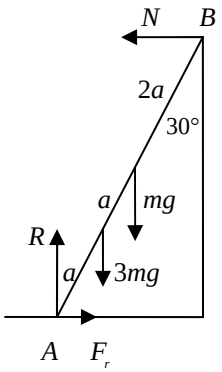
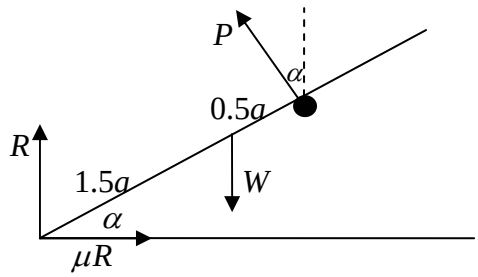
Question Number	Scheme	Marks
5.	(a) 	
	M(A) $N \times 4a\cos 30° = 3mg \times a\sin 30° + mg \times 2a\sin 30°$	M1 A2(1,0)
	$N = \frac{5}{4}mg\tan 30°$ ($= \frac{5}{4\sqrt{3}}mg$ = 7.07…m)	DM1 A1
	$\rightarrow$ $F_r = N$, $\uparrow$ $R = 4mg$	B1, B1
	Using $F_r = \mu R$	B1
	$\frac{5}{4\sqrt{3}}mg = \mu R$ for their R	M1
	$\mu = \frac{5}{16\sqrt{3}}$ awrt 0.18	A1 **(10)**
		[10]
	Alternative method: M(B): $mg \times 2a\sin 30 + 3mg \times 3a\sin 30 + F \times 4a\cos 30 = R \times 4a\sin 30$	
	$11mga\sin 30 + F \times 4a\cos 30 = R \times 4a\sin 30$	M1A3(2,1,0)
	$\frac{11mg}{2} + F\frac{4\sqrt{3}}{2} = 2R$	DM1A1
	$\uparrow$ $R = 4mg$,	B1
	Using $F_r = \mu R$	B1
	$8\mu\sqrt{3} = \frac{5}{2}$, $\mu = \frac{5}{16\sqrt{3}}$	M1 A1

Question Number	Scheme	Marks
5.	(a) 	
	$R(\uparrow)\quad R + P\cos\alpha = W$	M1 A1
	$M(A)\qquad P \times 2a = W \times 1.5a\cos\alpha$	M1 A1
	$\left(P = \frac{3}{4}W\cos\alpha\right)$	
	$R = W - P\cos\alpha = W - \frac{3}{4}W\cos^2\alpha$	DM1
	$= \frac{1}{4}\left(4 - 3\cos^2\alpha\right)W$ ∗ cso	A1 **(6)**
	(b) Using $\cos\alpha = \frac{2}{3}$, $\qquad R = \frac{2}{3}W$	B1
	$R(\rightarrow)\qquad \mu R = P\sin\alpha$	M1 A1
	Leading to $\mu = \frac{3}{4}\sin\alpha$	
	$\left(\sin\alpha = \sqrt{\left(1 - \frac{4}{9}\right)} = \frac{\sqrt{5}}{3}\right)$	
	$\mu = \frac{\sqrt{5}}{4}$ awrt 0.56	DM1 A1 **(5)**
		[11]

