DPP
DAILY PRACTICE PROBLEMS

CLASS : XITH
DATE :

Solutions

SUBJECT : PHYSICS
DPP NO. : 2

Topic :- THERMAL PROPERTIES OF MATTER

1 **(c)**

Rate of heat loss $E = \sigma\, eA(T^4 - T_0^4)$

$5.67 \times 10^{-8} \times 0.4 \times 200 \times 10^{-4} \times [(273 + 527)^4 - (273 + 27)^4]$

$5.67 \times 10^{-8} \times 0.4 \times 200 \times 10^{-4} \times (800)^4 - (300)^4 = 182\ J/s$

2 **(a)**

$Q = \frac{KA(\theta_1 - \theta_2)t}{l}$; in both the cases, A, l and $(\theta_1 - \theta_2)$ are same so $Kt =$ constant

$\Rightarrow \frac{K_1}{K_2} = \frac{t_2}{t_1} = \frac{30}{20} = \frac{3}{2} = 1.5$

3 **(b)**

According to Wien's displacement law

$\therefore \quad \lambda_m = \frac{b}{T}$ (b=constant)

$\therefore \quad \frac{\lambda_1}{\lambda_2} = \frac{T_2}{T_1}$

$\Rightarrow \quad \lambda_2 = \frac{\lambda_1 T_1}{T_2}$

Given, $\lambda_1 = 4800\text{Å}$, $T_1 = 6000$ K, $T_2 = 3000$ K

$\therefore \quad \lambda_2 = \frac{4800 \times 6000}{3000} = 9600\text{Å}$

4 **(a)**

According to Newton's law of cooling

$$\frac{\theta_1 - \theta_2}{t} = K\left[\frac{\theta_1 + \theta_2}{2} - \theta_0\right]$$

In the first case,

$\Rightarrow \quad \frac{60-50}{10} = K\left[\frac{60+50}{2} - \theta_0\right]$

$\Rightarrow \quad 1 = K(55 - \theta)$ ...(i)

In the second case,

$\Rightarrow \quad \frac{60-50}{10} = K\left[\frac{50+42}{2} - \theta_0\right]$

$\Rightarrow \quad 0.8 = K[46 - \theta]$ ...(ii)

Dividing Eq. (i) by Eq. (ii), we get

$$\frac{1}{0.8} = \frac{55-\theta}{46-\theta}$$

or $40 - \theta = 44 - 0.8\theta$

$\Rightarrow \theta = 10$

5 **(a)**

Energy gained by water (in 1 s)

= Energy supplied−energy lost

= (1000 J-160 J)=840 J

Total heat required to raise the temperature of water from 27°C to 77°C is $ms\Delta\theta$.

Hence, the required time,

$$t = \frac{ms\Delta\theta}{\text{rate by which energy is gained by water}}$$

$$= \frac{(2)(4.2\times10^3)(50)}{840} = 500 \text{ s}$$

= 8 min 20 s.

6 **(b)**

$$W = JQ \Rightarrow \frac{1}{2}\left(\frac{1}{2}mV^2\right) = J \times mS\Delta\theta \Rightarrow \Delta\theta = \frac{V^2}{4\,JS}$$

7 **(d)**

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

$$= \frac{300 \times 100 + 200 \times 0}{300 + 200} = 60°\text{C}$$

9 **(c)**

$'J'$ is a conversion

10 **(d)**

If the temperature of a body on Celsius and Fahrenheit scales are recorded as C and F respectively, then

$$\frac{C-0}{100-0} = \frac{F-32}{212-32}$$

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

Here, $C = 95°\text{C}$

$\therefore \frac{95}{5} = \frac{F-32}{9}$

Or $5F = 1015$

$\therefore F = \frac{1015}{5} = 203°\text{F}$

12 **(a)**

$$\frac{F-32}{9} = \frac{K-273}{5} \Rightarrow \frac{F-32}{9} = \frac{95-273}{5} \Rightarrow F = -288^oF$$

13 **(a)**

$$\therefore \frac{\lambda_{m_2}}{\lambda_{m_1}} = \frac{T_1}{T_2} \Rightarrow \lambda_{m_2} = \frac{2000}{2400} \times 4 = 3.33\,\mu m$$

14 **(b)**

Density of hot air is lesser than the density of cold air so hot air rises up

15 **(c)**

Mass and volume of the gas will remain same, so density will also remain same

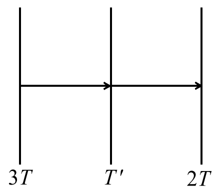
16 **(b)**

Pressure inside the mines is greater than that of normal pressure. Also we know that boiling point increases with increase in pressure

17 **(a)**

1 calorie is the heat required to raise the temperature of 1 g of water from 14.5°C to 15.5°C at 760 mm of Hg.

20 **(c)**



In steady state energy absorbed by middle plate is equal to energy released by middle plate

$\sigma A(3T)^4 - \sigma A(T'')^4 = \sigma A(T'')^4 - \sigma A(2T)^4$

$(3T)^4 - (T'')^4 = (T'')^4 - (2T)^4$

$2(T'')^4 - (16 + 81)T^4$

$T'' = \left(\frac{97}{2}\right)^{1/4} T$

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