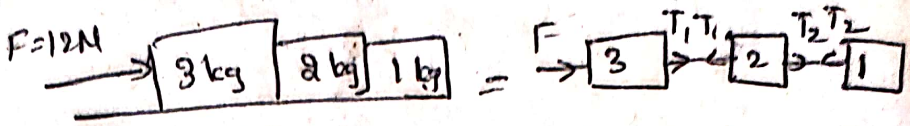
ws-18 · connecting bodies foundation + Track

(1)




Net acceleration $a = \frac{F}{m_1+m_2+m_3}$

$= \frac{12}{3+2+1} = \frac{12}{6} = 2 m/s^2$

The contact force b/w 2 kg and 1 kg is

$T_2 = m_1 a$

$= 1 \times 2 = 2N \rightarrow C$

(2)

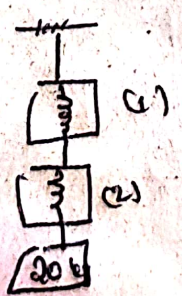
Here both 50 N, 120 N are acting in opposite directions

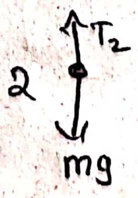
Net force $= 120 - 50 = 70N$

Acceleration $a = \frac{F}{m_1+m_2+m_3} = \frac{70}{2+4+1} = 10 m/s^2$

$\rightarrow B$

(3)



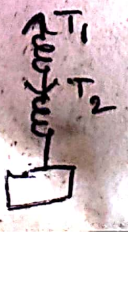




$T_2 - mg = 0$

$T_2 = mg = 20 \times 10 = 200 N$

(or) 20 kg

(1)




under equilibrium $T_2 - T_1 = m_2 a = 0$

$T_1 = T_2 = 200 N$

(or) 20 kg

$\rightarrow$ (A)

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(4)

From fig. acceleration $a = \frac{T_3}{m_1+m_2+m_3}$

$$a = \frac{40}{10+6+4} = \frac{40}{20} = 2\ m/s^2$$

For $m_3$ :- Free body diagram


$\Rightarrow T_3 - T_2 = m_3 a$

$\Rightarrow 40 - T_2 = 4 \times 2$

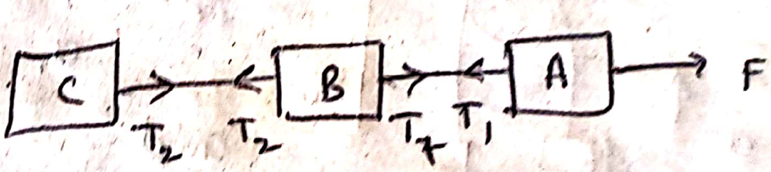
$\Rightarrow 40 - T_2 = 8 \Rightarrow T_2 = 40 - 8 = 32N \rightarrow C$

(5)

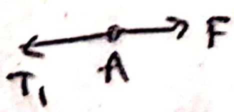
Net acceleration $a = \frac{F}{m_A+m_B+m_C}$

Given $m_A = m_B = m_C = m$ [let it be]

$$\therefore a = \frac{F}{m+m+m} = \frac{F}{3m}$$




For A :- Free body diagram




Net force $F - T_1 = m_A a$

$\Rightarrow F - T_1 = m \times \frac{F}{3m}$

$\Rightarrow F - T_1 = \frac{F}{3}$

$\Rightarrow T_1 = \frac{2F}{3}$

For :- c Free body diagram

$\overset{\bullet}{c} \longrightarrow T_2$

Net force on $c = T_2 = m_c a$

$$T_2 = m \frac{F}{3m} = \frac{F}{3}$$

$$\therefore \frac{T_1}{T_2} = \frac{\frac{2F}{3}}{\frac{F}{3}} = \frac{2}{1} \rightarrow B$$

(6)

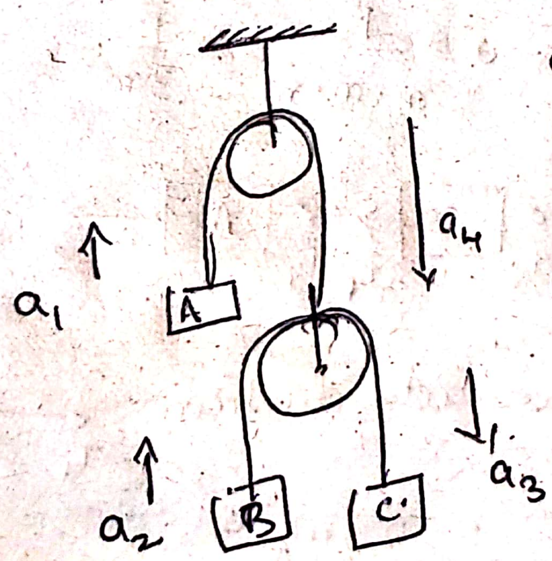
Given $m_1 = 30\ gm$; $m_2 = 40\ gm$

$\therefore$ acceleration of system $= \left(\frac{m_2 - m_1}{m_2 + m_1}\right) g$

