WS-8 gravitation 9th integrated

Task

(1)

(1)

From Newton's law of gravitation

$$F = G\frac{m_1 m_2}{r^2}$$

$m = d \times V$
$= d \times \frac{4\pi}{3} r^3$

$$\Rightarrow F = \frac{G d^2 \left(\frac{4\pi}{3}\right)^2 r^{\cancel{6}}}{\cancel{r^2}}$$

$\Rightarrow F \propto r^4$

d = constant because both are made up of same metal

$F_1 = F \rightarrow r_1 = r$

$F_2 = ? \rightarrow r_2 = 2r$

$$\frac{F_2}{F_1} = \left[\frac{r_2}{r_1}\right]^4 \Rightarrow \frac{F_2}{F} = \left(\frac{2\cancel{r}}{\cancel{r}}\right)^4 = 2^4$$

$\Rightarrow F_2 = 2^4 F = 16F$

(2)

$g_e = 10\ m/s^2$

$M_p = \frac{1}{5} m_e \qquad r_p = \frac{1}{2} r_e$

From $g = \frac{GM}{R^2}$

$$\Rightarrow \frac{g_p}{g_e} = \frac{M_p}{M_e}\left(\frac{R_e}{R_p}\right)^2$$

$$\Rightarrow g_p = g_e\left[\frac{1}{5}\frac{\cancel{M_e}}{\cancel{M_e}}\right]\left(\frac{\cancel{R_e}}{\frac{1}{2}\cancel{R_e}}\right)^2$$

$$\Rightarrow g_p = \cancel{10}^{2} \times \frac{1}{\cancel{5}} \times (2)^2 = 2 \times 2^2 = 8\ m/s^2$$

(3)

$R_e' = \frac{R}{2}$; $M_e' = \frac{1}{8} M$

From $g = \frac{GM}{R^2}$ $\Rightarrow g \propto \frac{M}{R^2}$

$$\Rightarrow \frac{g_e'}{g} = \frac{M_e'}{M} \times \left[\frac{R}{R_e'}\right]^2$$

$$\Rightarrow \frac{g_e'}{g} = \frac{\frac{1}{8}M}{M} \left[\frac{R}{\frac{R}{2}}\right]^2$$

$$\Rightarrow g_e' = g \times \frac{1}{8} \times 2^2 = \frac{g}{2}.$$

(4)

$M = 80\ kg$ $A = 0.6\ m^2$.

~~FOrce~~ $\text{Pressure} = \frac{\text{Force}}{\text{Area}}$

$$\Rightarrow \text{Pressure} = \frac{mg}{0.6} = \frac{80 \times 10}{0.6}$$

$$\Rightarrow \frac{8000}{6} = 1.33 \times 10^3\ N/m^2$$

(5)

Area of foot $= 80\ cm^2 = 80 \times 10^{-4}\ m^2$

$m = 80\ kg$

$$\text{Pressure} = \frac{F}{A} = \frac{mg}{2 \times \text{Area}} = \frac{80 \times 10}{2 \times 80 \times 10^{-4}}$$

$$= \frac{10 \times 10^4}{2} = 5 \times 10^4\ N/m^2$$

(6)

$P_{at} = 10^5$ Pa , Area $= 40 \times 80$
$= 3200 \times cm^2$
$= 3200 \times 10^{-4} m^2$

Force $=$ P $\times$ Area
$= 10^5 \times 3200 \times 10^{-4}$
$= 32 \times 10^3$ N. $\angle$ 3.2×10^4 N.

