

Daily Question

Day 7 Mechanics – Mark Scheme

Question 1

(a)	Horizontal distance: $57.6 = p \times 3$ $p = 19.2$	M1 A1	(2)
(b)	Use $s = ut + \frac{1}{2}at^2$ for vertical displacement. $-0.9 = q \times 3 - \frac{1}{2}g \times 3^2$ $-0.9 = 3q - \frac{9g}{2} = 3q - 44.1$ $q = \frac{43.2}{3} = 14.4$ *AG*	M1 A1 A1 cso	(3)
(c)	initial speed $\sqrt{p^2 + 14.4^2}$ $= \sqrt{576} = \underline{24}$ (m s ⁻¹)	(with their p) M1 A1 cao	(2)
(d)	$\tan \alpha = \frac{14.4}{p} (= \frac{3}{4})$	(with their p) B1	(1)
(e)	When the ball is 4 m above ground: $3.1 = ut + \frac{1}{2}at^2$ used $3.1 = 14.4t - \frac{1}{2}gt^2$ o.e ($4.9t^2 - 14.4t + 3.1 = 0$) $\Rightarrow t = \frac{14.4 \pm \sqrt{(14.4)^2 - 4(4.9)(3.1)}}{2(4.9)}$ $t = \frac{14.4 \pm \sqrt{146.6}}{9.8} = 0.023389... \text{ or } 2.70488...$ awrt 0.23 and 2.7 duration = $2.70488... - 0.23389...$ $= 2.47$ or 2.5 (seconds)	seen or implied M1 A1 M1 A1	(6)
or 6 (e)	M1A1M1 as above $t = \frac{14.4 \pm \sqrt{146.6}}{9.8}$ Duration $2 \times \frac{\sqrt{146.6}}{9.8}$ o.e. $= 2.47$ or 2.5 (seconds)	A1 M1 A1	(6)
(f)	Eg. : Variable ' g ', Air resistance, Speed of wind, Swing of ball, The ball is not a particle.	B1	(1)

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Question 2

(a)	Vertical motion: $v^2 = u^2 + 2as$ $(40 \sin \theta)^2 = 2 \times g \times 12$ $(\sin \theta)^2 = \frac{2 \times g \times 12}{40^2}$ $\theta = 22.54 = 22.5^\circ \text{ (accept 23)}$	M1 A1 A1 (3)
(b)	Vert motion $P \rightarrow R$: $s = ut + \frac{1}{2}at^2$ $-36 = 40 \sin \theta t - \frac{g}{2}t^2$ $\frac{g}{2}t^2 - 40 \sin \theta t - 36 = 0$ $t = \frac{40 \sin 22.54 \pm \sqrt{(40 \sin 22.54)^2 + 4 \times 4.9 \times 36}}{9.8}$ $t = 4.694\dots$ Horizontal P to R: $s = 40 \cos \theta t$ $= 173 \text{ m} \quad (\text{or } 170 \text{ m})$	M1 A1 A1 A1 M1 A1 (6)