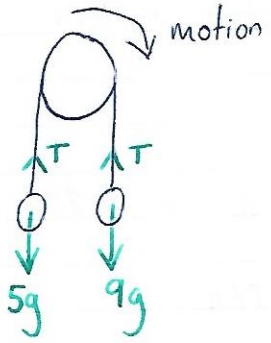
# $Rf = ma$ Connected Particles : Answers

1)




a) $Rf = ma$ whole system

$9g - 5g = 14a$

$4g = 14a$

$\frac{4g}{14} = a$

$\frac{2g}{7}\ m/s^2 = a = 2 \cdot 8\ m/s^2$

$Rf = ma$ for 9kg

$9g - T = 9\left(\frac{2g}{7}\right)$

$9g - T = \frac{18g}{7}$

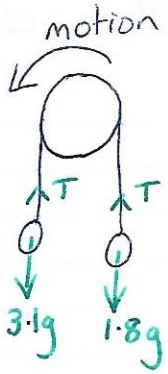
$9g - \frac{18g}{7} = T$

$\frac{63g}{7} - \frac{18g}{7} = T$

$\frac{45g}{7}\ N = T = 63N$

b) 'Light' implies that the string is weightless which means you can assume that the tension is constant throughout the entire string

2)




$Rf = ma$ whole system

$3 \cdot 1g - 1 \cdot 8g = 4 \cdot 9a$

$1 \cdot 3g = 4 \cdot 9a$

$\frac{1 \cdot 3g}{4 \cdot 9} = a$

$\frac{13}{49} g\ m/s^2 = a = 2 \cdot 6\ m/s^2$

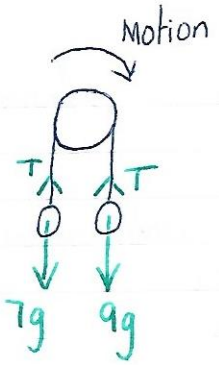
$Rf = ma$ for 3·1 kg

$3 \cdot 1g - T = 3 \cdot 1(2 \cdot 6)$

$3 \cdot 1(9 \cdot 8) - 3 \cdot 1(2 \cdot 6) = T$

$70 \cdot 56\ N = T$

3)




a) $RF = ma$ whole system

$9g - 7g = 16a$

$2g = 16a$

$\frac{9}{8}\ m/s^2 = a = 1.225\ m/s^2$

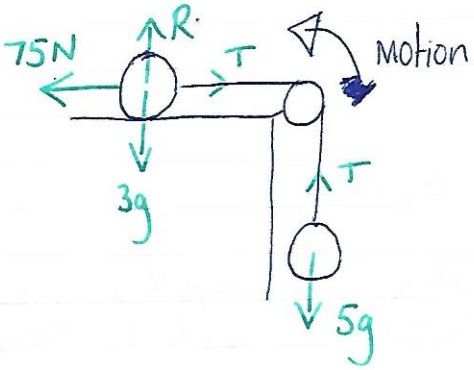
b) $RF = ma$ for 7kg

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

$T = \frac{7g}{8} + 7g$

$T = \frac{7g}{8} + \frac{56g}{8} = \frac{63g}{8}\ N = 77.175\ N$

4)




* (Notice $R = 3g$ These forces cancel each other)

$RF = ma$ whole system in direction of Motion

$75 - 5g = 8a$

$75 - 49 = 8a$

$26 = 8a$

$\frac{26}{8} = a$

$3.25 m/s^2 = a$

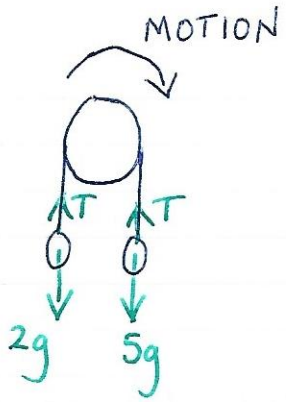
$RF = ma$ for 5kg

$T - 5g = 5(3.25)$

$T = 16.25 + 49$

$T = 65.25\ N$

5)




a) $RF = ma$ whole system

$5g - 2g = 7a$

$\frac{3g}{7}\ m/s^2 = a = 4{\cdot}2\ m/s^2$

$RF = ma$ 2kg mass

$T - 2g = 2\left(\frac{3g}{7}\right)$

$T = \frac{6g}{7} + 2g$

$T = \frac{6g}{7} + \frac{14g}{7} = \frac{20g}{7}\ N = 28\ N$

b) (i) constant acc calculation

$u = 0$
$t = 2$
$a = 4{\cdot}2$
$v = ?$

$v = u + at$
$v = 0 + 4{\cdot}2(2)$
$v = 8{\cdot}4\ m/s$

(ii) (A) will rise under gravity for a time. (1)

It will stop.

(A) will fall to the ground. (2)

Stage (1)

Rising $u = 8{\cdot}4\ m/s$ $a = -9{\cdot}8$ $s = s$
$v = 0\ m/s$ $t = t$

$v^2 = u^2 + 2as$
$0 = 8{\cdot}4^2 - 19{\cdot}6s$
$s = 3{\cdot}6m$

$v = u + at$
$0 = 8{\cdot}4 - 9{\cdot}8t$
$9{\cdot}8t = 8{\cdot}4$
$t = \frac{8{\cdot}4}{9{\cdot}8} = 0{\cdot}86$ secs.

Stage (2) falls to ground

$u = 0$ $a = 9{\cdot}8$ $t = t$ $s = 3{\cdot}6 + 18{\cdot}9 = 22{\cdot}5m$

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$s = ut + \frac{1}{2}at^2$

$22.5 = 0 + 4.9t^2$

$\sqrt{\frac{22.5}{4.9}} = t$

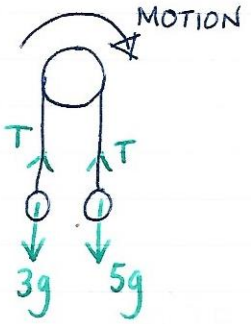
$2.14 \text{ secs} = t$

∴ Time for (A) to reach the ground

= 0.86 (up) + 2.14 (down)

= 3 secs

6)




a) $Rf = ma$ whole system

$5g - 3g = 8a$

$2g = 8a$

$\frac{g}{4} \text{ m/s}^2 = a = 2.45 \text{ m/s}^2$

$Rf = ma$ 3kg mass

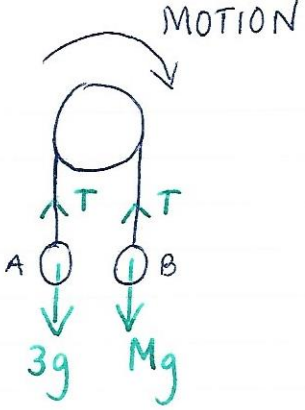
$T - 3g = 3\left(\frac{g}{4}\right)$

$T = \frac{3g}{4} + \frac{12g}{4} = \frac{15g}{4} \text{ N} = 36.75 \text{ N}$

b) 'Light' tells you the string is weightless and thus the tension can be assumed constant throughout the string

c) 'smooth' means that no friction is acting at the peg.

7)




$a = 0.4g \ m/s^2$

$RF = ma$ 3 kg mass

$T - 3g = 3(0.4g)$

$T = 1.2g + 3g$

$T = 4.2g \ N$ — (1)

$Rf = ma$ for $M$ kg mass

$Mg - T = M(0.4g)$

$Mg - 0.4Mg = T$

$0.6Mg = T$

From (1) $0.6Mg = 4.2g$

$M = \frac{4.2}{0.6} = 7$ kg.