Question Number	Answer	Mark	Additional Guidance
6a	Conservation of energy P to Q	M1	Dimensionally correct. Required terms and no others.
	$\frac{1}{2}mv^2 = mg \times 1.5 \quad \left(\Rightarrow v^2 = 3g\right)$	A1	Correct unsimplified equation. No need to substitute the value for m.
	Circular motion at Q:	M1	Dimensionally correct. Required terms and no others
	$R - mg = \frac{mv^2}{1.5}$	A1	Correct unsimplified equation.
	$\left(\Rightarrow R = mg + 2mg\right)$ $R = 5.9$ or 5.88 (N)	A1	2 sf or 3 sf only. Accept $0.6g$
		(5)	
6b	Conservation of energy e.g. from P to R: $\frac{1}{2}mv^2 = mg \times 0.75$	M1	Dimensionally correct. Required terms and no others. Q to R: $\frac{1}{2}mv^2 + mg \times 0.75 = \frac{1}{2}m\left(3g\right)$
	$v^2 = 1.5g \Rightarrow v = \sqrt{1.5g}$	A1	oe
	Equation for time from R to S	M1	Complete method using *suvat* Condone sin/cos confusion.
	e.g. $-0.75 = \sqrt{1.5g}\sin 60°t - 4.9t^2$	A1	Correct unsimplified equation
	$t = 0.856$	A1	0.86 or better seen or used $\left(\frac{\sqrt{210} + 3\sqrt{10}}{28} = 0.85636...\right)$
	Equation in terms of t for the horizontal distance after leaving R	M1	e.g. $\sqrt{1.5g}\cos 60°t$ Condone sin/cos confusion.
	Complete method for distance QS	M1	e.g. $1.5\sin 60° + \sqrt{1.5g}\cos 60°t$ or equivalent. Condone sin/cos confusion.
	$QS = 2.9$ or 2.94 (m)	A1	2 sf or 3 sf only
		(8)	
		(13)	
	Some useful values:		Other useful times: R to top of parabola: $\frac{3\sqrt{10}}{28} = 0.33881...$ Top of parabola to S: $\frac{\sqrt{210}}{28} = 0.51754...$

	$\sqrt{3g} = \frac{7\sqrt{15}}{5} = 5.42217...$ $\sqrt{1.5g} = \frac{7\sqrt{30}}{10} = 3.83405...$ $v_y = \frac{21\sqrt{10}}{20} = 3.32039...$ $v_x = \frac{7\sqrt{30}}{20} = 1.91702...$ $RS_{\text{horizontal}} = \frac{3\sqrt{7} + 3\sqrt{3}}{8} = 1.64167...$		