WS-16 for 6th class

Task

① $d_L = 0.16$ gm/cc ; $v = 4$ m/s

$= 0.16 \times 10^3$ kg/m^3

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

$\Rightarrow K.E = \frac{1}{2} d_L \text{ vol } v^2$

$\Rightarrow \frac{K.E}{\text{vol}} = \frac{1}{2} d_L v^2$

$= \frac{1}{2} \times 0.16 \times 10^3 \times 4^2$

$= \frac{1}{2} \times 160 \times 16$

$\Rightarrow 1280$ J

④ $m' = \frac{1}{8} m$ $\quad K.E = \frac{1}{2} m v^2$

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

$\Rightarrow \frac{K.E}{K.E'} = \frac{\frac{1}{2} m v^2}{\frac{1}{2} m' v'^2} = \frac{m v^2}{\frac{m}{8} (2v)^2}$

$\Rightarrow \frac{K.E}{K.E'} = \frac{8 m v^2}{4 m v^2} = \frac{1}{2}$

$\therefore K.E' = \frac{2}{8} K.E = \frac{1}{2} \times 100\% \ K.E$

$= 50\% \ K.E$

⑤ $m_1 = 2$ gm ; $m_2 = 8$ gm

$K.E_1 = K.E_2$;

$\Rightarrow$ We know that $K.E = \frac{p^2}{2m}$

$\Rightarrow 2m \cdot K.E = p^2$

$\Rightarrow p^2 \propto m \Rightarrow$

$\left[\frac{p_1}{p_2}\right]^2 = \frac{m_1}{m_2} = \frac{2}{8}$

$\Rightarrow \frac{p_1}{p_2} = \frac{1}{2}$

⑥ Given $m = 4$ kg ; $u = 0$; $a = 1.5$ m/s^2

$t = 2$ sec.

$v = u + at$.

$\Rightarrow v = 0 + (1.5)(2) \Rightarrow v = 0 + 3 = 3$ m/s

$\therefore K.E = \frac{1}{2} m v^2 = \frac{1}{2} \times 4 \times 3^2$

$= 2 \times 9 = 18$ J.

⑦ $m = 0.25$ kg ; $s = 4$ m $\quad w =$ change in K.E

$u = 4$ m/s $\quad v = 0$ $\quad w = \frac{1}{2} m (v^2 - u^2)$

$\Rightarrow w = \frac{1}{2} m (0^2 - 4^2)$

$= \frac{1}{2} \times 0.25 (0 - 16)$

$w = -2$ J [Force is Retarding force]

⑧ $m_1 = 6$ kg ; $m_2 = 4$ kg

$u = 0$; $K.E = 1200$ J

According to Law of conservation of momentum

$p_1 = -p_2$

$\Rightarrow m_1 v_1 = -m_2 v_2$

$\Rightarrow 6 v_1 = -4 v_2$

$\Rightarrow v_2 = -\frac{3}{2} v_1$

$\Rightarrow K.E_1 + K.E_2 = 1200$ J.

$\Rightarrow K.E_1 + \frac{3}{2} K.E_1 = 1200$

$\Rightarrow \frac{5}{2} K.E_1 = 1200 \Rightarrow K.E_1 = 480$ J.

$\frac{K.E_1}{K.E_2} = \frac{\frac{1}{2} m_1 v_1^2}{\frac{1}{2} m_1 v_2^2} = \frac{6 v_1^2}{4 (\frac{3}{2} v_1)^2}$

$\frac{K.E_1}{K.E_2} = \frac{6}{9} = \frac{2}{3}$

$\therefore K.E_2 = \frac{3}{2} K.E_1$

(9) Given $m = 400\ gm$
$= 400 \times 10^{-3}\ kg$

$l = 2m$; $\theta = 60°$

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

$= \frac{1}{2} \times 400 \times 10^{-3} [\sqrt{2gl(1-\cos\theta)}]^2$

$\Rightarrow \frac{1}{2} \times 0.4 [2 \times 10 \times 2 (1 - \cos 60)]$

$\Rightarrow 0.2 [2 \times 20 \times (1 - \frac{1}{2})]$

$\Rightarrow 4J$

(10) $m_B = m$

$u_B = u$

Acc to LCLM

$P_{Gun} = -P_{Bullet}$

$\Rightarrow M_G V_G = -m_B u_B$

$\Rightarrow M V_{recoil} = -mu$

$\Rightarrow V_{recoil} = -\frac{mu}{M}$

$\frac{K.E_B}{K.E_G} = \frac{\frac{1}{2} m_B u_B^2}{\frac{1}{2} M_G V_G^2} = \frac{mu^2}{M\left[\frac{mu}{M}\right]^2}$

