WS-15 for 6th class

Teacher

① No of steps = 50

width = 25 cm

Height of each step = 15 cm

Total height the body ascends

$H = n \times h = 50 \times 15 \times 10^{-2}$

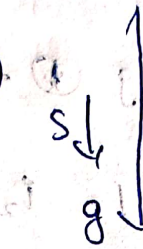
$\Rightarrow 7.5$ m

$W = FS\cos\theta = MgH\cos\theta$

$= 30 \times 10 \times 750 \times 10^{-2} \times \cos 180°$

$= -75 \times 30$

$= 2.25$ KJ

② 

$m = \frac{1}{20}$ gm

$m = \frac{1}{20} \times 10^{-3}$ kg

$W = FS\cos\theta$

$= Mg\, S\cos\theta$

$= \frac{1}{20} \times 10^{-3} \times 10 \times 200 \times 1$

$= \frac{1}{20} \times 2 = 0.1$ J

③ Given $a = \frac{g}{5}$; $S = d$; $\theta = 0$

$W = -FS\cdot\cos\theta$

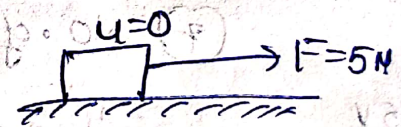
App cha Apparent change in weight $= m(g-a)$

$= m\left(g - \frac{g}{5}\right)$

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

$W = -\frac{4mg}{5}\, d(1)$

$W = \frac{4mgd}{5}$

④ 

$m = 4$ kg ; $t = 20$ sec

From $F = ma$

$\Rightarrow 5 = 4a$

$\Rightarrow a = \frac{5}{4}$ m/sec^2

From $s = ut + \frac{1}{2}at^2$

$s = 0 \times 20 + \frac{1}{2}\left(\frac{5}{4}\right)(20)^2$

$s = 250$ m

$W = FS\cos\theta$

$= 5(250)\cos 0$

$= 1250$ J

$= 1.25$ KJ

(5) Given $\frac{m_1}{m_2} = \frac{2}{4}$; $\frac{s_1}{s_2} = \frac{4}{2}$

$\frac{F_1}{F_2} = \frac{2}{4}$; $\theta_1 = 30°$

$\theta_2 = 60°$

$W = FS\cos\theta$

$\Rightarrow \frac{W_1}{W_2} = \frac{F_1}{F_2}\frac{S_1}{S_2}\frac{\cos\theta_1}{\cos\theta_2}$

$\Rightarrow \frac{W_1}{W_2} = \frac{2}{4} \times \frac{4}{2} \times \frac{\cos 30}{\cos 60}$

$= \frac{\sqrt{3}}{2} \times \frac{2}{1} = \frac{\sqrt{3}}{1}$

$\frac{W_1}{W_2} = 1.732$

(6) Given $= \frac{1}{6^{th}}$ Part of chain is hanging

from table $n = 6$

work done $= \frac{mgL}{2n^2} = \frac{MgL}{2(6)^2} = \frac{mgL}{72}$

(7) Given $m = 10$ kg. ; $W = F \times S$ = Area of graph

$W = Ma \underbrace{S}_{} = M \times \frac{1}{2} b \times h$

$W = 10 \times \frac{1}{2} \times 20 \times 10^{-2} \times 8 \times 10^{-2} = 8 \times 10^{-2}$

$\{ b = 8$ cm; $h = a = 20$ cm/s^2 $\}$

$= 8 \times 10^{-2}$ m $\quad h = 20 \times 10^{-2}$ m/s^2

(8) Here $= \frac{1}{4^{th}}$ Part of chain is hanging

$n = 4^{th}$

work done $= \frac{mgL}{2n^2} = \frac{mgL}{2(4)^2} = \frac{mgL}{32}$

(9) No. of steps $n = 26$

height of each step $= 30$ cm.

$m = 80$ kg

Total height $= n \times h$

$\Rightarrow 26 \times 30$ cm

$= 26 \times 30 \times 10^{-2}$ m

$\theta = 180°$; $W = FS\cos\theta$

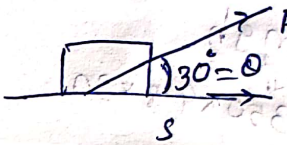
$W = mgH\cos 180°$

$= 80 \times 9.8 \times 26 \times 30 \times 10^{-2} \times (-1)$

$\Rightarrow -6115.20 \times 10^{-2}$

$W = 6115.20$ J.

