DPP
DAILY PRACTICE PROBLEMS

CLASS : XITH
DATE :

Solutions

SUBJECT : PHYSICS
DPP NO. : 9

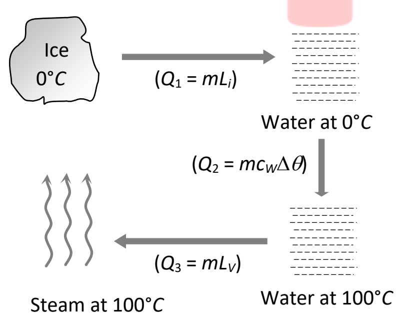
Topic :- THERMAL PROPERTIES OF MATTER

1 **(a)**
When a piece of glass is heated, due to low thermal conductivity it does not conduct heat fast. Hence unequal expansion of it's layers crack the glass

2 **(a)**
Latent heat is independent of configuration. Ordered energy spent in stretching the spring will not contribute to heat which is disordered kinetic energy of molecules of substance

3 **(c)**
$\frac{T_1}{T_2} = \frac{\lambda_{m_2}}{\lambda_{m_1}} = \frac{5.5 \times 10^5}{11 \times 10^5} = \frac{1}{2} \Rightarrow n = \frac{1}{2}$ [Given $T_1 = nT_2$]

4 **(c)**
Ice (0°C) converts into steam (100°C) in following three steps.
Total heat required $Q = Q_1 + Q_2 + Q_3$
$= 5 \times 80 + 5 \times 1 \times (100 - 0) + 5 \times 540 = 3600\ cal$



6 **(b)**
According to Newton's law $\frac{\theta_1 - \theta_2}{t} = k\left[\frac{\theta_1 + \theta_2}{2} - \theta_0\right]$
Initially,
$$\frac{(80 - 64)}{5} = K\left(\frac{80 + 64}{2} - \theta_0\right) \Rightarrow 3.2 = K(72 - \theta_0) \quad \ldots \text{(i)}$$
Finally
$$\frac{(64 - 52)}{10} = K\left[\frac{64 + 52}{2} - \theta_0\right] \Rightarrow 1.2 = K[58 - \theta_0] \quad \ldots \text{(ii)}$$
On solving equation (i) and (ii), $\theta_0 = 49$°C

7 **(a)**

Let the common temperature is x on both scales.

$$\frac{C}{5}=\frac{F-32}{9}$$

Put $C=F=x$

$$\therefore \quad \frac{x}{5}=\frac{x-32}{9}$$

Or $9x=5x-160$

Or $4x=-160$

$\therefore \quad x=-40°\text{C}$

8 **(c)**

$$\frac{dQ}{dt}=-KA\frac{d\theta}{dx}$$

$\because \frac{dQ}{dt}, K$ and A are constants for all points

$\Rightarrow d\theta \propto -dx$; $i.e.$, temperature will decrease linearly with x

9 **(a)**

The contraction in the length of the wire due to change in temperature$=\alpha LT=1.2\times10^{-5}\times3\times(-170-30)$

$$=-7.2\times10^{-3}\text{m}$$

The expansion in the length of wire due to stretching force

$$=\frac{F\,L}{A\,Y}=\frac{(10\times10)\times3}{(0.75\times10^{-6})(2\times10^{11})}$$

$$=2\times10^{-3}\text{ m}$$

Resultant change in length

$$=-7.2\times10^{-3}+2\times10^{-3}$$

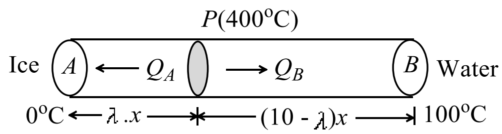
$$=-5.2\times10^{-3}\text{m}=-5.2\text{mm}$$

Negative sign shows a contradiction.

11 **(a)**

$$K\propto l^2\Rightarrow\frac{K_1}{K_2}=\frac{l_1^2}{l_2^2}=\left(\frac{10}{25}\right)^2=\frac{1}{6.25}$$

12 **(a)**



Hear received by end A, for melting of ice

$$Q_A=\frac{K\,A(400-0)t}{\lambda\cdot x}=m\,L_{ice} \quad \text{...(i)}$$

Heat received by end B, for vaporization of water

$$Q_B=\frac{K\,A(400-100)t}{(10-\lambda)x}=m\,L_{vap} \quad \text{...(i)}$$

Dividing both equation, $\dfrac{\frac{400}{\lambda\cdot x}}{\frac{300}{(10-\lambda)x}}=\dfrac{L_{ice}}{L_{vap}}$

$$\Rightarrow\frac{4}{3}\frac{(10-\lambda)}{\lambda}=\frac{80}{540}\Rightarrow\lambda=9$$

13 **(a)**

Freezing point of water decreases when pressure increases, because water expands on solidification. "Except water" for other liquid freezing point increases with increase in pressure.

Since the liquid in question is water. Hence, it expands on freezing

14 **(a)**

Thermal conductivity is independent of temperatures of the wall, it is a constant for the material, so it will remain unchanged

15 **(d)**

$\gamma_{\text{real}} = \gamma_{\text{app}} + \gamma_{\text{vessel}}; \gamma_{\text{vessel}} = 3\alpha$

For vessel $'A' \Rightarrow \gamma_{\text{real}} = \gamma_1 + 3\alpha$

For vessel $'B' \Rightarrow \gamma_{\text{real}} = \gamma_2 + 3\alpha_B$

Hence, $\gamma_1 + 3\alpha = \gamma_2 + 3\alpha_B \Rightarrow \alpha_B = \dfrac{\gamma_1 - \gamma_2}{3} + \alpha$

16 **(c)**

$$\frac{d\theta}{dt} = \frac{\varepsilon A\sigma}{mc} 4\theta_0^3 \Delta\theta$$

For given sphere and cube $\frac{\varepsilon A\sigma}{mc} 4\theta_0^3 \Delta\theta$ is constant so for both rate of fall of temperature $\frac{d\theta}{dt} = \text{constant}$

17 **(b)**

Loss in time per second $\frac{\Delta T}{T} = \frac{1}{2}\alpha\Delta\theta = \frac{1}{2}\alpha(t-0)$

$\Rightarrow$ loss in time per day

$$\Delta t = \left(\frac{1}{2}\alpha t\right) t = \frac{1}{2}\alpha t \times (24 \times 60 \times 60) = \frac{1}{2}\alpha t \times 86400$$

18 **(a)**

Cu is better conductor than Al and Ag is better conductor than Cu. Hence conductivity in increasing order is $Al < Cu < Ag$

19 **(a)**

Temperature of interface $\theta = \frac{K_1\theta_1 + K_2\theta_2}{K_1 + K_2}$

$[\because \frac{K_1}{K_2} = \frac{1}{4} \Rightarrow \text{If } K_1 = K \text{ then } K_2 = 4K]$

$$\Rightarrow \theta = \frac{K \times 0 + 4K \times 100}{5K} = 80^\circ\text{C}$$

20 **(a)**

Change in volume, $\Delta V = V\gamma\, \Delta t$

$\Rightarrow \quad 0.24 = 100 \times \gamma \times 40$

$\gamma = \frac{0.24}{100 \times 40}$

$= 0.00006 = 6 \times 10^{-5}$

$\alpha = \frac{\gamma}{3}$

$\Rightarrow \quad \alpha = 2 \times 10^{-5}\,^\circ\text{C}^{-1}$

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	A	A	C	C	A	B	A	C	A	D
Q.	11	12	13	14	15	16	17	18	19	20
A.	A	A	A	A	D	C	B	A	A	A