$\frac{KE_B}{KE_G} = \frac{M}{m}$

LTask

(1) Given $m = 40\ kg$

$F_1 = 8N$; $F_2 = 6N$; $\theta = 90°$

$F = \sqrt{F_1^2 + F_2^2 + 2F_1F_2\cos 90}$

$\Rightarrow F = \sqrt{8^2 + 6^2 + 2(8)(6)\cos 90}$

$\Rightarrow F = \sqrt{64 + 36} = \sqrt{100}$

$= 10\ N$

$a = \frac{F}{m} = \frac{10}{40} = \frac{1}{4} m/s^2$

From $v = u + at$

$\Rightarrow v = 0 + \frac{1}{4} \times 20$

$\Rightarrow v = 5\ m/sec.$

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

$= \frac{1}{2} \times 40 \times 5^2$

$= 500\ J$

(2) $K.E \propto P^2$; Given $\frac{dp}{p} = 0.02\%$

$\frac{\Delta K.E}{K.E} = 2\frac{dp}{p}$

$= 2 \times 0.02\%$

$= 0.04\%$

(3) $p' = P_1 + \frac{300}{100} P_1$

$p' = \frac{400}{100} P$

$p' = 4P$

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

$\Rightarrow K.E \propto P^2$

$\Rightarrow \frac{K.E}{K.E'} = \left[\frac{P}{P'}\right]^2$

$\Rightarrow \frac{K.E}{K.E'} = \left(\frac{P}{4P}\right)^2$

$\Rightarrow \frac{K.E}{K.E'} = \frac{1}{16}$

$\Rightarrow K.E' = 16\ K.E$

$= 1600\%\ K.E$

$\Rightarrow K.E' = (100\% + 1500\%) K.E$

$\therefore K.E$ increased by 1500%

(4) Given $m = 60\ kg$; $E_{in} = 24\ kJ$
$= 24 \times 10^3 J$

$\eta = 28\%$ $\Rightarrow \frac{E_{out}}{E_{in}} = 28\%$

$\Rightarrow E_{out} = \frac{28}{100} E_{in}$

$\Rightarrow mgh = \frac{28}{100} \times 24 \times 10^3$

$\Rightarrow 60 \times 10 \times h = 28 \times 24 \times 10$

$\Rightarrow h = 10.6\ m$

(5) Given $\vec{F} = 3\hat{i} + 4\hat{j}\ N$

$\vec{s} = 3\hat{i} + 4\hat{j}\ m$

$W = \vec{F} \cdot \vec{s} \Rightarrow (3\hat{i} + 4\hat{j}) \cdot (3\hat{i} + 4\hat{j})$

$= 9 + 16 = 25J$

(6) $v = \sqrt{2gh}$

$v = \sqrt{2 \times 9.8 \times 29.4}$

$= 24\ m/sec$

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

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

$\Rightarrow v^2 = 2gh$

$\Rightarrow v = \sqrt{2gh}$

$v = \sqrt{2 \times 2500}$

$v = \sqrt{2} \times 50$

$= 70\ m/sec.$

(9) At $\frac{3}{4}^{th}$ of height let V be its velocity from $v^2-u^2=2as$

$\Rightarrow v^2-u^2=2(-g)\left(\frac{3h}{4}\right)$

$\Rightarrow v^2-2gh=-\frac{6gh}{4}$

$\Rightarrow v^2=-\frac{6gh}{4}+2gh$

$\Rightarrow v^2=\frac{2gh}{4}$

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

$=\frac{1}{2}m\left(\frac{2gh}{4}\right)$

$\Rightarrow \frac{mgh}{4}$

and $P.E=mgh$

At $\frac{3}{4}^{th}$ of height

$P.E=mg\left(\frac{3h}{4}\right)$

$P.E=\frac{3mgh}{4}$

$\therefore \frac{K.E}{P.E}=\frac{\frac{mgh}{4}}{\frac{3mgh}{4}}=\frac{1}{3}$.

(10) Given $\frac{P.E}{K.E}=\frac{10}{4}=\frac{5}{2}$

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

$\Rightarrow \frac{2gh}{v^2}=\frac{5}{2}$

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

$\Rightarrow v^2=\frac{2}{5}\times 2\times 10\times 800$

$\Rightarrow v^2=6400$

$\Rightarrow v=80\ m/sec$