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C.U.Q

MEASUREMENT OF TEMPERATURE

1. Temperature of gas is a measure of
1) the average translational kinetic energy of the gas molecules
2) the average potential energy of the gas molecules
3) the average distance of the gas molecules
4) the size of the molecules of the gas

2. Celsius is the unit of
1) Temperature 2) Heat
3) Specific heat 4) Latent heat

3. On the Celsius scale the absolute zero of temperature is at
1) 0^0C 2) -32^0C 3) 100^0C 4) -273.15^0C

4. The correct value of 0^0C on the Kelvin scale is
1) 273.15^0C 2) 273.16^0C
3) 273^0C 4) 273.2^0C

5. The standard scale of temperature is
1) the mercury scale 2) the gas scale
3) the platinum resistance scale 4) liquid scale

6. Melting and Boiling point of water on Fahrenheit scale of temperature respectively
1) 212^0F, 32^0F 2) $32^0F, 212^0F$
3) $0^0F, 100^0F$ 4) $32^0F, 132^0F$

7. For measurements of very high temperature say around 5000^0C (of sun) , one can use:
1) Gas thermometer
2) Platinum resistance thermometer
3) Vapour pressure thermometer
4) Pyrometer(Radiation thermometer)

8. Mercury boils at 356^0C. However, mercury thermometers are made such that they can measure temperatures upto 500^0C. This is done by
1) maintaining vacuum above the mercury column in the stem of the thermometer
2) filling Nitrogen gas at high pressure above the mercury column
3) filling Nitrogen gas at low pressure above the mercury column
4) filling oxygen gas at high pressure above the mercury column

9. For measuring temperature near absolute zero,the thermometer used is
1) thermoelectric thermometer
2) radiation thermometer
3) magnetic thermometer
4) resistance thermometer

10. Which of the following scales of temperature has only positive degrees of temperature?
1) Centigrade 2) Fahrenheit scale
3) Reaumur scale 4)Kelvin scale

11. Which of the following is the smallest rise in temperature?
1) 1^oF 2) 1^oR 3) 1K 4) 1^oC

12. The temperature at which two bodies appear equally hot or cold when touched by a person is
1) 0^oC 2)37^oC 3) 25^oC 4) 4^oC

13. The range of clinical thermometer is
1) 37^oC to 42^oC 2) 95^oF to 110^oF
3) 90^0F to 112^0F 4) 95^0C to 104^0C

14. Which of the following is the largest rise in temperature?
1) 1^oF 2) 1^oR 3) 1K 4) 1^oC

THERMAL EXPANSION OF SOLIDS

15. Solids expand on heating because
1) the K.E. of the atoms increases.
2) the P.E. of the atoms increases
3) total energy of the atoms increases.
4) the K.E. of the atoms decreases.

16. Expansion during heating
1) occurs only in solids.
2) decreases the density of the material
3) occurs at same rate for all liquids and gases.
4) increases the weight of the material.

17. When a metal bar is cooled, then which one of these statements is correct.
1)Length, density and mass remain same.
2) Length decreases, density increases but mass remains same
3)Length and mass decrease but density remains the same.
4)Length and density decrease but mass remains the same.

18. When a metal bar is heated, the increase in length is greater, if
1) the bar has large diameter 2) The bar is long.
3) the temperature rise small 4) Small diameter

19. A ring shaped piece of a metal is heated, If the material expands, the hole will
1) contract 2) expand 3) remain same
4) expand or contract depending on the width

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

1) decrease 2) increase
3) remain same 4) have its shape changed

21. The substance which has negative coefficient of linear expansion is

1) lead 2) aluminum
3) iron 4) invar steel

22. 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

1) both spheres will expand equally.
2) hollow sphere will expand more than solid one
3) solid sphere will expand more than hollow one
4) hollow sphere will expand double that of solid one

23. If temperature of two spheres of same size but made of different materials changes by ΔT then

1) both expands equally
2) sphere with greater a expands or contracts more than other.
3) sphere with greater a expands or contracts less than other.
4) both contracts equally.

24. The linear expansion of a solid depends on

1) its original mass
2) nature of the material and temperature difference.
3) the nature of the material only
4) pressures

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

1) the unit of pressure
2) the nature of the material only
3) the nature of the material and temperature
4) unit of mass

26. If a_c and a_k denote the numerical values of coefficient of linear expansions of the solid, expressed per ^{0}C and per Kelvin respectively, then.

