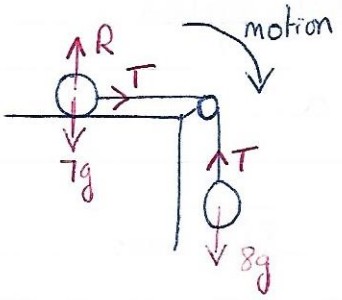
$Rf = ma$ Connected Particles 2 : Answers

1)



a) $Rf = ma$ whole system

$8g = 15a$

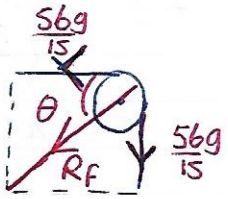
$\frac{8g}{15}\ m/s^2 = a$

b) $Rf = ma$ 7kg mass

$T = 7\left(\frac{8g}{15}\right)$

$T = \frac{56g}{15}\ N$

c)



$Rf^2 = \left(\frac{56g}{15}\right)^2 + \left(\frac{56g}{15}\right)^2$

$Rf^2 = \frac{3136}{225}g^2 + \frac{3136}{225}g^2$

$Rf^2 = \frac{6272}{225}g^2$

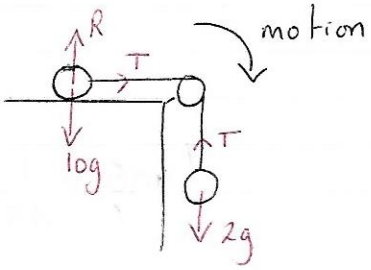
$Rf = \frac{56\sqrt{2}}{15}g\ N$

$\tan\theta = \frac{\frac{56g}{15}}{\frac{56g}{15}} = 1$

$\theta = 45^\circ$

OR $Rf = 5{\cdot}28g\ N$ = force on pulley

2)



a) $Rf = ma$ whole system

$2g = 12a$

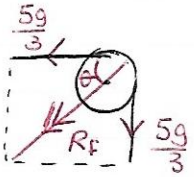
$\frac{g}{6}\ m/s^2 = a$

b) $Rf = ma$ 10 kg mass

$T = 10\left(\frac{g}{6}\right)$

$T = \frac{5g}{3}\ N$

c)



$Rf^2 = \left(\frac{5g}{3}\right)^2 + \left(\frac{5g}{3}\right)^2$

$Rf^2 = \frac{25g}{9} + \frac{25g}{9}$

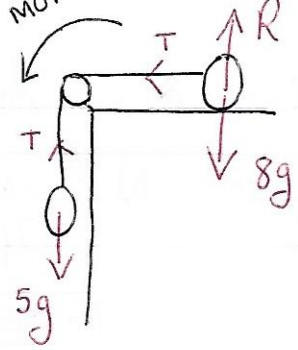
$Rf^2 = \frac{50g}{9}$

$Rf = \frac{5\sqrt{2}}{3}g\ N$

$\theta = 45^\circ$

OR $Rf = 2{\cdot}36g\ N$

3)



a) $Rf = ma$ whole system

$5g = 13a$

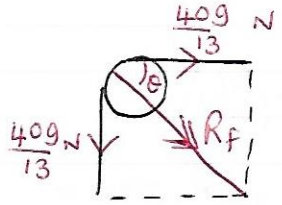
$\frac{5g}{13}\ m/s^2 = a$

b) $RF = ma$ for 8kg mass

$T = 8\left(\frac{5g}{13}\right)$

$T = \frac{40g}{13}\ N$

c)



$Rf^2 = \left(\frac{40g}{13}\right)^2 + \left(\frac{40g}{13}\right)^2$

$Rf^2 = \frac{1600}{169}g^2 + \frac{1600g^2}{169}$

$Rf^2 = \frac{3200g^2}{169}$

$Rf = \frac{40\sqrt{2}}{13}g\ N$

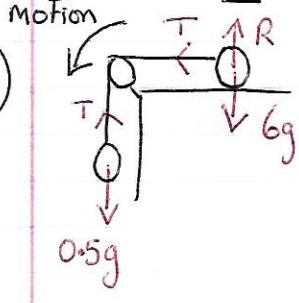
NOTICE The $\sqrt{2}$ at this stage of each question

