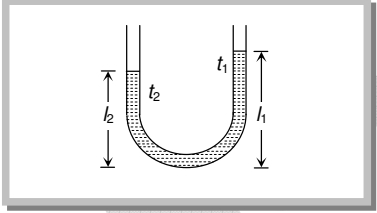
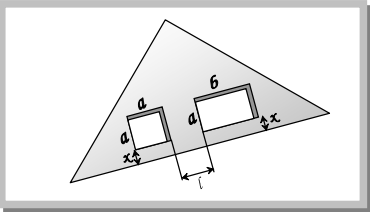
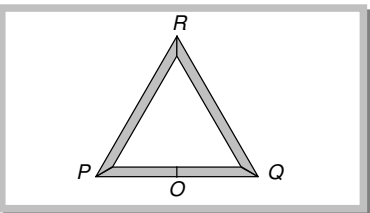


**Thermal Expansion Assignment**

- Standardisation of thermometers is obtained with
  - Jolly's thermometer
  - Platinum resistance thermometer
  - Thermocouple thermometer
  - Gas thermometer
- The gas thermometers are more sensitive than liquid thermometers because
  - Gases expand more than liquids
  - Gases are easily obtained
  - Gases are much lighter
  - Gases do not easily change their states
- Mercury thermometers can be used to measure temperatures upto
  - 100°C
  - 212°C
  - 360°C
  - 500°C
- A constant volume gas thermometer shows pressure reading of 50 cm and 90 cm of mercury at 0°C and 100°C respectively. When the pressure reading is 60 cm of mercury, the temperature is
  - 25°C
  - 40°C
  - 15°C
  - 12.5°C
- The relation that converts temperature in Celsius scale to temperature in Fahrenheit scale is
  - $t^{\circ}F = \frac{5}{9}(t^{\circ}C - 32^{\circ})$
  - $t^{\circ}F = \frac{5}{9}t^{\circ}C + 32^{\circ}$
  - $t^{\circ}F = \frac{9}{5}t^{\circ}C + 32^{\circ}$
  - $t^{\circ}F = \frac{9}{5}(t^{\circ}C + 32^{\circ})$
- A temperature difference of 5°C on Celsius scale corresponds to the following temperature difference in the Fahrenheit scale
  - 9°
  - 41°
  - 2.8°
  - 15°
- Mercury boils at 367°C. However, mercury thermometers are made such that they can measure temperature up to 500°C. This is done by
  - Maintaining vacuum above mercury column in the stem of the thermometer
  - Filling nitrogen gas at high pressure above the mercury column
  - Filling nitrogen gas at low pressure above the mercury column
  - Filling oxygen gas at high pressure above the mercury column
- Which of the following is the smallest temperature
  - 1°R
  - 1°C
  - 1°F
  - 1°K
- At some temperature  $T$ , a bronze pin is a little large to fit into a hole drilled in a steel block. The change in temperature required for an exact fit is minimum when
  - Only the block is heated
  - Both block and pin are heated together
  - Both block and pin are cooled together
  - Only the pin is cooled
- If the length of a cylinder on heating increases by 2%, the area of its base will increase by
  - 0.5%
  - 2%
  - 1%
  - 4%
- A thin wire of length  $L$  increases in length by 1% when heated to a certain range of temperature. If a thin copper plate of area  $2L \times L$  is heated through same range the percentage increase in area will be
  - 3%
  - 2.5%
  - 1.5%
  - 2%
- Two rods of length  $L_1$  and  $L_2$  are made of materials of coefficients of linear expansions  $\alpha_1$  and  $\alpha_2$  respectively such that  $L_1\alpha_1 = L_2\alpha_2$ . The temperature of the rods is increased by  $\Delta T$  and correspondingly the change in their respective lengths be  $\Delta L_1$  and  $\Delta L_2$ 
  - $\Delta L_1 \neq \Delta L_2$
  - $\Delta L_1 = \Delta L_2$
  - Difference in length  $(L_1 - L_2)$  is a constant and is independent of rise of temperature
  - Data is insufficient to arrive at a conclusion
- A rod of length 40 cm has the coefficient of linear expansion  $\alpha_1 = 6 \times 10^{-6}/^{\circ}C$ . Another rod of length  $l$  has the coefficient of linear expansion  $\alpha_2 = 4 \times 10^{-6}/^{\circ}C$ . If the difference in length of the two rods always remain same at all temperatures, then the value of  $l$  is
