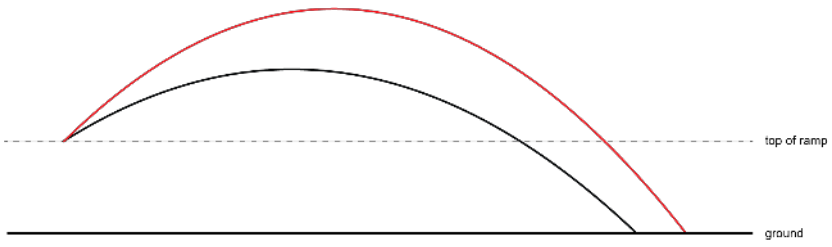


**Assessment Schedule – 2021**

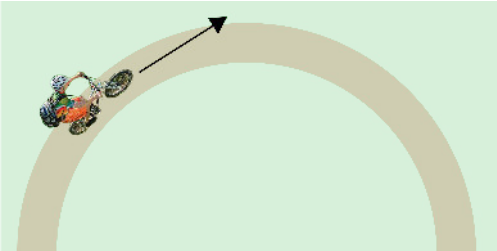
**Physics: Demonstrate understanding of mechanics (91171)**

**Evidence Statement**

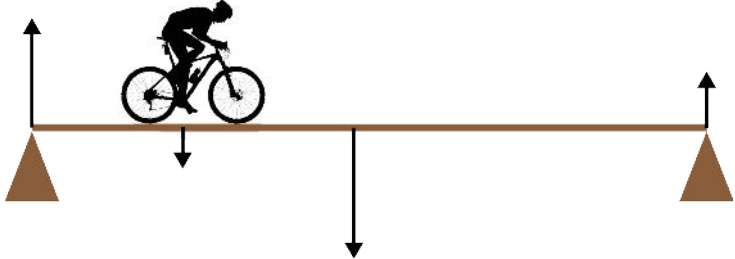
Q	Evidence	Achievement	Merit	Excellence
ONE (a)	$v_v = 10 \times \sin 30^\circ = 5 \text{ m s}^{-1}$	<ul style="list-style-type: none"> <li>• Correct working. (This is a show question).</li> </ul>		
(b)	$v_f^2 = v_i^2 + 2ad$ $0 = 5^2 + 2 \times (-9.8) \times d$ $d = 1.28 \text{ m}$ So height above ground = 2.38 m	<ul style="list-style-type: none"> <li>• 1.28 m</li> <li>OR</li> <li>• Adds 1.1 m to any calculated distance.</li> </ul>	<ul style="list-style-type: none"> <li>• 2.38 m</li> </ul>	
(c)		THREE of: <ul style="list-style-type: none"> <li>• parabolic shape</li> <li>• higher</li> <li>• peak further to right</li> <li>• greater horizontal distance</li> <li>• same starting position.</li> </ul>	FIVE of : <ul style="list-style-type: none"> <li>• parabolic shape</li> <li>• higher</li> <li>• peak further to right</li> <li>• greater horizontal distance</li> <li>• same starting position.</li> </ul>	

<p>(d)(i)</p> <p>(ii)</p>	<p>The speed is <math>5 \text{ m s}^{-1}</math> at a point on the downward journey that is at ramp height.</p> <p><math>v_f^2 = 5^2 + 2 \times 9.8 \times 1.1</math> makes <math>v = 6.82 \text{ m s}^{-1}</math></p> <p>Horizontal speed = <math>10 \times \cos 30^\circ = 8.66 \text{ m s}^{-1}</math></p> <p>Time of flight:</p> <p><math>v_f = v_i + at</math></p> <p><math>-6.82 = 5 - 9.8t</math></p> <p><math>t = 1.21\text{s.}</math></p> <p>Horizontal distance = <math>1.21 \times 8.66 = 10.4 \text{ m}</math></p> <p>OR</p> <p><math>d = -1.1, v_i = 5, \text{ so}</math></p> <p><math>d = v_i t + \frac{1}{2}at^2</math></p> <p><math>-1.1 = 5t - 4.9t^2</math></p> <p>Solving quadratic gives <math>t = 1.21</math></p> <p>Horizontal distance = <math>1.21 \times 8.66 = 10.4 \text{ m}</math></p>	<ul style="list-style-type: none"> <li>Finds <math>v = 6.82 \text{ m s}^{-1}</math>.</li> </ul> <p>OR</p> <p>Finds 8.66.</p>	<ul style="list-style-type: none"> <li>Finds <math>t = 1.21</math>.</li> </ul> <p>OR</p> <p>States a correct quadratic for which <math>t</math> could be found but does not solve for <math>t</math>.</p> <p>OR</p> <p>Makes one error.</p>	<ul style="list-style-type: none"> <li>10.4</li> </ul> <p>OR</p> <p>Uses valid method and makes a minor error eg incorrectly solves the correct quadratic for <math>t</math>.</p>
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Not Achieved			Achievement		Achievement with Merit		Achievement with Excellence	
NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	Very little Achievement evidence.	Some evidence at Achievement level, but most is at Not Achieved level.	A majority of the evidence is at the Achievement level.	Most evidence is at Achievement level.	Some evidence is at Merit level.	A majority of the evidence is at Merit level.	Evidence is provided for most tasks. The evidence at Excellence level may have minor errors, or the evidence is weak.	Evidence is provided for most tasks. The evidence at Excellence level is accurate.
–	1a	2a	3a	4a	1m + 3a	2m + 2a	1e + 2m	1e + 2m + 1a

