PHYSICS

BOOKS - CP SINGH PHYSICS (HINGLISH)

TEMPERATURE AND THERMAL EXPANSION

Example

1. A railway track (made of iron) is laid in winter when the average temperature is $18^{\circ}C$. The

track consists of sections of 12.2 m placed one after the other. How much gap should be left between two such sections so that there in no compression during summer when the maximum temperature goes to $48^{\circ}C$? Coefficient of linear expansion of iron $= 11 \times 10^{-5\circ} C^{-1}$.

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2. An iron rod and a copper rod lie side by side. As the temperature is changed, the difference in the lengths of the rods remains constant at a

value of $10cm$. Find the lengths at $0^\circ C$. Coefficient of linear expansion of iron and copper are $1.1 \times 10^{-5}/^\circ C$ and $1.7 \times 10^{-5}/^\circ C$ respectively.

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3. 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.

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4. (a) A pendulum clock consists of an iron rod connected to a small, heavy bob. If it is designed to keep correct time at $20^{\circ} C$, how fast or slow will it go in 24 hours at $50^{\circ} C$? $\alpha_{iron} = 1.2 \times 10^{-5} / ^{\circ} C$.

(b) A pendulum clock having copper rod keeps correct time at $20^{\circ} C$. It gains 15 seconds per

day if cooled to $0^\circ C$. Find the coefficient the of linear expansion of copper.

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5. A uniform steel wire of cross-sectional area $0.20mm^2$ is held fixed by clamping its two ends. If wire is cooled from $100^\circ C$ to $0^\circ C$, find

(a) temperature strain

(b) temperature stress

(c) extra force exerted by each clamp on the wire. Young's modulus of steel

$= 2 \times 10^{11} N/m^2$, coefficient of linear expansion of steel $= 1.2 \times 10^{-5}/^\circ C$.

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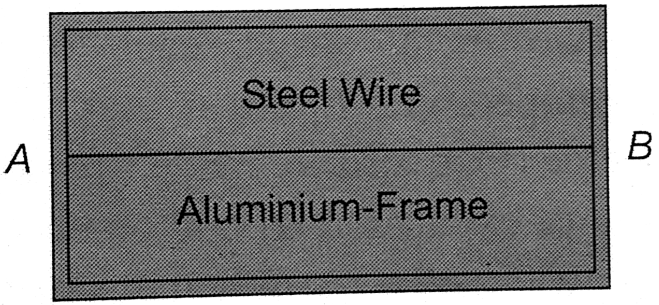
6. A steel wire AB of length $85cm$ at $10^\circ C$ is fixed rigidly at points A and B in an aluminium frame as shown. If the temperature of the system is raised to $110^\circ C$, what extra stress will be produced in the wire relative to aluminium frame. Assume that coefficient of linear expansion for aluminium and steel are $23 \times 10^{-6}/^\circ C$ and $11 \times 10^{-6}/^\circ C$

respectively and Young's moduls for steel is 2×10^{11} pa.



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7. (a) The brass scale of a barometer gives correct reading at $0^{\circ}C$. Coefficient of linear expansion of brass is $2.0 \times 10^{-5}/^{\circ}C$. The

barometer reads $75cm$ at $27^\circ C$. What is the atmospheric pressure at $27^\circ C$?

(b) A barometer reads $75.0cm$ on a steel scale. The room temperature is $30^\circ C$. The scale is correctly graduated for $0^\circ C$. The coefficient of linear expansion of steel is $\alpha = 1.2 \times 10^{-5}/^\circ C$ and the coefficient of volume expansion of mercury is $\gamma = 1.8 \times 10^{-4}/^\circ C$. Find the correct atmospheric pressure.

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8. Two metal strips, each of length l and thickness d at temperature T_0 are riveted together so that their ends coincide. One strip is made of metal A having a linear coefficient α_B where $\alpha_A > \alpha_B$. When this bimetallic-strip is heated to a temperature $(T_0 + \Delta T)$, one strip becomes longer than the other and the bimetallic strip bends into an arc of a circle. What is the radius of curvature R of the strip ?