  - 26 cm
  - 60 cm
  - 80 cm
  - 32 cm
- Two metal rods having same length and area of cross-section are fixed end to end between two rigid supports. The coefficients of linear expansion of the rods are  $\alpha_1$  and  $\alpha_2$  and their respective Young's moduli are  $Y_1$  and  $Y_2$ . The system is now cooled and it is observed that the junction between the rods does not shift at all for the condition
  - $Y_1\alpha_2 = Y_2\alpha_1$
  - $Y_1\alpha_1^2 = Y_2\alpha_2^2$
  - $Y_1\alpha_1 = Y_2\alpha_2$
  - $Y_1\alpha_2^2 = Y_2\alpha_1^2$
- The coefficient of linear expansion of crystal in one direction is  $\alpha_1$  and that in every direction perpendicular to it  $\alpha_2$ . The coefficient of cubical expansion is
  - $\alpha_1 + \alpha_2$
  - $2\alpha_1 + \alpha_2$
  - $\alpha_1 + 2\alpha_2$
  - None of these
- A liquid with coefficient of volume expansion  $\gamma$  is filled in a container of a material expansion  $\alpha$ . If the liquid overflows on heating then
  - $\gamma = 3\alpha$
  - $\gamma > 3\alpha$
  - $\gamma < 3\alpha$
  - $\gamma = \alpha^3$
- Water does not freeze at the bottom of the lakes in winter because

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- (a) Ice is a good conductor of heat (b) Ice reflects heat and light  
 (c) Of anomalous expansion of water between  $4^{\circ}\text{C}$  to  $0^{\circ}\text{C}$  (d) Nothing can be said
18. A one litre glass flask contains some mercury. It is found that at different temperatures the volume of air inside the flask remains the same. What is the volume of mercury in this flask if coefficient of linear expansion of glass is  $9 \times 10^{-6}/^{\circ}\text{C}$  while of volume expansion of mercury is  $1.8 \times 10^{-4}/^{\circ}\text{C}$   
 (a) 50 cc (b) 100 cc (c) 150 cc (d) 200 cc
19. A metal ball immersed in alcohol weighs  $W_1$  at  $0^{\circ}\text{C}$  and  $W_2$  at  $59^{\circ}\text{C}$ . The coefficient of cubical expansion of the metal is less than that of alcohol. Assuming that the density of 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)  $W_2 = (W_1 / 2)$
20. In a vertical U-tube containing a liquid, the two arms are maintained at different temperatures  $t_1$  and  $t_2$ . The liquid columns in the two arms have heights  $l_1$  and  $l_2$  respectively. The coefficient of volume expansion of the liquid is equal to
- (a)  $\frac{l_1 - l_2}{l_2 t_1 - l_1 t_2}$   
 (b)  $\frac{l_1 - l_2}{l_1 t_1 - l_2 t_2}$   
 (c)  $\frac{l_1 + l_2}{l_2 t_1 + l_1 t_2}$   
 (d)  $\frac{l_1 + l_2}{l_1 t_1 + l_2 t_2}$
- 
21. Two spheres of same size are made of the same material but one is solid and the other is hollow. They are heated to the same temperature  
 (a) Both spheres expand equally (b) The solid sphere expands more  
 (c) The hollow sphere expands more (d) Data is insufficient to arrive at a conclusion
22. A bimetallic strip is made up of two metals with different  $\alpha$   
 (a) On heating, it bends towards the metal with high  $\alpha$  (b) On heating, it bends towards the metal with low  $\alpha$   
 (c) On cooling, it bends towards the metal with high  $\alpha$  (d) On cooling, it bends towards the metal with low  $\alpha$
23. A metal rod of length  $L_0$ , made of material of Young's modulus  $Y$ , area  $A$  is fixed between two rigid supports. The coefficient of linear expansion of the rod is  $\alpha$ . The rod is heated such that the tension in the rod is  $T$   
