DPP
DAILY PRACTICE PROBLEMS

CLASS : XITH
DATE :

Solutions

SUBJECT : PHYSICS
DPP NO. : 4

Topic :- THERMAL PROPERTIES OF MATTER

1 **(b)**

$$\frac{Q}{t} = \frac{KA\Delta\theta}{l} \Rightarrow 6000 = \frac{200 \times 0.75 \times \Delta\theta}{1}$$

$$\therefore \ \Delta\theta = \frac{6000 \times 1}{200 \times 0.75} = 40°\text{C}$$

3 **(b)**

$$c = \frac{Q}{m.\Delta\theta} \rightarrow \frac{J}{kg \times °\text{C}}$$

4 **(a)**

$$P = \left(\frac{Q}{t}\right) \propto T^4 \Rightarrow \frac{W}{P_2} = \left(\frac{T}{T/3}\right)^4 \Rightarrow P_2 = \frac{W}{81}$$

5 **(b)**

From Wien's displacement law

$\lambda_m T$=constant

$\Rightarrow \quad \lambda_{m1}T_1 = \lambda_{m2}T_2$

Or $\quad \frac{T_1}{T_2} = \frac{\lambda_{m2}}{\lambda_{m1}}$ ...(i)

Here, $\lambda_{m1} = 510$ nm, $\lambda_{m2} = 350$ nm

So, on putting these values in Eq. (i)

$$\frac{T_1}{T_2} = \frac{350}{510} \Rightarrow \frac{T_1}{T_2} = \frac{35}{51} = 0.69$$

6 **(c)**

$P \times t = mc\Delta\theta$

$$\Rightarrow t = \frac{mc\Delta\theta}{P} = \frac{4200\, m\Delta\theta}{P} = \frac{4200 \times m \times \Delta\theta}{VI}$$

$$\left\{\because C_{water} = 4200\, {}^{J}/_{kg \times °\text{C}}\right\}$$

$$\Rightarrow t = \frac{4200 \times 1 \times (100 - 20)}{220 \times 4} = 381 \text{ sec} \approx 6.3 \text{ min}$$

7 **(c)**

Solids, liquids and gases all expand on being heated, as a result density (= mass/volume) decreases

8 **(c)**

Heat capacity/volume = $c \times \frac{m}{V} = c \times \rho$

Desired ratio $= \frac{c_1\rho_1}{c_2\rho_1} = \frac{3}{5} \times \frac{5}{6} = 1 : 2$

9 **(b)**

Heat current, $\frac{Q}{t} = \frac{KA(\theta_1 - \theta_1)}{l}$

$= \frac{100 \times 100 \times 10^{-4}(100-0)}{1}$

$\Rightarrow \quad \frac{Q}{t} = 100\text{J/s} = 6 \times 10^3$ J/min

11 **(d)**

Heat released to convert x g of steam at 100°C to water at 100°C is $x \times 540$ *cals*.

If y g of ice is converted from 0°C to water at 100°C it requires heat $y \times 80 + y \times 1 \times 100 = 180y$

$\therefore x \times 540 = 180y$ or $\frac{y}{x} = \frac{540}{180} = \frac{3}{1}$

12 **(c)**

$\frac{\Delta Q}{\Delta t} = \frac{KA\Delta\theta}{\Delta x} \Rightarrow$ Thermal gradient $\frac{\Delta\theta}{\Delta x}$

$= \frac{(\Delta Q/\Delta t)}{KA} = \frac{10}{0.4} = 25°\text{C}/cm$

13 **(b)**

In M.K.S. system unit of σ is $\frac{J}{m^2 \times s \times K^4}$

$\Rightarrow 1 \frac{J}{m^2 \times s \times K^4} = \frac{10^7 erg}{10^4 cm^2 \times s \times K^4} = 10^3 \frac{erg}{cm^2 \times s \times K^4}$

14 **(b)**

From Newton's law of cooling when a hot body is cooled in air, the rate of loss of heat by the body is proportional to the temperature difference between the body and its surroundings.

Given, $\theta_1 = 60°\text{C}, \quad \theta_2 = 50°\text{C}, \quad \theta = 25°\text{C}$

$\therefore$ Rate of loss of heat=K

(Mean temp.-Atmosphere temp.)

Where K is coefficient of thermal conductivity

$$\frac{\theta_1 - \theta_2}{t} = K\left(\frac{\theta_1 + \theta_2}{2} - \theta\right)$$

$$\frac{60-50}{10} = K\left(\frac{60+50}{2} - 25\right)$$

$\Rightarrow \quad K = \frac{1}{30}$

Also putting the value of K, we have

$$\frac{50-\theta_3}{10} = \frac{1}{30}\left(\frac{50+\theta_3}{2} - 25\right)$$

$\Rightarrow \quad \theta_3 = 42.85°\text{C}$

15 **(a)**

The temperature at which a black body ceases to radiate energy is 0 K.

16 **(c)**

Thermoelectric thermometer is used for finding rapidly varying temperature

17 **(c)**

Heat current, $H = \frac{Q}{t} = \frac{KA(\theta_1 - \theta_2)}{d}$

$$= \frac{0.01 \times 0.8(30° - 0°)}{2 \times 10^{-2}} = 12 \text{ J}s^{-1}$$

18 **(a)**

Natural convection arises due to difference of density at two places and is a consequence of gravity

19 **(d)**

At boiling point, vapour pressure becomes equal to the external pressure

20 **(a)**

Newton's law of cooling states that the rate of cooling of a body is directly proportional to temperature difference between the body and the surroundings, provided the temperature difference is small, (less than 10°C), and Newton's law of cooling is given by

$$\frac{dT}{dt} \propto (\theta - \theta_0)$$

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