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9. 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.

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10. 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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11. 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 $Hg = 1.8 \times 10^{-4} / ^{\circ} C$?

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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 heating to $100^{\circ} C$. How much mercury will spill out if coefficient of volume expansion of mercury is $1.2 \times 10^{-4} / ^{\circ} C$ and linear expansion of glass is $1.0 \times 10^{-4} / ^{\circ} C$ respectively ?

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13. 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.....

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14. 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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15. A long mercury glass tube with a uniform capillary bore has in it a thread of mercury

which is $1m$ long at $0^{\circ}C$. What will be its length at $100^{\circ}C$ if the real coefficient of expansion of mercury is 0.000182 and coefficient of cubical expansion of glass equal to 0.000025 ?

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16. a glass tube of length $133cm$ and of uniform cross-section is to be filled with mercury so that the volume of the unoccupied by mercury remains the same at all temperatures. If cubical coefficient for glass and mercury are

respectively $0.000026/^{\circ}C$ and $0.000182/^{\circ}C$, calculate the length of mercury column.

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17. A glass tube of length l_0 and of uniform cross-section is to be filled with mercury so that the length of the tube unoccoupied by mercury remains same at all temperatures. If $\gamma_g = 3\alpha$, calculate length of mercury column.

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18. An aluminium cube of side $20cm$ floats in mercury. How much farther will the block sink when tempereture rises from $27^{\circ}C$ to $77^{\circ}C$? Density of aluminium and mercury at $27^{\circ}C$ are 2.7 and $13.6g/$ while the coeficient of volume expansion of mercury and linear expansion of aluminium are $1.8 \times 10^{-4}/^{\circ}C$ and $23 \times 10^{-6}/^{\circ}C$ respectively.

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19. A U-tube is filled with mercury. When two limbs are maintained at temperatures of $0^{\circ}C$ and $100^{\circ}C$, then heights of the two columns are $100cm$ and $101.8cm$. What is the real coefficient of cubical expansion of mercury ? (Expansion of vessel may be neglected)

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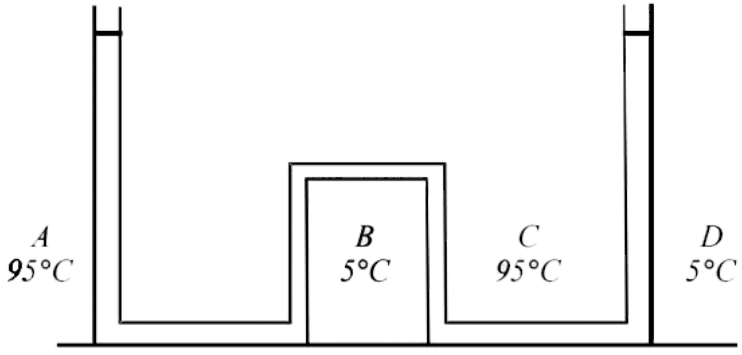
20. The apparatus shown in the figure consists of four glass columns connected by horizontal section. The height of two central column B and

C are 49 cm each. The two outer columns A and D are open to the temperature. A and C are maintained at a temperature of $95^\circ C$ while the columns B and D are maintained at $5^\circ C$. The height of the liquid in A and D measured from the base the are 52.8 cm and 51cm respectively. Determine the coefficient of thermal expansion of the liquid



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Exercises

1. A system X is neither in thermal equilibrium with Y nor with Z. The systems Y and Z

A. must be in thermal equilibrium

B. cannot be in thermal equilibrium

C. may be in thermal equilibrium

D. none

Answer: C

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2. If the temperature of a partient is $40^\circ C$, his temperature on the Fahrenheit scale will be

A. $72^\circ F$

B. $96^\circ F$

C. $100^\circ F$

D. $104^\circ F$

Answer: D

3. 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. $104^\circ C$

Answer: A

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4. Maximum density of $H2O$ is at the temperature

A. $32^\circ F$

B. $39.2^\circ F$

C. $42^\circ F$

D. $4^\circ F$

Answer: B

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5. 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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6. 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. having a positive intercept on the Y-axis

