Additional Problems For Self Practice (APSP)

PART- I : PRACTICE TEST PAPER

Max. Marks : 120 **Max. Time : 1 Hr.**

Important Instructions :

1. The test is of **1 hour** duration and max. marks 120.
2. The test consists **30** questions, **4 marks** each.
3. Only one choice is correct **1 mark** will be deducted for incorrect response. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.
4. There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instructions 3 above.

1. A steel scale is to be prepared such that the millimeter intervals are to be accurate within 6×10^{-5} mm. The maximum temperature variation from the temperature of calibration during the reading of the millimeter marks is ($\alpha = 12 \times 10^{-6}\ k^{-1}$)
(1) 4.0°C (2) 4.5°C (3) 5.0°C (4) 5.5°C

2. If a bimetallic strip is heated , it will .
(1) bend towards the metal with lower thermal expansion coefficient.
(2) bend towards the metal with higher thermal expansion coefficient.
(3) twist itself into helix. (4) have no bending.

3. A 5°C rise in temperature is observed in a conductor by passing a current. When the current is doubled the rise in temperature will be approximately :
(1) 16°C (2) 10°C (3) 20°C (4) 12°C

4. If 1g of steam is mixed with 1 g of ice, then the resultant temperature of the mixture is :
(1) 270°C (2) 230°C (3) 100°C (4) 50°C

5. An electric kettle takes 4A current at 220V. How much time will it take to boil 1 kg of water from temperature 20°C ? The temperature of boiling water is 100°C :
(1) 6.3 min (2) 8.4 min (3) 12.6 min (4) 4.2 min

6. The ratio of radii of two spheres of same material is 1 : 4, then the ratio of their heat capacities is
(1) $\frac{1}{4}$ (2) $\frac{1}{16}$ (3) $\frac{1}{32}$ (4) $\frac{1}{64}$

7. An iron bar of length ℓ and having a cross-section A is heated from 0 to 100ºC. It this bar is so held that it is not permitted to expand or bend, the force that is developed, is :
(1) inversely proportional to the cross-sectional area of the bar
(2) independent of the length of the bar
(3) inversely proportional to the length of the bar
(4) directly proportional to the length of the bar

8. A steel scale measures the length of a copper wire as 80.0 cm, when both are at 20ºC, the calibration temperature for the scale. What would the scale read for the length of the wire when both are at 40ºC? Given : α for steel = 11×10^{-6} /ºC and α for Cu = 17×10^{-6} /ºC :
(1) 80.0096 cm (2) 80.0272 cm (3) 1 cm (4) 25.2 cm

9. When a block of iron floats in mercury at 0°C a fraction k_1 of its volume is submerged, while at the temperature 60ºC, a fraction k_2 is seen to be submerged. If the coefficient of volume expansion of iron is γ_{Fe}, then the ratio $\frac{k_1}{k_2}$ can be expressed as:
(1) $\frac{1+60\gamma_{Fe}}{1+60\gamma_{Hg}}$ (2) $\frac{1-60\gamma_{Fe}}{1+60\gamma_{Hg}}$ (3) $\frac{1+60\gamma_{Fe}}{1-60\gamma_{Hg}}$ (4) $\frac{1+60\gamma_{Hg}}{1+60\gamma_{Fe}}$

10. 2 kg ice at – 20 ºC is mixed with 5 kg water at 20 ºC . Then final amount of water in the mixture would be : Given : specific heat of ice = 0.5 cal/g ºC, specific heat of water = 1 cal/g ºC, latent heat of fusion of ice = 80 cal/gm]

(1) 6 kg (2) 7 kg (3) 3.5 kg (4) 5 kg

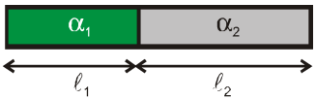
11. If I is the moment of inertia of a solid body having α -coefficient of linear expansion then the change in I corresponding to a small change in temperature ΔT is

(1) $\alpha I \Delta T$ (2) $\frac{1}{2}\alpha I \Delta T$ (3) $2\alpha I \Delta T$ (4) $3\alpha I \Delta T$

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

(1) $\gamma > 3\alpha$ (2) $\gamma < 3\alpha$ (3) $\gamma = 3\alpha$ (4) none of these.

13. Two rods having length ℓ_1 and ℓ_2, made of materials with the linear expansion coefficient α_1 and α_2, were soldered together. The equivalent coefficients of linear expansion for the obtained rod :-



(1) $\frac{\ell_1\alpha_2 + \ell_2\alpha_1}{\ell_1 + \ell_2}$ (2) $\frac{\ell_1\alpha_1 + \ell_2\alpha_2}{\alpha_1 + \alpha_2}$ (3) $\frac{\ell_1\alpha_1 + \ell_2\alpha_2}{\ell_1 + \ell_2}$ (4) $\frac{\ell_2\alpha_1 + \ell_1\alpha_2}{\alpha_1 + \alpha_2}$

14. In the following equation calculate the value of H.

1 kg steam at 200ºC = H + 1 Kg water at 100ºC (S_{steam} = Constant = 0.5 Cal/gm°C)

(1) 590 Kcal. (2) 490 Kcal. (3) 800 Kcal. (4) 600 Kcal.

