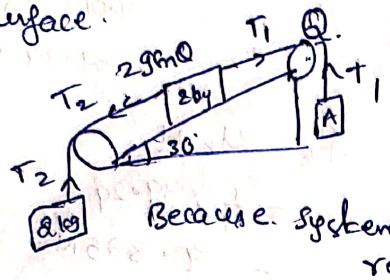
WS-18 for class 8

Task

① From fig.

FBD for 2 kg on inclined surface.

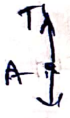


Because system is at rest

$\therefore T_1 = T_2 + 2gm\,30$

$\Rightarrow T_1 = 2g + 2g\left(\frac{1}{2}\right)$

$\Rightarrow T_1 = 3g$.

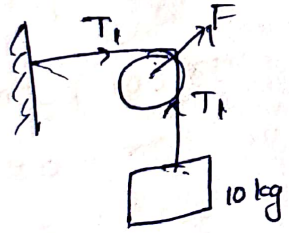


$T_1 = m_A g$

$\Rightarrow 3g = m_A g$

$\Rightarrow m_A = 3\,kg$

③



$T_1 = 10g$

$F_1 = F_2 = T_1$.

$F_R = \sqrt{F_1^2 + F_2^2 + 2F_1F_2\cos\theta}$

$= \sqrt{T_1^2 + T_1^2 + 2T_1T_1\cos 90^\circ}$

$= \sqrt{T_1^2 + T_1^2} = \sqrt{2}\,T_1$.

$F_R = 10g\sqrt{2} = 100\sqrt{2}\,N$

④ ② Force on Q $F_1 = F_2 = T_1$

$F_Q = \sqrt{F_1^2 + F_2^2 + 2F_1F_2\cos\theta}$

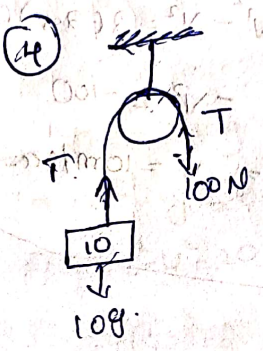
$= \sqrt{T_1^2 + T_1^2 + 2T_1T_2\cos 60^\circ}$

$= \sqrt{2T_1^2 + 2T_1^2\left(\frac{1}{2}\right)}$

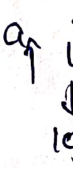
$= \sqrt{3}\,T_1 = \sqrt{3}(3g)$

$= 30\sqrt{3}\,N$

⑭



FBD for 10 kg mass



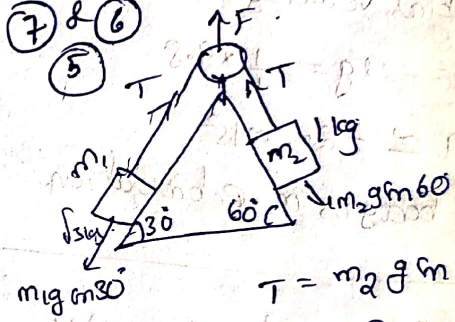
$\Rightarrow F_{net} = T - 10g$

$\Rightarrow ma = 100 - 10\times 9.8$

$\Rightarrow 10a = 100 - 98$

$\Rightarrow a = \frac{2}{10} = 0.2\,m/s^2$

⑦ & ⑥ ⑤



$T = m_2 g\,cos\,60$

$T = \frac{\sqrt{3}}{2} g$.