B. having a positive intercept on the X-axis

C. passing through the origin

D. having a negative intercepts on both the axis

Answer: A

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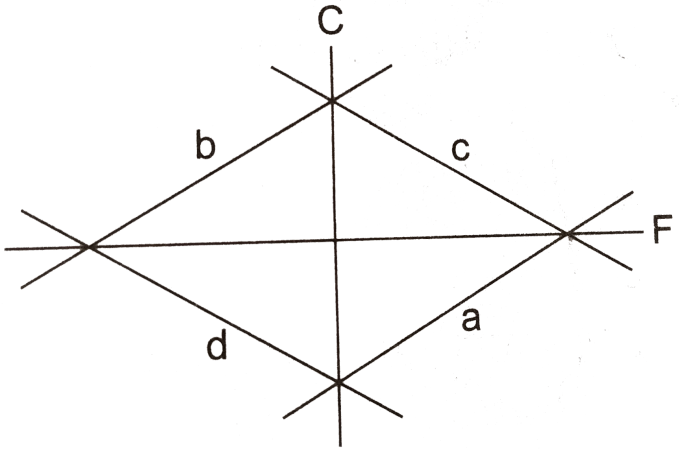
7. Which of the curves in figure represents the telation between Celsius and Fahrenheit

temperatures?



A. a

B. a

C. a

D. a

Answer: B

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8. which of the following pairs may give equal numerical values of the temperature of a boy?

A. Fahrenheit and Kelvin

B. Celsius and Kelvin

C. Kelvin and platinum

D. none

Answer: A

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9. In which of the following pairs of temperature scales, the size of a degree is idenital ?

(i) mercury scale and ideal gas scale

(ii) Celsius scale and mercury scale

(iii) Celsius scale and ideal gas scale

(iv) ideal gas scale and absolute scale

A. $(i), (iii)$

B. $(ii), (iii)$

C. $(iii), (iv)$

D. $(i), (iv)$

Answer: C

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10. A centigrade and a Fehrenheit thermometer are dipped in boiling water. The water temperature is lowered until the Fehrenheit thermometer registers $140^{\circ}C$. What is the fall in temperature as register by the centigrade thermometer

A. 30°

B. 40°

C. 60°

D. 80°

Answer: B

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11. On a new scale of temperature (which is linear) and called the W scale. The freezing and boiling points of water are $39^\circ W$ and $239^\circ W$

respectively. What will be the temperature on the new scale, corresponding to a temperature of $39^\circ C$ on the Celsius scale?

A. $200^\circ W$

B. $139^\circ W$

C. $78^\circ W$

D. $117^\circ W$

Answer: D

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12. What is the correct value of $0^{\circ}C$ on the Kelvin scale?

A. $273.15K$

B. $272.85K$

C. $273K$

D. $273.2K$

Answer: A

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13. The change in temperature of a body is $50^{\circ} C$. The change on the Kelvin scale is

A. $50K$

B. $323K$

C. $70K$

D. $30K$

Answer: A

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

A. low temperature and low pressure

B. low temperature and high pressure

C. high temperature and low pressure

D. high temperature and high pressure

Answer: C

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15. The gas thermometer are more sensitive than the liquid thermometers because gases

A. expand more than liquids

B. do not change their state easily

C. are much lighter

D. are easy to obtain

Answer: A

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16. A temperature T is measured by a constant volume gas thermometer

(i) T is independent of the gas used at all pressure

(ii) T is independent of the gas used only at low pressure

(iii) The ideal gas scale agrees with the absolute scale of temperature

(iv) The ideal gas scale does not agrees with the absolute scale of temperature

A. $(i), (iii)$

B. $(ii), (iii)$

C. $(iii), (iv)$

D. $(i), (iv)$

Answer: B

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17. A constant volume gas thermopmeter shows pressure reading of $50cm$ and $90cm$ of mercury at $0^\circ C$ and $100^\circ C$ respectively. When the

pressure reading is $60cm$ of mercury, the temperature is

A. $25^\circ C$

B. $40^\circ C$

C. $15^\circ C$

D. $12.5^\circ C$

Answer: A

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18. A constant pressure air thermometer gave a reading of 47.5 units of volume when immersed in ice cold water, and 67 units in a boiling liquid. The boiling point of the liquid will be

