Question Number	Scheme	Marks
4(a)	$R\cos\alpha = mg$	M1 A1
	$R\sin\alpha = \dfrac{m\left(\frac{1}{4}gr\right)}{r}$ **OR:** $mg\sin\alpha = \dfrac{m\left(\frac{1}{4}gr\right)}{r}\cos\alpha$ M2 A2	M1A1
	$\tan\alpha = \dfrac{1}{4}$ *	A1*
		(5)
4(b)	Vert equil: $S\cos\alpha - F\sin\alpha = mg$ Perp N2L: $S - mg\cos\alpha = \dfrac{mV^2}{r}\sin\alpha$	M1A1
	N2L towards O: $S\sin\alpha + F\cos\alpha = \dfrac{mV^2}{r}$ Parallel N2L: $F + mg\sin\alpha = \dfrac{mV^2}{r}\cos\alpha$	M1A1
	$F = \mu S$	B1
	Eliminate F, sub for trig and solve for V in terms of μ, r and g.	dM1
	$V = \sqrt{rg\dfrac{(1+4\mu)}{(4-\mu)}}$ oe	A1
		(7)
		(12)
	Notes	
4(a)		
	Note: For use of θ instead of α in (a) penalise only the last mark in (a). The maximum score is M1A1M1A1A0*	
M1	Resolve vertically correct no. of terms, condone sign errors and sin/cos confusion.	
A1	Correct equation	
M1	Equation of motion horizontally correct no. of terms, condone sign errors and sin/cos confusion. V does not need to be substituted. Allow $r\omega^2$ for acceleration but not 'a'.	
A1	Correct equation. May still contain V and either form of acceleration (circular).	
OR	M2 Equation of motion down the plane correct no. of terms, condone sign errors and sin/cos confusion. A1 Correct equation with at most one error A1 Correct equation	
A1*	Correctly obtain given answer, written exactly.	
4(b)		
M1	Resolve vertically or equation of motions perpendicular. Correct no. of terms, condone sign errors and sin/cos confusion. M0 if R from (a) is used.	

Question Number	Scheme	Marks
A1	Correct equation	
M1	Equation of motion horizontally or parallel to slope. Correct no. of terms, condone sign errors and sin/cos confusion. M0 if R from (a) is used.	
A1	Correct equation	
B1	$F = \mu S$ seen where S is the normal reaction in (b).	
dM1	Eliminate F, sub for trig and solve for V in terms of μ, r and g. Dependent on both previous M marks.	
A1	Correct answer.	