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Class: 11
Subject: Physics
Topic: Kinetic theory of gases
No. of Questions: 20
Duration: 60 Min
Maximum Marks: 60

1. Convert 25^oC temperature difference into Fahrenheit scale

   A. 25^oF
   B. 45^oF
   C. 57^oF
   D. 120^o
   Sol: B
   $\frac{x}{180} = \frac{25}{100}$

2. Distance between two places is 200km. an of metal is 2.5×10^{-5} /^{o} C. Total space that must be left between steel rails to allow for a change of temperature from 36^oF to 117^oF is

   A. 2.25 km
   B. 0.225 km
   C. 22.5 km
   D. 0.0225 km
   Sol: B
   $l_1 - l_2 = l_1 \alpha \Delta t$

3. If d_1 and d_2 are the densities of a liquid at t_1 ^oC then $\frac{d_1}{d_2}$ is (γ= coefficient t of real expansion)

   A. $\frac{1+¥t_1}{1+¥t_2}$
   B. $\frac{1-¥t_1}{1-¥t_2}$
   C. $\frac{1+¥t_2}{1+¥t_1}$
   D. $\frac{1-¥t_2}{1-¥t_1}$

   Sol: C

   $d0 = d\,t\,(1 + \gamma\,\Delta t)$

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4. Assertion (A): A thin rod and a thick rod made of same material having same length are heated through same range of temperature. Then both the rods expand equally.
Reason (R): The linear expansion *e* = *l*á*Ät*

A. A and R are correct and R is correct explanation for A
B. A and R are correct and R is not correct explanation for A
C. A is true and R is false
D. A is wrong and R is true

Sol: A

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

A. $T_A=T_B$
B. $T_B=\frac{3}{2}T_A$
C. $T_B=\frac{2}{3}T_A$
D. $T_B=\frac{3}{4}T_A$

Sol: B

$$\frac{(276.16)T_A}{200}=\frac{(276.16)T_B}{300}$$

6. At 0ºC, a square steel bar of 1 cm side, is rigidly clamped at both ends so that its length cannot increase. Young's modulus of steel is 20×10^{10} Nm^{-2} and its coefficient of linear expansion is 11 × 10-6 /ºC. When the temperature is raised to 10ºC, the force exerted on the clamp is

A. 1100N
B. 2200N
C. 3300N
D. 4400N
Sol: B

F = *Y*Da D*t*

7. The liquid with coefficient of real expansion of 27×10^{-6} /ºC is heated in a vessel with the coefficient of linear expansion 9×10^{-6}/ºC. The level of the liquid

A. Rises
B. Falls
C. Remains same
D. First fails then rises
Sol: A

$\gamma_r = \gamma_a + \gamma_g$

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

   A. 8% of ã (real)
   B. 16% of ã (real)
   C. 24% of ã (real)
   D. 25.3% of ã (real)

   Sol: A

   $$\gamma_a = \frac{76}{100}\gamma_r$$

9. If L1 and L2 are the lengths of two rods of coefficients of linear expansion á1 and á2 respectively the condition for the difference in lengths to be constant at all temperatures is

   A. $L_1á_1 = L_2á_2$
   B. $L_1á_2 = L_2á_1$
   C. $L_1á_1 = L2á_2^2$
   D. $L_1á_2^2 = L2á_1^2$
   Sol: A

10. brass rod and a lead rod each 80 cm long at 0°c, are clamped together at one end with their free ends coinciding. The separation of the free ends of the rods, if the system is placed in steam bath is ($á_{pb} = 28 \times 10^{-6}\ /^oC$, $á_{br} = 18 \times 10^{-6}\ /^oC$)