(7)

$W_{air} = 25$ N ; $W_w = 20$ N.

upthrust $=$ weight of liquid displaced
$=$ loss of weight of body in liquid
$\Rightarrow W_{air} - W_{water}$
$\Rightarrow 25 - 20$
$\Rightarrow 5$ N

(8)

$W_{water} = \frac{1}{3} W_a$
$W_2 = \frac{1}{3} W_1$

$\therefore$ The apparent loss of weight of the body
$= W_a - W_{water}$
$= W_a - \frac{1}{3} W_a$
$= \frac{2}{3} W_a = \frac{2}{3} W_1$

(9)

$W_{air} = 100\ N$; $W_{kerosene} = 70\ N.$

The apparent loss of weight of the body

$= W_{air} - W_{kerosene}$

$= 100 - 70$

$= 30\ N.$

(10)

Pressure on ground floor $= 270\ kPa$

$= 270 \times 10^3\ Pa$

variation of Pressure with height

$P = \rho g h$

where ρ = density of liquid (or) water

Here $\rho_w = 10^3\ kg/m^3$

$\therefore\ 27\cancel{0} \times \cancel{10^3} = \cancel{10^3} \times \cancel{10} \times h$

$\Rightarrow h = 27\ m$

(12)

Scanned with OKEN Scanner

(12)

The density of Sea water > density of river water
The weight of a man gets balanced by the less immersed part of his body in sea water as compared to river water.

Thus it is easier for a person to swim in sea water than in river water.

(11)

According to law of floatation, the weight of the floating body is equal to the weight of the liquid displaced by the floating body.

∴ the apparent weight of an isolated floating body is zero.

∴ option B correct.

(13), (14)

For a body floating in a liquid (water) it's apparent weight is zero.

Because the weight of water displaced acting vertically upwards is just equal to the weight of the body acts vertically downwards

(15) , (16) , (17)

$h_{water} = 10\ cm = 10^{-1}\ m$

bottom Area of glass $= 10\ cm^2 = 10 \times 10^{-4}\ m^2$

Top area of glass $= 30\ cm^2 = 30 \times 10^{-4}\ m^2$

volume $= 1\ lit = 10^{-3}\ m^3$

Given $d_w = 10^3\ kg/m^3$; $g = 10\ m/s^2$; $P_{at} = 1.01 \times 10^5\ N/m^2$

Force on bottom =

$F = (P_0 + \rho g h)\, A_{bottom}$

$F_1 = [1.01 \times 10^5 + 10^3 \times 10 \times 10^{-1}] \times 10^{-3}$

$F_1 = 102$ downward

Resultant force exerted by the sides of glass on water

Net upward force = Net downward force

$F + F_3 = w + F_2 \rightarrow (1)$

w = weight of water = volume × density × g

$= 10^{-3} \times 10^3 \times 10 = 10N \downarrow$

F_2 = Force exerted by atmosphere on water $= P_0 A_{Top}$

$\Rightarrow 1.01 \times 10^5 \times 3 \times 10^{-3}$

$= 303\ N \downarrow$

$F_3 \Rightarrow$ Buoyant force $= -F_1 = 102$ upward

(15), (16), (17) continuedra

From (1)

$$F = F_g + w - F_3$$

$$= 303 + 10 - 102$$

$$= 211\text{ N (upwards)}$$

If the air inside the Jar is completely Pumped out.

$$F = \rho g h . A_{base}$$

$$= 10^3 \times 10 \times 10^{-1} \times 10^{-3}$$

$$= 1\text{N downwards}$$

LTask

Jee main's level

(1)

$d_1 = d$; $d_2 = 2d$

$F_1 = F$ $\quad F_2 = ?$

From Newton's law of gravitation

$$F = \frac{G m_1 m_2}{d^2} \Rightarrow F \propto \frac{1}{d^2}$$

$$\Rightarrow \frac{F_1}{F_2} = \left[\frac{d_2}{d_1}\right]^2 = \left[\frac{2d}{d}\right]^2$$

$$\Rightarrow \frac{F}{F_2} = 4 \Rightarrow F_2 = \frac{F}{4}.$$

(12)

$P_{atm} = 10^5$ Pa ; Area of window $= 10\,cm \times 20\,cm$

$= 200\ cm^2$

$= 200 \times 10^{-4}\ m^2$

Force = P x Area

$= 10^5 \times 200 \times 10^{-4}$

$\Rightarrow 2 \times 10^3 = 0.2 \times 10^4\ N$

(13)

