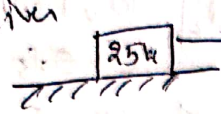
WS-17 for 8th class

T.Task

(1) Given



F = 122.5 N

$\mu = ?$

$\Rightarrow$ By applying 122.5 N of force the block just begin to move

$f = F$

$\Rightarrow \mu mg = 122.5$

$\Rightarrow \mu \times 25 \times 10 = 122.5$

$\Rightarrow \mu = 0.5$

(2) $u = 15\,m/s \longrightarrow v = 0$

$s = 25\,m \quad [a = \mu g]$

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

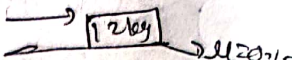
$\Rightarrow 0^2 - 15^2 = 2(\mu g)s$

$\Rightarrow -15^2 = 2 \times \mu \times 10 \times 25$

$\Rightarrow -15 \times 15 = \mu \times 500$

$\Rightarrow \mu = \frac{-225}{500} = 0.45$

(3) F = 5 N



12 kg, $\mu = 0.15$

static friction

$f_s = \mu_s mg$

$f_s = 0.15 \times 12 \times 10$

$f_s = 18\,N$

$F \le f_s$ then $f_s = F$

Because static friction is self adjusting force so $f_s = 5\,N$

(4) Given $\mu = 0.24$

If Applied force $F \le f_s$

$\Rightarrow ma < \mu_s mg$

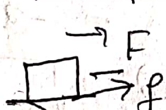
$\Rightarrow a < \mu_s g$

$\Rightarrow a < 0.24 \times 10$

$\Rightarrow a < 2.4$

(5) Given $u = 4.9\,m/s$

$\mu = 0.07$, $s = ?$ $v = 0$



$\Rightarrow$ For the suitcase to move the minimum force $F = f$

$\Rightarrow ma = m\mu g$

$\Rightarrow a = \mu g$

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

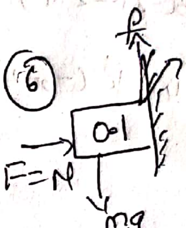
$\Rightarrow 0^2 - u^2 = 2\mu g s$

$\Rightarrow s = -\frac{u^2}{2\mu g}$

$\Rightarrow s = \frac{(4.9)^2}{2 \times 9.8 \times 0.7}$

$\Rightarrow s = \frac{7}{4} = 1.75\,m$

(6)



$\mu = 0.5$

0.1

F = N

mg

$F = 5N$

$W = mg$

$= 0.1 \times 9.8$

$W = 0.98\,N$

$\therefore f = \mu N$

$\Rightarrow f = 0.5 \times 5$

$\Rightarrow f = 2.5\,N$

$f > W$

$\therefore f = W = 0.98$

f self adjusting force

(8) $u = 14\,m/s \longrightarrow v = 0$

$s = 40\,m$

$f = \mu mg$

$\Rightarrow ma = m\mu g$

$\Rightarrow a = \mu g$

$= 9.8\mu$

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

$\Rightarrow 0^2 - 14^2 = 2 \times 9.8\mu \times 40$

$\Rightarrow -14^2 = \mu(2 \times 98 \times 4)$

$\Rightarrow \mu = \frac{14^2}{2 \times 98 \times 4}$

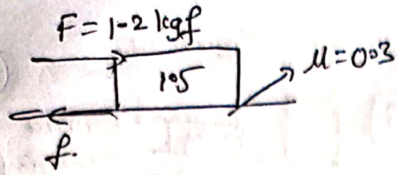
$\Rightarrow \mu = \frac{1}{4}$

(9) $u = 6\,m/s$, $\mu = 0.3$

$s = \frac{u^2}{2\mu g} = \frac{6^2}{2 \times 0.3 \times 10}$

$s = \frac{36}{6} = 6\,m$

(7)



frictional force = μmg

$\Rightarrow f = 0.3 \times 1.5 \times g$

$\Rightarrow f = 0.45g$

Applyied force $F = 1.2g$ N

$F > f$.

