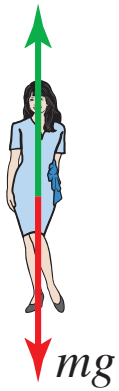
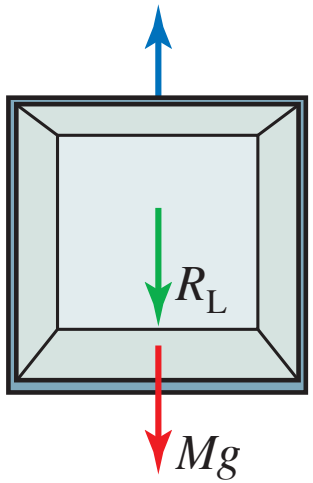
Question Number	Scheme	Marks
1(a)	$R = mg\cos 40$	B1
	Use of $F = \mu R$	B1
	$mg\sin 40 - F = \pm ma$	M1A1
	$acc = 2.55$ (m s^{-2}) or 2.5 (m s^{-2})	A1 (5)
(b)	$v^2 = u^2 + 2as = 2 \times a \times 3$ Speed at B is 3.9 (m s^{-1}) or 3.91(m s^{-1})	M1A1 (2)
		[7]

2 (a)





(5)

(b) $R_P = R_L = 50g,\ T = 500g$

(8)

(c) $T = 5400,\ R_P = R_L = 540$

(5)

3.(a)	Inextensible string	B1	(1
(b)	$4mg - T = 4ma$	M1A1	
	$T - 2mg\sin\alpha - F = 2ma$	M1A1	(4)
(c)	$F = 0.25R$	B1	
	$R = 2mg\cos\alpha \cos\alpha = 0.8$	B1	
	or $\sin\alpha = 0.6$ Eliminating R, F and T	B1	
	$a = 0.4g = 3.92$	M1 A1	(5)
	$-2mg\sin\alpha - F = 2ma'$		
(d)	$v^2 = 2 \text{ x } 0.4gh$	M1	
	$a' = -0.8g$	M1 A1	
	$0^2 = 0.8gh - 2\text{x } 0.8g \text{ x } s$		
	$s = 0.5h$	M1 A1	
	$XY = 0.5h + h = 1.5h$	A1	
			(6)
			16

4. **(a)**	$R = 0.3g\cos\alpha$ $= 0.24g = 2.35$ (3sf)=2.4 (2sf)	M1 A1 (2)
(b)	$mg - T = 1.4m$ $T - 0.3g\sin\alpha - F = 0.3$ x 1.4 $F = 0.5R$ Eliminating R and T $-0.3g\sin\alpha - F = 0.3a$ $m = 0.4$	M1 A1 M1 A2 M1 **DM**1 A1 (8)
(c)	$v = 1.4$ x 0.5 $a = -9.8$ $0 = 0.7 - 9.8t$ $t = 0.071$ s or 0.0714 s (1/14 A0)	B1 M1 A1 A1 M1 A1 (6) **16**

5. $m(B)$: $R \times 4\cos\alpha = F \times 4\sin\alpha + 20g \times 2\cos\alpha$ M1 A2

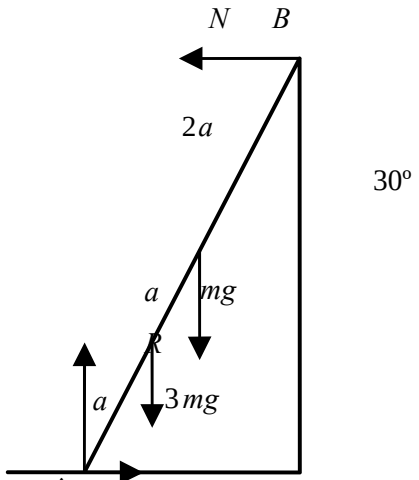
Use of $F = \frac{1}{2}R$ M1

Use of correct trig ratios B1

R = 160N or 157N DM1 A1

[7]

6 (a)



$\rightarrow F_r = N$, $\uparrow R = 4mg$ Using $F_r = \mu R$

M(A) $N \times 4a \cos 30° = 3mg \times a \sin 30° + mg \times 2a \sin 30°$ M1 A2(1,0)

$N = \frac{5}{4} mg$ $\tan 30° (= \frac{5}{4\sqrt{3}} mg =$ 7.07...m) DM1 A1

B1, B1

B1

$\frac{5}{4\sqrt{3}} mg = \mu R$ for their R M1

$\mu = \frac{5}{16\sqrt{3}}$ awrt 0.18 A1 10

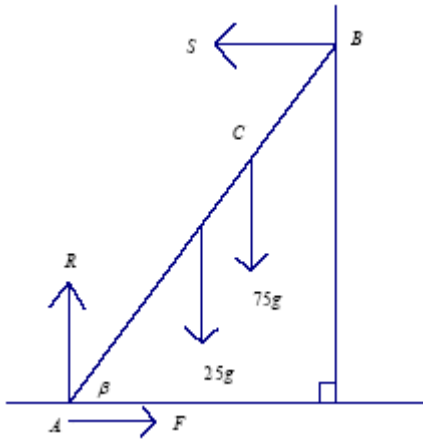
7. (a)

$R(\uparrow)$: $R = 25g + 75g (= 100g)$ B1

$F = \mu R \Rightarrow F = \frac{11}{25} \times 100g$ M1

$= 44g\ (=431)$ A1 3

(b)



M(A):

$25g \times 2\cos\beta + 75g \times 2.8\cos\beta$ M1

$= S \times 4\sin\beta$ A2, 1, 0

R(↔): $F = S$

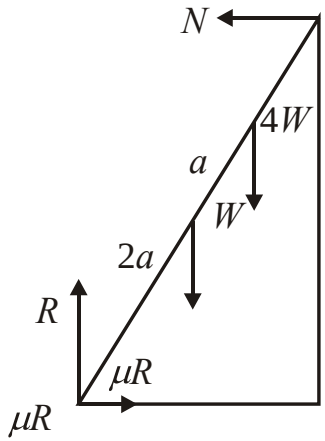
$176g\sin\beta = 260g\cos\beta$ M1A1

$\beta = 56(°)$ A1 6

(c) So that Reece's weight acts directly at the point C. B1 1

[10]

8.



B1

↑ $R = 5W$ B1

M(B): $4Wa\cos\theta + W.2a\cos\theta + \mu R4a\sin\theta = R.4a\cos\theta$ M1 A1

Having enough equations & solving them for μ M1

$\mu = 0.35$ A1 6

(b) ↑ $S = (5 + k)W$ B1

Use of $F = 0.35S$ or $F \leq 0.3S$ M1

$M(B)$: $kW4a\cos\theta + W.2a\cos\theta + F4a\sin\theta = S.4a\cos\theta$ M1 A1

Having enough equations & solving them for k M1

$k = \frac{10}{7}$ awrt 1.42 A1

$k \mid \frac{10}{7}$ ft their k, accept > and decimals A1ft 7

[13]