1) $a_c > a_k$ 2) $a_c < a_k$
3) $a_c = a_k$ 4) $a_c = 2a_k$

27. If a_c and a_f denote the numerical values of coefficient of linear expansion of a solid, expressed per ^{0}C and per ^{0}F respectively, then

1) $a_c > a_f$ 2) $a_f > a_c$
3) $a_f = a_c$ 4) $a_f + a_c = 0$

28. The coefficient of linear expansion of a metal rod is 12×10^{-6} / ^{0}C, its value in per ^{0}F

1) $\frac{20}{3} \times 10^{-6} /^0 F$ 2) $\frac{15}{4} \times 10^{-6} /^0 F$
3) $21.6 \times 10^{-6} /^0 F$ 4) $12 \times 10^{-6} /^0 F$

29. The coefficient of volume expansion is

1) equal to the coefficient of linear expansion.
2) twice the coefficient of linear expansion
3) equal to the sum of coefficients of linear and superficial expansions.
4) Twice the coefficient of areal expansion.

30. Always platinum is fused into glass, because

1) platinum is good conductor of heat
2) melting point of platinum is very high
3) they have equal specific heats
4) their coefficients of linear expansion are equal

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

1) length 2) mass
3) coefficient of linear expansion 4) resistivity

32. Thermostat is based on the principle of

1) equal expansion of two rods of different lengths.
2) different expansion of two rods of different lengths.
3) different expansion of two rods of same length
4) equal expansion of two rods of same length.

33. A pendulum clock shows correct time at 0^0 C. At a higher temperature the clock.

1) looses time 2) gains time
3) neither looses nor gains time 4)will not operate

34. To keep the correct time modern day watches are fitted with balance wheel made of

1) steel 2) platinum 3) invar 4) tungsten

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

1) the system must be cooled
2) the system must be heated
3) the plate may be heated (or) cooled
4) the disc must be heated

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

1) unequal expansion of glass
2) equal contraction of glass
3)unequal contraction of glass 4)glass is delicate

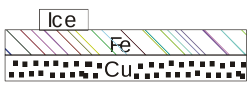
37. When the temperature of a body increases

1) density and moment of inertia increase
2) density and moment of inertia decrease
3) density decreases and moment of inertia increases.
4) density increases and moment of inertia decreases.

38. **In balance wheel of watch, the factors that make its oscillations uniform are**
1) tension in string
2) moment of inertia of balance wheel
3) temperature 4) pressure

39. **When a metal ring is heated**
1) the inner radius decreases and outer radius increases
2) the outer radius decreases and inner radius increases
3) both inner and outer radii increases
4) both inner and outer radii decreases

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



1) Ice moves downward 2) Ice moves upward
3) Ice remains in rest 4) None of the above

41. **To withstand the shapes of concave mirrors against temperature variations used in high resolution telescope, they are made of**
1) quartz 2) flint glass
3) crown glass 4)combination of flint and silica

42. **The holes through which the fish plates are fitted to join the rails are oval in shape because**
1) bolts are in oval shape
2) to allow the movement of rails in the direction of length due to change in temperature.
3) to make the fitting easy and tight
4) only oval shape holes are possible

43. **A semicircular metal ring subtends an angle of 180^0 at the centre of the circle. When it is heated, this angle**
1) remains constant 2) increases slightly
3) decreases slightly 4) becomes 360^0

44. **The diameter of a metal ring is D and the coefficient of linear expansion is a. If the temperature of the ring is increased by 1^0C, the circumference and the area of the ring will increases by**
1) $p Da$, $2p Da$ 2) $2p Da$, $p D^2 a$
3) $p Da$, $\frac{p Da}{2}$ 4) $p Da$, $\frac{p D^2 a}{2}$

45. **The moment of inertia 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 a).**
1)Zero 2)Ia Δt 3)2 Ia Δt 4)3 Ia Δt

46. **A bimetal made of copper and iron strips welded together is straight at room temperature. It is held vertically so that the iron strip is towards the left hand and copper strip is towards right hand. The bimetal strip is then heated. The bimetal strip will**
1) remain straight 2) bend towards right
3) bend towards left 4) have no change

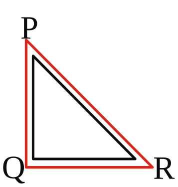
47. **If L_1 and L_2 are the lengths of two rods of coefficients of linear expansion a_1 and a_2 respectively the condition for the difference in lengths to be constant at all temperatures is**
1) $L_1 a_1 = L_2 a_2$ 2) $L_1 a_2 = L_2 a_1$
3) $L_1 a_1^2 = L_2 a_2^2$ 4) $L_1 a_2^2 = L_2 a_1^2$