$d_{atm} = 1.29\ kg/m^3$; $h = ?$; $P_{atm} = 1.01 \times 10^5\ Pa$

Pressure $= \rho g h$

$\Rightarrow 1.01 \times 10^{5} = 1.29 \times 10 \times h$

$\Rightarrow h = \frac{1.01}{1.29} \times 10^4 = 7989\ m \simeq 8\ km$

(14)

$h = 5\,m$; $\rho_w = 10^3\ kg/m^3$; $g = 10\,m/s^2$

variation of pressure with depth $P = P_a + \rho g h$

$\Rightarrow P = 10^5 + 10^3 \times 10 \times 5$

$= 1.5 \times 10^5 = 1.5$ atm

$1\,atm = 10^5$ Pa

15

$W_{air} = 50\,N$; $W_{w} = 35\,N.$

upthrust acting on body = loss of weight in liquid

$= W_{air} - W_{water}$

$= 50 - 35$

$= 15\,N.$

16

$W_{Liquid} = \frac{1}{5} W_{air}$ $\Rightarrow W_2 = \frac{1}{5} W_1.$

Then apparent loss of weight $= W_{air} - W_{liquid}$

$= W_1 - \frac{1}{5} W_1$

$\Rightarrow \frac{4}{5} W_1$

17

$W_a = 75$; $W_{alcohol} = 50\,N.$

The apparent loss of weight of the body

$= W_{air} - W_{alcohol}$

$= 75 - 50$

$= 25\,N.$

(18)

$P_{ground} = 100 \text{ kPa} = 100\times10^{3} \text{ Pa}$

$h = ?$ $\quad \rho_{water} = 10^{3} \text{ kg/m3}$

$P = \rho g h$

$\Rightarrow 100\times10^{3} = 10^{3}\times10\times h$

$\Rightarrow h = 10 m$

(19)

$g_p = \frac{1}{6} g_e \quad ; \quad R_p = \frac{1}{3} R_e$

From $\quad g = \frac{GM}{R^2}$

$$\Rightarrow \frac{g_p}{g_e} = \frac{M_p}{M_e}\times\left[\frac{R_e}{R_p}\right]^2$$

$$\Rightarrow \frac{\frac{1}{6}\cancel{g_e}}{\cancel{g_e}} = \frac{M_p}{M_e}\times\left[\frac{\cancel{R_e}}{\frac{1}{3}\cancel{R_e}}\right]^2$$

$$\Rightarrow \frac{1}{6} = \frac{M_p}{M_e}\times 3^2 \Rightarrow \frac{M_p}{M_e} = \frac{1}{6\times9} = \frac{1}{54}$$

(20)

Given $\quad m_2 = 5 \text{ kg} \quad ; \quad m_1 = 10 \text{ kg} \quad ; \quad r = 5 m$

From Newton's law of gravitation $F = \frac{G m_1 m_2}{r^2}$

$$\Rightarrow F = \frac{6.67\times10^{-11}\times\cancel{5}\times\overset{2}{\cancel{10}}}{\cancel{5^2}} = 6.67\times10^{-11}\times2$$

$$= 1.334\times10^{-10} N$$

21

If earth stops rotating, then there will be no centripetal force acting on the body, and gravitational force increases, therefore the value of g will increase in some places and remain the same in other places.

option. A & D are correct

22

From kepler's law $T^2 = \frac{4\pi^2}{GM} R^3$

As G decreases, Time Period of rotation of Earth increases, hence length of years increases

$$K.E = \frac{GMm}{2R}$$

As $G \downarrow$, K.E also decreases

$\therefore$ a, c are correct

23

R:- The level of water does not change. because on drinking the water [say m gm] the weight of man increases by m gm and hence water displaced by man increased by m gm, tending to raise the level. However, this much amount of water has already been consumed by the man. Therefore the level of pond remain same.