15. From what height should a piece of ice (0°C) fall so that it melts completely? Only one-quarter of the energy produced is absorbed by the ice as heat. The latent heat of ice is 3.4×10^5 J kg^{-1} and g is 10 N kg^{-1}.

(1) 100 km (2) 136 km (3) 400 km (4) 500 km.

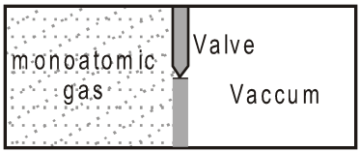
16. A copper cube of mass 200g slides down on a rough inclined plane of inclination 37º at a constant speed. Assume that any loss in mechanical energy goes into the copper block as thermal energy. Find the increase in the temperature of the block as it slides down through 60 cm. Specific heat capacity of copper = 420 J/kg-K.

(1) 2.6×10^{-3} ºC (2) 8.6×10^{3} ºC (3) 2.6×10^{3} ºC (4) 8.6×10^{-3} ºC

17. Value of – 40ºC in Fahrenheit scale is :

(1) –40º F (2) 32°F (3) –32ºF (4) 40ºC

18. A non-conducting container is divided into two chambers that are separated by a valve. The left chamber contains one mole of a monoatomic gas and right chamber is evacuated. The valve is opened and gas rushes freely into the right chamber. Which of the following statement concerning this process is false.

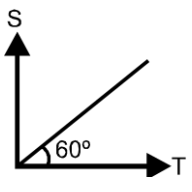


(1) There is no workdone by gas.
(2) The temperature of gas remain constant.
(3) Pressure of the gas decreases.
(4) Root mean square velocity of gas increases.

19. 32 g of O_2 is contained in a cubical container of side 1m and maintained at a temperature of 127°C. The isothermal bulk modulus of elasticity of the gas in terms of universal gas constant R is

(1) 127 R (2) 400 R (3) 200 R (4) 560 R

20. The specific heat of many solids at low temperatures varies with absolute temperature T according to the graph as shown. Then heat energy required to raise the temperature of a unit mass of such a solid from T = 0 to T = 30 K



(1) $300\sqrt{3}$ J (2) $900\sqrt{3}$ J

(3) $450\sqrt{3}$ J (4) $150\sqrt{3}$ J

21. Rise of 10ºC is equivalent to rise of :

(1) 18ºF (2) 16ºF (3) 50ºF (4) 12ºF

22. A liquid of temperature coefficient of volume expansion $\gamma = 4 \times 10^{-5}$ /ºC is poured in a cylindrical container of metal. On increasing temperature height of liquid in container will remain same if temperature coefficient of linear expansion of container is approximately :
(1) 2×10^{-5} /ºC (2) 3×10^{-5} /ºC (3) 8×10^{-5} /ºC (4) 6×10^{-5} /ºC

Comprehension # 1

In a container of negligible heat capacity, 200 gm ice at 0°C and 100 gm steam at 100°C are added to 200 gm of water that has temperature 55°C. Assume no heat is lost to the surroundings and the pressure in the container is constant 1.0 atm. (Latent heat of fusion of ice = 80 cal/gm, Latent heat of vapourisation of water = 540 ca/gm, Specific heat capacity of ice = 0.5 cal/gm-K, Specific heat capacity of water = 1 cal/gm)

23. What is the final temperature of the system ?
(1) 48°C (2) 72°C (3) 94°C (4) 100°C

24. At the final temperature, mass of the total water present in the system, is
(1) 472.6 gm (2) 483.3 gm (3) 493.6 gm (4) 500 gm

25. Amount of the steam left in the system, is equal to
(1) 16.7 gm (2) 12.0 gm (3) 8.4 gm (4) 0 gm, as there is no steam left.

26. The boiling water is changing into steam. Under this condition, the specific heat of water is
(1) zero (2) one (3) infinite (4) less than one

27. A steel scale is to be prepared such that the millimeter intervals are to be accurate within 6×10^{-5} mm. The maximum temperature variation from the temperature of calibration during the reading of the millimeter marks is ($\alpha = 12 \times 10^{-6}\ k^{-1}$)
(1) 4.0°C (2) 4.5°C (3) 5.0°C (4) 5.5°C

28. Expansion during heating –
(1) occurs only in a solid (2) increases the density of the material
(3) decreases the density of the material (4) occurs at the same rate for all liquids and solids.