48. **When a copper ball is cooled the largest percentage increase will occur in its**
1) diameter 2) area 3) volume 4) density

49. **The coefficients of linear expansion of P and Q are a_1 and a_2 respectively. If the coefficient of cubical expansion of 'Q' is three times the coefficient of superficial expansion of P, then which of the following is true ?**
1) $a_2=2a_1$ 2) $a_1=2a_2$ 3) $a_2=3a_1$ 4) $a_1=3a_2$

50. **The substance which contracts on heating is**
1) silica glass 2) iron
3) invar steel 4) aluminum

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.**



1) increases
2) decreases
3) remains same
4) becomes 135^0

52. **A brass scale gives correct length at 0^0C. If the temperature be 25^0C and the length read by the scale is 10 cm. Then the actual length will be**
1) more than 10 cm 2) less than 10 cm
3) equal to 10 cm 4) we can not say

53. **The coefficient of volume expansion is**
1) twice the coefficient of linear expansion.
2) twice the coefficient of real expansion.
3) thrice the coefficient of real expansion.
4) thrice the coefficient of linear expansion

54. **When a metal sphere is heated maximum percentage increase occurs in its**
1) density 2) surface area
3) radius 4) volume

55. **A solid sphere and a hollow sphere of same material have same mass. When they are heated by 50°C, increase in volume of solid sphere is 5 c.c. The expansion of hollow sphere is**
1) 5 c.c. 2) more than 5 c.c.
3) Less than 5 c.c. 4) None

C.U.Q - KEY

1) 1	2) 1	3)4	4)1	5)2	6)2
7) 4	8)2	9)3	10)4	11)1	12)2
13)2	14)2	15)1	16)2	17)2	18)2
19)2	20)1	21)1	22)1	23)2	24)2
25)2	26)3	27)1	28)1	29)3	30)4
31)3	32)3	33)1	34)3	35)1	36)1
37)3	38)2	39)3	40)1	41)1	42)2
43)1	44)4	45)3	46)3	47)1	48)4
49)1	50)1	51)3	52)1	53)4	54)4
55)2					

LEVEL - I (C.W)

MEASUREMENT OF TEMPERATURE

1. **If the temperature of a patient is $40^{o}C$ his temperature in the Fahrenheit scale will be**
1) 72^0F 2) 96^0F 3) 100^0F 4) 104^0F

2. **The freezing point on a thermometer is marked as 20^0 and the boiling point as 150^0. A temperature of 60^0C on this thermometer will be read as**
1) 40^0 2) 65^0 3) 98^0 4) 110^0

3. **A Celsius thermometer and a Fahrenheit thermometer are put in a hot bath. The reading on Fahrenheit thermometer is just 3 times the reading on Celsius thermometer. The temperature of the hot bath is**
1)26.67^{0}C 2)36.67^{0}C 3)46.67 ^{0}C 4)56.67 ^{0}C

4. **Oxygen boils at $-183^{o}C$. This temperature is approximately**
1) $215^{o}F$ 2) $-297^{o}F$ 3) $329^{o}F$ 4) $361^{o}F$

5. **A mercury thermometer 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**
1) $194^{o}F$ 2) $162^{o}F$ 3) $112^{o}F$ 4) $113^{o}F$

6. **A Centigrade and a Fehrenheit thermometer are dipped in boiling water. The water temperature is lowered until the Fahrenheit thermometer registers 140^{o}. What is the fall in temperature as registered by the Centigrade thermometer**
1) 30^0 2) 40^0 3) 60^0 4) 80^0

7. **Two absolute scales A and B 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**
1) $T_A = T_B$ 2) $T_B = \frac{3}{2}T_A$
3) $T_B = \frac{2}{3}T_A$ 4) $T_B = \frac{3}{4}T_A$

8. **The temperature coefficient of resistance of wire is $12.5\times10^{-4}/C^{o}$. At 300 K the resistance of the wire is 1 ohm. The temperature at which resistance will be 2 ohm is**
1) 1154 K 2)1100 K 3)1400 K 4) 1127 K

9. **The reading of Centigrade thermometer coincides with that of Fahrenheit thermometer in a liquid. The temperature of the liquid is**
1) $-40^{o}C$ 2) $0^{o}C$ 3) $100^{o}C$ 4) $300^{o}C$