$$= \left[\frac{40-30}{40+30}\right] 10$$

$$= \frac{10}{70} \times 10 = \frac{10}{7}\ m/s^2 \rightarrow A$$

(7)




$a_1$ & $a_4$ are opposite and equal

$a_1 = -a_4$.

and

$a_3 - a_4 + a_2 - a_4 = 0$

$\Rightarrow a_2 + a_3 - 2a_4 = 0$

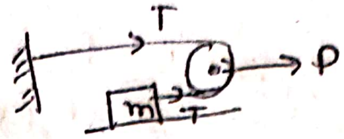
$\Rightarrow 4 + 6 - 2a_4 = 0$

$\Rightarrow a_4 = 1\ m/s^2$

Since $a_1 = -a_4$

$a_1 = -1\ m/s^2 \rightarrow D$

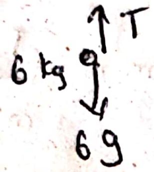
(8) From fig $F = ma$




$P = 2T$ $\qquad$ $T = ma$

$a = f_{net} = \frac{T}{m} = \frac{P}{2m} \rightarrow$ A

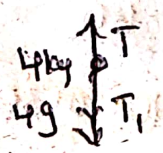
(9). The given arrangement is at rest.




Net force on 6 kg $= 0$

$\therefore T = 6g$.

For 4 kg



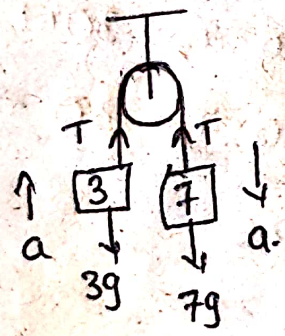

Net force $= 0$

$T = T_1 + 4g$

$\Rightarrow 6g = T_1 + 4g$

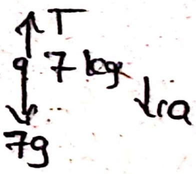
$\Rightarrow T_1 = 2g = 2 \times 10 = 20N$

(10)



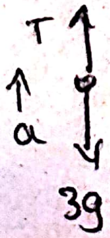

Given $a = 2 \ m/s^2$.

For 7 kg FBD




Net force $= 7a = 7g - T \rightarrow (1)$

For 3 kg FBD




Net force

$3a = T - 3g$

$\rightarrow (2)$

(1) $-$ (2)

$7a + 3a = \cancel{T} - 3g - 7g + \cancel{T}$

$\Rightarrow$

$10a = -10g + 2T$

$10 \times 2 = -100 + 2T$

$\Rightarrow 2T = 120$

$T = 60N \rightarrow C$

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# Advanced

(1)

All bodies move with same accelerabra

$$a = \frac{F}{m_1+m_2+m_3}$$

but $T_1 = \frac{m_1 F}{m_1+m_2+m_3}$ , $T_2 = \frac{(m_1+m_2)F}{m_1+m_2+m_3}$

$T_1 \neq T_2$.

$\rightarrow$ D

(3)

acceleration of the system $a = \frac{T_3}{m_1+m_2+m_3}$

$$a = \frac{60}{10+20+30} = 1\ m/s^2.$$

$T_1 = m_1 a \Rightarrow 10 \times 1 = 10\ N$

For 30 kg :- FBD $T_3 - T_2 = 30a$

$\Rightarrow 60 - T_2 = 30 \times 1$

$\Rightarrow 60 - T_2 = 30 \Rightarrow T_2 = 30N$

$T_3 \neq T_1 + T_2$ $\rightarrow$ C

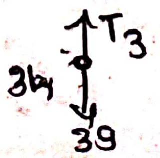
(4)

Since the system is at rest.