A. $135^\circ C$

B. $125^\circ C$

C. $112^\circ C$

D. $100^\circ C$

Answer: C

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19. The thermometer suitable for measuring a temperature of about $2000^{\circ} C$ is

A. gas thermometer

B. mercry thermometer

C. vapour pressure thermometer

D. total radiation pyrometer

Answer: D

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20. The temperature of the sun is measured with

A. Platinum thermometer

B. Gas thermometer

C. Pyrometer

D. Vapour pressure thermometer

Answer: C

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21. On a thermometer, the freezing points of water is marked as $20^\circ C$ and the boiling points of water is marked as $150^\circ C$. A temperature of $60^\circ C$ will be read on this thermometer as

A. $40^\circ C$

B. $65^\circ C$

C. $98^\circ C$

D. $110^\circ C$

Answer: C

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22. A constant volume gas thermometer shows pressure reading of $50cm$ and $90cm$ of mercury at $0^\circ C$ and $100^\circ C$, respectively. When the pressure reading is $70cm$ of mercury, the temperature is

A. $25^\circ C$

B. $50^\circ C$

C. $15^\circ C$

D. $12.5^\circ C$

Answer: B

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23. The ratio among coefficient of volume expansion, superficial expansion and linear expansion i.e.,

$\gamma . \beta : \alpha$ is

A. $1:1:1$

B. $1:2:1$

C. $1:3:2$

D. $3:2:1$

Answer: D

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24. An iron tyre is to be fitted onto a wooden wheel 1.0 m in diameter. The diameter of the tyre is 6 mm smaller than that of wheel the tyre should be heated so that its temperature increases by a minimum of (coefficient of volume expansion of iron is $3.6 \times 10^{-5} / {}^{\circ} C$)

A. $167^\circ C$

B. $334^\circ C$

C. $500^\circ C$

D. $-1000^\circ C$

Answer: C

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25. Two rods of length l_1 and l_2 are made of material whose coefficient of linear expansion are α_1 and α_2 , respectively. The difference

between their lengths will be independent of temperatiure if l_1 / l_2 is to

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

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

C. $\left(\frac{\alpha_1}{\alpha_2}\right)^{1/2}$

D. $\left(\frac{\alpha_2}{\alpha_1}\right)^{1/2}$

Answer: B

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26. Two rods , one of aluminium and the other made of steel, having initial length l_1 and l_2 are connected together to from a sinlge rod of length $l_1 + l_2$. The coefficient of linear expansion for aluminium and steel are α_a and α_s for AC and BC . If the distance DC remains constant for small changes in temperature,

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

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

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

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

Answer: C

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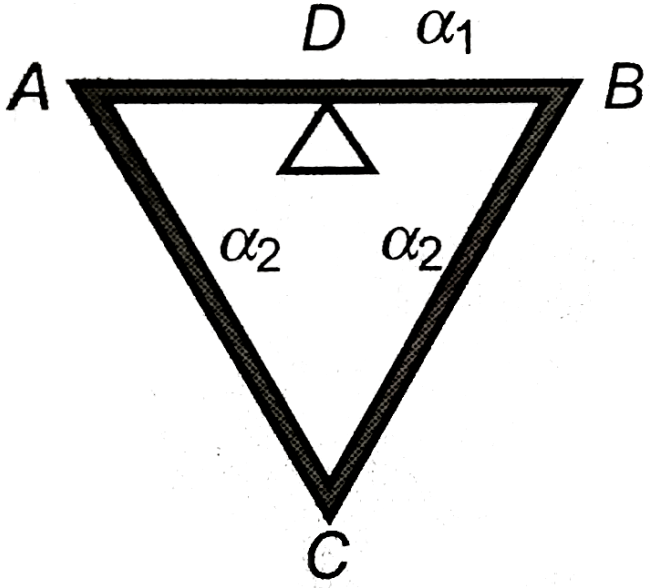
27. Three rods of equal of length are joined to from an equilateral triangle ABC. D is the midpoint of AB. The coefficient of linear expansion is α_1 for AB and α_2 for AC and BC. If the distance DC remains constant for small