29. A rectangular block is heated from 0ºC to 100ºC. The percentage increase in its length is 0.10% What will be the percentage increase in it volume ?
(1) 0.03 % (2) 0.10% (3) 0.30% (4) none of these

30. A difference of temperature of 25º C is equivalent to a difference of :
(1) 45º F (2) 72º F (3) 32º F (4) 25º F

Practice Test (JEE-Main Pattern)

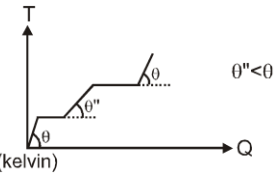
OBJECTIVE RESPONSE SHEET (ORS)

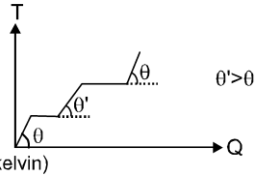
Que.	1	2	3	4	5	6	7	8	9	10
Ans.										
Que.	11	12	13	14	15	16	17	18	19	20
Ans.										
Que.	21	22	23	24	25	26	27	28	29	30
Ans.										

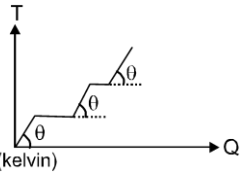
PART - II : PRACTICE QUESTIONS

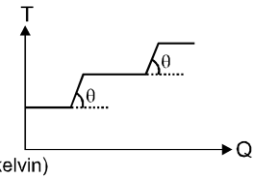
1. 5 kg ice at – 40 ºC is mixed with 4.5 kg water at 40 ºC . Then final amount of water in the mixture will be :[Specific heat of ice = 0.5 cal/gm ºC, Specific heat of water = 1 cal/gm ºC, Latent heat of fusion of ice = 80 cal/gm]
(1) 5.5 kg (2) 7 kg (3) 3.5 kg (4) none of these

2. Which of the following graph is correct between heat supplied and temperature for phase transformation of water :

(1) 

(2) 

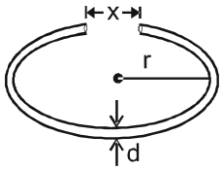
(3) 

(4) 

3. If two liquids A & B and different specific heat and different initial temperature, are mixed then it's observed that final temperature is more close to initial temperature of A. Then the best conclusion of experiment is:

(1) Specific heat of A is more than B. (2) Heat capacity of A is more than B.
(3) Amount of A is more than B. (4) Temperature of A is more than B.

4. A thin metal rod of length L_0 is shaped into a ring with a small gap x as shown. On heating the system

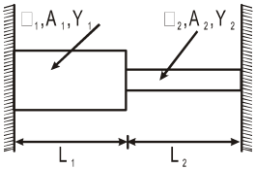


(1) x decreases, r and d increase (2) x and r increase, d decreases
(3) x, r and d all increase (4) Data insufficient to arrive at a conclusion

5. A uniform pressure P is exerted by an external agent on all sides of a solid cube at temperature t ºC. 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 ?

(1) $P\gamma/B$ (2) $P/B\gamma$ (3) $B/\gamma P$ (4) $1/BP\gamma$

6. Two rods are joined between fixed supports as shown in the figure. Condition for no change in the lengths of individual rods with the increase of temperature will be (α_1, α_2 = linear expansion co-efficient ; A_1, A_2 = Area of rods ; Y_1, Y_2 = Young modulus)



(1) $\frac{A_1}{A_2} = \frac{\alpha_1 Y_1}{\alpha_2 Y_2}$ (2) $\frac{A_1}{A_2} = \frac{L_1\alpha_1 Y_1}{L_2\alpha_2 Y_2}$ (3) $\frac{A_1}{A_2} = \frac{L_2\alpha_2 Y_2}{L_1\alpha_1 Y_1}$ (4) $\frac{A_1}{A_2} = \frac{\alpha_2 Y_2}{\alpha_1 Y_1}$

7. Thermal coefficient of volume expansion at constant pressure for an ideal gas sample of n moles having pressure P_0, volume V_0 and temperature T_0 is

(1) $\frac{R}{P_0V_0}$ (2) $\frac{P_0V_0}{R}$ (3) $\frac{1}{T_0}$ (4) $\frac{1}{nT_0}$

8. A pendulum clock (fitted with a small heavy bob that is connected with a metal rod) is 5 seconds fast each day at a temperature of 15°C and 10 seconds slow at a temperature of 30°C. The temperature at which it is designed to give correct time, is

(1) 18°C (2) 20°C (3) 24°C (4) 25°C

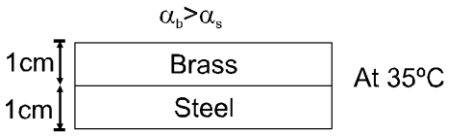
9. A solid sphere of iron at 2°C is lying at the bottom of a bucket full of water at 2°C. If the temperature of the water is increased to 3°C, the buoyant force on the sphere due to water will

(1) Increase (2) Be unchanged (3) Decrease
(4) Increase or decrease depends upon the numerical values of coefficient of expansion of water and iron.

