

Question			Answer	Marks	AO	Guidance
14	(a)		The size and shape of the ball are neglected	B1 [1]	2.4	Sensible comment equivalent to “the object is modelled as a point mass”. Do not allow for a statement that includes correct and incorrect ideas. (see appendix)
14	(b)		Vertical motion $s = -3.6, a = -9.8, t = 2.4$ $s = u_y t + \frac{1}{2} a t^2$ $-3.6 = 2.4 u_y - 4.9 \times 2.4^2$ Giving $u_y = 10.26 \text{ m s}^{-1}$	M1 A1 [2]	3.1b 1.1	Use of <i>suvat</i> equation(s) with $s = \pm 3.6$ and $v \neq 0$ leading to a value for u_y Allow sign errors cao Allow SC1 if M0 awarded and $u \sin \alpha$ seen. Or award SC2 for $u \sin \alpha$ in (b) if 10.26 seen in (c)
14	(c)		The horizontal velocity of the ball must be the same as the velocity of the man $u = \sqrt{4^2 + 10.26^2} = 11.01$ $\alpha = \tan^{-1} \frac{10.26}{4} = 68.7^\circ$	B1 B1 M1 A1	3.1b 1.1 1.1 1.1	Soi eg $u \cos \alpha = 4$ FT their (b) and their horizontal velocity Also allow from solving $u \cos \alpha = 4$ or $u \sin \alpha = 10.26$ FT their (b) and their horizontal velocity
			Alternative solution for last 3 marks $-3.6 = 2.4 \frac{4}{\cos \alpha} \sin \alpha - 4.9 \times 2.4^2$ $\alpha = 68.7^\circ$ So $u = \left[\frac{4}{\cos 68.7} \right] = 11.01$	M1 A1 B1 [4]		Substitute for u in terms of $\cos \alpha$ leading to a value for $\tan \alpha$ FT their horizontal velocity FT their value for α

Exemplar responses for Q14(a)

Response	Mark
The mass is concentrated at the centre	B0
The object has no mass	B0
There is no air resistance	B0
The weight acts at the centre [of mass]	B0
There is no spin	B1
The ball's size and shape do not matter	B1
Only its mass is taken into account so it doesn't spin	B1
The size of the ball is negligible and there are no external forces acting on the ball	B0
Point mass means there is no air resistance	B0
There is no air resistance because the object has no size	B0