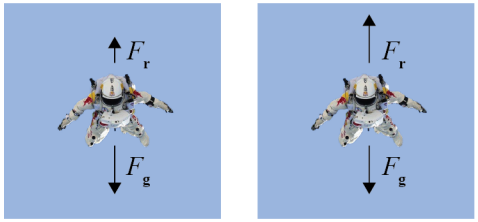
# Assessment Schedule – 2020

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

### Evidence Statement

| Q | Evidence | Achievement | Merit | Excellence |
|---|---|---|---|---|
| ONE (a) | Section A: accelerating<br>Section C: constant speed | • TWO correct. | | |
| (b) | From graph: 350 m $s^{-1}$ | • Correct answer. | | |
| (c) | $a = \frac{\Delta v}{\Delta t}$<br>$= \frac{300}{30}$<br>$= 10 \text{ m s}^{-2}$ | • Correct calculated answer (working not required). | | |
| (d) | Distance fallen = area under the graph<br>= ½ base × height<br>= ½ × 30 × 300<br>= 4500 m | • Attempted (used area under the graph).<br>OR<br>$d = vt = 300 \times 30 = 9000$ m | • Calculated, however, has made a mistake (reading data off graph incorrectly) (working not required). | • Correct answer (working not required). |

| | | | | |
|---|---|---|---|---|
| (e)(i) | Two labelled forces drawn.<br>**Section A** **Section C**<br>  <br> | • Draws FOUR forces with correct labels. | • A pair of arrows are the same (horizontally or vertically). | • All force arrows are labelled and correct sizes.<br>Both $F_g$s need to be the same size.<br>Section A $F_g$ needs to be larger than $F_r$.<br>Section C $F_g$ and $F_r$ need to be the same size. |
| (e)(ii) | The net force will determine the motion.<br>In Section A the force due to gravity is larger than the reaction force; therefore Felix accelerates downwards as $F_{net}$ does not equal 0.<br>In Section C, the downward force balances the $F_r$ (due to air resistance)<br>Since $F_{net} = 0$, acceleration = 0, so therefore no change in speed. | • Correctly names the two vertical forces.<br>OR<br>Explains what causes the reaction force.<br>OR<br>Balanced forces cause constant motion.<br>OR<br>Unbalanced forces cause acceleration. | • Links the net force to the motion of ONE section.<br>OR<br>Named forces are balanced so motion is constant.<br>OR<br>Named unbalanced forces cause acceleration. | • Links the net force to the velocity and acceleration in both sections. |

| NØ | 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. | TWO Merit points. | THREE Merit points. | TWO Excellence points. | THREE Excellence points. |

| Q | Evidence | Achievement | Merit | Excellence |
|---|---|---|---|---|
| TWO<br>(a) | $F = mg = 80 \times 10 = 800$<br>$W$ (both days) $= Fd$<br>$= 80 \times 10 \times 25 = 20\,000$ J<br>Power $= \frac{W}{t}$<br>Day 1 $= \frac{20\,000}{50} = 400$ W<br>Day 1 $= \frac{20\,000}{30} = 667$ W<br>Work done on both days is the same because weight force and height is the same.<br>Power is greater on day 2 because time taken to climb the stairs is less. | • Calculates weight force correctly.<br>• Correct work calculation.<br>OR<br>ONE correct power calculation.<br>• One correct statement about work or power. | • THREE correct calculations.<br>• Correct statements about work OR power. | • FOUR correct calculations.<br>AND<br>Correct statements concerning work and power. |
| (b) | $E_k = ½\ mv^2 = ½ \times 1.5 \times 20^2$<br>$= 300$J<br>Since $E_p = E_k$, 300 J = $E_p$<br>$300 = 1.5 \times 10 \times h$<br>Therefore $h = 20$ m | • Calculates $E_k$ correctly.<br>• States or implies $E_k = E_p$. | • Correct method with a mistake in the working. Allow for follow-on errors.<br>OR<br>First two steps are correct. | • Correct answer with working and unit(s). |
| (c) | Air resistance opposes motion, causing some of the kinetic energy to be transformed to heat due to the movement of air particles against the helmet, so therefore the helmet does not reach 20 m $s^{-1}$ / this speed. | • States air resistance.<br>OR<br>Some $E_k$ is lost. | • Air resistance / friction against air causes a loss of $E_k$ / produces heat. | • Air resistance / friction against air opposes motion.<br>AND<br>This causes the loss of kinetic energy to heat.<br>AND<br>Therefore the helmet does not reach 20 m $s^{-1}$. |

| NØ | 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. | TWO Merit points. | THREE Merit points. | TWO Excellence points. | THREE Excellence points. |

| Q | Evidence | Achievement | Merit | Excellence |
|---|---|---|---|---|
| THREE (a) | Mass is amount of matter in an object.<br>Weight is effect of gravity on the object. | • One definition. | | |
| (b) | For every 1 kg mass, there is a weight force of 10 Newtons being acted upon it by the Earth. | • States 10 Newtons per kilogram. | • For every 1 kilogram (of mass), there is a weight force of 10 Newtons. | |
| (c) | On Earth: $F_w = mg$<br>$2500 \times 10 = 25000$ N<br>On Mars: $F_w = mg$<br>$2500 \times 3.7 = 9250$ N | • One calculation is correct.<br>(Units not required.) | | |
| (d) | $P = \frac{F}{A}$<br>$= \frac{25\,000}{6 \times 0.25}$<br>$= 16\,667$ Pa (or N m$^{-2}$) | • Selects correct formula. | • Correct calculation but only used one wheel (10 000 Pa). | • Correct calculation using all six wheels. |
| (e) | $P$ on Mars $= \frac{F}{A}$<br>$= \frac{9250}{6 \times 0.25}$<br>$= 6166$ Pa (or N m$^{-2}$)<br>The vehicle weight force on Mars is less due to smaller $F_g$, and since the area is the same, the pressure is less, so the vehicle does not sink as far into the surface. | • Selects correct equation.<br>• Sink less in Martian soil.<br>OR<br>Less force on Mars.<br>OR<br>Same area. | • Calculation using wrong area (allow follow on error for area).<br>• Sink less in Martian soil because there is less force and therefore less pressure. | • Correct answer.<br>AND<br>Sinks less / less pressure in Martian soil because there is less force and **the area stays** the same. |

| NØ | 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. | TWO Merit points. | THREE Merit points. | TWO Excellence points; missing unit. | TWO Excellence points. |

## Cut Scores

| Not Achieved | Achievement | Achievement with Merit | Achievement with Excellence |
|---|---|---|---|
| 0 – 7 | 8 – 14 | 15 – 19 | 20 – 24 |