27, 28

$m = 4\ kg$; Area $= 2\ m^2$; $g = 10\ m/s^2$

<u>weight</u> of the body $= mg$

$= 4 \times 10$

$= 40N$

<u>Pressure</u> $= \frac{F}{A} = \frac{mg}{A} = \frac{40}{2}$

$= 20\ N/m^2$

ws-9 sound 9th integrated

Task

(40)

Given $V_{sound} = 300\ m/s$

There is no effect of Pressure on velocity of sound

We know $V = \sqrt{\frac{P}{\rho}} = \sqrt{\frac{P}{\frac{m}{vol}}}$

$\Rightarrow v = \sqrt{\frac{P \times vol}{m}}$ Here $vol \propto \frac{1}{P}$

when $P' = 2P$ [Pressure is doubled]

then volume $V' = \frac{1}{2}$ Vol.

$\therefore$ velocity of sound $v' = \sqrt{\frac{P'\ Vol'}{m}}$

$\Rightarrow v' = \sqrt{\frac{2P\ \frac{V}{\cancel{2}}}{m}} = \sqrt{\frac{PV}{m}} = v$

No change in velocity of sound $v' = 300\ m/s$

No change in velocity of sound $v' = 300\ m/s$

WS-3 from sound

Integrated

I Topic → 4, 5, 6, 7, 8, 9, 10 → same from WS-3 5th
16, 17

b) LTopic → 1, 2, 3, 4, 5 (SAQ's), 9, 10, 16, 17 same from WS-3 8th

WS-10 9th integrated

sp. heat

Thank

1

1

$Q = 30\ kcal \rightarrow \quad m = 15\ kg \quad d\theta = (40-20) = 20°C$

Thermal capacity $= \frac{dQ}{d\theta} = \frac{30\ kcal}{20}$

$= 1.5\ kcal/°C$

2

$m = 20 \times 10^{-3}\ kg \ : \ V = 210\ m/s$

Energy $= \frac{1}{2} m v^2 = \frac{1}{\cancel{2}} \times \overset{10}{\cancel{20}} \times 10^{-3} \times (210)^2$

$= 10 \times 10^{-3} \times (210)^2 \Rightarrow 441000 \times 10^{-3}$

$= 441\ J$

$1\ cal = 4.2\ J.$

$\therefore$ Energy in cal $= 105\ cal$

3

Given $\frac{r_1}{r_2} = \frac{2}{3} \ : \ \frac{s_1}{s_2} = \frac{3}{4} \ : \ \frac{d_1}{d_2} = \frac{4}{5}$

water equivalent $w = MS = d \times vol \times s = d \times \frac{4\pi}{3} \times r^3 \times s$

$\frac{w_1}{w_2} = \frac{d_1}{d_2} \times \left[\frac{r_1}{r_2}\right]^3 \times \frac{s_1}{s_2} = \frac{\cancel{4}}{5} \times \left[\frac{2}{3}\right]^3 \times \frac{3}{\cancel{4}} = \frac{8}{5 \times 27 \cancel{9}} \times \cancel{3}$

$= \frac{8}{45}$

(4)

$v = 42$ m/s   K-E is converted into heat

According to Joule's law

$W = J Q$

$\Rightarrow \frac{1}{2} m v^2 = J \; Q.$

Here due to K-E of bullet, the temp rising

$\therefore \quad Q = m s \, d\theta.$

$\Rightarrow \frac{1}{2} \cancel{m} v^2 = J \cancel{m} s \, d\theta$

$\Rightarrow \quad d\theta = \frac{v^2}{2 J s} = \frac{(42)^2}{2 \times 1263 \times 1}$

$= 0.69 \simeq 0.7^\circ C$

(5)

$m = 21$ kg   : $v = 20$ kmph $= 20 \times \frac{5}{18}$ m/s $= \frac{100}{18}$ m/s

$\mu = 0.05$ $t = 1$ hr $= 3600$ sec.