10. A thick metallic cubical container of inner dimensions 1m × 1m × 1m and outer dimensions 1.2m × 1.2m × 1.2m at 27ºC is used to store gas of volume $1m^3$. The linear thermal expansion coefficient of the metal is positive. If the container is heated upto 100ºC, then volume of gas it can contain at 100ºC is :

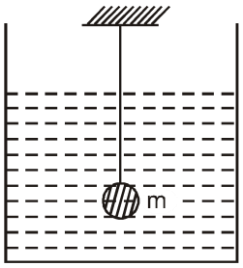
(1) more than $1m^3$ (2) less than $1m^3$ (3) same as $1m^3$ (4) zero

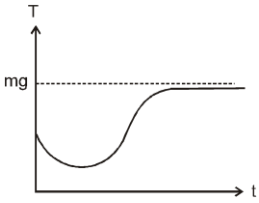
11. Steel and brass strips are welded together as shown in the figure. It forms an arc of radius 1m when heated uniformly from 35ºC to 40ºC, then $\alpha_b - \alpha_s$ is :

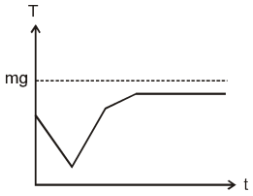


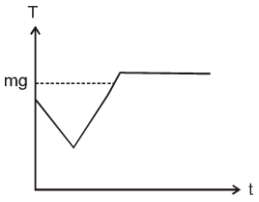
(1) 4×10^{-3} /ºC (2) 2×10^{-3} /ºC
(3) 1×10^{-3} /ºC (4) 3×10^{-3} /ºC

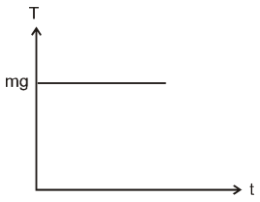
12. Initially tension in string is non-zero and water at 0ºC. Now temperature of water is increased slowly at constant rate(consider vaporisation of water also). Then tension in string with time will be best represented as : (neglect change in volume of ball)



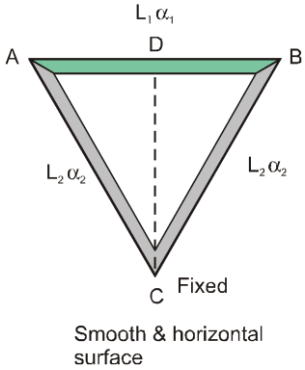
(1) 

(2) 

(3) 

(4) 

13. Figure shows isosceles triangle frame ABC of two different material shown in figure. Thermal expansion cofficient of the rod ADB is α_1 and for rod ACB is α_2. End C is fixed and whole system is placed on smooth horizontal surface and D is midpoint of rod AB and CD is perpendicular to the AB. If temperature of the system is increase such as it is found that distance CD remain fixed then.



(1) $\frac{\ell_1}{\ell_2} = 2\sqrt{\frac{\alpha_2}{\alpha_1}}$ (2) $\frac{\ell_1}{\ell_2} = 2\sqrt{\frac{\alpha_1}{\alpha_2}}$

(3) $\frac{\ell_1}{\ell_2} = \sqrt{\frac{\alpha_1}{\alpha_2}}$ (4) $\frac{\ell_1}{\ell_2} = \sqrt{\frac{\alpha_2}{\alpha_1}}$

APSP Answers

PART- I

1.	(3)	**2.**	(1)	**3.**	(3)	**4.**	(3)	**5.**	(1)	**6.**	(4)	**7.**	(2)
8.	(1)	**9.**	(1)	**10.**	(1)	**11.**	(3)	**12.**	(1)	**13.**	(3)	**14.**	(1)
15.	(2)	**16.**	(4)	**17.**	(1)	**18.**	(4)	**19.**	(2)	**20.**	(3)	**21.**	(1)
22.	(1)	**23.**	(4)	**24.**	(2)	**25.**	(1)	**26.**	(3)	**27.**	(3)	**28.**	(3)
29.	(3)	**30.**	(1)										

PART - II

1.	(1)	**2.**	(1)	**3.**	(2)	**4.**	(3)	**5.**	(2)	**6.**	(4)	**7.**	(3)
8.	(2)	**9.**	(1)	**10.**	(1)	**11.**	(2)	**12.**	(1)	**13.**	(1)		