DPP
DAILY PRACTICE PROBLEMS

CLASS : XITH
DATE :

Solutions

SUBJECT : PHYSICS
DPP NO. : 7

Topic :- THERMAL PROPERTIES OF MATTER

1 **(a)**

Work done $W = JQ$

$=4.2(0.5 \times 10 + 1 \times 80 + 1 \times 100 + 1 \times 540)$

$=3045$ J

2 **(c)**

Modulus of elasticity = $\frac{\text{Force}}{\text{Area}} \times \frac{l}{\Delta l}$

$$3 \times 10^{11} = \frac{33000}{10^{-3}} \times \frac{l}{\Delta l}$$

$$\frac{\Delta l}{l} = \frac{33000}{10^{-3}} \times \frac{1}{3\times10^{11}}$$

$$= 11 \times 10^{-5}$$

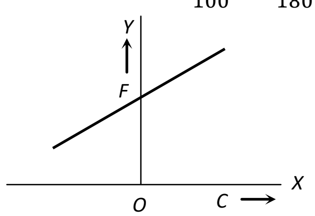
Change in length, $\frac{\Delta l}{l} = \alpha \Delta T$

$$11 \times 10^{-5} = 1.1 \times 10^{-5} \times \Delta T$$

$\Rightarrow$ ΔT = 10K or 10℃

3 **(a)**

We know that, $\frac{C}{100} = \frac{F-32}{180}$ or $F = \frac{9}{5}C + 32$



Equation of straight line is, $y = mx + c$

Hence, $m = (9/5)$, positive and $c = 32$ positive. The graph is shown in figure

5 **(b)**

$$mc\,(\Delta T) = \frac{\frac{1}{2}\left(\frac{1}{2}m\,v^2\right)}{J}$$

$$\Delta T = \frac{v^2}{4Jc} = \frac{480 \times 480}{4 \times 4.2 \times (0.03 \times 10^3)} = 457℃$$

6 **(c)**

At absolute zero $(i.e., 0\ K) v_{rms}$ becomes zero

7 **(a)**

$\Delta\theta = 0.0023h = 0.0023 \times 100 = 0.23°C$

8 **(d)**

The thermal radiation from a hot body travels with a velocity of light in vacuum $i.e. 3 \times 10^8 m\ s^{-1}$

9 **(c)**

Heat transferred in one minute is utilised in melting the ice so, $\frac{KA(\theta_1-\theta_2)t}{l} = m \times L$

$$\Rightarrow m = \frac{10^{-3} \times 92 \times (100-0) \times 60}{1 \times 8 \times 10^4} = 6.9 \times 10^{-3} kg$$

10 **(b)**

Triple point of water is 273.16 K

11 **(b)**

According to Wien's law

$$T \propto \frac{1}{\lambda}$$

Red colour has maximum wavelength, so its temperature will be minimum and hence, it will cool at the earliest

12 **(d)**

Let the temperature of common interface be T°C. Rate of heat flow

$$H = \frac{Q}{t} = \frac{KA\Delta T}{l}$$

$\therefore \quad H_1 = \left(\frac{Q}{t}\right)_1 = \frac{2KA(T-T_1)}{4x}$

And $\quad H_2 = \left(\frac{Q}{t}\right)_2 = \frac{KA(T_2-T)}{x}$

In steady state, the rate of heat flow should be same in whole system *ie*,

$$H_1 = H_2$$

$\Rightarrow \quad \frac{2KA(T-T_1)}{4x} = \frac{KA(T_2-T)}{x}$

$\Rightarrow \quad \frac{T-T_1}{2} = T_2 - T$

$\Rightarrow \quad T - T_1 = 2T_2 - 2T$

$\Rightarrow \quad T = \frac{2T_2+T_1}{3}$ ...(i)

Hence, heat flow from composite slab is

$$H = \frac{KA(T_2-T)}{x}$$

$$= \frac{KA}{x}\left(T_2 - \frac{2T_2+T_1}{3}\right) = \frac{KA}{3x}(T_2 - T_1) \quad ...(ii)$$

[from Eq. (i)]

Accordingly, $H = \left[\frac{A(T_2-T_1)K}{x}\right] f$ ... (iii)

By comparing Eqs. (ii) and (iii), we get

$\Rightarrow \quad f = \frac{1}{3}$

13 **(b)**

According to Wien's displacement law

$$\lambda_m T = \text{constant}$$

$$\therefore \quad \frac{(\lambda_m)_1}{(\lambda_m)_2} = \frac{T_2}{T_1}$$

Here $\frac{T_1}{T_2} = \frac{3}{2}, (\lambda_m)_1 = 4000\text{Å} = 4000 \times 10^{-10}\text{m}$

$$\therefore \quad (\lambda_m)_2 = \frac{4000 \times 10^{-10} \times 3}{2} = 6000\text{Å}$$

14 **(a)**

When the relative humidity is low (approx. 25%), the evaporation from our body is faster. Thus we feel colder

15 **(b)**

The metal X has a higher coefficient of expansion compared to that for metal Y so, on placing bimetallic strip in a cold bath, X will shrink more than Y. Hence, the strip will bend towards the left.

16 **(c)**

$$\frac{X - L}{U - L} = \frac{C}{100} \Rightarrow \frac{62 - (-10)}{110 - (-10)} = \frac{C}{100} \quad (C = 60°\text{C})$$

17 **(a)**

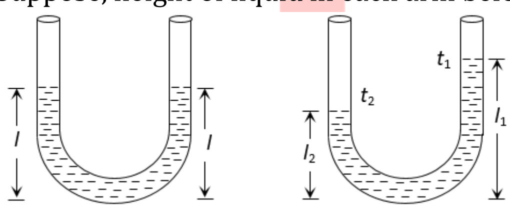
Ordinary glass prism (crown, flint) absorbs the infrared radiation but rock salt prism transmit them. Hence it is used to obtain the spectrum of infrared radiation

19 **(d)**

$$Q \propto T^4 \Rightarrow \frac{H_A}{H_B} = \left(\frac{273 + 727}{273 + 327}\right)^4 = \left(\frac{10}{6}\right)^4 = \left(\frac{5}{3}\right)^4 = \frac{625}{81}$$

20 **(a)**

Suppose, height of liquid in each arm before rising the temperature is l.



With temperature rise height of liquid in each arm increases $i.e. \, l_1 > l$ and $l_2 > l$

Also $l = \frac{l_1}{1+\gamma t_1} = \frac{l_2}{1+\gamma t_2}$

$$\Rightarrow l_1 + \gamma l_1 t_2 = l_2 + \gamma l_2 t_1 \Rightarrow \gamma = \frac{l_1 - l_2}{l_2 t_1 - l_1 t_2}$$

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