changes in temperature,



A. $\alpha_1 = \alpha_2$

B. $\alpha_1 = 2\alpha_2$

C. $\alpha_1 = 4\alpha_2$

D. $\alpha_1 = 1/2\alpha_2$

Answer: C

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

A. $80.0096cm$

B. $80.0272cm$

C. $1cm$

D. $25.2cm$

Answer: A

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29. A measuring tape amde of steel is calibrated at $5^\circ C$. If the coefficient of linear expansion of steel $10^{-5}/^\circ C$. If the coefficinet of linear

expansion of steel $10^{-5}/^{\circ}C$, the percent error in measurement at $40^{\circ}C$ is

A. 0.035

B. 0.07

C. 0.105

D. 0.14

Answer: A

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30. Two indentical recrangular strips. One of copper and the other of steel, are rivetted together to from o bimetallic strip $(\alpha_c opper > \alpha_s teel)$. On hearing. This strip will

A. remain straight

B. bend with copper on convex side

C. bend with steel on convex side

D. get twisted

Answer: B

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31. If a bimetallic strip is heated it will

A. bend towards the metal with lower thermal expansion coefficient

B. bend towards the metal with higher thermal expansion coefficient

C. not bent at all

D. twisted at all

Answer: B

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32. A steel sheet at $20^\circ C$ has the same surface area as a brass sheet at $10^\circ C$. If the coefficient of linear expansion of steel is $11 \times 10^{-6}/K$ and that of bross is $19 \times 10^{-6}/K$, the common temperature at which both the sheets would have the same surface area is

A. $3.75^\circ C$

B. $-3.75^\circ C$

C. $7.5^\circ C$

D. $-7.5^{\circ}C$

Answer: B

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33. If the pemperature of a uniform fod is slifhely increased by Δt its mement of inertia I about o pqrpendicular bisector imcreases by

A. zero

B. $\alpha I \Delta t$

C. $2\alpha I\Delta t$

D. $3\alpha I\Delta t$

Answer: C

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34. If the temperature of a uniform rod is slightly increased by Δt, its moment of inertia I about a line parallel to itself will increased by

A. zero

B. $\alpha I \Delta t$

C. $2\alpha I \Delta t$

D. $3\alpha I \Delta t$

Answer: A

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

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

C. $\alpha \Delta t$

D. $2\alpha \Delta t$

Answer: D

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36. The volume of a block of a metal changes by $012\,\%$ when it is heated through $20^{\circ}C$. The coefficient of linear expansion of the metal is

A. $2.0 \times 10^{-5} per^{\circ} C$

B. $4.0 \times 10^{-5} per^{\circ} C$

C. $6.0 \times 10^{-5} per^{\circ} C$

D. $8.0 \times 10^{-5} per^{\circ} C$

Answer: A

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37. A horizontal tube, open at both ends, contains a column of liquid. The length of this liquid column does not change with

temperature. Let γ : coefficient of volume expansion of the liquid and α : coefficient of linear expansion of the material of the tube

A. $\gamma = \alpha$

B. $\gamma = 2\alpha$

C. $\gamma = 3\alpha$

D. $\gamma = 0$

Answer: B

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38. 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. $\gamma = \alpha^3$

Answer: B

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39. A flask is filled with mercury at temperature $28^\circ C$. If the flask and the contents are heated to $48^\circ C$, the volume of mercury above the mark will be $\left(\alpha_{glass} = 9 \times 10^{-6}/^\circ C\right.$, $\left.\gamma_{Hg} = 180 \times 10^{-6}/^\circ C\right)$

A. $0.15 cm^3$

B. $0.25 cm^3$

C. $0.3 cm^3$

D. $0.5 cm^3$

Answer: A

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40. A one litre flask contains some mercury. It is found that at different temperatures the volume of air inside the flask remains the same. The volume of mercury in the flask is $\left(\alpha_{glass} = 9 \times 10^{-6}/^{\circ} C, \gamma_{Hg} = 180 \times 10^{-6}/^{\circ} C\right)$