10. **The pressure of a gas filled in the bulb of a constant volume gas thermometer at 0^0C and 100^0C are 28.6 cm and 36.6 cm of mercury respectively. The temperature of bulb at which pressure will be 35.0 cm of mercury will be**
1) 80^0C 2) 70^0C 3) 55^0C 4) 40^0C

THERMAL EXPANSION OF SOLIDS

11. **The coefficient of linear expansion of a metal is $1\times10^{-5}/^0$C. The percentage increase in area of a square plate of that metal when it is heated through 100^0C is**
1) 0.02% 2) 0.1% 3) 0.001% 4) 0.2%

12. **The length of each steel rail is 10m in winter. The coefficient of linear expansion of steel is $0.000012/^0$C and the temperature increases by 15^0C in summer. The gap to be left between the rails**
1) 0.0018m 2) 0.0012m 3) 0.0022m 4) 0.05m

13. **A clock while keeps correct time at 30^0 C has a pendulum rod made of brass. The number of seconds it gains (or) looses per second when the temperature falls to 10^0 C is [α of brass = $18\times10^{-6}/^0$ C]**
1) 18×10^{-6} sec 2) 18×10^{-5} sec
3) 0.0018 sec 4) 0.018 sec

14. **A metal plate of area 1.2 m^2 increases its area by 2.4×10^{-4} m^2 when it is heated from 0^0 C to 100^0 C. The coefficient of cubical expansion of the metal expressed in per ^{0}C is**

1) 2×10^{-6} 2) 4×10^{-6} 3) 6×10^{-6} 4) 3×10^{-6}

15. **The length of a metal rod at 0^0C is 0.5m. When it is heated, its length increases by 2.7mm. The final temperature of rod is (coeff. of linear expansion of metal = $90 \times 10^{-6}/^0C$)**

1) 20^0C 2) 30^0C 3) 40^0C 4) 60^0C

16. **The density of a substance at 0^0C is 10 g/c.c. and at 100^0C its density is 9.7g/c.c. The coefficient of linear expansion of the substance is.**

1) $10^{-4}/^0C$ 2) $3 \times 10^{-4}/^0C$
3) $6 \times 10^{-4}/^0C$ 4) $9 \times 10^{-4}/^0C$

17. **What force should be applied to the ends of steel rod of a cross sectional area 10 cm^2 to prevent it from elongation when heated form 273 K to 303 k? (a of steel 10^{-5} $^0C^{-1}$, Y = 2×10^{11} Nm^{-2})**

1) 2×10^4N 2) 3×10^4N
3) 6×10^4N 4) 12×10^4 N

18. **The inner diameter of a brass ring at 273 K is 5 cm. To what temperature should it be heated for it to accommodate a ball 5.01 cm in diameter. ($a = 2 \times 10^{-5}$ $/^0$ C)**

1) 273 K 2) 372 K 3) 437 K 4) 173K

19. **A metal sheet having size of 0.6 $\times$ 0.5 m^2 is heated from 293 K to 520^0 C. The final area of the hot sheet is {a of metal=2×10^{-5} $/^0$ C]**

1) 0.306 m^2 2) 0.0306 m^2
3) 3.06 m^2 4) 1.02m^2

20. **A crystal has linear coefficients 0.00004/^{0}C, 0.00005/^{0}C, 0.00006/^{0}C. Coefficient of cubical expansion of the crystal is**

1) 0.000015/^{0}C 2) 0.00015/^{0}C
3) 0.00012/^{0}C 4) 0.00018/^{0}C

21. **A wire of length 60 cm is bent into a circle with a gap of 1 cm. At its ends, on heating it by 100^0C, the length of the gap increases to 1.02 cm. a of material of wire is**

1) $2 \times 10^{-4}/^0C$ 2) $4 \times 10^{-4}/^0C$
3) $6 \times 10^{-4}/^0C$ 4) $1 \times 10^{-4}/^0C$

LEVEL - I (C.W) - KEY

1) 4	2) 3	3) 1	4) 2	5) 1	6) 2
7) 2	8) 3	9) 1	10) 1	11) 4	12) 1
13) 2	14) 4	15) 4	16) 1	17) 3	18) 2
19) 1	20) 2	21) 1			

LEVEL - I (C.W) - HINTS

1. $\left(\frac{F-32}{180}=\frac{C-0}{100}\right)$ 2. $\left(\frac{C-0}{100}\right)=\frac{X-L}{U-L}$

3. $\left(\frac{F-32}{180}=\frac{C-0}{100}\right)$ and F=2C

4. $\left(\frac{F-32}{180}=\frac{C-0}{100}\right)$ 5. $\left(\frac{F-32}{180}=\frac{9}{10}\right)$

