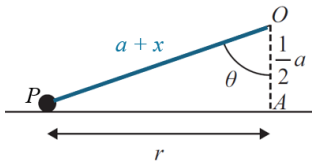
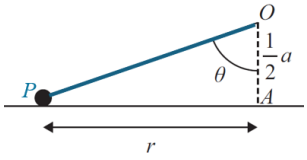
Question Number	Scheme		Marks
6(a)	Horizontal equation of motion		M1
	$T\sin\theta = \dfrac{mrg}{a}$		A1
	Use triangle AOP to form an equation in θ, r, a and x  	Use triangle AOP to form an equation in θ, r and OP  	M1
	Eg • $\sin\theta = \dfrac{r}{a+x}$	Eg • $\sin\theta = \dfrac{r}{OP}$ • $r = OP\sin\theta$	A1
	Use of HL with extension $T = \dfrac{3mgx}{a}$	Use of HL with OP $T = \dfrac{3mg(OP-a)}{a}$	M1
	Eliminate θ and T	Eliminate θ and T	DM1
	Eg • $\dfrac{3mgx}{a}\left(\dfrac{r}{a+x}\right) = \dfrac{mgr}{a}$	Eg • $\dfrac{3mg(OP-a)}{a}\left(\dfrac{r}{OP}\right) = \dfrac{mgr}{a}$	A1
	$(OP =)\ \dfrac{3}{2}a$ *		A1*
			(8)
6(b)	Vertical equilibrium		M1
	$"R" + T\cos\theta = mg$		A1
	Use $T = \dfrac{3mg}{2}$ and $\cos\theta = \dfrac{1}{3}$ to find an expression for $"R"$ in terms of m and g only		DM1
	$(R =)\ \dfrac{1}{2}mg$		A1
			(4)
6(c)	EPE $= \dfrac{3mg}{2a}\left(\dfrac{1}{2}a\right)^2 \quad \left(= \dfrac{3mga}{8}\right)$		B1
	Expression for sum of EPE and KE KE of the form $\dfrac{1}{2}m(r\omega)^2$ with $\omega = \sqrt{\dfrac{g}{a}}$ and $r = \sqrt{\left(\dfrac{3a}{2}\right)^2 - \left(\dfrac{a}{2}\right)^2}$ $\left(r\omega = \sqrt{2ag}\right)$		M1

Question Number	Scheme	Marks
	$=\frac{1}{2}m\left(a\sqrt{2}\sqrt{\frac{g}{a}}\right)^2+\frac{3mg}{2a}\left(\frac{1}{2}a\right)^2$	A1
	$=\frac{11mga}{8}$	A1
		(4)
		(16)
	Notes for question 6	
6(a)		
M1	Horizontal equation of motion. All required terms and no extras. Condone sin/cos confusion. Acceleration does not need to be replaced. Accept any form of acceleration, $r\omega^2$ or $\frac{v^2}{r}$. Condone a for acceleration for this M mark only.	
A1	Correct equation with acceleration correctly replaced and correct radius. A0 if OP is the radius.	
M1	Use triangle OPA to form an equation in θ, r and **either** OP **or** a and x. Condone sin/cos confusion. (Pythagoras alone is M0)	
A1	Correct equation	
M1	Use of Hooke's Law in terms of extension or OP	
DM1	Dependent on all 3 previous M marks. Eliminate T and θ to produce an equation in m, g, a, r and either OP or x (r's may have been cancelled)	
A1	Correct equation	
A1*	Given answer obtained from complete and correct working. Condone missing OP. Accept $\frac{3}{2}a$, $\frac{3a}{2}$.	
6(b)		
M1	Method using vertical equilibrium. All required terms present and no extras. Condone sign errors and sin/cos confusion. If seen in part (a), it must be used in (b) to earn the marks. Note that R is not defined in the question, may use another letter or even the wording from the question.	
A1	Correct unsimpified equation.	
DM1	Dependent on previous M. Substitute for T and $\cos\theta$ to obtain an expression for "R" in terms of m and g only.	
A1	Correct answer in terms of m and g	
6(c)		
B1	Correct expression for EPE	
M1	Method to find total, KE + EPE. Must have terms added together and not just listed. Required terms only. Dimensionally correct expression with energy terms of the correct structure. KE term, must use $v=r\omega$ with $\omega=\sqrt{\frac{g}{a}}$ and $r=\sqrt{\left(\frac{3a}{2}\right)^2-\left(\frac{a}{2}\right)^2}$	
A1	Correct unsimplified expression.	
A1	Correct answer. Must be simplified to one term in m, g and a. Accept $1.375mga$, $1.38\ mga$, $1.4\ mga$.	