A. $150 cm^3$

B. $225 cm^3$

C. $300 cm^3$

D. $450 cm^3$

Answer: A

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

A. $\alpha_1 + \alpha_2$

B. $2\alpha_1 + \alpha_2$

C. $\alpha_1 + 2\alpha_2$

D. none of these

Answer: C

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42. The real coefficient of volume expansion of glycerine is $0.000597 per^{\circ} C$ and linear coefficient of expansion of glass is $0.000009 par^{\circ} C$. Then the apparent volume coefficient of glycerine is

A. $0.00058 per^{\circ} C$

B. $0.00057 per^{\circ} C$

C. $0.00027 per^{\circ} C$

D. $0.00066 per^{\circ} C$

Answer: B

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

coefficient of linear expansion of copper, than that of silver is

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

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

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

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

Answer: B

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44. There are two sphers of same radius and material at the same temperature but one being solid while the other hollow. Which sphere will expand more if they are given the same amount of heat ?

A. same

B. hollow sphere

C. solid sphere

D. no conclusion

Answer: A

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45. In the previous problem, same heat is given to two sphere, which will expand more

A. same

B. hollow sphere

C. solid sphere

D. no conclusion

Answer: B

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46. A solid metal ball has a spherical cavity. If the ball is heatd, the volume of the cavity will

A. increase

B. decrease

C. remain unffeceted

D. remain unaffected but the sphere of the cavity will change

Answer: A

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47. The temperature of water at the surface of a deep lake is $2^\circ C$. The temperature expected at the bottom is

A. $0^\circ C$

B. $2^\circ C$

C. $4^\circ C$

D. $6^\circ C$

Answer: C

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48. When water is heated from $0^\circ C$ to $10^\circ C$, its volume

A. increase

B. decrease

C. remain unchanged

D. first decreases and then increases

Answer: D

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49. A metal sheet with a cricular hole in heated.

The hole

A. gets larger

B. gets smalller

C. remain the same size

D. gets deformed

Answer: A

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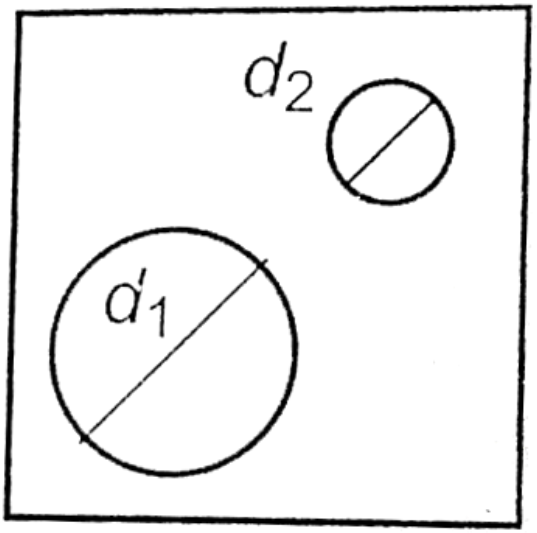
50. Two holes of unequal diameters d_1 and $d_2(d_1 > d_2)$ are cut in metal sheet is heated



A. both d_1 and d_2 will decreases

B. both d_1 and d_2 will increases

C. d_1 will increase, d_2 will decreases

D. d_1 will increase, d_2 will increases

Answer: B

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

A. increase

B. decrease

C. remain constant

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

Answer: A

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

(i) the length of the rod will increase

(ii) the gap will decrease

(iii) the gap will increase

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

A. $(i), (ii), (iii)$

B. $(i), (ii), (iv)$

C. $(i), (iii), (iv)$

D. $(ii), (iii), (iv)$

Answer: C

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53. A the temperature is increased, the time period of a pendulum

A. increase proportionately with temperature

B. increases

C. decreases

D. remain constant

Answer: B

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54. A second's pendulum gives correct time at $25^\circ C$. The pendulum shaft is thin and is made of steel. How many second will it lose per day at g$35^\circ C$? $\left(\alpha_{steel} = 11 \times 10^{-5} / ^\circ C\right)$