6. $\frac{F-32}{180}=\frac{C-0}{100}$

7. Size of the degree on absolute scale A= size of the degree on absolute Scale B

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

8. $a = \frac{R_2 - R_1}{R_1 t_2 - R_2 t_1}$ 9. $\left(\frac{C-32}{180}=\frac{C-0}{100}\right)$

10. $t=\frac{P_t-P_0}{P_{100}-P_o}\times 100$ 11. $b = 2a$, $\frac{\Delta A}{A}100 = b\Delta t 100$

12. $l_2-l_1=l_1 a\left(t_2-t_1\right)$ 13. $\frac{\Delta T}{T}=\frac{1}{2}a\Delta t$

14. $b=\frac{A_2-A_1}{A_1\left(t_2-t_1\right)}, g=\frac{3}{2}b$ 15. $t_2-t_1=\frac{l_2-l_1}{l_1 a}$

16. $g=\frac{d_0-d_t}{d_t \Delta t}, a=\frac{g}{3}$

17. $\Delta l=\frac{Fl}{AY}$ ---- (1)

Increase in length, $\Delta l = l\,a\,\Delta t$ ---- (2)

from (1) and (2); $\frac{Fl}{AY}=l\,a\,\Delta t \Rightarrow F=YAa\Delta T$

18. $\Delta t=\frac{r_2-r_1}{r_1 a}$ 19. $A_2=A_1\left(1+b\Delta t\right)$

20. $g = a_x + a_y + a_z$

21. $a=\frac{l_2-l_1}{l_1\Delta t}$ (gap can be taken as l_1)

LEVEL - I (H.W)

1. **What is the temperature on Fahrenheit scale corresponding to 30^0C**

1) 86^0F 2) 52^0F 3) 62^0F 4) 72^0F

2. A faulty thermometer has its fixed points marked at 6^o and 96^o. What is the correct temperature on the Centigrade scale when this thermometer reads 87^o

1) 83^oC 2) 93^oC 3) 90^oC 4) 85^oC

3. The temperature at which Celsius reading is half the Fahrenheit reading

1) 40^oC 2) 20^oC 3) 160^oC 4) 80^oC

4. The normal boiling point of liquid hydrogen is -253^oC. What is the corresponding temperature on absolute scale

1) 22 K 2) 20 K 3) 274 K 4) -20 K

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

1) 16.67^oC 2) 16^oC 3) 15^oC 4) 15.5^oC

6. The temperature of a substance increases by 27^oC. On the Kelvin scale this increase is equal to

1) 300 K 2) 2.46 K 3) 27 K 4) 7 K

7. A Fahrenheit thermometer registers 107^o while a faulty Celsius thermometer registers 42^o. Find the error in the later.

1) 0.6^oC 2) 0.72^oC 3) 1.2^oC 4) 7.2^oC

8. A platinum wire has a resistance of 2. 62 Ω at 15 ^{0}C and 3.29 Ω at 80 ^{o}C. Find the temperature coefficient of the resistance of platinum wire.

1) 4.18 x 10^{-3} $^oC^{-1}$ 2) 9.34 x 10^{-3} $^oC^{-1}$
3) 1. 934 x 10^{-3} $^oC^{-1}$ 4) 934 x 10^{-3} $^oC^{-1}$

9. The Fahrenheit and Kelvin scales of temperature will give the same reading at

1) –40 2) 313 3) 574.25 4) 732.75

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

1) 50^{0}C 2) 75^{0}C 3) 95^{0}C 4) 150^{0}C

THERMAL EXPANSION OF SOLIDS

11. A brass sheet is 25 cm long and 8 cm breadth at 0^0 C. Its area at 100^{0}C is ($\alpha = 18\times10^{-6}/^0C$)

1) 207.2 cm^2 2) 200.72 cm^2
3) 272 cm^2 4) 2000.72 cm^2

12. A metal rod having a linear coefficient of expansion 2 × 10^{-5} /^{0} C has a length 1m at 25^{0}C, the temperature at which it is shortened by 1 mm is (1983 E)

1) 50^{0}C 2) -50^{0}C 3) -25^{0}C 4) -12.5^{0}C

13. A clock with an iron pendulum keeps correct time at 15^{0}C. If the room temperature rises to 20^{0}C, the error in seconds per day will be (coefficient of linear expansion for iron is 0.000012/^{0}C)

1) 2.5sec 2) 2.6sec 3) 2.4sec 4) 2.2sec

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 [a = 10^{-6}/^{0}C]