work done = F × displacement

$= \mu m g \times v \times t.$

$= 0.05 \times 21 \times 10 \times \frac{100}{18} \times 3600$

$= \cancel{500 \times 70} \quad 5 \times 420000$

this work done $\frac{W}{J} = Q. = \cancel{5000} \times$

$\Rightarrow \frac{5 \times 420000}{4200} = Q \Rightarrow Q = 500$ J

(6)

Given height from which lead dropped $h = 210m$

50% of striking Energy converted into heat

ie $\frac{50}{100} \times P.E = Q$

$\Rightarrow \frac{1}{2} \times \overset{mgh}{\cancel{\frac{1}{2}mv^2}} = ms\,d\theta$

[Here due to the conversion of P.E into heat there is rise in temperature of the lead]

$\Rightarrow \frac{1}{2} \overset{gh}{\cancel{m v^2}} = \cancel{m} s\,d\theta$ [$s = 0.03$ kcal/kg $= 0.03 \times 4200$ J/kg]

$\Rightarrow \frac{1}{2} \times \frac{gh}{JS} = d\theta$

$\Rightarrow d\theta = \frac{1}{2} \times \frac{10 \times 210}{4200 \times 0.03} = \frac{2100}{2 \times \cancel{4200} \times 3 \times 10^{-2}}$

$\Rightarrow \frac{100}{4 \times 3} = \frac{25}{3}\ ^\circ C$

(7)

$m = 2\,kg$; $v = 2\,m/s$; $\mu = 0.3$ $t = 5\,sec$

work done $= f\,s \Rightarrow \mu mg\,(v \times t)$

$= 0.3 \times 2 \times 9.8 \times 2 \times 5 = 0.6 \times 98$

$= 58.8$.

heat Produced $= \frac{W}{J}$ [Joule's law]

$= \frac{58.8}{4.2} = 14\,J$

(8)

$Q = 270$ kcal $= 270 \times 10^3$ cal ; $t = 1$ hr ; $L = 540$ cal/gm

Here heat is converted into water

$\therefore Q = mL$

$\Rightarrow m = \frac{Q}{L} = \frac{270 \times 10^3}{540} = \frac{1}{2} \times 10^3$ gm

$= 0.5 \times 10^3$ gm

$= 0.5$ kg

(9)

$m = 0.1$ kg ; $h_1 = 10m$; $h_2 = 7m$; $S = 0.1$ kcal/kg $= 0.1 \times 4200$ J/kg

here loss of P.E converted in heat energy

$\Rightarrow mg[h_1 - h_2] = dQ.$

and heat energy is used to rise the temperature

$\Rightarrow \cancel{m}g[h_1 - h_2] = \cancel{m}sd\theta \qquad [S = \frac{1}{m}\frac{dQ}{d\theta}]$

$\Rightarrow g[h_1 - h_2] = sd\theta$

$\Rightarrow d\theta = \frac{g[h_1 - h_2]}{s} = \frac{10 \times [10-7]}{0.1 \times 4200}$

$= \frac{100 \times 3}{4200} = \frac{3}{42} = \frac{1}{14} = 0.07^\circ C$

(10)

Force of friction = 100 N ; $m = 1\ kg$; $s = 600\ J/kg\ K$

distance = 30 m

work done by friction = friction × displacement

$= 100 \times 30$

$= 3000\ J$

this $\frac{\text{work done}}{J} = dQ$ [heat produced from Joule's law]

$\Rightarrow dQ = \frac{3000}{1}$

we know $s = \frac{1}{m}\frac{dQ}{d\theta}$

$\Rightarrow dQ = ms\,d\theta$

$\Rightarrow ms\,d\theta = 3000$

$\Rightarrow 1 \times \cancel{600} \times d\theta = \cancel{3000}^{5}$

$d\theta = 5°C$

(16)

(i) Given

Angular velocity $\omega = 180\ rpm$; $m = 180\ gm = 180 \times 10^{-3}\ kg$

$\frac{d\theta}{dt} = 0.5°/sec.$ $S_{steel} = 420\ J/sec.$

$dQ = ms\,d\theta = 180 \times \frac{4200}{4.2} \times 0.5 \times 10^{-3}$

$= 9\ cal/sec.$

work done $= Q \times J \Rightarrow 9 \times 4.2\ cal/sec$

$= 37.8\ cal/sec$

$= 37.8\ W$

(17)

Given 0.1% of ice melts on reaching ground

let 'm' be the mass of ice

$m' =$ mass of ice melts on reaching ground

$= 0.1\% \, m$

$= \frac{0.1}{100} \times m = \frac{1}{1000} m.$

Here loss of P.E converted into heat energy.