A. $1.75s$

B. $2.5s$

C. $3.5s$

D. $4.75s$

Answer: D

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55. A steel rod of length $25cm$ has a cross-sectional area of $0.8cm^2$. The force required to stretch this rod by the same amount as the expansion produced by heating it through $10^\circ C$ is $\left(\alpha_{steel} = 10^{-5}/^\circ C \text{ and } Y_{steel} = 2 \times 10^{10} N/m^2\right)$

A. $40N$

B. $80N$

C. $120N$

D. $160N$

Answer: D

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56. Two metal rods of the same length and area of cross-section are fixed end to end between rigid supports. The materials of the rods have Young module Y_1 and Y_2 , and coefficient of linear expansion α_1 and α_2 . The junction between the rod does not shift and the rods are cooled

A. $Y_1\alpha_1 = Y_2\alpha_1$

B. $Y_1\alpha_2 = Y_2\alpha_1$

C. $Y_1\alpha_1^2 = Y_2\alpha_2^2$

D. $Y_1^2\alpha_1 = Y_2^2\alpha_2$

Answer: A

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57. An aluminum sphere is dipped into water as $10^\circ C$. If the temperature is increased, the force of buoyancy

A. will increase

B. will decrease

C. will remain constant

D. may increase of decrease depending on the radius of the sphere

Answer: B

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58. A solid with coefficient of linear expansion $aplha$ just floats in a liquid whose coefficient of

volume expansion is γ . If the system is heated, the solid will

A. sink in all cases

B. continue to float in all cases

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

D. sink if$\gamma < 3\alpha$

Answer: C

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59. A metal ball is being weighed in liquid whose temperature is raised continuously. Then the apparent weight of the ball

A. remain unchanged

B. increases

C. decreases

D. change erratically

Answer: B

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60. 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. $W_2 = W_1/2$

Answer: C

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61. 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. remain unchanged

B. decrease continuously

C. decreases till $4^\circ C$ and then incresase

D. increases till $4^\circ C$ and then decresase

Answer: D

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

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

Answer: A

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

A. $\dfrac{f_1 - f_2}{f_2 t_1 - f_2 t_1}$

B. $\dfrac{f_1 - f_2}{f_2 t_1 - f_2 t_1}$

C. $\dfrac{f_1 + f_2}{f_2 t_1 + f_2 t_1}$

D. $\dfrac{f_1 + f_2}{f_2 t_1 + f_2 t_1}$

Answer: A

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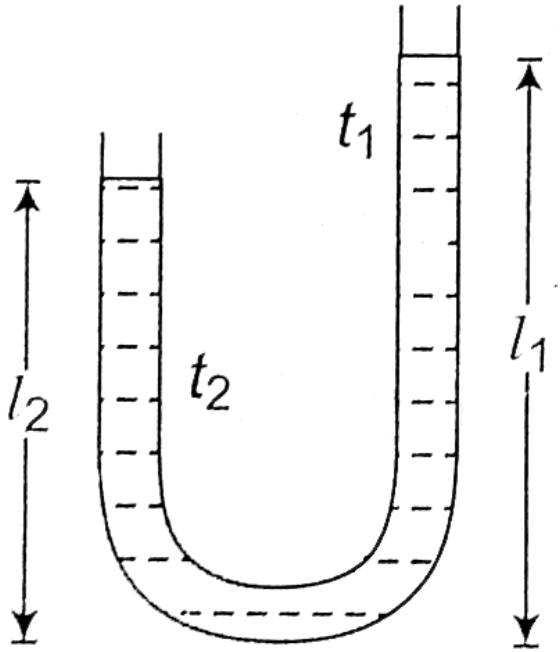
64. In a vertical U-tube containing a luquid, the two arms are maintained at different temperatures, t_1 and t_2 . The liquid coplumns in the two arms have heights l_1 and l_2 respectively. The coefficient o0f volume

expansion of the liquid is equal to



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

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

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

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

Answer: A

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