7th class WS-12

Task

(1) From the given data,

Acc to law of conservation of energy.

$-K.E = \text{Loss of } P.E$

$\Rightarrow \frac{1}{2}mv^2 = mgh_1$

$\Rightarrow v^2 = 2gh_1$

Gain in $P.E = \frac{75}{100}$ loss of $K.E$

$\Rightarrow mgh_2 = \frac{3}{4}\frac{1}{2}mv^2$

$\Rightarrow gh_2 = \frac{3}{4}\frac{1}{2}2gh_1$

$\Rightarrow h_2 = \frac{3}{4} \times 12 = 9m$

(2) Given

$E = 980$ cal.

$m = 42kg$; $1cal = 4.2J$

$\Rightarrow mgh = 980$ cal

$\Rightarrow 42 \times 9.8 \times h = 980 \times 4.2$

$\Rightarrow 98h = 980$

$h = 10m$

(3) Given $m = 3kg$

$v = 4 m/s$.

Just Before reaching ground

$K.E = \frac{1}{2}mv^2$

$= \frac{1}{2} \times 3 \times 4^2$

$\Rightarrow 24J$

(4) Given $m = 5kg$; $P = 5Ns$

$K.E = \frac{P^2}{2m} = \frac{(5)^2}{2\times 5}$

$K.E = 2.5J$

(5) Given $m = 2kg$; $K.E = 490J$

$g = 9.8 m/s^2$.

Given $K.E' = \frac{1}{2}K.E$

Acc to Law of conservation of Energy

Gain in $P.E$ = Loss of $K.E$

$\Rightarrow mgh = K.E - K.E'$

$\Rightarrow mgh = \frac{1}{2}K.E$

$\Rightarrow 2 \times 9.8 \times h = \frac{1}{2} \times 490$

$\Rightarrow 2h = 25$

$\Rightarrow h = 12.5m$

(6) Given $m_1 = 2kg$

$m_2 = 3kg$; $K_2 = 10J$

$K.E = \frac{P^2}{2m}$ $K.E \propto \frac{1}{m}$

$\Rightarrow \frac{K_1}{K_2} = \frac{m_2}{m_1}$

$\Rightarrow \frac{K_1}{10} = \frac{3}{2}$

$\Rightarrow K_1 = 15J$.

(7) Given $K.E = 4P$.

$v = 2$

$K.E = \frac{1}{2}mv^2$

$\Rightarrow 4P = \frac{1}{2}Pv$

$\Rightarrow v = 4 \times 2 = 8 m/s$

(8) $m_1 = 2m$, $m_2 = m$.

$\frac{K_1}{K_2} = \frac{8}{1}$; $K.E = \frac{P^2}{2m}$

$\Rightarrow \frac{K_1}{K_2} = \frac{m_2}{m_1}\left[\frac{P_1}{P_2}\right]^2$

$\Rightarrow \frac{8}{1} = \frac{m}{2m}\left[\frac{P_1}{P_2}\right]^2$

$\Rightarrow \frac{16}{1} = \left[\frac{P_1}{P_2}\right]^2$

$\Rightarrow \frac{P_1}{P_2} = \sqrt{\frac{16}{1}} = \frac{4}{1}$

(9) Here they gave body loses 40% of it's Energy. So with remaining 60% it is rebounding.

$\frac{1}{2}mv^2 = mgh_1$

$\Rightarrow v^2 = 2gh_1$

Gain in $P.E = 60\%$ of $K.E$

$\Rightarrow mgh_2 = \frac{60}{100}\frac{1}{2}mv^2$

$\Rightarrow gh_2 = \frac{3}{5}\frac{1}{2}2gh_1$

$\Rightarrow h_2 = \frac{3}{5}h_1 = 3 \times 6$

$h_2 = 18m$ $[h_1 = 30m]$

(16) Given P.E = 3.6J ; m = 0.1

K.E = 6.2 J.

Acc to law of conservation of Energy.

Loss of K.E = Gain in P.E

$\Rightarrow \frac{1}{2}mu^2 - \frac{1}{2}mv^2 = 3.6$

$\Rightarrow \frac{1}{2}m u^2 - 6.2 = 3.6$

$\Rightarrow \frac{1}{2}mu^2 = 9.8$

$\Rightarrow u^2 = \frac{2\times 9.8}{m} = 2\times 98$

$H_{max} = \frac{u^2}{2g} = \frac{2\times 98}{2\times 9.8} = 10m$

(17) (a) P.E = mgh

$h = h_2 - h_1 = 1.5 - 0.3$

$= 1.2$

$\therefore P.E = 12\times 10\times 1.2$

$= 144 J$

At Max height

V = 0

(18) m = 5 kg

u = 65 m/s

V = 15 cm/sec

t = 0.025 sec.

From $v = u + at$

$a = \frac{v-u}{t}$

$a = \frac{50\times 10^{-2}}{0.2}$

$a = 250\times 10^{-2}$ m/s.

$f = ma$

$= 5\times 250\times 10^{-2}$.

$= 1250\times 10^{-2}$

$= 12.50$ N.

(19) K.E = 50J

$m_2 = 2m$

$u_2 = 2u$.