1) 0.02cm 2) 0.02mm 3) 2m 4) 20 mm

15. A wire of length 100cm increases in length by 10^{-2} m when it is heated through 100^0 C. The coefficient of linear expansion of the material of the wire expressed in /K units is

1) -1×10^{-6} 2) 1×10^4 3) 1×10^{-4} 4) 10^{-2}

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

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

3) $d_2 = \dfrac{d_1}{1-2g(t_2-t_1)}$ 4) $d_2 = \dfrac{d_1}{1+2g(t_2-t_1)}$

17. An iron bar whose cross sectional area is 4cm^2 is heated from 0^{0}C and 100^{0}C. The force required to prevent the expansion of the rod is [Y of Iron = 2 × 10^{12} dyne / cm^2
a of Iron = 12 × 10^{-6} /^{0} C]

1) 0.96 × 10^8 N 2) 0.96 × 10^7 N
3) 9.6 × 10^7 N 4) 96 × 10^3 N

18. A hole is drilled in a copper sheet. The diameter of the hole is 4.24 cm at 27.0^0C. What is the change in the diameter of the hole when the sheet is heated to 227^0C? a for copper = $1.70\times10^{-5}K^{-1}$

1) $1.44\times10^{-2}\,cm$ 2) $14.4\times10^{-2}\,cm$
3) $144\times10^{-2}\,cm$ 4) $0.144\times10^{-2}\,cm$

19. Distance between two places is 200km. a of metal is 2.5 × 10^{-5} /^{0} 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

1) 2.25km 2) 0.225km 3) 22.5km 4) 0.0225km

20. A crystal has a coefficient of linear expansion $12\times10^{-6}/^0C$ in one direction and $244\times10^{-6}/^0C$ in every direction at right angles to it . Then the coefficient of cubical expansion of crystal is

1) $450\times10^{-6}/^0C$ 2) $500\times10^{-6}/^0C$
3) $244\times10^{-6}/^0C$ 4) $36\times10^{-6}/^0C$

21. When a thin rod of length 'l' is heated from t^0_1C to t^0_2C length increases by 1%. If plate of length $2l$ and breadth 'l' made of same material is heated form t^0_1C to t^0_2C, percentage increase in area is

1) 1 2) 2 3) 3 4) 4

LEVEL - I (H.W) - KEY

1)1	2)3	3)3	4)2	5)1	6)3
7)1	8)1	9)3	10)1	11)2	12)3
13)2	14)4	15)3	16)1	17)4	18)1
19)2	20)2	21) 2			

LEVEL - I (H.W) - HINTS

1. $\left(\frac{F-32}{180}=\frac{C-0}{100}\right)$ 2. $\frac{C-0}{100}=\frac{X-L}{U-L}$

3. $\left(\frac{F-32}{180}=\frac{C-0}{100}\right)$; F=2C

4. K=C+273 5. $\frac{C-0}{100}=\frac{X-L}{U-L}$

6. $\Delta^0C=\Delta^0K$ 7. $\frac{F-32}{180}=\frac{X-L}{U-L}$

8. $a=\frac{R_2-R_1}{R_1t_2-R_2t_1}$

9. $\left(\frac{F-32}{180}=\frac{K-273}{100}\right)$ But F = K = x

10. $t=\frac{P_t-P_0}{P_{100}-P_o}\times100$

11. $A_2=A_1(1+b\Delta t), b=2a$

12. $t_2-t_1=\frac{l_2-l_1}{l_1\Delta t}$

13. $loss\ or\ gain\ in\ time\ per\ day=\frac{1}{2}a\Delta t\,86400$

14. $l_2-l_1=l_1a\Delta t$ 15. $a=\frac{l_2-l_1}{l_1(t_2-t_1)}$

16. $d_t=\frac{d_0}{(1+g\Delta t)}$

17. $\Delta l=\frac{Fl}{AY}$ ---- (1)

Increase in length $\Delta l=l\,a\,\Delta t$ ---- (2)

from (1) and (2) $\frac{Fl}{AY}=l\,a\,\Delta t\Rightarrow F=YAa\Delta T$

18. $L_2-L_1=L_1a\Delta T$ 19. $l_2-l_1=l_1a\Delta t$

20. $g=a_x+a_y+a_y$

21. $\left(\frac{\Delta A}{A}\right)100=b\times\Delta t\times100$ $b=2a$

LEVEL - II (C.W)

MEASUREMENT OF TEMPERATURE

1. The resistance of a certain platinum resistance thermometer is found to be 2.56 Ω at 0°C and 3.56 Ω at 100° C . When the thermometer is immersed in a given liquid, its resistance is observed to be 5.06 Ω. The temperature of the liquid

1) 45 ^{0}C 2) 250 ^{0}C 3)225 ^{0}C 4)120 ^{0}C

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

1) 45 ^{0}C 2) 30 ^{0}C 3) 25 ^{0}C 4) 20 ^{0}C

3. On a hypothetical scale A the ice point is 42^0 and the steam points is 182^0 For another scale B. The ice point is –10^0 and steam point in 90^0. If B reads 60^0. The reading of A is.