$F_{net} = 0$

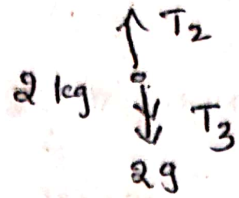
$\Rightarrow$ acceleration $= 0$

For 3 kg



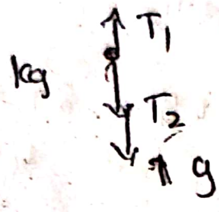

$\Rightarrow T_3 = 3g = 30N$

For 2 kg




$$T_2 = T_3 + 2g$$
$$= 30 + 20 = 50\,N$$

For 1 kg

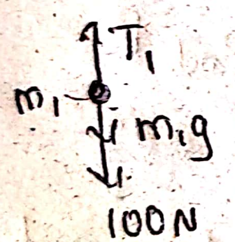



$$= T_1 = T_2 + g$$
$$= 50 + 10 = 60\,N$$

$\rightarrow$ B

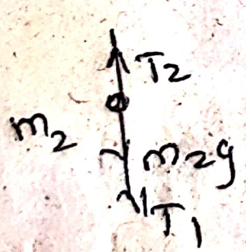
5

Given $m_1 = m_2 = m_3 = 3$ kg : $F_{applied} = 160\,N$

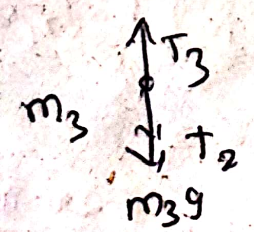



$\Rightarrow$ $T_1 = m_1 g + 100 = 3 \times 10 + 100 = 130\,N$

$\rightarrow$ A




$$T_2 = m_2 g + T_1$$
$$= 3 \times 10 + 130 = 160\,N \rightarrow D$$




$$T_3 = m_3 g + T_2$$
$$= 3 \times 10 + 160 = 190\,N \rightarrow B$$

⑥

Given $m_1 = 2\ kg$, $m_2 = 4\ kg$

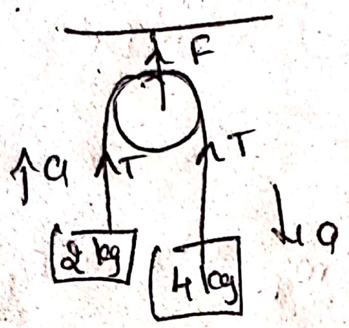
when masses are released, then the masses move with common magnitude of acceleration

$$a = \left(\frac{m_2 - m_1}{m_1 + m_2}\right) g = \left(\frac{4-2}{4+2}\right) \times 10 = 3.33\ m/s^2$$

$$(or) = \frac{g}{3}$$

$$T = \frac{2 m_1 m_2}{m_1 + m_2} \times g = \frac{2 \times 4 \times 2}{4+2} \times 10 = 26.67\ N$$

(i)




$F = 2T$

$= 2(26.67)$

$= 53.34\ N \to C$

(ii)

From $s = ut + \frac{1}{2} a_{net} t^2$ ; ~~u=0~~

$a_{net} = (g - a) = g - \frac{g}{3} = \frac{2g}{3}$

$u = 0 \to$ system starts from rest

$S = \frac{20}{3} m$ given

$\therefore \frac{20}{3} = 0 \times t + \frac{1}{2} \frac{2g}{3} t^2$

$\Rightarrow \frac{20}{\cancel{3}} = \frac{g}{\cancel{3}} t^2 \Rightarrow t^2 = \frac{20}{g} = \frac{20}{10}$

$\Rightarrow t = \sqrt{2}$ sec

⑦

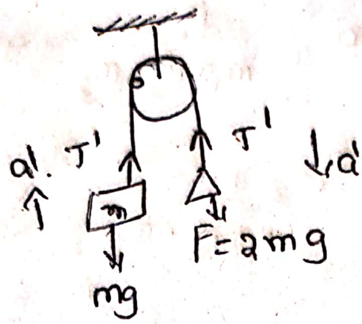
Fig ①

$$a_1 = \left(\frac{m_2 - m_1}{m_1 + m_2}\right) g = \left[\frac{2m - m}{2m + m}\right] g$$

$$a_1 = \frac{m}{3m} g = \frac{g}{3}$$

$$T_1 = \frac{2m_1 m_2 g}{m_1 + m_2} = \frac{2m(2m)g}{m+2m} = \frac{4m g}{3m} = \frac{4g}{3} N$$

Fig ii)