$L_{ice} = 80$ cal/gm ; $J = 4.2$ J/cal.

$\therefore$ P.E $= dQ$ $\left[L_i = \frac{dQ}{m'} \quad dQ = m'L \right]$

$\Rightarrow m'gh = m'L$

$\Rightarrow \frac{m}{1000} \times 10 \times h = \frac{m}{1000} \times 80 \times 4.2.$

$\Rightarrow \frac{h}{1000} = 8 \times 4.2$

$\Rightarrow h = 8 \times 4.2 \times 10^3$

$= 33.6 \times 10^3$

$= 33.6$ km

(17)

let velocity of the bullet be v.

Given $K.E = 20$ cal $[1 \text{ cal} = 4.2 J]$

$= 20 \times 4.2 J$

$= 84 J$

mass of bullet $= 4.2$ gm $= 4.2 \times 10^{-3}$ kg

$\therefore K.E = \frac{1}{2} m v^2$

$\Rightarrow \frac{1}{2} m v^2 = 84$

$\Rightarrow \frac{1}{\cancel{2}} \times \overset{2.1}{\cancel{4.2}} \times 10^{-3} \times v^2 = 84$

$\Rightarrow 21 \times 10^{-4} \times v^2 = 84$

$v^2 = 4 \times 10^2$

$\Rightarrow v = \sqrt{4 \times 10^2} = 200$ m/s

L Task

Jee main level

(1)

$m = 200$ gm $= 200 \times 10^{-3}$ kg ; $Q = 252 J$; $d\theta = 10°C$

Thermal capacity $= \frac{dQ}{d\theta} = \frac{252}{10} = 25.2$ J/K

(2)

Given

(2)

Given $\frac{S_1}{S_2} = \frac{2}{3}$; $\frac{d_1}{d_2} = \frac{6}{5}$.

we know that thermal capacity = mS

$\Rightarrow C = d \times vol \times S$

$\Rightarrow \frac{C}{vol} = d \times S$

$\therefore \frac{[\frac{C}{V}]_1}{[\frac{C}{V}]_2} = \frac{d_1}{d_2} \times \frac{S_1}{S_2} = \frac{\cancel{6}^2}{5} \times \frac{2}{\cancel{3}}$

$= \frac{4}{5}$.

(3)

$m = 300\ gm$; $h = 3\,m$. ; $g = 9.8\ m/s^2$

$= \cancel{300}$, 300×10^{-3} kg

According to Joule's law $W = JQ$

$\Rightarrow Q = \frac{W}{J} = \frac{mgh}{J} = \frac{300 \times 9.8 \times 3 \times 10^{-3}}{4200}$

$= 2.1$ cal

(4)

$V = 420\ m/s$. $S_{lead} = 0.03\ cal/gm°c = 0.03 \times 4200\ J/kg°c$

loss of K.E = heat produced

$\Rightarrow \frac{1}{2} m v^2 = dQ$ $\left[S = \frac{1}{m} \frac{dQ}{d\theta} \right]$

$\Rightarrow \frac{1}{2} \cancel{m} v^2 = \cancel{m} s\, d\theta$

$\Rightarrow d\theta = \frac{v^2}{2s} = \frac{(420)^2}{2 \times 0.03 \times 4200} = \frac{700}{2} = 350°c$