$F_{net} = F - f$

$\Rightarrow ma = 1.2g - 0.45g$

$\Rightarrow 1.5a = \cancel{0.75}\, g$

$\Rightarrow a = \frac{g}{2} = \frac{9.8}{2}$

$\Rightarrow a = 4.9\ m/s^2$

(10) Given $P = 0.98$ kW

$= 0.98 \times 10^3$ W

$P = \frac{W}{t} = \frac{Fs}{t}$

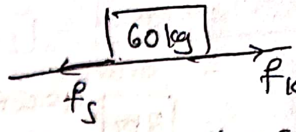
$\Rightarrow 0.98 \times 10^3 = \frac{\mu mgs}{t}$

$\Rightarrow t = \frac{\mu mgs}{0.98 \times 10^3}$

$\Rightarrow t = \frac{0.3 \times 100 \times \cancel{10} \times 4}{98 \times \cancel{10}}$

$\Rightarrow t = 1.2$ sec

(16)



$\mu_s = 0.5$; $\mu_k = 0.4$

$F_{net} = f_s - f_k$

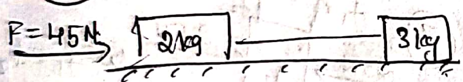
$\Rightarrow ma = \mu_k mg - \mu_s mg$

$\Rightarrow a = (\mu_k - \mu_s)g$

$\Rightarrow a = 9.8(0.5 - 0.4)$

$\Rightarrow a = 0.98\ m/s^2$

(17) $f = \mu N$; $N = mg$.



$f_1 = \mu m_A g$ $\quad$ $f_2 = \mu m_B g$

$\Rightarrow F_{net} = F - (f_1 + f_2)$

$\Rightarrow m_T a = 45 - (\mu 2g + \mu 3g)$

$\Rightarrow 5a = 45 - 5\mu g$

$\Rightarrow 5a = 45 - 5 \times 0.1 \times 10$

$\Rightarrow 5a = 45 - 5$

$\Rightarrow a = 8\ m/s^2$

(18) From fig : $\mu = 0.15$

$F = f_T + R$

$\Rightarrow R = F - f_T$

$f_T = \mu(m_A + m_B)g$

$= 0.15(5+10)9.8$

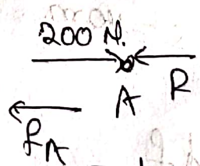
$= 0.15 \times 15 \times 9.8$

$= 22.05$

$\Rightarrow R = 200 - 22.05$

$\Rightarrow R = 177.95$ N

(19) Take FBD for A



$F_{net} = 0$

$\Rightarrow (200 - (R + f_A)) = 0$

$\Rightarrow 200 = R + f_A$

$\Rightarrow R = 200 - f_A$

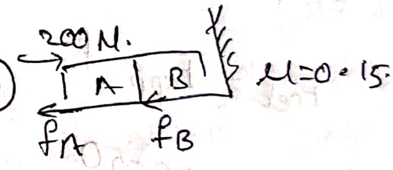
$\Rightarrow R = 200 - \mu mg$

$= 200 - 0.15 \times 5 \times 9.8$

$= 200 - 7.35$

$= 192.65$ N

(20)



$F_{net} = 200 - (f_A + f_B)$

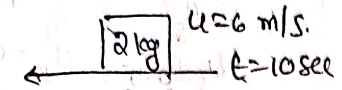
$\Rightarrow Ma = 200 - \mu(m_A + m_B)g$

$\Rightarrow 15a = 200 - 0.15 \times 9.8 \times 15$

$\Rightarrow a = \frac{192.65}{15} = 12.8$

L Task

(1)



F_{net} = friction $V=0$

$\Rightarrow ma = \mu mg$

$\Rightarrow a = -\mu g$

From $V = u + at$

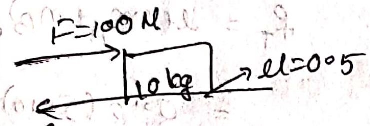
$\Rightarrow 0 = u - \mu g t$

$\Rightarrow u = \mu g t$

$\Rightarrow 6 = \mu \times 10 \times 10$

$\Rightarrow \mu = 0.06$

(4)



$f = 0.5 \times 10 \times 10$

$\Rightarrow f = 50\,N$

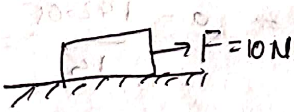
$F_{net} = F_{app} - f$

$ma = 100 - 50$

$\Rightarrow 10a = 50$

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

(8)



$F_{applied} = 5N.$

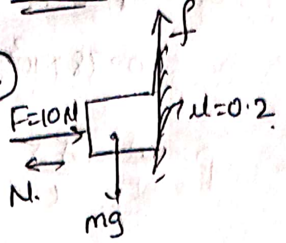
The min force required to Pull the body is $F_{min} = 10N$

$\therefore F_{applied} < F_{min}$ [This is static frictional force]

Since static friction is self adjusting force

$f_s = F_{applied} = 5N$

(2)



$N = 10\,N$

$f = \mu N$

$f = 0.2 \times 10$

$= 2\,N.$

static friction is

$\therefore w = f$ [self adjusting]