$T' - mg = ma' \to (1)$

$2mg - T' = 0$

$T' = 2mg \to (2)$

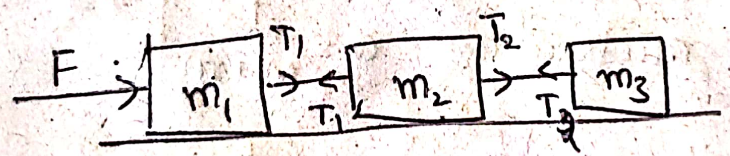
From (1) ∴ $2mg - mg = ma'$

$mg = ma'$

$a' = g$

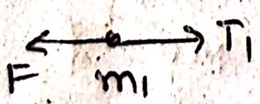
LTask CUQ's

(1) The fig can be drawn as




Draw FBD for $m_1, m_2$ & $m_3$

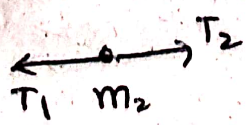
For $m_1$ :-




Net force on $m_1 = T_1 - F$

$\Rightarrow m_1 a = T_1 - F \to (1)$

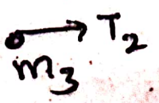
For $m_2$ :-




Net force on $m_2 = T_1 - T_2$

$\Rightarrow m_2 a = T_1 - T_2 \to (2)$

For $m_3$




Net force on $m_3 = T_2$

$m_3 a = T_2 \to (3)$

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(1) + (2) + (3) $\Rightarrow m_1 a + m_2 a + m_3 a = F - T_1 + T_2 - T_1 - T_2$

$$\Rightarrow a\,(m_1 + m_2 + m_3) = F$$

$$\Rightarrow a = \frac{F}{m_1 + m_2 + m_3} \rightarrow A$$

$$T_2 = m_3 a = \frac{m_3 F}{m_1 + m_2 + m_3}$$

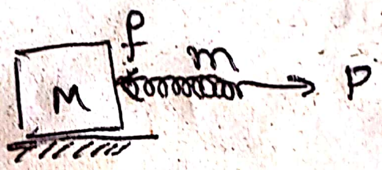
From (2)

$$T_1 = m_2 a + T_2 \Rightarrow m_2 a + m_3 a$$

$$\Rightarrow (m_2 + m_3)\, a.$$

(2)

For given question.




f be the contact force

acceleration $a = \frac{P}{M+m}$

On M only $f'$ is acting

Net force on $M = f$

$$\Rightarrow Ma = f$$

$$\Rightarrow f = \frac{MP}{M+m} \rightarrow C.$$

(3)

For the system acceleration $a = \frac{F}{m_1+m_2+m_3}$

let here assume '$F$' be the applied force on $m_3$

For $m_1$ → Net force $= T_1$

$$m_1 a = T_1 \rightarrow (1)$$

For $m_2$ → Net force $= T_2 - T_1$

$$m_2 a = T_2 - T_1 \rightarrow (2)$$

For $m_3$ → Net force $= F - T_2$

$$m_3 a = F - T_2 \rightarrow (3)$$

(1) + (2) + (3)

$$m_1 a + m_2 a + m_3 a = T_1 + T_2 - T_1 + F - T_2$$

$$(m_1+m_2+m_3)a = F$$

$$\Rightarrow a = \frac{F}{m_1+m_2+m_3}$$

From (2)

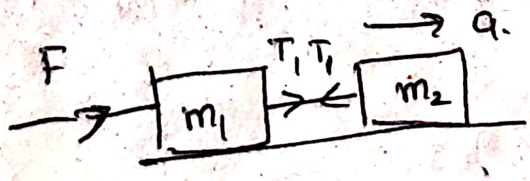
$$T_2 - T_1 = m_2 a$$

$$\Rightarrow T_2 = m_2 a + T_1 = m_2 a + m_1 a$$

$$T_2 = (m_1+m_2)a$$

(4)