 (a)  $T \propto L_0$  (b)  $T \propto A_0^0$  (c)  $T \propto A$  (d)  $T \propto L_0^0$
24. A triangular plate has two cavities, one square and one rectangular as shown. The plate is heated
- (a)  $a$  increases,  $b$  decreases  
 (b)  $a$  and  $b$  both increase  
 (c)  $a$  and  $b$  increase,  $x$  and  $l$  decrease  
 (d)  $a$ ,  $b$ ,  $x$  and  $l$  all increase
- 
25. The coefficient of volume expansion of a solid is  $x$  times the coefficient of linear expansion. Then  $x$  is  
 (a) 1.5 (b) 2 (c) 2.5 (d) 3
26. The metal of a pendulum clock has a coefficient of expansion as  $2 \times 10^{-5}/\text{K}$ . Its period is 2s at  $15^{\circ}\text{C}$ . If the temperature increases to  $25^{\circ}\text{C}$ , shall the clock  
 (a) Show correct time (b) Lose time (c) Gain time (d) First lose and then gain time
27. Three rods of equal length  $l$  are joined to form an equilateral triangle  $PQR$ .  $O$  is the mid point of  $PQ$ . Distance  $OR$  remains same for small change in temperature. Coefficient of linear expansion for  $PR$  and  $RQ$  is same i.e.  $\alpha_2$  but that for  $PQ$  is  $\alpha_1$ . Then
- (a)  $\alpha_2 = 3\alpha_1$   
 (b)  $\alpha_2 = 4\alpha_1$   
 (c)  $\alpha_1 = 3\alpha_2$   
 (d)  $\alpha_1 = 4\alpha_2$
- 
28. Amount of heat required to raise the temperature of a body through 1K is called its  
 (a) Water equivalent (b) Thermal capacity (c) Entropy (d) Specific heat
29. The specific heat of metals at low temperature is

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- (a) Proportional to  $T$       (b) Proportional to  $T^2$       (c) Proportional to  $T^3$       (d) Independent of  $T$
30. A body of mass  $m$  gram has specific heat  $c$   
 (a) Heat capacity of the body is  $mc$       (b) Water equivalent of the body is  $m$   
 (c) Water equivalent of the body is  $mc$       (d) Heat capacity of the body is  $c$
31. A system  $S$  receives heat continuously from an electrical heater of power  $10\text{ W}$ . The temperature of  $S$  becomes constant at  $50^\circ\text{C}$  when the surrounding temperature is  $20^\circ\text{C}$ . After the heater is switched off,  $S$  cools from  $35.1^\circ\text{C}$  to  $34.9^\circ\text{C}$  in  $1\text{ minute}$ . The heat capacity of  $S$  is  
 (a)  $750\text{ J}^\circ\text{C}^{-1}$       (b)  $1500\text{ J}^\circ\text{C}^{-1}$       (c)  $3000\text{ J}^\circ\text{C}^{-1}$       (d)  $6000\text{ J}^\circ\text{C}^{-1}$
32. A metallic ball and highly stretched spring are made of the same material and have the same mass. They are heated so that they melt, the latent heat required  
 (a) Are the same for both  
 (b) Is greater for the ball  
 (c) Is greater for the spring  
 (d) For the two may or may not be the same depending upon the metal
33. A mass of liquid with volume  $V_1$  is completely changed into a gas of volume  $V_2$  at a constant external pressure  $P$  and temperature  $T$ . If the latent heat of evaporation for the given mass is  $L$ , then the increase in the internal energy of the system is  
 (a) Zero      (b)  $P(V_2 - V_1)$       (c)  $L - P(V_2 - V_1)$       (d)  $L$
34. During the melting of a slab of ice at  $273\text{ K}$  at atmospheric pressure  