~~2×0.03×4200~~ $\cancel{42}\times 0.03$

5

Given $v = 100\ m/s$; $S = 100\ J/kg\ k.$

Given Total k.E converted into heat

$\Rightarrow \frac{1}{2} m v^2 = dQ$ $\quad [S = \frac{1}{m}\frac{dQ}{d\theta}]$

$\Rightarrow \frac{1}{2} \cancel{m} v^2 = \cancel{m} s\, d\theta$

$\Rightarrow d\theta = \frac{v^2}{2s} = \frac{[100]^{\cancel{2}}}{2 \times \cancel{100}} = \frac{100}{2} = 50\ ^\circ k.$

6

$\frac{m_A}{m_B} = \frac{1}{2}$: $\frac{S_A}{S_B} = \frac{2}{3}$

we know $d\theta = \frac{gh}{S \cdot J}$

$\Rightarrow \frac{d\theta_1}{d\theta_2} = \frac{h_1}{h_2} \times \frac{S_2}{S_1} = 1 \times \frac{\cancel{3}}{\cancel{3}} = \cancel{\frac{3}{2}}\ \frac{2}{3}$

7

$\frac{d_1}{d_2} = \frac{3}{4}$; $\frac{S_1}{S_2} = \frac{4}{3}$

Thermal capacity = m s

$C = \text{density} \times \text{vol} \times S$

$\Rightarrow \frac{C}{Vol} = d \times S$

$\Rightarrow \frac{[\frac{C}{V}]_1}{[\frac{C}{V}]_2} = \frac{d_1}{d_2} \times \frac{S_1}{S_2}$

$= \frac{3}{4} \times \frac{4}{3}$

$= \frac{1}{1}$.

8

$d_A = 0.5$ gm/c.c ; $d_B = 0.6$ gm/c.c

$V_A = 8$ lit $V_B = 10$ lit

we know heat capacity = $m \times S$

$C = d \times vol \times S$

C = constant.

$\frac{S_A}{S_B} = \frac{d_B}{d_A} \cdot \frac{V_B}{V_A}$

$= \frac{0.6}{0.5} \times \frac{10}{8}$

$= \frac{\cancel{6}^{3}}{\cancel{5}} \times \frac{\cancel{10}^{2}}{\cancel{8}_{4\,2}}$

$= \frac{3}{2}$.

(9)

let m be the original mass.

mass melted $m' = 75\% \, m$; $L_{ice} = 80$ cal/gm $= 80 \times 10^3$ cal/kg $= 80 \times 10^3 \times 4.2$ J/kg

loss of P.E = Heat energy

$\Rightarrow m g h = dQ$ $\left[L = \frac{dQ}{m} \right.$

$\Rightarrow m g h = m' L_{ice}$ $\left. m' L = dQ \right]$

$\Rightarrow \cancel{m} \times 10 \times h = \frac{75}{100} \cancel{m} \times \cancel{80}^{8} \times 10^3 \times 4.2$

$\Rightarrow h = \frac{3}{4} \times \cancel{8}^{2} \times 4.2 \times 10^3$

$= 25.2 \times 10^3 = 25.2$ km

(10)

$m = 0.42$ kg ; $V = 200$ m/s.

Given Thermal Energy $Q =$ K.E

$\Rightarrow JQ = \frac{1}{2} m v^2$

$= \frac{1}{2} (0.42)(200)^2$

$\Rightarrow 0.42 \times \frac{\cancel{40000}^{2}}{2}$

$\Rightarrow Q = 0.42 \times \frac{20000}{J}$ cal

$\Rightarrow 0.42 \times \frac{20000}{4.2}$ cal

$= \underline{2 \text{ k cal}}$

16

(i) $h = 500m$;

we know that

rise in temperature $d\theta = \frac{gh}{JS}$

$\Rightarrow d\theta = \frac{9.8 \times 500}{4200} = \frac{\cancel{490}\,49}{42} = 1.16°C$

(ii)

$m_w = 100\ kg$

$L = \frac{dQ}{m} = s\,d\theta = 4200 \times 1.16$

$\simeq 4900 J/k.$