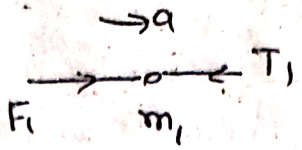
Given arrangement can be replaced as




For $m_2$ :- $\underset{T_1}{\longleftarrow}$o $m_2$  Net force on $m_2 = T_1$

$$\Rightarrow m_2 a = T_1 \rightarrow (1)$$

For $m_1$ :-




Net force on $m_1 = F - T_1$

$\Rightarrow m_1 a = F - T_1 \rightarrow ①$

① + ②  $m_1 a + m_2 a = F - T_1 + T_1$

$\Rightarrow (m_1 + m_2) a = F$

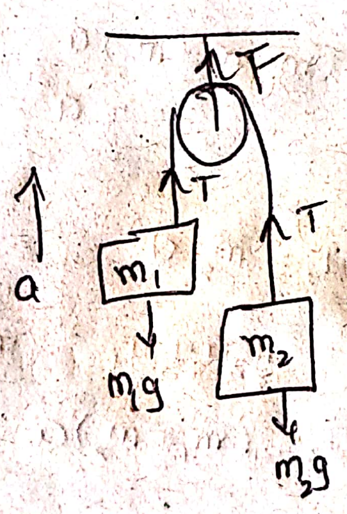
$a = \dfrac{F}{m_1 + m_2}$

$T_1$ is contact force

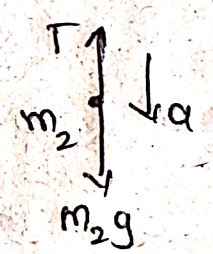
$T_1 = m_2 a$

$= \dfrac{m_2 F}{m_1 + m_2} \rightarrow A$

⑤, ⑥, ⑦

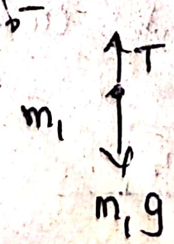



For $m_2$ Free body diagram




$\Rightarrow m_2 g - T = m_2 a \rightarrow ①$

For $m_1$ :-




$\Rightarrow T - m_1 g = m_1 a \rightarrow ②$

① + ②  $m_1 a + m_2 a = m_2 g - \cancel{T} + \cancel{T} - m_1 g$

$\Rightarrow a(m_1 + m_2) = m_2 g - m_1 g$

$$\Rightarrow a(m_1+m_2) = (m_2-m_1).g$$

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

up thrust $F = T+T = 2T$

sub $a$ in (1) we get

$$\Rightarrow m_2 g - T = m_2\left[\frac{m_2-m_1}{m_1+m_2}\right]g$$

$$\Rightarrow m_2 g - T = \frac{-m_1m_2 g + m_2^2 g}{m_1+m_2}$$

$$\Rightarrow T = m_2 g - \frac{(-m_1m_2 g + m_2^2 g)}{m_1+m_2}$$

$$\Rightarrow T = \frac{m_2(m_1+m_2)g + m_1m_2 g - m_2^2 g}{m_1+m_2}$$

$$\Rightarrow T = \frac{m_2m_1 g + \cancel{m_2^2} g + m_1m_2 g - \cancel{m_2^2} g}{m_1+m_2}$$

$$T = \left(\frac{2m_1m_2}{m_1+m_2}\right)g \rightarrow C$$

(8), (9)

For $m_1$ Free body diagram

$$f_1 \longleftarrow m_1 \longrightarrow F \qquad \rightarrow a_1$$

Net force on $m_1 = F-T$

$$m_1a_1 = F - f_1 \rightarrow A$$

$\rightarrow$ (1)

For $m_2$ :-

$$m_2 \xrightarrow{a_2} f_1$$

Net force on $m_2 = f_1$

$$m_2a_2 = f_1 \rightarrow (2)$$

$\rightarrow D$

sub (2) in (1) $\quad m_1a_1 = F - m_2a_2$ $\qquad f_1 \rightarrow$ spring force

$$F = m_1a_1 + m_2a_2$$

Jee mains level

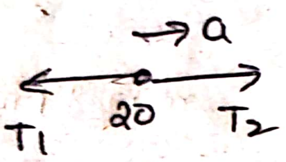
①

From fig $a = \frac{T_3}{m_1+m_2+m_3} = \frac{60}{10+20+30} = 1\ m/s^2$

Net force on $T_1$ is $= 10a$

$\therefore T_1 = 10(1) = 10N$

on 20 kg




Net force $= T_2 - T_1$

$m_2 a = T_2 - 10$

$\Rightarrow 20(1) = T_2 - 10$

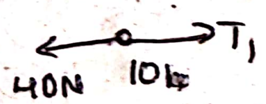
$\Rightarrow T_2 = 30\ N \rightarrow C$

②

From fig acceleration $a = \frac{F}{m_1+m_2+m_3}$

$\Rightarrow a = \frac{40}{10+6+4} = \frac{40}{20} = 2\ m/s^2$

For 10 kg body




Net force $= 40 - T_1$

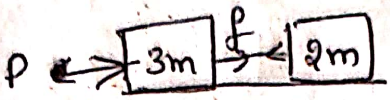
$\Rightarrow 10a = 40 - T_1$

$\Rightarrow 10(2) = 40 - T_1$

$\Rightarrow 20 = 40 - T_1$

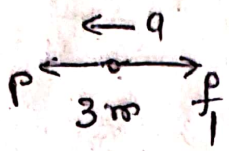
$\Rightarrow T_1 = 40 - 20$
$= 20N \rightarrow B$

