$\Rightarrow L = 4872\ J/k$

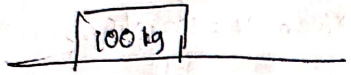
WS-16 for 7th class

Task-1

① $m = 100\ kg$

$\mu = 0.5;\ u = 0$

$v = 10\ m/sec.$



$a = \mu g = 0.5 \times 10$

$= 5$

From $v^2 - u^2 = 2as$

$\Rightarrow s = \frac{v^2}{2a} = 10\ m$

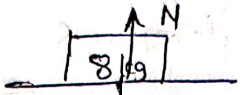
$w = fs$

$= \mu mg\ s$

$= 0.5 \times 100 \times 9.8 \times 10$

$\Rightarrow 4.9 \times 10^3\ J$

② $F = 4\sqrt{3}\ kg\ wt$



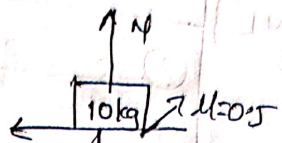
$N = Mg$

$f = \mu N$

$\Rightarrow 4\sqrt{3}\ g = \mu \times 8g$

$\Rightarrow \mu = \frac{\sqrt{3}}{2} = \frac{2}{}$

③



$f_s = \mu_s N$

$= 0.5 \times 10 \times 10$

$f_s = 50\ N.$

$F_{app} < f_s$

since static friction is self adjusting

$f_s = F_{app} = 4\mu$

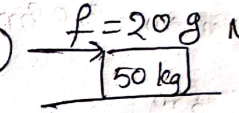
④ $\tan\theta = \frac{N}{f}$

$\Rightarrow \tan\theta = \frac{10}{\frac{10}{\sqrt{3}}}$

$\Rightarrow \tan\theta = \sqrt{3}$

$\Rightarrow \theta = 60^\circ$

⑤



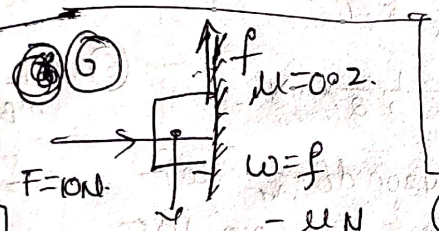
$f = 20g$

$\Rightarrow \mu Mg = 20\ g$

$\Rightarrow \mu \times 5g = 2g$

$\Rightarrow \mu = 0.4$

⑥



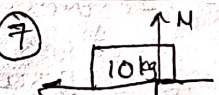
$w = f$

$= \mu N$

$= 0.2 \times 10$

$= 2\ N.$

⑦



$f_s = \mu_s mg$

$= 0.6 \times 10 \times 10$

$\mu_s = 0.6$

$\mu_k = 0.4$

$\Rightarrow f_s = 60\ N$

$F_{app} < f_s$

$\therefore f_s = F_{app} = 45\ N$

a = -ve

(8) $u = 6\,m/s \longrightarrow v = 0$, $s = 9\,m$

From $v^2 - u^2 = 2as$

$\Rightarrow 0^2 - 6^2 = 2(-a) \times 9$

$\Rightarrow -36 = -18a$

$\Rightarrow a = 2\,m/sec^2$

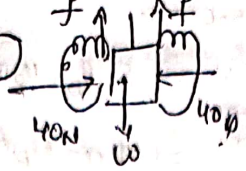
$\therefore F_{net} = f$

$\Rightarrow ma = \mu mg$

$\Rightarrow 2 = \mu \times 10$

$\Rightarrow \mu = 0.2$

(9)



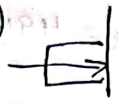
$f_1 + f_2 = \mu N + \mu N$

$\Rightarrow 2\mu N = W$

$\Rightarrow 2\mu \times 40 = 20$

$\Rightarrow \mu = \frac{1}{4} = 0.25$

(10)



$W = 1.5\,N$

$\mu = 0.7$

$f = \mu N$

$= 0.7 \times 6 = 4.2\,N$

$\text{down force} = f + 1.5$

$= 4.2 + 1.5 = 5.7\,N$

(18) $f = \mu N$.

$\Rightarrow f = 0.4 \times 2000$

$\Rightarrow f_L = 800\,N$

(19) $P = 52\,N$

$P = f_s$

$\Rightarrow 52 = \mu N$

$\Rightarrow 52 = \mu(200)$

$\Rightarrow \mu = 0.26$

$N = mg$

(20) (i) $f_s = \mu N$

$= 20 \times 2 \times 50$

$= 10\,N$

$F_{app} = 5\,N < f_s$

$\therefore f_s = 5\,N.$

(ii) $F = 25\,N$

$F_{app} > \text{friction}$

friction $= 10\,N$.