 (a) Positive work is done by ice-water system on the atmosphere  
 (b) Positive work is done on the ice-water system by the atmosphere  
 (c) The internal energy of the ice-water system increases  
 (d) The internal energy of the ice-water system decreases
35.  $1\text{ gm}$  steam at  $100^\circ\text{C}$  can melt how much ice at  $0^\circ\text{C}$   
 (a)  $\frac{80}{540}\text{ gm}$       (b)  $\frac{540}{80}\text{ gm}$       (c)  $8\text{ gm}$       (d)  $8\text{ gm}$
36. The melting of solids under atmospheric pressure is  
 (a) An isometric change      (b) An isobaric change  
 (c) Both isobaric and isothermal change      (d) An adiabatic change
37.  $3.2\text{ kg}$  of ice at  $-10^\circ\text{C}$  just melts with a mass  $m$  of steam  
 (a)  $m = 400\text{ gm}$       (b)  $m = 800\text{ gm}$       (c)  $m = 500\text{ gm}$       (d)  $m = 900\text{ gm}$
38. A  $10\text{ kg}$  iron bar (specific heat  $0.11\text{ cal/gm}^\circ\text{C}$ ) at  $80^\circ\text{C}$  is placed on a block of ice. How much ice melts  
 (a)  $1.1\text{ kg}$       (b)  $10\text{ kg}$       (c)  $16\text{ kg}$       (d)  $60\text{ kg}$
39. Water at  $0^\circ\text{C}$  was boiled away over a burner supplying heat at a constant rate. If the time to raise the temperature from  $0^\circ\text{C}$  to  $100^\circ\text{C}$  is  $5\text{ min}$  and the time to boil away at  $100^\circ\text{C}$  is  $28\text{ min}$ , then the specific latent heat of steam in  $\text{J g}^{-1}$  is (take  $s = 1.0\text{ cal g}^{-1}\text{ K}^{-1}$ )  
 (a)  $540$       (b)  $2250$       (c)  $2352$       (d)  $2392$
40. An object of mass  $3.5\text{ kg}$  is situated at a height of  $2\text{ km}$  from the earth's surface at a temperature of  $-15^\circ\text{C}$ . It is dropped from rest. It falls in a tube containing ice at  $0^\circ\text{C}$  and immediately comes to rest. During the journey its temperature becomes  $0^\circ\text{C}$  due to friction with air as it reaches the surface of the earth. If  $g$  is  $10\text{ m/s}^2$  and latent heat of ice is  $3.5 \times 10^5\text{ J/kg}$ , the object will melt  
 (a)  $400\text{ gm}$  of ice      (b)  $300\text{ gm}$  of ice      (c)  $200\text{ gm}$  of ice      (d)  $100\text{ gm}$  of ice
41. An immersion heater takes time  $t_1$  to raise the temperature of a mass  $M$  of a liquid from a temperature  $T_1$  to its normal boiling point  $T_2$ . In a further time  $t_2$ , a mass  $m$  of the liquid is vaporized. If the specific heat capacity of the liquid is  $c$  and heat losses to the atmosphere and to the containing vessel are ignored, the specific latent heat of vaporisation is  
 (a)  $\frac{Mc(T_2 - T_1)t_2}{mt_1}$       (b)  $\frac{mc(T_2 - T_1)t_2}{MT_1}$       (c)  $\frac{McT_1T_2}{mt_1}$       (d)  $\frac{mt_1}{Mc(T_2 - T_1)t_2}$
42.  $100\text{ g}$  of ice is mixed with  $100\text{ g}$  of water at  $100^\circ\text{C}$ . What will be the final temperature of the mixture  
 (a)  $10^\circ\text{C}$       (b)  $20^\circ\text{C}$       (c)  $30^\circ\text{C}$       (d)  $40^\circ\text{C}$
43. One  $\text{kg}$  of ice at  $0^\circ\text{C}$  is mixed with  $1\text{ kg}$  of water at  $10^\circ\text{C}$ . The resulting temperature will be  
 (a) Between  $0^\circ\text{C}$  and  $10^\circ\text{C}$       (b) Equal to  $0^\circ\text{C}$       (c) Less than  $0^\circ\text{C}$       (d) Greater than  $0^\circ\text{C}$