$\therefore K.E \propto mu^2$

$\Rightarrow \frac{K_1}{K_2} = \frac{m_1}{m_2}\left[\frac{u_1}{u_2}\right]^2$

$\Rightarrow \frac{50}{K_2} = \frac{m}{2m}\left[\frac{u}{2u}\right]^2$

$\Rightarrow \frac{50}{K_2} = \frac{1}{8}$

$\Rightarrow K_2 = 400$ J

(4) $m = 10$ gm. ; $V = 10$ m/s

$= 10\times 10^{-3}$ kg ; $V = 10\times 10^{-2}$ m/sec.

Acc to law of conservation of Energy

P.E = Loss of K.E

$= \frac{1}{2}mv^2 = \frac{1}{2}\times 10^{-2}\times 1$

$= 0.005$ J

LTask

(1) Given

m = 1200 kg

V = 80 kmph

$= 80\times\frac{5}{18}$

$V = \frac{200}{9}$ m/sec.

$K.E = \frac{1}{2}mV^2$

$= \frac{1}{2}\times 1200\times\left(\frac{200}{9}\right)^2$

$\Rightarrow \frac{8}{27}\times 10^6$

$\Rightarrow \frac{80}{27}\times 10^5$

$\Rightarrow 3\times 10^5$ J

(2) Given m = 120 gm

$m = 120\times 10^{-3}$ kg

$V = 2\hat{i} + 5\hat{j}$ m/sec

$|V| = \sqrt{2^2+5^2} = \sqrt{29}$

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

$= \frac{1}{2}\times 120\times 10^{-3}\times 29$

$= 60\times 29\times 10^{-3}$

$= 1.74\times 10^{-2}$

$= 1.74$ J.

(3) h = 1m ; g = 10 m/sec

mass = density × vol

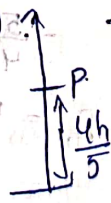
$= 1000\times 1$

$= 1000$ kg.

P.E = mgh

$= 1000\times 10\times 1$

$= 10000$ J

(5) 

$T.E_P = T.E_Q$

$P.E + K.E = K.E_Q$

$\Rightarrow \frac{4}{5}mgh + K.E_P = 2mgh$

$\Rightarrow K.E_P = mgh - \frac{4}{5}mgh$

$\Rightarrow K.E_P = \frac{1}{5}mgh$ → (1)

$\Rightarrow \frac{1}{2}mV^2 = \frac{1}{5}mgh$ $\quad h = \frac{u^2}{2g}$

$u^2 = 2gh$

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

$= \frac{1}{2}m2gh$

$\therefore K.E_P = \frac{1}{2}mV^2$

$\Rightarrow \frac{1}{5}mgh = \frac{1}{2}mV^2$

$\therefore \frac{P.E_P}{K.E_P} = \frac{\frac{4}{5}mgh}{\frac{1}{5}mgh} = \frac{4}{1}$

$\therefore \frac{K.E_P}{P.E_P} = \frac{1}{4}$.

⑥ $m = 5$ kg.

$P.E = mgh$

$\Rightarrow 5 \times 9.8 \times h = 500$

$\Rightarrow h = 10.2$ m

⑦ $u = 2$; $v = 2u$ m/sec.

$k' = 4k$.

$\Rightarrow \frac{1}{2} m v^2 = 4 \cdot \frac{1}{2} m u^2$

$\Rightarrow v = 2u$

$\Rightarrow 2 = 2u$

$\Rightarrow u = 1$ m/s

⑧ $u = 0$; $a = g$

$h = 10$m ↑ $m = 1$ kg

↓ 4.

$v = gt = 10 \times 10$

$v = 100$

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

$= \frac{1}{2} \times 1 \times 100^2$

$= 5$ kJ

⑨ $m = 5$kg ; $u = 8$ m/sec

$h = 12$m.

$k.E = \frac{1}{2} m u^2$

$= \frac{1}{2} \times 5 \times 8^2$

$= 160$J.

$P.E = mgh$

$= 5 \times 10 \times 12$

$= 600$J

∴ Loss of Energy

$= P.E \sim k.E$

$= 600 \sim 160$

$= 440$J

⑩ $P.E = 9\,k.E$

$mgh = 9 \cdot \frac{1}{2} m v^2$

$\Rightarrow v^2 = \frac{2}{9} gh$

$\Rightarrow v^2 = \frac{2}{9} \times 9.8 \times 5$

$\Rightarrow v = 3.25$ m/sec

Adv ⑨ $m = 5$ kg

$P = 10$ kgm/sec

$F = 0.2$ N ; $t = 10$ sec

$u = \frac{P}{m} = \frac{10}{5} = 2$ m/sec

$a = \frac{F}{m} = \frac{0.2}{5} = 0.04$ m/s^2

$v = u + at$.

$= 2 + 0.04 \times 10$

$v = 2.4$

(i) $\Delta P = F \cdot dt = 0.2 \times 10 = 2$ kg m/s

$\Delta k.E = \frac{1}{2} m (v^2 - u^2)$

$= \frac{1}{2} \times 10 ((2.4)^2 - 2^2)$

$= 5 [4.4] [0.4]$

$= 8.8$ J