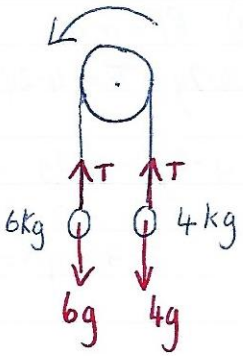
$Rf = ma$ Connected Particles 1 : Answers

1)



a) $Rf = ma$ whole system

$6g - 4g = 10a$

$2g = 10a$

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

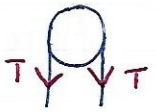
b) $Rf = ma$ 6kg mass

$6g - T = 6\left(\frac{g}{5}\right)$

$6g - \frac{6g}{5} = T$

$\frac{24g}{5}\ N = T$

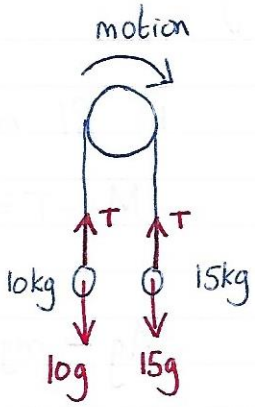
c)



Force $= 2T$

$= \frac{48g}{5}\ N$

2)



a) $Rf = ma$ whole system

$15g - 10g = 25a$

$\frac{5g}{25} = a$

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

b) $Rf = ma$ 15 kg mass

$15g - T = 15\left(\frac{g}{5}\right)$

$15g - \frac{15g}{5} = T$

$\frac{60g}{5} = T$

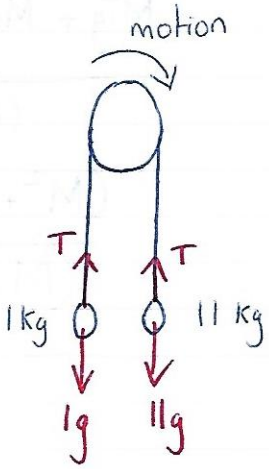
$12g\ N = T$

c)

Force $= 2T$

$= 24g\ N$

3)



a) $Rf = ma$ whole system

$11g - 1g = 12a$

$\frac{10g}{12} = a$

$\frac{5g}{6}\ m/s^2 = a$

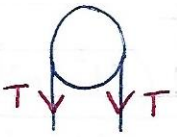
b) $Rf = ma$ 11 kg mass

$11g - T = 11\left(\frac{5g}{6}\right)$

$11g - \frac{55g}{6} = T$

$\frac{11g}{6}\ N = T$

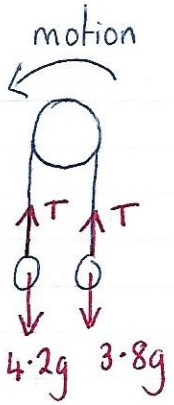
c)



Force $= 2T$

$= \frac{11g}{3}\ N$

(4)



a) $RF = ma$ whole system

$4 \cdot 2g - 3 \cdot 8g = 8a$

$0 \cdot 4g = 8a$

$\frac{0 \cdot 4}{8} g = a$

$\frac{g}{20}\ m/s^2 = a$

b) $RF = ma$ $4 \cdot 2\,kg$ mass

$4 \cdot 2g - T = 4 \cdot 2\left(\frac{g}{20}\right)$

$4 \cdot 2g - \frac{4 \cdot 2g}{20} = T$

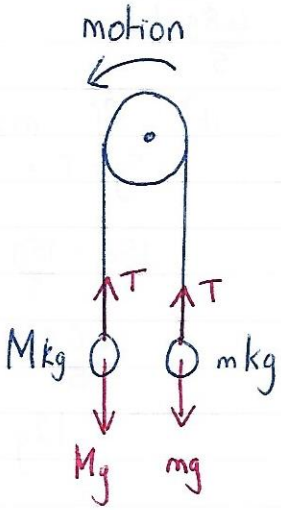
$3 \cdot 99\,gN = T$

c)

force $= 2T$

$= 7 \cdot 98gN$

(5)



a) $RF = ma$ whole system

$Mg - mg = (M+m)a$

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

b) $RF = ma$ $M\,kg$ mass

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

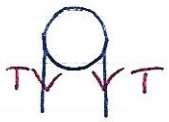
$Mg - mg\left(\frac{M-m}{M+m}\right) = T$

$\frac{Mg(M+m) - mg(M-m)}{(M+m)} = T$

$\frac{M^2g + Mmg - Mmg + m^2g}{(M+m)} = T$

$\frac{(M^2+m^2)g}{(M+m)}\ N = T$

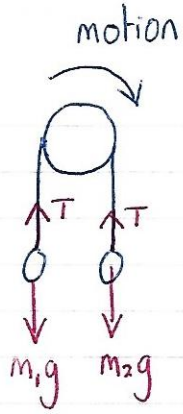
c)



Force $= 2T$

$= \frac{2(M^2+m^2)}{(M+m)} g \quad N$

6)



a) $RF = ma$ whole system

$m_2g - m_1g = (m_1 + m_2)a$

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

b) $RF = ma$ for m_2

$m_2g - T = m_2\left(\frac{m_2 - m_1}{m_2 + m_1}\right)g$

$m_2g - \frac{m_2(m_2 - m_1)g}{(m_2 + m_1)} = T$

$\frac{m_2g(m_2 + m_1) - m_2(m_2 - m_1)g}{(m_2 + m_1)} = T$

$T = \frac{m_2^2g + m_1m_2g - m_2^2g + m_1m_2g}{(m_2 + m_1)}$

$T = \frac{2m_1m_2g}{(m_2 + m_1)}$ N

c) $F = 2T$

$= \frac{4m_1m_2g}{(m_2 + m_1)}$ N

7) 'Light' means the string is weightless. This means you can assume the tension is constant throughout the string.

8) 'inextensible' means the string doesn't stretch

9) 'particles' means the masses have no dimensions and are therefore not affected by air resistance.

10) 'smooth' means there is no friction at the pulley.