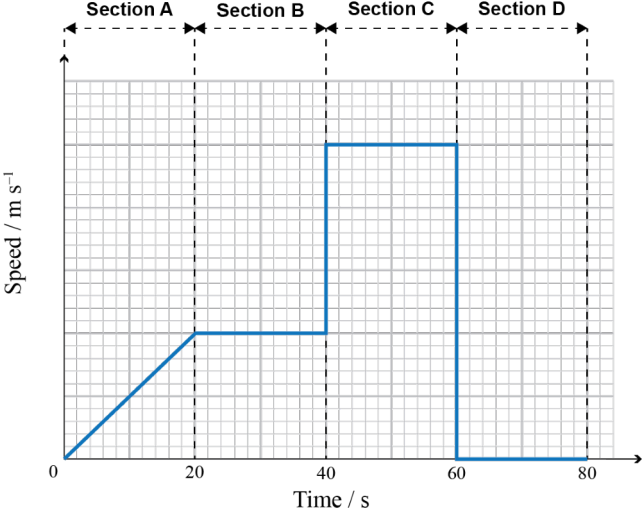


**Assessment Schedule – 2022**

**Science: Demonstrate understanding of aspects of mechanics (90940)**

**Evidence Statement**

Q	Evidence	Achievement	Merit	Excellence
ONE (a)	Section A: accelerating Section B: constant speed Section C: constant speed Section D: stopped	<ul style="list-style-type: none"> <li>• TWO correct.</li> </ul>	<ul style="list-style-type: none"> <li>• FOUR correct.</li> </ul>	
(b)(i)	<p style="text-align: center;">Speed / time graph</p> 	<ul style="list-style-type: none"> <li>• ONE section correct.</li> </ul>	<ul style="list-style-type: none"> <li>• TWO sections correct.</li> </ul>	<ul style="list-style-type: none"> <li>• THREE sections correct.</li> </ul>
(ii)	$v = \frac{\Delta d}{\Delta t}$ $= \frac{200}{20} = 10 \text{ m s}^{-1}$	<ul style="list-style-type: none"> <li>• Correct calculated answer (no working is provided). OR Correct equation selected.</li> </ul>		

<p>(c)</p>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Section A</p> </div> <div style="text-align: center;"> <p>Section B</p> </div> </div> <p>In both diagrams:  <math>F_l = F_g</math>                  In Section A:  <math>F_T &gt; F_d</math>                  In Section B:  <math>F_T = F_d</math></p>	<ul style="list-style-type: none"> <li>Two correctly named forces.</li> </ul>	<ul style="list-style-type: none"> <li>One correct diagram. OR Two pairs of named forces, one from each diagram .</li> </ul>	<ul style="list-style-type: none"> <li>All named forces drawn with correct sizes.</li> </ul>
<p>(d)</p>	<p>The net force will determine the motion.                  In Sections A and B, the downward force due to gravity is equal and opposite to the lift force which means the boat will not lift or sink                  In Section A, the forward thrust is greater than the drag, and therefore the boat is accelerating in the direction of the net force                  In Section B, the drag and forward thrust are equal and opposite, and due to balanced forces, the boat is moving at a constant speed.</p>	<ul style="list-style-type: none"> <li>Correctly name the two vertical or two horizontal forces.</li> <li>Balanced forces cause constant motion. OR Unbalanced forces cause acceleration. Upward and downward forces are equal.</li> </ul>	<ul style="list-style-type: none"> <li>Links the net force to the motion of ONE section.</li> <li>Named forces are balanced so motion is constant. OR Named unbalanced forces cause acceleration Explains that upward and downward forces are balanced so boat does not lift up / sink down.</li> </ul>	<ul style="list-style-type: none"> <li>Links the net force horizontally to the velocity <b>and</b> acceleration in both sections. Must have <b>in the direction of the net force for Section A</b> AND Links the upward and downward forces are equal and opposite and hence no vertical acceleration/does not lift up / sink down.</li> </ul>

N0	N1	N2	A3	A4	M5	M6	E7	E8
No response; or no relevant evidence.	ONE Achievement point.	TWO Achievement points.	THREE Achievement points.	FOUR Achievement points.	THREE Merit points.	FOUR Merit points.	TWO Excellence points.	THREE Excellence points.