(3) The arrangement can be replaced as




· $f'$ → contact force

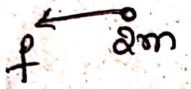
For 3m :-




Net force on $3m = P - f_1$

$\Rightarrow 3ma = P - f_1 \rightarrow (1)$

For 2m :-




Net force on $2m = f_1$

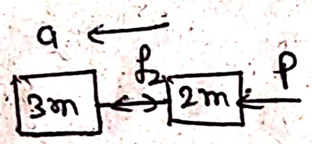
$\Rightarrow 2ma = f_1 \rightarrow (2)$

$\Rightarrow (1) + (2)$ $3ma = P - 2ma \Rightarrow P = 5ma$

$\Rightarrow a = \frac{P}{5m}$

∴ from (2) $f_1 = 2m \times \frac{P}{5m} = \frac{2P}{5}$

case ii :-




$a = \frac{P}{5m}$

$\Rightarrow f_2 = 3ma = 3m \frac{P}{5m} = \frac{3P}{5}$

$\frac{f_1}{f_2} = \frac{\frac{2P}{5}}{\frac{3P}{5}} = \frac{2P \times 5}{5 \times 3P} = \frac{2}{3} \rightarrow B$

(4)

Acceleration $a = \frac{F}{m_1 + m_2 + m_3} = \frac{F}{1+3+5} = \frac{F}{9}$

For m. Net force $ma = F - T_1$

$\Rightarrow \frac{F}{8} = F - T_1$

$\Rightarrow T_1 = F - \frac{F}{9} = \frac{8F}{9}$ Given $T_1 = 16\,N$

$\Rightarrow 16 = \frac{8F}{9} \Rightarrow F = \frac{16 \times 9}{8} = 18\,N$

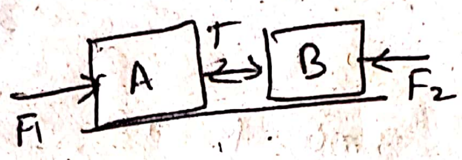
Acceleration $= \frac{F}{9} = \frac{18}{9} = 2\,m/s^2 \rightarrow B$

(5)

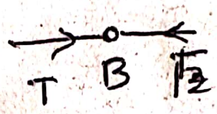
From fig Net force $= F_1 - F_2 = 20 - 10 = 10\,N$

acceleration $a = \frac{\text{Net force}}{m_1 + m_2} = \frac{10}{2+3} = \frac{10}{5} = 2\,m/s^2$

T is force on B by A




For B




Net force $= T - F_2$

$F_2 = 10\,N$

$\Rightarrow m_B a = T - 10$

$\Rightarrow 3 \times 2 = T - 10$

$\Rightarrow T = 16\,N \rightarrow A$

(6)

Given

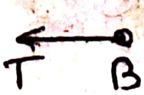
$F = 20\,N$ ; $m_A = 2\,kg$ ; $m_B = 3\,kg$

The arrangement can be replaced as


T is contact force applied by A on B.

$a = \frac{F}{m_A + m_B} = \frac{20}{2+3} = \frac{20}{5} = 4\,m/s^2$

For B




Net force on B $= m_B a$

$\Rightarrow T = 3 \times 4$
$= 12\,N \rightarrow D$

(7)

let $F = 120\,N$

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

Given $m_1 = m_2 = m_3 = m$ (let it be)

acceleration $= \frac{\text{Force}}{\text{mass}} \Rightarrow a = \frac{F}{m_1+m_2+m_3}$

$\Rightarrow 2 = \frac{120}{3m} \Rightarrow m = \frac{120}{6} = 20\,kg \rightarrow A$

(8)

According to the question is, the arrangement is a simple atwood machine

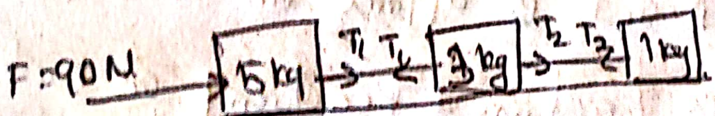
so acceleration $a = \left(\frac{m_2 - m_1}{m_1+m_2}\right)g$

