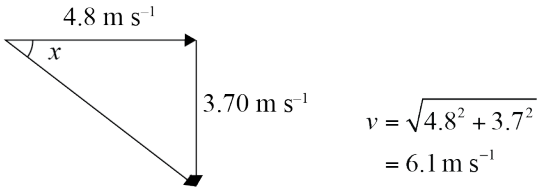
# Assessment Schedule – 2022

## Physics: Demonstrate understanding of mechanics (91171)

### Evidence Statement

| Q | Evidence | Achievement | Merit | Excellence |
|---|---|---|---|---|
| ONE (a) | $d = v_i t + 0.5at^2 \Rightarrow 0 \times t + 0.5 \times 9.8t^2$<br>$t = 0.29$ s | • Correct answer. | | |
| (b) | • The acceleration of both balls is constant (9.8 m s$^{-2}$).<br>• The time for both balls to fall is the same. | • ONE bullet point. | • BOTH bullet points. | |
| (c)(i) | EITHER<br>$v_f^2 = v_i^2 + 2ad$<br>$v_f^2 = 0 + 2 \times 9.8 \times 0.7 \Rightarrow v_f = 3.7$ m s$^{-1}$<br>OR<br>$d - v_i t + 0.5at^2 \Rightarrow 0.7 = 0.5 \times 9.8 \times t^2 \Rightarrow t = 0.377$ (0.378 with rounding)<br>then $v_f = v_i + at$<br>$= 9.8 \times 0.377 = 3.7$ m s$^{-1}$ | • ONE of:<br>- $t = 0.377$<br>- $v_f = 3.7$ m s$^{-1}$<br>- Part (ii). | • $v_f = 3.7$ m s$^{-1}$<br>AND<br>Part (ii). | |
| (ii) | Assuming no external forces / air friction or acceleration is solely down to gravity. | | | |

| | | | | |
|---|---|---|---|---|
| (d) | $d = v_i t + 0.5at^2 \Rightarrow 0.7 = 0 + 0.5 \times 9.8t^2 \Rightarrow t = 0.377$<br>$v_h = \frac{d}{t} = \frac{1.8}{0.377} = 4.8 \text{ m s}^{-1}$<br>  <br><br>$v = \sqrt{4.8^2 + 3.7^2}$<br>$= 6.1 \text{ m s}^{-1}$<br>$\tan x = \frac{3.7}{4.8} \Rightarrow 37.6°$ (or 0.66 rad)<br>OR angle from vertical = 52.4° (or 0.91 rad) | • Shows $v_h = 4.8 \text{ m s}^{-1}$<br>OR<br>Calculates 6.1 m s$^{-1}$ assuming the 'show' part. | • Method correct with ONE major error. | • Method correct with ONE minor error. |

| 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. |
| No relevant physics | 1a | 2a | 3a | 4a | 2m + 1a | 3m | 1e + 2m | 1e + 2m +1 a |

| Q | Evidence | Achievement | Merit | Excellence |
|---|---|---|---|---|
| TWO (a) | $E_p = 0.5kx^2$<br>$E_p = 0.5 \times 250 \times 0.10^{2}$<br>$E_p = 1.25$ J | • 1.25 J | | |
| (b)(i)<br><br><br>(ii) | $m_r v_r + m_b v_b$ before = $m_r v_r + m_b v_b$ after<br>$0 = (2 \times .5) + (0.5 \times v)$<br>$v = -2$ m s$^{-1}$<br>Assumption is no external forces.<br>[Alternative approach using conservation of energy accepted with assumption of no energy loss] | • Correct solution.<br>OR<br>Correct assumption if appropriate calculation attempted. | • Correct answer. | |
| (c) | • They both have the same (change) in momentum. $(\Delta)p = F \times t$<br>• The time for the collision for the red car will be longer than the blue car.<br>• The red / blue car will experience less / more force, **so** will have less / more damage | • ONE bullet point. | • Correct answer. | |
| (d)(i)<br><br>(ii) | There is a force from the cart on the solid board and an equal and opposite force from the solid board to the cart.<br>For cart $\Delta p$ =4<br>$\Delta p = F \times t$<br>$4 = F \times 0.02$<br>$F = 200$ N<br>So final force on the board is 200 N away from the cart. | • ONE of<br>- (i)<br>- $F = 200$ N<br>- Final force towards the board. | • ONE error,<br>e.g. missing direction. | • Comprehensive explanation including unambiguous direction. |

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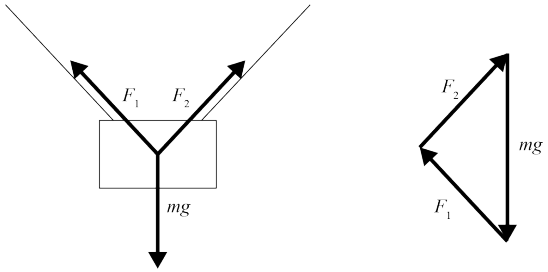
| No relevant evidence | 1a | 2a | 3a | 4a | 1m + 3a | 2m + 2a | 1e + 1m + 2a | 1e + 2m + 1a |

| Q | Evidence | Achievement | Merit | Excellence |
|---|---|---|---|---|
| THREE (a) | $F = -kx$<br>$x = 0.2$ m<br>$k = \frac{2.94}{0.2} = 14.7$ N m$^{-1}$ | • Correct answer. | | |
| (b)(i) and (ii) |  | • Correct free body diagram. Any reasonable force-related labels acceptable.<br>OR<br>Correct vector diagram with labels.<br>(Ignore size of forces.) | • Correct answer. | |
| (c) | Taking moments about end A<br>$0 + F_b \times 0.3 = 1 \times 3 \times 9.8 \Rightarrow F_b = 98$ N upwards<br>The down force = the up force<br>$F_a + 3 \times 9.8 = 98 \Rightarrow F_a = 68.6$ N downwards | • Correct idea of torques, at least one calculated **with** pivot identified. | • Correct answer. | |
| (d) | • A centripetal / unbalanced force keeps the jelly on the spinning plate.<br>• There is friction force between the jelly and the plate.<br>• Friction provides the centripetal force.<br>• As the velocity increases, greater force is required to keep the jelly in circular motion.<br>• The jelly slides off at a tangent to the plate. | • ONE bullet point. | • TWO LINKED bullet points. | • Comprehensive answer. |

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| No relevant evidence | 1a | 2a | 3a | 4a | 1m + 3a | 2m + 2a | 1e + 1m + 2a | 1e + 2m + 1a |

## Cut Scores

| Not Achieved | Achievement | Achievement with Merit | Achievement with Excellence |
|---|---|---|---|
| 0 – 7 | 8 – 13 | 14 – 18 | 19– 24 |