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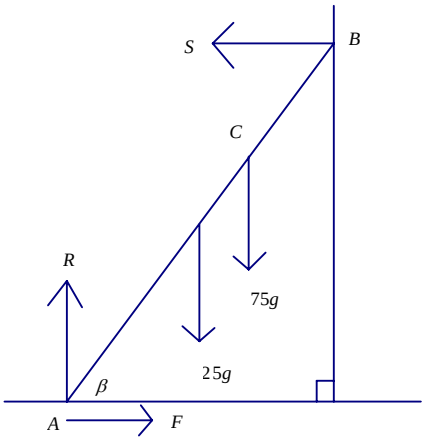
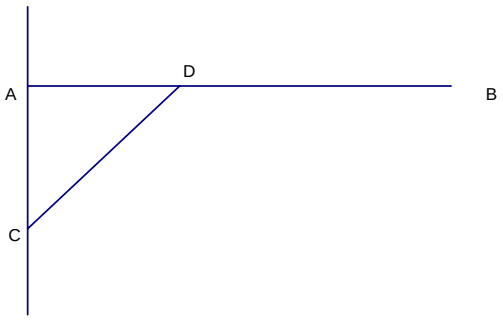
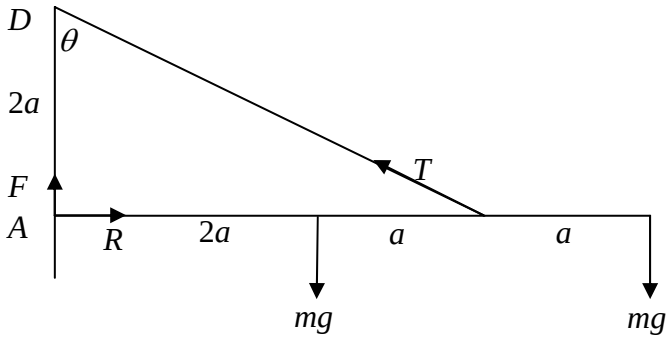
Mark Scheme

Question Number		Scheme	Marks
2	(a)	 $\mathrm{R}(\uparrow): R = 25g + 75g (= 100g)$	B1
		$F = \mu R \Rightarrow F = \frac{11}{25} \times 100g$	M1
		$= 44\text{g } (=431)$	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
		$\mathrm{R}(\leftrightarrow): F = S$	
		$176g\sin\beta = 260g\cos\beta$	M1A1
		$\beta = 56(°)$	A1
			(6)
	(c)	So that Reece's weight acts directly at the point C.	B1
			[10]

Question Number	Scheme	Marks
Q4 (a)	 Taking moments about A:	
	$3g \times 0.75 = \frac{T}{\sqrt{2}} \times 0.5$	M1A1A1
	$T = 3\sqrt{2}g \times \frac{7.5}{5} = \frac{9\sqrt{2}g}{2} (= 62.4N)$	A1
		(4)
(b)	$\leftarrow \pm H = \frac{T}{\sqrt{2}} (= \frac{9g}{2} \approx 44.1N)$	B1
	$\uparrow \pm V + \frac{T}{\sqrt{2}} = 3g \quad (\Rightarrow V = 3g - \frac{9g}{2} = \frac{-3g}{2} \approx -14.7\,\text{N})$	M1A1
	$\Rightarrow \lvert R \rvert = \sqrt{81+9} \times \frac{g}{2} \approx 46.5(N)$	M1A1
	at angle $\tan^{-1}\frac{1}{3}$ = 18.4° (0.322 radians) below the line of BA	M1A1
	161.6° (2.82 radians) below the line of AB (108.4° or 1.89 radians to upward vertical)	
		(7) **[11]**

Question Number	Scheme	Marks
Q6.	$m(B): R \times 4\cos\alpha = F \times 4\sin\alpha + 20g \times 2\cos\alpha$	M1 A2
	Use of $F = \frac{1}{2}R$	M1
	Use of correct trig ratios	B1
	R = 160N or 157N	DM1 A1
		[7]

Question Number	Scheme	Marks
Q6		
(a)	M(A) $3a \times T\cos\theta = 2amg + 4amg$	M1 A1 A1
	$\cos\theta = \left(\frac{2}{\sqrt{9+4}} = \right)\frac{2}{\sqrt{13}}$	B1
	$\frac{6}{\sqrt{13}}T = 6mg$	
	$T = mg\sqrt{13}$ *	A1 (5)
(b)	$3a \times T \times \cos\theta = 2amg + 4aMg$	M1
	$T = \frac{(2mg + 4Mg)}{6}\sqrt{13} \leq 2mg\sqrt{13}$	A1
	$mg + 2Mg < 6mg$	
	$M \leq \frac{5}{2}m$ * cso	A1 (3)
		[8]