Q	Evidence	Achievement	Merit	Excellence
TWO (a)	$F = \frac{mv^2}{r} = 1286 \text{ N} = 1300 \text{ N}$	<ul style="list-style-type: none"> <li>• Correct working and answer.</li> </ul>		
(b)	 <p>When the biker rides over the slippery patch, there is no friction. No friction means there is no inwards centripetal force and therefore no unbalanced force acting on the bike. The bike carries on in a straight line at a constant speed tangent to the circle.</p>	<p>TWO of:</p> <ul style="list-style-type: none"> <li>• tangent</li> <li>• constant speed</li> <li>• no unbalanced force</li> <li>• straight line.</li> </ul> <p>OR</p> <p>Arrow drawn that is tangent.</p> <p>OR</p> <p>Partially explain a wider curve.</p>	<ul style="list-style-type: none"> <li>• No unbalanced/centripetal force AND</li> </ul> <p>TWO of:</p> <ul style="list-style-type: none"> <li>• tangent</li> <li>• constant speed</li> <li>• straight line.</li> </ul> <p>OR</p> <p>Clearly and correctly explains a wider curve</p>	
(c)	$F = mg = -kx$ $80 \times 9.8 = 803.6 = -40\,000x$ $x = 0.0196 \text{ m}$ $E = 0.5kx^2$ $E = 7.68 \text{ J}$	<ul style="list-style-type: none"> <li>• ONE correct calculation.</li> </ul>	<ul style="list-style-type: none"> <li>• BOTH correct.</li> </ul>	
(d)	<p>The change in momentum is the same. The spring increases the time of impact. The equation <math>F = \frac{\Delta p}{t}</math> means if time increases, the force will decrease.</p> <p>A smaller force is safer.</p> <p>OR</p> <p>The spring absorbs energy on impact, so less is transmitted to the rider over a longer time, and this reduces risk of injury.</p>	<p>ONE correct statement.</p>	<ul style="list-style-type: none"> <li>• TWO linked statements.</li> </ul>	<ul style="list-style-type: none"> <li>• Complete argument.</li> </ul>

Not Achieved			Achievement		Achievement with Merit		Achievement with Excellence	
NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	Very little Achievement evidence.	Some evidence at Achievement level, but most is at the Not Achieved level.	A majority of the evidence is at Achievement level.	Most evidence is at Achievement level.	Some evidence is at Merit level.	A majority of the evidence is at Merit level.	Evidence is provided for most tasks. The evidence at Excellence level may have minor errors, or the evidence is weak.	Evidence is provided for most tasks. The evidence at Excellence level is accurate.
–	1a	2a	3a	4a	1m + 3a	2m + 2a	1e + 2m	1e + 2m + 1a

Q	Evidence	Achievement	Merit	Excellence
THREE (a)	$E_p = mgh = \text{work done} = 85 \times 9.8 = 4 = 3332 \text{ J}$ $\text{Power} = \frac{\text{work done}}{\text{time}} = \frac{3332}{3} = 1110 \text{ W}$	<ul style="list-style-type: none"> <li>• Correct <math>E_p</math> (3332 J).</li> <li>OR</li> <li>• Correct power calculated from incorrect <math>E_p</math>.</li> </ul>	<ul style="list-style-type: none"> <li>• Correct power (1110 W).</li> </ul>	
(b)	No net forces and no net torques.	<ul style="list-style-type: none"> <li>• BOTH correct.</li> </ul>		
(c)	 <p>The diagram shows a horizontal beam supported by two triangular supports. On the left support, an upward arrow is drawn. On the right support, an upward arrow is drawn. A person on a bicycle is on the beam, with a downward arrow below them. To the right of the bicycle, another downward arrow is drawn. The beam is brown, and the supports are also brown.</p>	<ul style="list-style-type: none"> <li>• FOUR arrows correct direction and placement.</li> </ul>	<ul style="list-style-type: none"> <li>• FOUR arrows correct direction and placement with some attempt at relative lengths.</li> </ul>	
(d)	<p>Weight force of bridge = <math>700 \times 9.8 = 6860 \text{ N}</math>.                      Weight of person + bike = <math>833 \text{ N}</math>                      Taking moments about B:  <math>4F_a = (85 \times 9.8 \times 3) + (700 \times 9.8 \times 2)</math>  <math>F_a = 4055 = 4100 \text{ N}</math>                      upward forces = downward forces  <math>F_a + F_b = (85 \times 9.8) + (700 \times 9.8)</math>  <math>F_a + F_b = 7693 \text{ N}</math>  <math>F_b = 7693 - F_a = 3638 = 3600 \text{ N}</math></p>	<ul style="list-style-type: none"> <li>• ONE correct torque.</li> </ul>	<ul style="list-style-type: none"> <li>• Correct solution except for one error.</li> </ul>	Found both support forces.

Not Achieved			Achievement		Achievement with Merit		Achievement with Excellence	
NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	Very little Achievement evidence.	Some evidence at Achievement level, but most is at Not Achieved level.	A majority of the evidence is at Achievement level.	Most evidence is at Achievement level.	Some evidence is at Merit level.	A majority of the evidence is at Merit level.	Evidence is provided for most tasks. The evidence at Excellence level may have minor errors, or the evidence is weak.	Evidence is provided for most tasks. The evidence at Excellence level is accurate.
–	1a	2a	3a	4a	1m + 3a	2m + 2a	1e + 2m	1e + 2m + 1a

**Cut Scores**

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 7	8 – 13	14 – 19	20 – 24