$

C. $15 \times 10^{-4/0}C$

D. $115 \times 10^{-4/0}C$

Answer: A

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6. the coefficient of volume expansion of mercury is 20times the linear expansion of glass. Find the volume of mercury that must be poured in to glass vessel of volume V so that the volume above the mercury remain constant at all temperatures

A. $\frac{3V}{40}$

B. $\frac{V}{20}$

C. $\frac{3V}{20}$

D. $\frac{V}{30}$

Answer: C

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7. If γ (apparent) of a liquid in a vessel is 76% of γ(real) of that liquid, the coefficient of linear expansion of the vessel is

A. 8% of γ (real)

B. 16% of γ (real)

C. 24% of γ (real)

D. 25.3% of γ (real)

Answer: A

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8. The height of the mercury column in a barometer provided with a brass scale corrercted at $0^0 C$ is observed to be $74.9 cm$ at $15^0 C$. Find the true height of the column at $0^0 C$.

$\alpha_b = 20 \times 10^{-6/^0}C$ and $\gamma_{Hg} = 175 \times 10^{-6/^0 C}$

A. $74.82 cm$

B. $79.92 cm$

C. $74.12 cm$

D. $72.64cm$

Answer: A

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9. A cylinder contained $10kg$of gas at pressure $10^7 \frac{N}{m^2}$. The quantity of gas taken out of cylinder if final pressure is $2.5 \times 10^6 N/m^2$ is (Assume temperature of gas is constant)

A. Zero

B. $7.5Kg$

C. $2.5Kg$

D. $5Kg$

Answer: B

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10. An air bubble of volume V_0 is released by a fish at a depth h in a lake. The bubble rises to the surface. Assume constant temperature and standard atmospheric pressure P above the lake. The volume of the bubble just before reaching the surface is

(d is the density of water).

A. $V_0 + \frac{hgd}{P}$

B. $\frac{V_0(P + hgd)}{P}$

C. $\frac{V_0}{P} + hgd$

D. $(V_0 + V_0 dg)$

Answer: B

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11. If the pressure of a gas contained in a closed vessel increases by $X\%$ when heated bu $1^0 C$, it initial temperature is

A. $(100/x)$ Kelvin

B. $(100/x)$ Celsius

C. $\left(\frac{x+100}{x}\right)$ Kelvin

D. $\left(\frac{100-x}{x}\right)$ Kelvin

Answer: A

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12. A closed vessel contains $8g$ of oxygen and $7g$ of nitrogen. The total pressure is 10 atm at a given temperature. If now oxygen is absorbed by introducting a suitable absorbent, the pressure of the remaining gas in atm will be

A. $10 \times 7 / 15 atm$

B. $10 \times 8 / 15 atm$

C. $10 \times 8 / 16 atm$

D. $10 \times 8 / 32 atm$

Answer: C

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13. A gas is enclosed in a vessel at a pressure of $2.5 atm$. Due to leak in the vessel., after some time the pressure is reduced to $2 atm$, temperature remaining unchanged. The percentage of gas that has leaked out is

A. 40

B. 15

C. 20

D. 25

Answer: C

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14. The volume of a gas at 0^0C is 546. At constant pressure it is heated from 30^0C to 50^0C the change in volume is

A. 20

B. 40

C. 10

D. 273

Answer: B

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15. A flask is filled with $13g$ of an ideal gas at $27^{\circ} C$ and its temperature is raised to $52^{\circ} C$. The mass of the gas that has to be released to maintain the temperature of the gas in the flask at $52^{\circ} C$, the pressure remaining the same is

A. $2.5g$

B. $2.0g$

C. $1.5g$

D. $1.0g$

Answer: D

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16. A one litre spherer and a two litre sphere are connected with a capillary tube of nefligible volume. They contain an idel gas at $27^{0} C$ at a pressure of $100 cm$ of Hg. Keeping the temperature of one litre sphere constant at $27^0 C$, if temperature of two litre sphere is increased to $127^0 C$, then the final pressure is

A. $110 cm$ of Hg

B. $120 cm$ of Hg

C. $150 cm$ of Hg

D. $200 cm$ of Hg

Answer: B

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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. $\left(\frac{P_1}{T_1} + \frac{P_2}{T_2}\right)$

B. $\frac{1}{2}\left(\frac{P_1}{T_1}+\frac{P_2}{T_2}\right)$

C. $\frac{P_1T_2+P_2T_1}{T_1+T_2}$

D. $\frac{P_1T_2-P_2T_1}{T_1-T_2}$

Answer: B

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18. During an experiment, an ideal gas is found to obey an additional law $VP^2 = cons\tan t$, The gas is initially at a temperature T, and volume V. When it expands to a volume $2V$, the temperature becomes.......

A. T

B. $2T$

C. $T\sqrt{2}$

D. $T/2$

Answer: D

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19. The density of a gas at $N.T.P.$ is $1.5g/lit.$ Its density at a pressure of $152cm$ of Hg and temperature 27^0C

A. $\frac{273}{100}g/lit$

B. $\frac{150}{273}g/lit$

C. $\frac{1}{273}g/lit$

D. $1.5g/lit$

Answer: A

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