$w = 2N$

(5) $u = 20\,m/s;\ V=0$

$\mu = 0.5\quad S = ?$

frictional force $= \mu mg$

$ma = \mu mg$

$\Rightarrow a = \mu g = 0.5 \times 10 = 5$

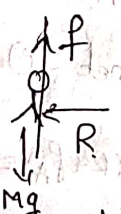
$\therefore$ From $v^2 - u^2 = 2as$

$\Rightarrow 0^2 - (20)^2 = 2(-5)s$

$\Rightarrow -400 = -10s$

$\Rightarrow s = 40m.$

(9)



$\mu = 0.5$

$M = 60\ kg$

$N = F_{min}$

$f = W$

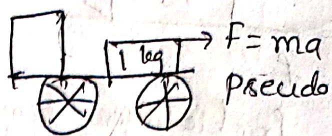
$\Rightarrow \mu N = Mg$

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

$\Rightarrow \frac{N}{2} = 600$

$\Rightarrow N = 1200N$

(3)



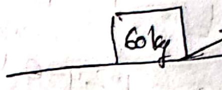
$\mu = 0.6\quad a = 5\ m/s^2.$

$\therefore f = \mu mg\qquad F_{app} = ma = 1 \times 5$

$= 0.6 \times 1 \times 10\qquad = 1 \times 5$

$f = 6N\qquad = 5N$

(6)



$S = 0.9\,m$

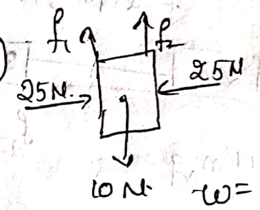
W = force × displacement

$W = \mu mg\,S$

$= 0.15 \times 60 \times 10 \times 0.9$

$= 79.45$

(7)



$w = f_1 + f_2$

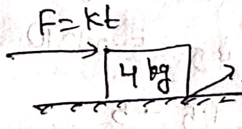
$w = \mu N_1 + \mu N_2$

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

$\Rightarrow 10 = \mu(25 + 25)$

$\Rightarrow \mu = \frac{1}{5} = 0.2$

(15) $F = kt$



$f = \mu mg = 0.2 \times 4 \times 10$

$f_s = 8\,N.$

$F = kt$

$= 2 \times 5$

$F = 10$

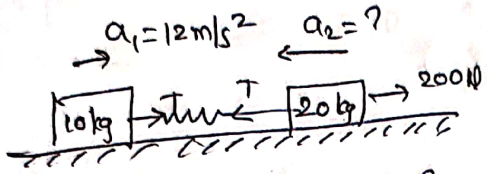
$F > f$

$\therefore f = 8N.$

Suppose if $F < f$

$f = F$ Because static friction is self adjusting force.

(16)



FBD for A

$f_A \leftarrow A \rightarrow T$

$F = T - f_A$

$\Rightarrow ma_1 = T - \mu mg$

$\Rightarrow 10 \times 12 = T - 0.1 \times 10 \times 10$

$\Rightarrow T = 130 N.$

FBD for B

$T \quad f_B \leftarrow B \rightarrow 200$

$F_{net} = 200 - (T + f)$

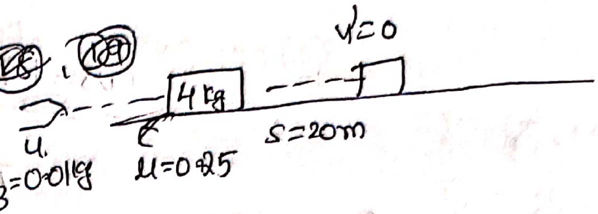
$\Rightarrow m_B a_2 = 200 - (130 + 0.1 \times 20 \times 10)$

$\Rightarrow 20 a_2 = 200 - (130 + 20)$

$\Rightarrow 20 a_2 = 200 - 150$

$\Rightarrow a_2 = 2.5 m/s^2$

(17),



$f_s = \mu mg$

Normal reaction $N = (m + M)g$

$= (0.01 + 4) \times 9.8$

$= 4.01 \times 9.8$

$= 39.29 N$

(18) $f_k = \mu_k N$

$= \frac{1}{4} \times 39.29$

$= 9.825 N.$

(19) $s = 20 m$; $v' = 0$

Initial velocity, $u = v$.

$a = -\mu g = -\frac{1}{4} \times 9.8$

$a \simeq -2.5 m/s^2$

The body is in retardation.

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

$\Rightarrow v'^2 - v^2 = 2(-2.5)(20)$

$\Rightarrow -v^2 = -100$

$\Rightarrow v = 10 m/sec.$

According to law of conservation of linear momentum

$P_{Before} = P_{After}$

$mu + Mu' = (m + M)v$

$\Rightarrow 0.01u + 4(0) = (0.01 + 4) \times 10$

$\Rightarrow 0.01 u = 4.01 \times 10$

$\Rightarrow u = 4010 m/sec$