Question Number	Scheme	Marks
6(a)	$\frac{1}{2}mv^2 - \frac{1}{2}mu^2 = mgr(1-\cos\theta)$	M1A2
	$mg\cos\theta = \frac{mv^2}{r}$	M1A1
	Eliminate v^2 and solve for $\cos\theta$	M1
	$\cos\theta = \frac{2gr+u^2}{3gr}$ *	A1*
		(7)
6(b)	$\cos\theta = \frac{4}{5}$	B1
	$v^2 = rg\cos\theta \qquad \left(v = \sqrt{\frac{4rg}{5}}\right)$	M1
	Horiz cpt at C: $H = v\cos\theta$ $\left(H = \frac{4}{5}\sqrt{\frac{4rg}{5}} = \sqrt{\frac{64rg}{125}}\right)$	
	Vert cpt at C: $V = \sqrt{(v\sin\theta)^2 + 2gr\cos\theta}$ $\left(V = \sqrt{\frac{236rg}{125}}\right)$	M1
	Speed at C: W where A to C: $\frac{1}{2}m\left(W^2 - \frac{2gr}{5}\right) = mgr$ **OR** B to C: $\frac{1}{2}m\left(W^2 - v^2\right) = mgr\cos\theta$ $\left(W = \sqrt{\frac{12rg}{5}}\right)$	M1
	$\tan\alpha = \frac{V}{H} = \frac{\sqrt{W^2 - H^2}}{H} = \frac{V}{\sqrt{W^2 - V^2}}$	DM1
	$= \frac{\sqrt{59}}{4}$	A1
		(6)
		(13)
	Notes for question 6	
6(a)		
M1	Use conservation of energy to form a dimensionally correct equation. All terms present and no extras. Condone sign errors and sin/cos confusion. Anything that should be resolved has been resolved.	
A1	An unsimplified equation with at most one error.	
A1	A correct unsimplified equation.	
M1	Use N2L to form an equation of motion towards O. Equation must be dimensionally correct. All terms present and no extras. Condone sign errors and sin/cos confusion. Anything that should be resolved has been resolved Allow this mark with or without R.	

Question Number	Scheme	Marks
	Condone $\pm \mathrm{R} + mg\cos\theta = \frac{mv^2}{r}$	
A1	Correct equation ($R = 0$ must be used now at some point) A0 if R never becomes 0	
M1	Solve to find an expression for $\cos\theta$ in terms g, r and u	
A1*	Given answer obtained from correct and complete working. Working should include a line with v^2 eliminated before reaching the given answer.	
6(b)		
B1	For $\cos\theta = \frac{4}{5}$ seen or implied	
M1	Solve to find v in terms of g, r and θ	
M1	Correct method to find at least **one** of H, V or W in terms of g, r and θ Condone finding H^2 , V^2 or W^2 Equation must be dimensionally correct. All terms present and no extras. Condone sign errors and sin/cos confusion. Anything that should be resolved has been resolved. M0: If they use the speed from (a) instead of v	
M1	Correct method to find any **two** of H, V or W in terms of g, r and θ Condone finding H^2 , V^2 or W^2 Equation must be dimensionally correct. All terms present and no extras. Condone sign errors and sin/cos confusion. Anything that should be resolved has been resolved. M0: If they use the speed from (a) instead of v	
DM1	Dependent on previous two M's. Complete method to find $\tan\alpha$ Condone if they go straight to $\alpha = \tan^{-1}(...)$ and never state $\tan\alpha =$…	
A1	A correct value for $\tan\alpha$ $\frac{\sqrt{59}}{4}$ Accept any equivalent surd, eg $\sqrt{\frac{59}{16}}$ but must be exact. A0 if they go straight to α and never find $\tan\alpha$	