    A. 0.2 mm
    B. 0.8 mm
    C. 1.4 mm
    D. 1.6 mm

    Sol: B
    Y1 ~ 1 D t = Y2 ~ 2 D t

11. What is the temperature of Fahrenheit scale corresponding to 20ºC

    A. 68°F
    B. 52°F
    C. 62°F
    D. 72°F

    Sol: A

    $$\left(\frac{F-32}{180} = \frac{C-0}{100}\right)$$

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12. A platinum sphere floats in mercury. Find the percentage change in the fraction of volume of sphere immersed in mercury when the temperature is raised by 80ºC: (volume expansivity of mercury is $182 \times 10^{-6}/^{0}C$ and linear expansivity of platinum is $9 \times 10^{-6}/^{0}C$ respectively)

A. 1.24%
B. 1.38%
C. 2.48%
D. 2.76%
Sol: A
The percentage change in volume
$\frac{\Delta V}{V} \times 100 = (\gamma_m - \gamma_p)\Delta t \times 100$

13. To keep the correct time modern day watches are fitted with balance wheel made of
A. A. Steel
B. B. Platinum
C. C. Invar
D. D. Tungsten

Sol: C

14. 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. remain same
D. have its shape changed

Sol: A

15. Two spheres 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

Sol: A

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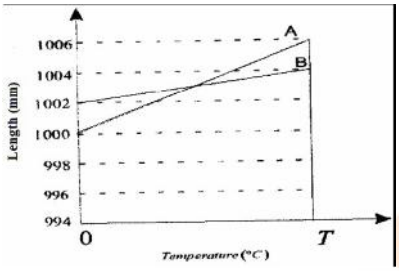
16. The coefficient of cubical expansion of liquid and glass are in the ratio of 8:1. The volume of the liquid to be taken into 800 cc container so that the unoccupied portion remains constant is

A. 10cc
B. 100cc
C. 80cc
D. 8cc

Sol: B
$\gamma 1v1 = \gamma 2v2$

17. The variation of lengths of two metal rods A and B with chanfe in temperature are shown in figure. The coefficients of linear expansion áA for the metal A and the temperature T will be:



(Given á$B = 9 \times 10^{-6}$ /^{0}C)

A. $\alpha A = 3 \times 10^{-6}$ /^{0}C, 500^{0}C
B. $\alpha A = 3 \times 10^{-6}$ /^{0}C, 222.22^{0}C
C. $\alpha A = 27 \times 10^{-6}$ /^{0}C, 500^{0}C
D. $\alpha A = 27 \times 10^{-6}$ /^{0}C, 222.22^{0}C

Sol: B

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Slope of the line $A\ \frac{1006-1000}{T}=\frac{\Delta L}{\Delta T}$

$\frac{6}{T}=1000mm\alpha_A$ -(1)

similarly forB line

$\frac{2}{T}=1002mm\alpha_B$ -(2)

From (1) & (2)

$\alpha_A=3\alpha_B$

$\alpha_A=3\times9\times10^{-6}=27\times10^{-6}$

and $T_A=\frac{6}{1000\alpha_A}=222.2°C$

18. Mercury boils at 356^0 C. However, mercury thermometers are made such that they can measure temperatures upto 590^0 C. This is done by

A. Maintaining vacuum above the mercury column in the stem 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

Sol: B

19. The coefficient of apparent expansion of a liquid in a vessel A is $18 \times 10^{-4}/^0$C and in vessel B is $21 \times 10^{-4}/^0$C. The difference in the coefficients of linear expansions of A and B is

$\gamma_r=\gamma_{app1}+3\alpha_1$ $\gamma_r=\gamma_{app2}+3\alpha_2$

find $(\alpha_1\approx\alpha_2)$

20. A body is floating in water at $4\ ^0$C such that 0.98 of its total volume is immersed in water. If the coefficient of real expansion of water is $3.3 \times 10^{-4}/\ ^0$C. The temperature at which the body gets immersed completely is

A. 32.8C
B. 28.4^0C
C. 65.8^0C
D. 72.4^0C

Sol: C

Weight of body $= 0.98VD_{L4}g - Vd_u g$

$$\frac{d_4}{d_t} = [1 + \gamma_r (t - 4)]$$