(10)



$W = FS\cos\theta$

$= 100 \times 10 \times \cos 30$

$\Rightarrow 100 \times 10 \times \frac{\sqrt{3}}{2} \Rightarrow 100 \times 5 \times 1.732$

$\Rightarrow 866.0$ J

(11) Given $u = 0$; $v = 80$ kmph $= 80 \times \frac{5}{18}$; $t = 10$ sec.

$M = 300$ kg.

(i) $a = \frac{v-u}{t}$

$= \frac{80 \times \frac{5}{18} - 0}{10}$

$a = \frac{20}{9} = 2.2$ m/s^2

(ii) $F = Ma$

$= 300 \times 2.2$

$= 660$ N

$S = 2$ km

(iii) $W = FS\cos\theta$ $\quad = 2 \times 10^3$ m

$= 660 \times 2 \times 10^3 \times \cos 0$

$\Rightarrow 132 \times 10^4$ J.

L Table

(1) $F = 30N$; $S = 6m$

$\theta = 0$

$W = FS\cos\theta$

$= 30 \times 6 \times 1$

$= 180J$

(2) $F = 6N$; $S = 25m$

$\theta = 0^\circ$

$W = FS\cos\theta$

$= 6 \times 25 \times \cos 0$

$= 150J$

(3) As the body completes one rotation Initial & Final Position of the body are same so displacement $= 0$

$\therefore W = FS\cos\theta$

$= F(0)\cos\theta = 0$

(4) No. of bags $n = 5$

$m = 70kg$; $h = 30m$

$\therefore$ work done in lifting

$W = mgh$

$= 350 \times 9.8 \times 30$

$= 102.9 kJ$

(5) Given $F = 6N$

$S = 12m$; $\theta = 60^\circ$

$W = FS\cos\theta$

$= 6 \times 12 \times \cos 60$

$= 6 \times 12 \times \frac{1}{2}$

$= 36$

(6) Given $\vec{F} = 5\hat{i} - 3\hat{j} + 2\hat{k}\ N$

$\vec{r_1} = 2\hat{i} + 7\hat{j} + 4\hat{k}$

$\vec{r_2} = 5\hat{i} + 2\hat{j} + 8\hat{k}$ then

$\vec{S} = \vec{r_2} - \vec{r_1}$

$= (5\hat{i} + 2\hat{j} + 8\hat{k}) - (2\hat{i} + 7\hat{j} +$

$= 3\hat{i} - 5\hat{j} + 4\hat{k}$

$W = \vec{F} \cdot \vec{S}$

$= (5\hat{i} - 3\hat{j} + 2\hat{k}) \cdot (3\hat{i} - 5\hat{j} + 4\hat{k}$

$\Rightarrow 5(3) + (-3)(-5) + 2(4)$

$\Rightarrow 15 + 15 + 8 = 38J$

(7) $F = 2\hat{i} + 4\hat{j} + 3\hat{k}\ N$

$S_z = 12m$ $\theta = 0^\circ$

$W_z = F_z S_z \cos\theta$

$= 3 \times 12 \times \cos 0$

$= 36J$

(8) Given $m = 30kg$

$u = 0$; $F = 6N$; $t = 3s$

$F = ma$

$\Rightarrow a = \frac{F}{m} = \frac{6}{30} \Rightarrow \frac{1}{5} m/s^2$

From $S = ut + \frac{1}{2}at^2$

$\Rightarrow S = 0 \times 3 + \frac{1}{2}(\frac{1}{5})3^2$

$\Rightarrow S = \frac{9}{10}$

$\Rightarrow W = F \cdot S = 6 \times \frac{9}{10}$

$= \frac{27}{5} J$

(9) Given $F = 100N$; $S = 4m$; $\theta =$

$W = FS\cos\theta$

$\Rightarrow 200 = 100 \times 4\cos\theta$

$\Rightarrow \cos\theta = \frac{1}{2}$

$\Rightarrow \theta = 60^\circ$

(10) Given

$\vec{F} = 6\hat{i} - 8\hat{j}\ N$

$\vec{S} = 6\hat{i} + 8\hat{j}\ m$

$W = \vec{F} \cdot \vec{S}$

$\Rightarrow (6\hat{i} - 8\hat{j}) \cdot (6\hat{i} + 8\hat{j})$

$\Rightarrow 6 \times 6 + (-8)(8)$

$\Rightarrow 36 - 64$

$= -28J$

Advanced 8, 9, 10

Given $M = 3kg$, $l = 1m$; $F = 9N$

(8) $W_H = FS_H$

$= 9 \times 1$

$= 9J$

(9) $W_V = mgh$

$= 3 \times 10 \times 2$

$= 60J$

(10) $W_T = W_H + W_V$

$= 9 + 60$

$= 69J$