44.  $1\text{ g}$  of ice at  $0^\circ\text{C}$  is mixed with  $1\text{ g}$  of steam at  $100^\circ\text{C}$ . After thermal equilibrium is attained the temperature of the mixture is  
 (a)  $1^\circ\text{C}$       (b)  $50^\circ\text{C}$       (c)  $81^\circ\text{C}$       (d)  $100^\circ\text{C}$
45. A  $50\text{ gm}$  piece of iron at  $100^\circ\text{C}$  is dropped into  $100\text{ gm}$  water at  $20^\circ\text{C}$ . The temperature of mixture  $25.5^\circ\text{C}$ . The specific heat of iron in  $\text{Calorie/gm}^\circ\text{C}$  will be  
 (a)  $0.341$       (b)  $0.267$       (c)  $0.082$       (d)  $0.148$

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46. A mass  $m$  of steam at  $100^\circ\text{C}$  is to be passed into a vessel containing  $10\text{g}$  of ice and  $100\text{g}$  of water at  $0^\circ\text{C}$  so that all the ice is melted and the temperature is raised to  $5^\circ\text{C}$ . Neglecting heat absorbed by the vessel, we get
- (a)  $m = 2.1\text{g}$                       (b)  $m = 4.2\text{g}$                       (c)  $m = 6.3\text{g}$                       (d)  $m = 8.4\text{g}$
47. A ball of thermal capacity  $10 \text{ cal}/^\circ\text{C}$  is heated to the temperature of furnace. It is then transferred into a vessel containing water. The water equivalent of vessel and the contents is  $200 \text{ gm}$ . The temperature of the vessel and its contents rises from  $10^\circ\text{C}$  to  $40^\circ\text{C}$ . What is the temperature of furnace
- (a)  $640^\circ\text{C}$                       (b)  $64^\circ\text{C}$                       (c)  $600^\circ\text{C}$                       (d)  $100^\circ\text{C}$
48.  $10 \text{ g}$  of ice at  $-20^\circ\text{C}$  is dropped into a calorimeter containing  $10 \text{ g}$  of water at  $10^\circ\text{C}$ . The specific heat of water is twice that of ice. When equilibrium is reached, the calorimeter will contain
- (a)  $10 \text{ g}$  of ice and  $10 \text{ g}$  water                      (b)  $20 \text{ g}$  water  
(c)  $5 \text{ g}$  ice and  $15 \text{ g}$  water                      (d)  $20 \text{ g}$  ice
49. Three liquids of equal volumes are thoroughly mixed. If their specific heats are  $s_1, s_2, s_3$  and their temperatures  $\theta_1, \theta_2, \theta_3$  and their densities  $d_1, d_2, d_3$  respectively, then the final temperature of the mixture is
- (a)  $\frac{s_1\theta_1 + s_2\theta_2 + s_3\theta_3}{d_1s_1 + d_2s_2 + d_3s_3}$                       (b)  $\frac{d_1s_1\theta_1 + d_2s_2\theta_2 + d_3s_3\theta_3}{d_1s_1 + d_2s_2 + d_3s_3}$   
(c)  $\frac{d_1s_1\theta_1 + d_2s_2\theta_2 + d_3s_3\theta_3}{d_1\theta_1 + d_2\theta_2 + d_3\theta_3}$                       (d)  $\frac{d_1\theta_1 + d_2\theta_2 + d_3\theta_3}{s_1\theta_1 + s_2\theta_2 + s_3\theta_3}$
50. Equal masses of three liquids  $A, B$  and  $C$  have temperatures  $10^\circ\text{C}, 25^\circ\text{C}$  and  $40^\circ\text{C}$  respectively. If  $A$  and  $B$  are mixed, the mixture has a temperature of  $15^\circ\text{C}$ . If  $B$  and  $C$  are mixed, the mixture has a temperature of  $30^\circ\text{C}$ . If  $A$  and  $C$  are mixed, the mixture will have a temperature of
- (a)  $16^\circ\text{C}$                       (b)  $20^\circ\text{C}$                       (c)  $25^\circ\text{C}$                       (d)  $29^\circ\text{C}$