$F_{net} = 0 \Rightarrow a = 0$

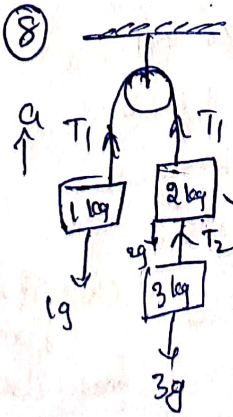
$F_R = \sqrt{F_1^2 + F_2^2 + 2F_1F_2\cos\theta}$

$F_R = \sqrt{T^2 + T^2}$

$= \sqrt{2}\,T = \sqrt{2}\,\frac{\sqrt{3}}{\sqrt{2}}\,g$

$F_R = \sqrt{3}\,g$

⑧



Force on Right side

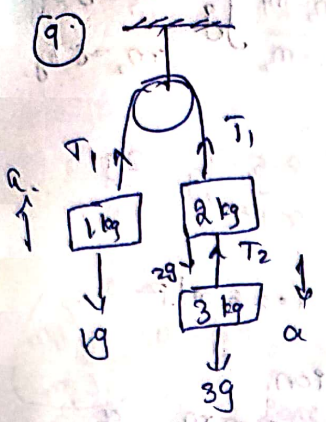
$F_R = 2g + 3g = 5g$

Force on left

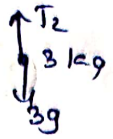
$F_L = 1g$

$F_{net} = F_R - F_L = 5g - 1g = 4g$

(9)

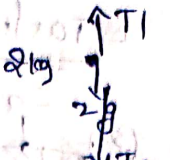


For FBD



$F = 3g - T_2$

$\Rightarrow 3a = 3g - T_2 \rightarrow (1)$



$F = 2g + T_2 - T_1$

$\Rightarrow 2a = 2g + T_2 - T_1 \rightarrow (2)$

For FBD

$\Rightarrow F = T_1 - g$

$a = T_1 - g \rightarrow (3)$

(1) + (2) + (3)

$3a + 2a + a = 3g - T_2 + T_2 + 2g - T_1 + T_1 - g$

$\Rightarrow 6a = 4g$

$\Rightarrow a = \frac{2g}{3}$.

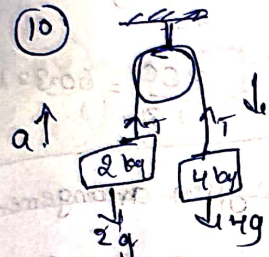
From (3) $a = T_1 - g$

$\Rightarrow T_1 = a + g = \frac{5g}{3}$

From (2)

$\Rightarrow T_2 = 10\,N$

(10)

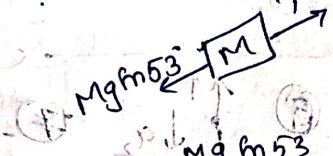


$a = \frac{(m_2 - m_1)g}{m_1 + m_2}$

$a = \frac{(4-2)g}{4+2}$

$a = \frac{g}{3}$

(13) FBD for M

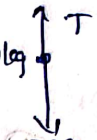


$T = Mg\sin 53$

$T = 100 \times 10 \times \frac{4}{5}$

$T = 800\,N$

For



$F_{net} = T - 50g$

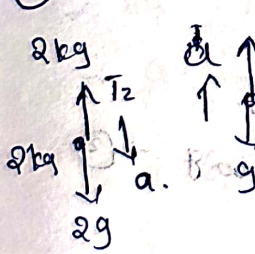
$\Rightarrow 50a = T - 500$

$\Rightarrow 50a = 800 - 500$

$\Rightarrow 50a = 300$

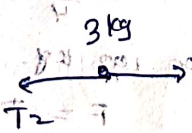
$\Rightarrow a = 6\,m/s^2$

(14) FBD For



$F = 2g - T_2$

$\Rightarrow 2a = 2g - T_2 \rightarrow (2)$



$F = T_2 - T_1$

$a = T_1 - g \rightarrow (2)$

$3a = T_2 - T_1 \rightarrow (3)$

(1) + (2) + (3)

$a + 2a + 3a = T_1 - g + 2g + T_2 + T_2 - T_1$

$\Rightarrow 6a = g \Rightarrow a = \frac{g}{6}\,m/s^2$.

From (3) $2\left(\frac{g}{6}\right) = 2g - T_2$

$\Rightarrow \frac{g}{3} = 2g - T_2 \Rightarrow T_2 = \frac{5g}{3}$.