1) 160^0 2) 140^0 3) 120^0 4) 110^0

4. The upper and lower fixed points of a faulty mercury thermometer are 210^{0}F and 34^{0}F respectively. The correct temperature read by this thermometer is

1) 22^{0}F 2) 80^{0}F 3) 100^{0}F 4) 122^{0}F

5. A Fahrenheit thermometer registers 110^0F while a faulty Celsius thermometer registers 44^0C. Find the error in the later

1) 0.37^0 2) 0.87^0 3) 0.67^0 4) 0.48

THERMAL EXPANSION OF SOLIDS

6. **When a rod is heated from 25^0C to 75^0C, it expands by 1 mm. When a rod of same material but with 4 times the length is heated from 25^0C to 50^0C. The increase in length is**
1) 1mm 2) 1.5mm 3)1.6mm 4)2 mm

7. **An iron metal rod is to maintain an accuracy of one part per million. The coefficient of linear expansion of iron is 1×10^{-5} /^{0} C. The minimum variations in temperature of the rod could be**
1) $\pm 1^0$C 2) $\pm 5^0$C 3) $\pm 0.1^0$C 4) $\pm 0.01^0$C

8. **Two metal rods have coefficients of linear expansion 1.1×10^{-5} /^{0} C and 1.65×10^{-5} /^{0} C respectively. The difference in lengths is 10cm at all temperatures. Their initial lengths must be respectively.**
1) 40 cm and 50 cm 2) 40 cm and 30 cm
3) 50 cm and 60 cm 4) 30 cm and 20 cm

9. **Two rods of same length and same diameter are drawn from equal masses and same quantity of heat is supplied to the two rods. Find the ratio of expansions if specific heats of the material is 2/3 and that of coefficient of linear expansion is 1/2**
1) 4/3 2) 1/2 3) 3/4 4)1/3

10. **Two rods of different materials having coefficients of thermal expansion a_1, a_2 and young's modulus Y_1,Y_2 respectively are fixed between two rigid walls. The rods are heated such that they undergo the same increase in temperature. There is no bending of rods. If $a_1 : a_2$=2:3, thermal stress developed in the rods are equal provided Y_1:Y_2 is equal to**
1) 2:3 2) 1:1 3) 3:2 4) 4:9

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^0C, the length of each rod increases by the same amount. Then $\frac{l_1}{l_1+l_2}$ is**
1) $\frac{\alpha_s}{\alpha_a+\alpha_s}$ 2) $\frac{\alpha_a}{\alpha_a+\alpha_s}$ 3) $\frac{\alpha_a}{\alpha_s}$ 4) $\frac{\alpha_s}{\alpha_a}$

12. **When the temperature of a body increases from t to t+ Δt, its moment of inertia increases from I to I +ΔI. The coefficient of linear expansion of the body is a . The ratio ΔI/I is (2012 E)**
1) Δt/t 2) 2 Δt/t 3) $a\,\Delta$t 4) $2a\,\Delta$t

13. **There is some change in length when a 33000 N tensile force is applied on a steel rod of area of cross-section $10^{-3}m^2$. The change of temperature required to produce the same elongation of the steel rod when heated is (Y=$3\times10^{11} N/m^2$, $a = 1.1\times10^{-5}/^0C$)**
1) 20^0C 2) 15^0C 3) 10^0C 4) 0^0C

14. **Brass scale of a Barometer gives correct reading at 0^0C. coefficient of linear expansion of brass is 18×10^{-6} /^{0}C. If the barometer reads 76cm at 20^0C, the correct reading is (g_{Hg}=18×10^{-5} /^{0} C)**
1 76.426 cm 2) 75.7cm
3) 76.642 cm 4) 76.264 cm

15. **A thin brass sheet at 10°C and a thin steel sheet at 20°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, 19×10^{-6}/°C are 11×10^{-6}/°C)**
1) –3.75°C 2) –2.75°C 3) 2.75°C 4)3.75°C

