

<b>2</b>	<p><b>The only correct answer is C (initial acceleration is same for coin and feather, and time taken to reach the ground is less for coin)</b></p> <p>A is not correct because both objects have the same initial acceleration          B is not correct because both objects have the same initial acceleration and object A has a greater terminal velocity          D is not correct because object A has a greater terminal velocity</p>	<b>1</b>
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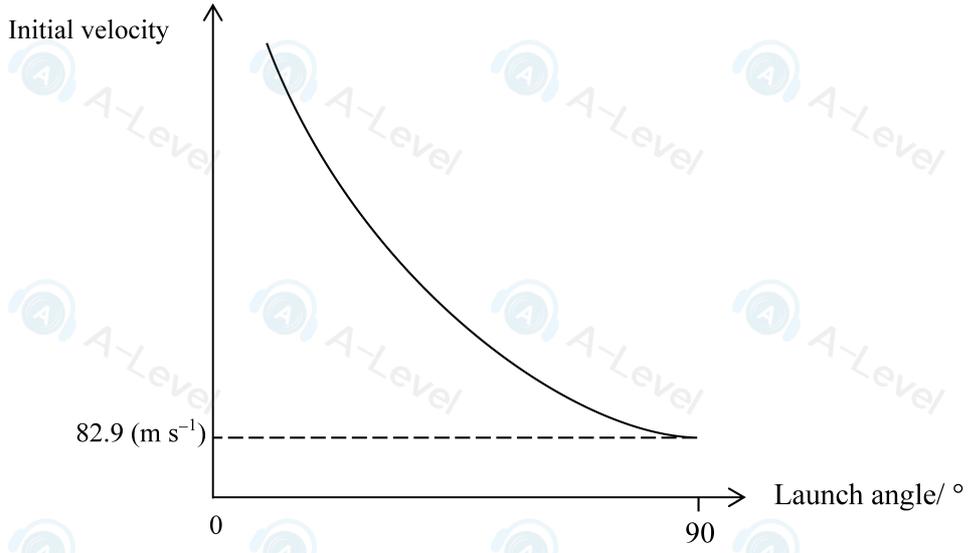
<b>7</b>	<p><b>A is the correct answer</b></p> <p>B is incorrect because the distance has not been doubled and the time has not been squared          C is incorrect because the distance is in the wrong unit          D is incorrect because the distance is in the wrong unit, has not been doubled and the time has not been squared</p>	<b>1</b>
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<b>4</b>	<p><b>The only correct answer is B</b> as <math>s = vt</math> and <math>s = 1.2 \times 0.9</math></p> <p><i>A is not the correct answer as <math>s = vt</math> and <math>s = 1.2 \times 0.9</math></i>  <i>C is not the correct answer as <math>s = vt</math> and <math>s = 1.2 \times 0.9</math></i>  <i>D is not the correct answer as <math>s = vt</math> and <math>s = 1.2 \times 0.9</math></i></p>	<b>(1)</b>
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<b>6</b>	<p><b>The only correct answer is C</b> (The initial horizontal velocity is equal to the final horizontal velocity)</p> <p>A is not correct because the horizontal component of velocity remains constant throughout the motion. A constant value does not have a minimum or maximum, so it is not appropriate to describe the horizontal velocity as minimum          B is not correct because at maximum height the vertical velocity is 0          D is not correct because the final position is below the initial position</p>	<b>1</b>
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<b>4</b>	<p><b>B is the correct answer</b></p> <p>A is incorrect because the graph would have a gradient of <math>g/2</math>          C is incorrect because the graph would have a gradient of <math>2/g</math>          D is incorrect because the graph would have a gradient of <math>1/g</math></p>	<b>(1)</b>
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<b>9</b>	<p><b>C is the correct answer</b></p> <p>This is because <math>s = \frac{1}{2}gt^2</math>. So if in one unit of time the sphere has fallen one unit of distance, i.e. from image 1 to image 2, then in 2 units of time it will have fallen 4 units of distance, i.e. from image 1 to R.</p>	<b>(1)</b>
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Question Number	Answer	Mark
14(a)(i)	<ul style="list-style-type: none"> <li>Use of equation(s) of motion to determine <math>u_v</math>  <b>Or</b> Use of <math>E_k = E_{\text{grav}}</math></li> <li><math>u_v = 83 \text{ (m s}^{-1}\text{)}</math>  (for mp2 must have used <math>v = 0</math> and <math>-g</math>)</li> </ul> <p><u>Example of calculation</u>  <math>0^2 = u^2 + 2(-9.81 \text{ m s}^{-2})(350 \text{ m})</math>  <math>u = 82.9 \text{ m s}^{-1}</math></p>	(1) (1) <b>2</b>
14(a)(ii)	<ul style="list-style-type: none"> <li>Launch angle increasing as initial velocity decreases (i.e. negative gradient)</li> <li>Curve drawn</li> <li>Minimum initial velocity marked, and graph passes through (90, 82.9/80)  <b>Or</b> other correct pair of points labelled and plotted</li> <li>Initial velocity axis asymptotic</li> </ul> 	(1) (1) (1) (1) <b>4</b>
14(b)	(Perpendicular) distance to firework = time (counted) $\times$ speed of sound Diameter of firework = $2 \times \text{distance} \times \tan(\phi/2)$ (allow Diameter of firework = distance $\times \tan(\phi/2)$ )	(1) (1) <b>2</b>
<b>Total for question 14</b>		<b>8</b>

Question Number	Answer	Additional Guidance	Mark
19(a)	Acceleration of the shot is constant Because air resistance will be negligible Or the only force acting is weight	(1) (1)	2
19(b)(i)	Use of $s = ut + \frac{1}{2}at^2$ with $a = 0$ $u_{\text{horizontal}} = 8.82 \text{ (m s}^{-1}\text{)}$ (to at least 3 significant figures)	(1) (1) Example calculation $14.2 \text{ m} = u_{\text{horizontal}} \times 1.61 \text{ s}$ $u_{\text{horizontal}} = \frac{14.2 \text{ m}}{1.61 \text{ s}} = 8.8199 \text{ m s}^{-1}$	2
19(b)(ii)	Use of $s = ut + \frac{1}{2}at^2$ with $a = (-)9.81 \text{ m s}^{-1}$ and $s = (-)1.85 \text{ m}$ Use of Pythagoras to determine $u$ Or Use of appropriate trigonometry to determine $u$ $u = 11 \text{ m s}^{-1}$ [ecf from (b)(i)] Use of appropriate trigonometry to determine $\theta$ $\theta = 37^\circ$ [ecf from (b)(i)]	(1) (1) (1) (1) (1) Example calculation $u_{\text{vertical}} = \frac{\frac{1}{2} \times 9.81 \text{ m s}^{-2} \times (1.61 \text{ s})^2 - 1.85 \text{ m}}{1.61 \text{ s}} = 6.75 \text{ m s}^{-1}$ $u^2 = (8.82 \text{ m s}^{-1})^2 + (6.75 \text{ m s}^{-1})^2 = 123.4 \text{ m}^2 \text{ s}^{-2}$ $u = \sqrt{123.4 \text{ m}^2 \text{ s}^{-2}} = 11.1 \text{ m s}^{-1}$ $\tan \theta = \frac{6.75 \text{ m s}^{-1}}{8.82 \text{ m s}^{-1}} = 0.765$ $\theta = \tan^{-1}(0.765) = 37.4^\circ$	5
<b>Total for question 19</b>			<b>9</b>