Q	Evidence	Achievement	Merit	Excellence
TWO (a)	Her mass is the amount of matter in her, whereas her weight is the downward force due to gravity	<ul style="list-style-type: none"> <li>One correct definition.</li> </ul>	<ul style="list-style-type: none"> <li>Both definitions are correct.</li> </ul>	
(b)(i)  (ii)  (iii)	<p>(b)(i) <math>W = Fd</math>  <math>= 55 \times 10 \times 25</math>  <math>= 13\,750 \text{ N m (J)}</math></p> <p>(ii) <math>P = \frac{W}{t}</math>  <math>= \frac{13\,750}{120}</math>  <math>= 114.58 \text{ W}</math></p> <p>(iii) To reduce the power output, she must climb to the top more slowly, as work stays the same, and power is work divided by time taken. (or she could reduce her mass (using a smaller board).</p>	<ul style="list-style-type: none"> <li>ONE correctly calculated equation (E.g. calculates power using wrong work value). OR Selects both equations correctly.</li> <li>Makes one statement about work or power (e.g. power is less if walk slower) .</li> </ul>	<ul style="list-style-type: none"> <li>Both calculations are calculated correctly.</li> <li>Explains how power could be reduced by increasing time taken.</li> </ul>	<ul style="list-style-type: none"> <li>Both calculations are correct and explains how power could be reduced by keeping the <b>work the same</b> and increasing the time taken.</li> </ul>
(c)(i)  (ii)  (iii)	<p>(c)(i) <math>E_p = mgh</math>  <math>= 55 \times 10 \times 25</math>  <math>= 13750 \text{ J}</math>  OR stated that the work done is the same as the energy gained or lost, so it must be 13 750 J.</p> <p>(ii) <math>E_k = \frac{1}{2} mv^2 = \frac{1}{2} \times 55 \times 12^2</math>  <math>= 3960 \text{ J}</math></p> <p>(iii) Some of the Gravitational Potential Energy is converted to kinetic energy, and some is converted to heat/friction, due to friction between board and sand.</p>	<ul style="list-style-type: none"> <li>Attempts first calculation.</li> <li>Attempts second equation</li> <li>States that some energy is lost.</li> </ul>	<ul style="list-style-type: none"> <li>Correctly calculates one equation (working or unit is missing). OR States that work done is the same as energy gained or lost.</li> <li>States that not all <math>E_p</math> is converted to <math>E_k</math>.</li> </ul>	<ul style="list-style-type: none"> <li>Correct answer for both with working and unit.</li> <li>AND</li> <li><b>States that not all <math>E_p</math> is converted to <math>E_k</math></b> and some energy is converted to heat / sound <b>due</b> to friction of the board against the sand.</li> </ul>

<b>NØ</b>	<b>N1</b>	<b>N2</b>	<b>A3</b>	<b>A4</b>	<b>M5</b>	<b>M6</b>	<b>E7</b>	<b>E8</b>
No response; or no relevant evidence.	ONE Achievement point.	TWO Achievement points.	THREE Achievement points.	FOUR Achievement points.	THREE Merit points.	FOUR Merit points.	TWO Excellence points. (Missing Unit)	TWO Excellence points.

Q	Evidence	Achievement	Merit	Excellence
THREE (a)	P = Pressure (Pascals) (Newton/ meters squared) F = Force (Newtons) A = Area (metres squared)	<ul style="list-style-type: none"> <li>• Defines two terms.</li> <li>• Mentions two units.</li> </ul>	<ul style="list-style-type: none"> <li>• Defines all terms. AND All units are correct.</li> </ul>	
(b)(i)	This is a show question.  $P = \frac{F}{A}$ $= \frac{20}{0.008}$ $= 2500 \text{ Pa}$	<ul style="list-style-type: none"> <li>• Attempts first equation</li> </ul> OR	<ul style="list-style-type: none"> <li>• Correct answer with equation and working (unit not required).</li> </ul>	
(ii)	$P = \frac{F}{A}, \text{ therefore}$ $F = PA$ $= 2500 \times 0.04$ $= 100 \text{ N}$	Attempts second equation.	<ul style="list-style-type: none"> <li>• Correct rearranged formula with incorrect values. OR Correct answer and working with incorrect unit.</li> </ul>	<ul style="list-style-type: none"> <li>• Correct answers and units for both equations</li> </ul>
(c)(i)	$a = \frac{\Delta v}{\Delta t}$ $= \frac{(0 - 20)}{4}$ $= -5 \text{ m s}^{-2}$	<ul style="list-style-type: none"> <li>• Attempts first equation.</li> </ul>	<ul style="list-style-type: none"> <li>• Two correct calculations (units/negative are not important).</li> </ul>	<ul style="list-style-type: none"> <li>• Two correct calculations and states the direction of the force <b>because</b> the car is slowing down / coming to a stop.</li> </ul>
(ii)	$F = ma$ $= 1000 \times 5$ $= 5000 \text{ N}$	<ul style="list-style-type: none"> <li>• Attempts second equation.</li> </ul>		
(iii)	The force is in the opposite direction to the movement of the car, as the car is slowing down.	<ul style="list-style-type: none"> <li>• Mentions direction of force.</li> </ul>	<ul style="list-style-type: none"> <li>• Mentions the direction of the force to cause the car to slow down.</li> </ul>	

<b>NØ</b>	<b>N1</b>	<b>N2</b>	<b>A3</b>	<b>A4</b>	<b>M5</b>	<b>M6</b>	<b>E7</b>	<b>E8</b>
No response; or no relevant evidence.	ONE Achievement point.	TWO Achievement points.	THREE Achievement points.	FOUR Achievement points.	THREE Merit points.	FOUR Merit points.	TWO Excellence points (missing unit or missing the negative).	TWO Excellence points.

**Cut Scores**

<b>Not Achieved</b>	<b>Achievement</b>	<b>Achievement with Merit</b>	<b>Achievement with Excellence</b>
0 – 8	9 – 14	15 – 18	19 – 24