16. **A pendulum clock gives correct time at 20^0C at a place where g= 10m/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 = 10.01m/s^2 at what temperature the pendulum gives correct time (a of steel is 10^{-5}/^{0}C) [2007 E]**
1) 30^0C 2) 60^0C 3) 100^0C 4) 120^0C

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 rods are a_1 and a_2 respectively, the effective coefficient of linear expansion of the composite rod is [2012 E]**
1) $\frac{L_1a_1 - L_2a_2}{L_1+L_2}$ 2) $\frac{L_1a_1 + L_2a_2}{L_1+L_2}$
3) $\sqrt{a_1a_2}$ 4) $\frac{a_1+a_2}{2}$

18. A clock pendulum made of invar has a period of 0.5sec at 20°C. If the clock is used in a climate where the temperature averages to 30°C, how much time does the clock loose in each oscillation. For invar $\alpha = 9\times10^{-7}\,{}^0C^{-1}$

1) 2.25×10^{-6} sec 2) 2.5×10^{-7} sec
3) 5×10^{-7} sec 4) 1.125×10^{-6} sec

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

1) 4.001m 2) 5.001 m 3) 4.999m 4) 4.501m

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°C. Find the temperature through which the second rod is to be heated so that its expansion is twice that of first is

1) 60°C 2) 40°C 3) 30°C 4) 10°C

LEVEL - II (C.W)-KEY

1) 2	2) 3	3) 2	4) 4	5) 3	6) 4
7) 3	8) 4	9) 3	10) 3	11) 1	12) 4
13) 3	14) 2	15) 1	16) 4	17) 2	18) 1
19) 4	20) 2				

LEVEL - II (C.W)- HINTS

1. $t = \frac{R_t - R_0}{R_{100} - R_0}\times100$ 2. $t = \left(\frac{P_t - P_0}{P_{100} - P_0}\right)100$

3. $\frac{\text{Reading} - \text{LFP}}{\text{UFP} - \text{LFP}} = \text{constant}$

$\frac{X_A - L_A}{U_A - L_A} = \frac{X_B - L_B}{U_B - L_B}$

4. $\frac{\text{Reading} - \text{LFP}}{\text{UFP} - \text{LFP}} = \text{constant}$

$\frac{F-32}{180} = \frac{X-L}{U-L}$

5. $\frac{C-0}{100} = \frac{F-32}{180}$

6. As $\alpha_1 = \alpha_2$ $\Rightarrow \frac{e_1}{l_1\Delta t_1} = \frac{e_2}{l_2\Delta t_2}$

7. $\frac{\Delta l}{l} = 1/10^6$ $\Rightarrow \frac{\Delta l}{l} = \alpha\,\Delta t$

8. $l_1\alpha_1 = l_2\alpha_2, l_1 - l_2 = 10$

9. $Q_1 = Q_2$; $ms_1(\Delta t)_1 = ms_2(\Delta t)_2$

10. Thermal stress $Y_1\alpha_1\Delta t = Y_2\alpha_2\Delta t$

11. $l_1\alpha_a\Delta t_1 = l_2\alpha_s\Delta t_2$

12. from $I = MR^2, \frac{\Delta I}{I} = 2\times\frac{\Delta R}{R}, \frac{\Delta I}{I} = 2\alpha\Delta t$

13. $\Delta t = \frac{F}{YA\alpha}$

14. True value =scale reading $[l - (\gamma - \alpha)\Delta t]$

15. $t = \frac{\beta_1 t_1 - \beta_2 t_2}{\beta_1 - \beta_2}$ 16. $\frac{\Delta l}{l} = \frac{\Delta g}{g} = \alpha\Delta t$

17. $\frac{\Delta L_1}{\Delta t} = L_1\alpha_1$; $\frac{\Delta L_2}{\Delta t} = L_2\alpha_2$

$\therefore \frac{\Delta L}{\Delta t} = \frac{\Delta L_1}{\Delta t} + \frac{\Delta L_2}{\Delta t}$; $(L_1 + L_2)\alpha = L_1\alpha_1 + L_2\alpha_2$

18. $\Delta T = \frac{1}{2}\alpha\Delta t$; 19. $l_c = l_m[1 + (\alpha_S \sim \alpha_b)(t_2 - t_1)]$

20. $\Delta l = \alpha l \Delta t \Rightarrow \frac{\Delta t_1}{\Delta t_2} = \frac{\alpha_2}{\alpha_1}\times\frac{l_2}{l_1}$