$\tan\theta = 1$

$\theta = 45^\circ$ again

OR $Rf = 4{\cdot}35g\ N$

4)



a) $Rf = ma$ whole system

$0{\cdot}5g = 6{\cdot}5a$

$\frac{0{\cdot}5}{6{\cdot}5}g = a$

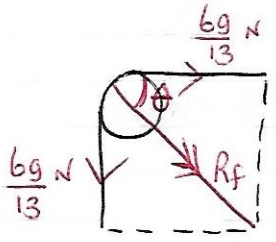
$\frac{1}{13}g\ m/s^2 = a$

b) $Rf = ma$ 6kg

$T = 6\left(\frac{g}{13}\right)$

$T = \frac{6g}{13}\ N$

c)



$Rf^2 = \left(\frac{6g}{13}\right)^2 + \left(\frac{6g}{13}\right)^2$

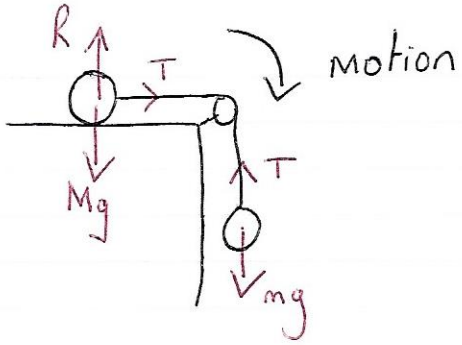
$Rf = \frac{6\sqrt{2}}{13}g\ N$

OR $Rf = 0{\cdot}65g\ N$

$\tan\theta = 1$

$\theta = 45^\circ$

5)



a) $Rf = ma$ whole system

$mg = (M+m)\,a$

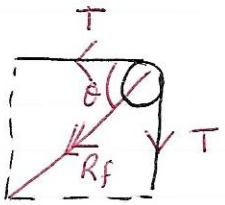
$\frac{m}{(M+m)}\,g \ m/s^2 = a$

b) $Rf = ma$ M kg mass

$T = M\left(\frac{m}{M+m}\right)g$

$T = \frac{mM}{(M+m)}\,g$ N

c)



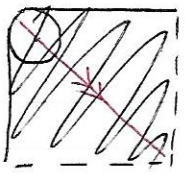
$\tan\theta = 1$

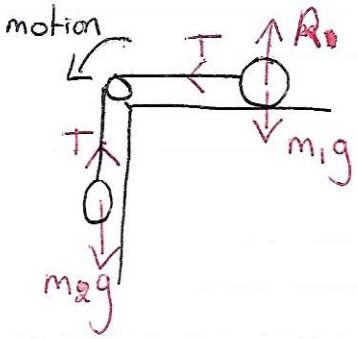
$\theta = 45°$

$Rf = \frac{\sqrt{2}mM}{(M+m)}\,g$ N

Notice use of $\sqrt{2}$ as compared to previously.

6)





a) $Rf = ma$ whole system

$m_2 g = (m_1+m_2)\,a$

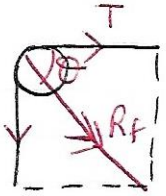
$\frac{m_2}{(m_1+m_2)}\,g \ m/s^2 = a$

b) $Rf = ma$ for m_1 kg

$T = m_1 \frac{m_2}{(m_1+m_2)}\,g$ N

$T = \frac{m_1 m_2}{(m_1+m_2)}\,g$ N

c)



$\tan\theta = 1$

$\theta = 45°$

from Pythag

$Rf = \frac{\sqrt{2}\,m_1 m_2}{(m_1+m_2)}\,g$ N