Given
$m_1 = 8\,kg$
$m_2 = 12\,kg$

$\Rightarrow a = \left(\frac{12-8}{12+8}\right) \times 10 = \frac{4}{20} \times 10 = 2\,m/s^2 \rightarrow B$

(9)

According to given ~~an~~ question




Acceleration $= \frac{\text{Force}}{\text{mass}} = \frac{90}{9} = 10\,m/s^2 \rightarrow C$

(10)

For the given arrangement

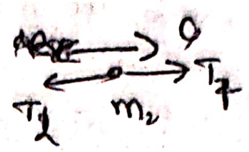
acceleration $= \frac{T_3}{m_1+m_2+m_3} = \frac{60}{5+8+2} = \frac{60}{15} = 4\,m/s^2$

For $m_1$ $\quad \overset{\rightarrow a}{m_1 \rightarrow T_1}$ Net force on $m_1 = T_1$

$\Rightarrow \quad m_1 a = T_1$

$\Rightarrow 5 \times 4 = T_1 \quad \Rightarrow T_1 = 20\,N.$

For $m_2$ :-




Net force on $m_2 = T_1 - T_2$

$\Rightarrow m_2\, a = \cancel{20}\, T_2 - T_1$

$\Rightarrow 8 \times 4 = \cancel{20 - T_2}\ T_2 - 20$

$\Rightarrow 32 = T_2 - 20$

$\Rightarrow T_2 = 52\,N \rightarrow D$

## Advanced level

(2)

Both bodies have same acceleration.

$$a = \frac{F}{m_1 + m_2}$$

A and B applies an equal and opposite forces [action & Reaction] on each other.

(3)

For the given arrangement

$$a = \frac{F}{m_1 + m_2 + m_3} \quad \text{same for all bodies.}$$

$T_1 \Rightarrow$ Tension between $m_3$ & $m_2 = \dfrac{m_3 F}{m_1 + m_2 + m_3}$

$T_2 \Rightarrow$ Tension between $m_1$ & $m_2$ = $\cancel{(m_1+m_2)}$

For $m_2$:-

Net force on $m_2 = T_2 - T_1$

$\Rightarrow m_2 a = T_2 - m_3 a$

$\Rightarrow T_2 = m_2 a + m_3 a$

$= (m_2 + m_3) a = \frac{(m_2 + m_3) F}{m_1 + m_2 + m_3}$

only b, c correct → c

(4) Take Free body diagram for all bodies

For $m_1$ $\quad m_1 \xrightarrow{T_1}$ $\quad$ Net force $= T_1$

$m_1 a \Rightarrow T_1 \rightarrow (1)$

For $m_2$ $\quad T_1 \leftarrow m_2 \rightarrow T_2$ $\quad$ Net force $= T_2 - T_1$

$m_2 a = T_2 - T_1 \rightarrow (2)$

For $m_3$ $\quad T_2 \leftarrow m_3 \rightarrow F$ $\quad$ Net force $= F - T_2$

$m_3 a = F - T_2 \rightarrow (3)$

(1) + (2) + (3) $\quad m_1 a + m_2 a + m_3 a = T_1 + T_2 - T_1 + F - T_2$

$\Rightarrow a(m_1 + m_2 + m_3) = F$

$\Rightarrow a = \frac{F}{m_1 + m_2 + m_3}$

From (1) $\quad T_1 = \frac{m_1 F}{m_1 + m_2 + m_3}$

From (2) $\quad T_2 = m_2 a + T_1$

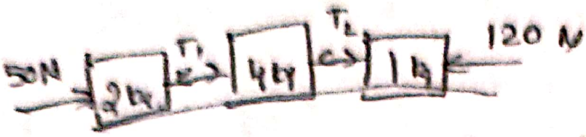
$= m_2 a + m_1 a$

$= (m_2 + m_1) a$

$\Rightarrow T_2 = \frac{(m_2 + m_1) F}{m_1 + m_2 + m_3}$

$T_2 > T_1$ always

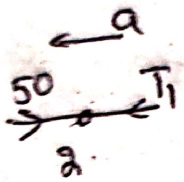
(5)




Net force = $F_2 - F_1 = 120 - 50 = 70$

Acceleration = $\frac{\text{Net force}}{\text{mass}} = \frac{70}{2+4+1} = \frac{70}{7} = 10 \, m/s^2$

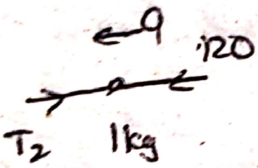
$T_1$ is force b/w 2 & 4 kg. $T_1 - 50 = 2a$