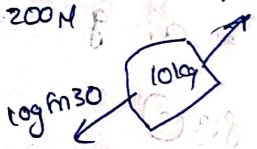
From (3)

$3\frac{g}{6} = \frac{5g}{3} - T_1$.

$\Rightarrow T_1 = \frac{5g}{3} - \frac{3g}{6}$

$T_1 = \frac{7g}{6}$

(15) $T = 200\,N$



$F = 10g\sin 30 + 10$

$= 10 \times g \times \frac{1}{2} + 10 = 60\,N$

$F_{net} = T - (10g\sin 30 + 10)$

$\Rightarrow 10a = 200 - 60$

$\Rightarrow 10a = 140 \Rightarrow a = 14\,m/s^2$

$F_R = \sqrt{F_1^2 + F_2^2 + 2F_1F_2\cos\theta}$.

$= \sqrt{T^2 + T^2} = \sqrt{2}\,T = 200\sqrt{2}\,N$

L Table

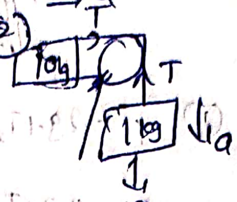
① For given arrangement

$$a = \frac{(m_2 - m_1)}{m_1 + m_2} g$$

$$a = \frac{(10-1)}{10+1} g$$

$$\Rightarrow a = \frac{9g}{11}$$

② $\rightarrow a$



T ↑ 1kg ↓ g

$F_1 = g - T$

$a = g - T \rightarrow ①$

$F_{10} = T \Rightarrow 10a = T \rightarrow ②$

①+②

$\Rightarrow a + 10a = g - T + T$

$\Rightarrow 11a = g$

$\Rightarrow a = \frac{g}{11}$

③ + ④

$$a = \left[\frac{m_2 - m_1}{m_1 + m_2}\right] g \qquad m_1 = 5\,kg,\ m_2 = 8\,kg.$$

$$\Rightarrow a = \left[\frac{8-5}{8+5}\right] g = \frac{3g}{11}$$

$a = 2.26\,m/s^2$

Tension.

$$T = \frac{2 m_1 m_2}{m_1 + m_2} g$$

$$T = \frac{2 \times 8 \times 5}{8+5} \times 10$$

$$T = \frac{800}{13} = 60.32\,N$$

⑤

From First fig.

$T = F = 2mg$

a_1 ↑ T, m, ↓ mg

$\Rightarrow m a_1 = T - mg$

$\Rightarrow m a_1 = 2mg - mg$

$\Rightarrow a_1 = g$

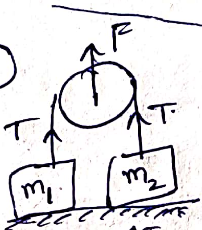
For fig ②

$$a_2 = \left(\frac{m_2 - m_1}{m_1 + m_2}\right) g = \frac{2m - m}{2m + m} g$$

$$a_2 = \frac{g}{3}$$

$$a_1 \sim a_2 = g \sim \frac{g}{3} = \frac{2g}{3}$$

⑥



For m_1: ↑T, m_1 ↑a_1, ↓$m_1 g$

$F_1 = T - m_1 g$

$\Rightarrow m_1 a = 250 - 5 \times 9.8$

$\Rightarrow 5 a_1 = 201$

$\Rightarrow a_1 = 40.2\,m/s^2$

↑T, ↓a_2, ↓$m_2 g$

$\Rightarrow F_2 = T - m_2 g$

$\Rightarrow m_2 a_2 = 250 - 10 \times 9.8$

$\Rightarrow a_2 = 14.8\,m/s^2$

~~⑦ For given arrangement~~

~~$a = \frac{(m_2 - m_1)}{m_1 + m_2} g$~~

~~$a = \left[\frac{100-60}{100+60}\right] g$~~

~~$a =$~~

⑦ For given arrangement

$a_{mr} = a \Rightarrow a_r - a_m = a.$

$a_r = \frac{5g}{4}$

For 60 kg

$\Rightarrow F = T - 60g$

$\Rightarrow 60(a_r - a) = T - 60g \rightarrow ①$

For 100 kg.