(iii) $F_{app} = 50\,N$

$F_{app} > \text{friction}$

friction $= 10\,N$

Body is in motion

Task

(1) $m = 4\,kg$

$\mu = 0.8$

$a = 15\,m/s^2$

$N = ma$

$= 4 \times 15 = 60$

$f = \mu N = 0.8 \times 60$

$= 48\,N$

(2) Contact force

$R = \sqrt{f^2 + N^2}$

Given $R = \sqrt{2} f$

$\Rightarrow \sqrt{2} f = \sqrt{f^2 + N^2}$

S.O.B.S

$\Rightarrow 2f^2 = f^2 + N^2$

$\Rightarrow f^2 = N^2$

$\Rightarrow f = N$

$\Rightarrow \mu = 1$

(3) $N = mg \Rightarrow 1 \times 10 = 10$

Given $\mu = 0.6$

$m = 1\,kg$

$a = 5\,m/s^2$

From $f = \mu N$

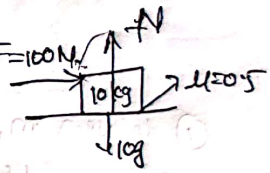
$\Rightarrow f = 0.6 \times 10$

$\Rightarrow f = 6\,N$

(If we take $g = 9.8$)

$\therefore f = 5.88\,N$

(4)



$\therefore f = \mu N = 0.5 \times 10 \times g$

$\Rightarrow f = 50\,N$

$\therefore F_{net} = F_{app} - f$

$\Rightarrow ma = 100 - 50$

$\Rightarrow 10a = 50$

$\Rightarrow a = 5\,m/s^2$

(5) Given $u = 20\,m/s$

$v = 0$; $\mu = 0.5$

$\Rightarrow F_{net} = f$

$\Rightarrow ma = \mu mg$

$\Rightarrow a = \mu g$

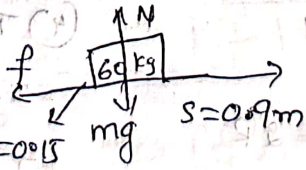
$\therefore v^2 - u^2 = 2as$

$\Rightarrow 0^2 - (20)^2 = -2\mu g s$

$\Rightarrow +400 = +2 \times 0.5 \times 10 s$

$\Rightarrow 400 = 10s \Rightarrow s = 10\,m$

(6)



$\mu = 0.15$

$\therefore f = \mu N$

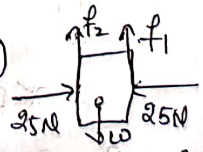
$\Rightarrow f = \mu mg$

$= 0.15 \times 60 \times 9.8$

$W = 0.15 \times 60 \times 9.8 \times 0.9$

$= 79.4\,J$

(7)



$W = f_1 + f_2$

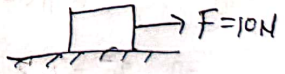
$\Rightarrow 10 = \mu N_1 + \mu N_2$

$\Rightarrow 10 = \mu(N_1 + N_2)$

$\mu = \frac{10}{50} = \frac{1}{5}$

$\mu = 0.2$

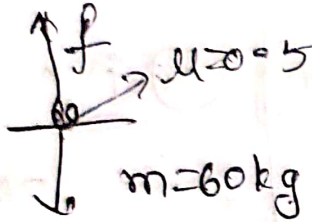
(8)



$F' = 5\,N < F_{min}$

$\therefore$ friction

$f' = F' = 5\,N$

(9) 

$W = Mg$

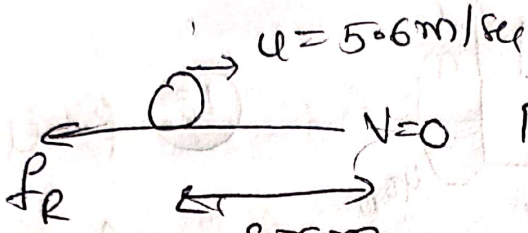
$\Rightarrow N = F_{min}$

$\Rightarrow f = W$

$\Rightarrow \mu N = Mg$

$\Rightarrow \frac{1}{2} N = 60 \times 10$

$\Rightarrow N = 1200\,N.$

(17) 

$F = f_R = \mu_R mg$

$\Rightarrow ma = \mu_R mg$

$\Rightarrow a = \mu_R g$

$S = \frac{u^2}{2\mu_R g}$

$\Rightarrow S = \frac{(5.6)^2}{2 \times \mu_R \times 9.8}$

$\Rightarrow \mu_R = \frac{(5.6)^2}{2 \times 8 \times 9.8}$

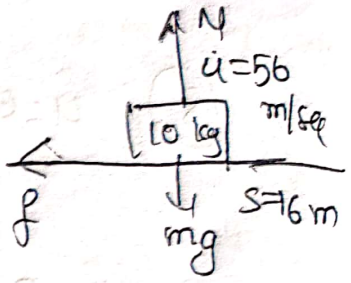
$= 2 \times 0.1$

$\mu_R = 0.2$

(18) $F_{neb} = \mu N$

$ma = \mu mg$

$\Rightarrow a = \mu g$

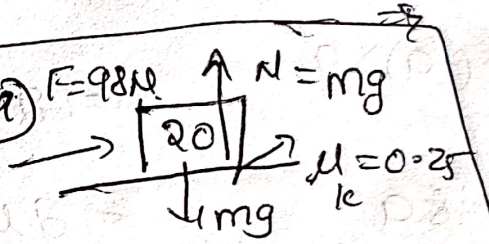


$W = fS$

$= \mu mg S$

$20.5 \times 10 \times 10 \times 16$

$= 80\,N$

(19) 

$f_k = \mu_k N$

$= 0.25 \times 20 \times 9.8$

$f_k = 49\,N$

(20) $F_{neb} = F_{app} - f_k$

$\Rightarrow ma = 98 - 49$

$\Rightarrow 20a = 49$

$\Rightarrow a = \frac{49}{20}$

$\Rightarrow a = 2.45\,m/s^2$