

Question 5 (Total 13 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	Horizontal speed = $20 \cos 30^\circ$ (= $10\sqrt{3} \text{ m s}^{-1}$)	B1	This mark is given for a correct expression for the horizontal speed of P
	$v = u + at$ at $t = 1$	M1	This mark is given for a method to find the vertical speed of P
	Vertical speed = $20 \sin 30^\circ - 9.8$ = 0.2 m s^{-1}	A1	This mark is given for a correct value for the vertical speed of P
	$\theta = \tan^{-1} \pm \frac{0.2}{10\sqrt{3}}$ (=0.662)	M1	This mark is given finding an expression for the value of θ
	Speed = $\sqrt{(10\sqrt{3})^2 + 0.2^2}$	M1	This mark is given for using Pythagoras to find the magnitude of the speed of P
	17.3 m s^{-1} upwards at 0.662° to the horizontal	A1	This mark is given for finding the correct velocity of P (showing both magnitude and direction)
(b)	Sum of horizontal distances = 50 m	M1	This mark is given for stating the sum of the horizontal distances
	$(u \cos \theta) \times 1 = 50 - (20 \cos 30^\circ) \times 1$ $u \cos \theta = 50 - 20 \cos 30^\circ$	A1	This mark is given for a correct expression for the horizontal distance
	Vertical distances equal $(20 \sin 30^\circ) - \frac{g}{2} = (u \sin \theta) - \frac{g}{2}$	M1	This mark is given for equating the vertical distances
	$u \sin \theta = 20 \sin 30^\circ$	A1	This mark is given for a correct expression for the vertical distance
	$\tan \theta = \frac{20 \sin 30^\circ}{50 - 20 \cos 30^\circ}$	M1	This mark is given for a correct method to find θ and u
	$\theta = 17.0^\circ, u = 34.2 \text{ m s}^{-1}$	A1	This mark is given for finding correct values of θ and u
(c)	For example: The effect of the wind The effect of the spinning of the balls The size of the balls	B1	This mark is given for one correct limitation of the model stated