$F = T - 100g.$

$\Rightarrow 100a = T - 100g \rightarrow ②$

① ②

$\Rightarrow 75g - 40g = 160a$

$\Rightarrow a = \frac{35}{16}\,m/sec^2$

From ② $100 \times \frac{35}{16} = T - 100 \times 9.8$

$\Rightarrow 218.75 = T - 980$

$\Rightarrow T = 1218\,N.$

⑧ Force on block $= T$

$\Rightarrow 2a = 2$

$\Rightarrow a = 1\,m/s^2$

From fig

$2T = F$

$\Rightarrow 2T = 4$

$\Rightarrow T = 2N$

⑨ $a = \left(\frac{m_2 - m_1}{m_1 + m_2}\right) g$

$$a = \left[\frac{10-5}{10+5}\right] g$$

$$a = \frac{g}{3}$$

⑩ Force on 4 kg $= T$

$\Rightarrow T = 4a \rightarrow ①$

Force on 5 kg

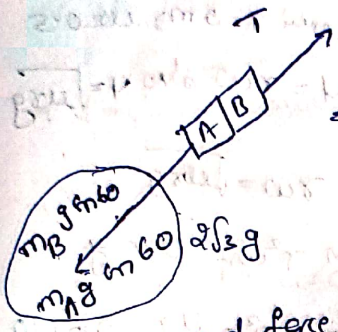
$\Rightarrow 5a = 5g - T$

$\Rightarrow 5a = 5g - 4a.$

$\Rightarrow 9a = 5g$

$\Rightarrow a = \frac{5g}{9} = 5.45\,m/s^2$

(13) FBD For AB



Net downward force

$\Rightarrow (m_A + m_B) g \sin 60$

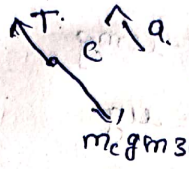
$\Rightarrow 4g\frac{\sqrt{3}}{2} = 2g\sqrt{3}$

F on AB

$F_{AB} = 2\sqrt{3}g - T$

$\Rightarrow 4a = 2\sqrt{3}g - T \rightarrow (1)$

For C



$F_C = T - g$

$\Rightarrow 2a - T - g \rightarrow (2)$

(1) + (2)

$\Rightarrow 4a + 2a = 2\sqrt{3}g - T + T - g$

$\Rightarrow 6a = 2\sqrt{3}g - g$

$\Rightarrow a = 4.01 m/s^2$.

From (2)

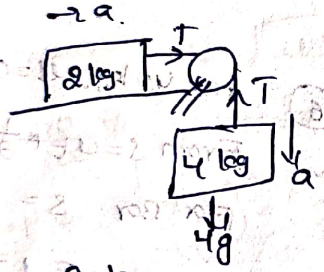
$T = 2a + g$

$= 2(4.01) + 9.8$

$= 8.02 + 9.8$

$= 18 N$

(14)



Force on 2kg

$\Rightarrow F = T$

$\Rightarrow T = 2a \rightarrow (1)$

Force on 4kg.

$\Rightarrow F = 4g - T$

$\Rightarrow 4a = 4g - 2a$

$\Rightarrow 6a = 4g$

$\Rightarrow a = \frac{2g}{6} = \frac{g}{3}$

$\Rightarrow a = 6.54 m/s^2$

$T = 2a$

$= 2 \times 6.54$

$T = 13 N.$

(15) Force on 60kg

$F = T$

$\Rightarrow 60a = T \rightarrow (1)$

Force on 10kg $= 10g - T$

$\Rightarrow 10a = 10g - T \rightarrow (2)$

From (1) + (2)

$\Rightarrow 10a + 60a = 10 \times 9.8$

$\Rightarrow 70a = 98$

$a = 1.04 m/s^2$.

$T = 60a = 60 \times 1.04$

$= 85.7 N.$