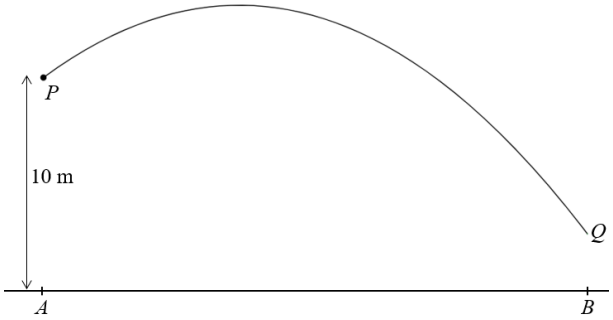
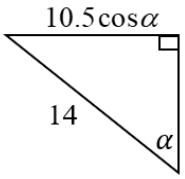
Question Number	Answer	Mark
5		
5(a)	Conservation of energy used to find relevant height	M1
	$\frac{1}{2}m(14)^2 - \frac{1}{2}m(10.5)^2 = mgh$ $\left(h = \frac{343}{8g} = \frac{35}{8}\right)$	A1
	$(BQ =)5.6$ or 5.63 (m)	A1
		(3)
5(b)	Horizontal component of velocity = $10.5\cos\alpha$ seen	B1
	Use direction of motion at Q with $10.5\cos\alpha$ to form an equation in α only  e.g. $\sin\alpha = \frac{10.5\cos\alpha}{14}$ **OR** $14^2 = (10.5\cos\alpha)^2 + (14\cos\alpha)^2$ **OR** $(14\cos\alpha)^2 = (10.5\sin\alpha)^2 + 2g \times 4.375$ **OR** $\begin{pmatrix}10.5\cos\alpha\\10.5\sin\alpha\end{pmatrix}.\begin{pmatrix}10.5\cos\alpha\\-\sqrt{14^2-(10.5\cos\alpha)^2}\end{pmatrix} = 0$ i.e. $(10.5\cos\alpha)^2 - 10.5\sin\alpha\sqrt{14^2-(10.5\cos\alpha)^2} = 0$ **OR** similarly: $(10.5\cos\alpha)^2 - 10.5\sin\alpha\sqrt{(10.5\sin\alpha)^2 + 2g\times 4.375} = 0$ **OR** $(10.5\cos\alpha)^2 - 10.5\sin\alpha \times 14\cos\alpha = 0$	M1
	$\tan\alpha = \frac{3}{4}$ *	A1*
		(3)

5(c)	Complete method to find an equation in the time from P to Q only (t) using vertical motion e.g. $-14\cos\alpha = 10.5\sin\alpha - gt$ **OR** $10 - 5.625 = -10.5\sin\alpha \times t + \frac{1}{2}gt^2$	M1A1
	Horizontal motion of ball: $AB = 10.5\cos\alpha \times t$ ($AB = 15$)	M1
	Motion of car: $AB = \frac{1}{2}at^2$	M1
	$a = 9.4$ or 9.41 (m s^{-2})	A1
		(5)
		(11)
	Notes for question	
	N.B. Allow use of a different angle for α throughout apart from in the answer to (b).	
(a)		
M1	Method using conservation of energy as directed in the question to find a relevant height. Dimensionally correct, all required terms.Condone sign errors. **N.B**. Award the mark if seen, even if not used. M0 if only *suvat* is used.	
A1	Correct unsimplified equation.	
A1	Correct answer for BQ to 2 or 3 sf (45/8 is A0)	
(b)		
B1	Horizontal component of velocity **seen**.	
M1	Use perpendicularity of velocities at P and Q to form a trig equation in α only. **N.B.** Must see any scalar product evaluated. **N.B.** $\tan\alpha = \frac{10.5}{14}$ is M0.	
A1*	Obtain given answer from complete and correct working. **N.B.** $\tan\theta = \frac{3}{4}$ is A0.	
(c)		
M1	Complete method to find an equation in time from P to Q only, condone sign errors and sin/cos confusion. **N.B.** M0 if they use $s = 10$ or -10 but allow their $\pm BQ$	
A1	**Correct equation**	
M1	Method using horizontal motion to form an equation in AB and t only (t does not need to be substituted)	
M1	Correct method to find an equation in AB, t and a (t does not need to be substituted)	
A1	Correct answer, 2/3 sf (exact is 9.408)	