$\Rightarrow T_1 - 50 = 2 \times 10$

$\Rightarrow T_1 - 50 = 20$

$\Rightarrow T_1 = 70N$




$T_2$ is force b/w 1 & 4 kg

$120 - T_2 = \cancel{2}\, 1 \times a$

$\Rightarrow 120 - T_2 = 1 \times 10$

$\Rightarrow 120 - T_2 = 10 \Rightarrow T_2 = 110\,N$

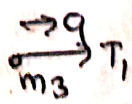
(7)

Given $m_1 = 20\,kg$; $m_2 = 30\,kg$; $m_3 = 50\,kg$

$F = 200N$

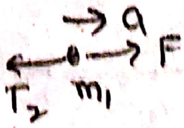
Acceleration $a = \frac{F}{m_1 + m_2 + m_3} = \frac{200}{20+30+50} = 2 \, m/s^2$

Net force on $m_3 = T_1 = m_3 a$




$= 50 \times 2 = 100\,N \rightarrow B$

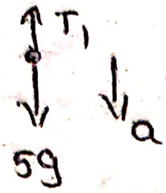
Net force on $m_1 = F - T_2$




$\Rightarrow m_1 a = 200 - T_2$

$\Rightarrow 20 \times 2 = 200 - T_2 \Rightarrow T_2 = 200 - 40 = 160N \rightarrow B$

(8) For C

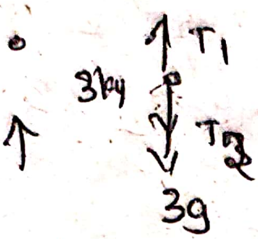



Force = ma

Net force on C $= 5g - T_1$

$\Rightarrow 5a = 5g - T_1 \rightarrow (1)$

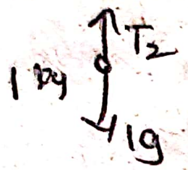
For A :




Net force on A $= T_1 - (T_2 + 3g)$

$3a = T_1 - (T_2 + 3g) \rightarrow (2)$

For B




Net force on B $= T_2 - g$

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

(1) + (2) + (3)

$5a + 3a + a = 5g - \cancel{T_1} + \cancel{T_1} - \cancel{T_2} - 3g + \cancel{T_2} - g$

$\Rightarrow 9a = g$

$a = \frac{g}{9} \rightarrow B$

From (1) $5a = 5g - T_1 \Rightarrow T_1 = 5g - 5a$

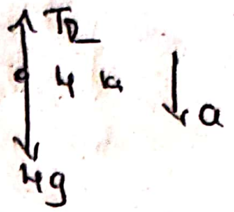
$= 5g - \frac{5g}{9}$

$= \frac{40}{9} g \rightarrow A$

From (3) $a = T_2 - g$

$\Rightarrow T_2 = a + g = \frac{g}{9} + g = \frac{10g}{9} \rightarrow D$

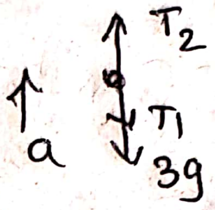
(9) For 4 kg




Net force on $4\,kg = 4g - T_2$

$\Rightarrow 4a = 4g - T_2 \rightarrow (1)$

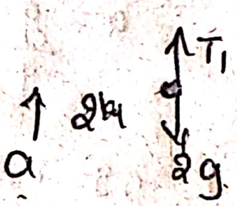
Net For 3 kg




Net force on $3\,kg = T_2 - (T_1 + 3g)$

$\Rightarrow 3a = T_2 - T_1 - 3g \rightarrow (2)$

For 2 kg




Net force on $2\,kg = T_1 - 2g$

$2a = T_1 - 2g \rightarrow (3)$

(1) + (2) + (3)

$$4a + 3a + 2a = 4g - T_2 + T_2 - T_1 - 3g + T_1 - 2g$$

$$\Rightarrow 9a = -g \Rightarrow a = -\frac{g}{9} \rightarrow A$$

From (3)

$$2a = T_1 - 2g$$

$$T_1 = 2a + 2g = -\frac{2g}{9} + 2g$$

$$= \frac{-2g + 18g}{9} = \frac{16g}{9} \rightarrow B$$

From (1)

$$4a = 4g - T_2$$

$$T_2 = 4g - 4a$$

$$= 4g + \frac{4g}{9}$$

$$T_2 = \frac{36g + 4g}{9}$$

$$T_2 = \frac{40g}{9} \rightarrow C$$