## Assessment Schedule – 2015

## Physics: Demonstrate understanding of electricity and electromagnetism (91173)

| | NØ | N1 | N2 | A3 | A4 | M5 | M6 | E7 | E8 |
|---|---|---|---|---|---|---|---|---|---|
| | No relevant evidence. | Very little Achievement evidence. | Some evidence at Achievement level; partial explanations. | Most evidence at Achievement level. | Nearly all evidence at Achievement level. | Some evidence at Merit level with remainder at Achievement level. | Most evidence at Merit level with some evidence at Achievement level. | Evidence provided for most task, but weak or incomplete at Excellence level. | Evidence provided for most tasks and Excellence level is accurate and full. |
| Q 1,4 | No response; no relevant evidence. | 1a | 2a | 3a | 4a | 2m + 1a | 2m + 2a | 2m + 1e | 1e + 2m + 1a |
| Q 2,3 | No response; no relevant evidence. | some evidence | 1a | 2a | 3a | 2m | 2m + 1a | 1e+1m+1a | 1e + 2m |

### Evidence Statement

| Q | Evidence | Achievement | Merit | Excellence |
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| ONE (a) | $E = \frac{V}{d} = \frac{6.0}{1.0} = 6.0 \text{ V m}^{-1}$ | Correct answer. | | |
| (b) | The force on an electron is $F = Eq$<br>The charge is constant, so if the electric field strength is constant, then the force will be constant. | Constant force. | Constant force AND reason. | |
| (c) | $\Delta E = Eqd$<br>$d = \frac{\Delta E}{Eq} = \frac{9.6 \times 10^{-20}}{6.0 \times (1.6 \times 10^{-19})}$<br>$d = 0.10 \text{ m}$ | Correct equation and re-arrangement. | Correct answer. | |
| (d) | $F = Eq \qquad E = \frac{V}{d}$<br>$F = \frac{Vq}{d}$<br>If he adds another battery in series, this will double the voltage.<br>If he halves the wire length, this will double the electric field strength.<br>Both together will cause the force to be 4 times larger. | Recognises the voltage will double by adding another battery in series.<br>OR<br>Recognises the electric field strength will double by halving the length of wire. | Recognises the voltage will double by adding another battery in series.<br>AND<br>Recognises the electric field strength will double by halving the length of wire. | Complete answer linking ideas to show that force increases four times. |

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| TWO (a) | Down. | Correct answer. | | |
| (b) | $V = Bvl$<br>$v = \dfrac{V}{Bl} = \dfrac{0.15\times10^{-3}}{(3.0\times10^{-3})\times(6.0\times10^{-2})} = 0.83\text{ m s}^{-1}$ | Correct except for wrong length OR wrong unit conversion. | Correct answer. | |
| (c) | $V = Bvl$<br>So if the speed doubles, the voltage doubles.<br>Assuming the resistance is constant, this will cause the current to double. | Current doubles. | Correct answer and reason. | |
| (d) | The current is zero.<br>Both sides of the loop are cutting across the magnetic field.<br>Both sides of the loop have the same voltage induced.<br>One voltage pushes the charges clockwise. The other voltage pushes the charge anticlockwise. The net voltage is zero (OR voltages cancel). | The current is zero. | The current is zero AND a reason (e.g. both wires are cutting the field and have an induced voltage). | Correct answer showing understanding of connection between concepts. |

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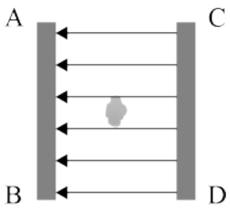
| THREE (a) | <br>Field is uniform.<br>Field is directed right to left. | Correct direction, and uniform spacing. | | |
| (b) | $F = Eq$<br>$E = \dfrac{F}{q} = \dfrac{5.88\times10^{-16}}{2\times(1.6\times10^{-19})}$<br>$E = 1837.5$<br>$E = 1800\text{ N C}^{-1}$ | Correct except for charge. | Correct answer. | |
| (c) | The force is zero.<br>A charged particle experiences a force due to a magnetic field only when it is cutting across the field. | The force is zero. | Correct answer and reason. | |
| (d) | $\Delta E = Eqd \qquad \Delta E = \frac{1}{2}mv^2$<br>$\frac{1}{2}mv^2 = Eqd$<br>$v = \sqrt{\dfrac{2Eqd}{m}}$<br>$v = \sqrt{\dfrac{2\times1837.5\times(2\times1.6\times10^{-19})\times0.0024}{1.7\times10^{-7}}}$<br>$v = 4.07\times10^{-6}\text{ m s}^{-1}$ | Attempts to link both equations. | Links equations but mis-calculation. | Correct answer and working. |

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| FOUR (a) | $P = VI$<br>$I = \frac{P}{V} = \frac{2.0}{6.0} = 0.33\text{ A}$ | Correct answer. | | |
| (b) | Voltage across resistor = 9.0 – 6.0 = 3.0 V<br>Current through resistor = 2 × 0.33 = 0.66 A<br>$V = IR$<br>$R = \frac{V}{I} = \frac{3.0}{0.66} = 4.5\ \Omega$ | Correct voltage OR current. | Correct answer and working. | |
| (c) | The lamps are in parallel, so removing one lamp increases total resistance.<br>The supply voltage is the same, so if the total resistance increases, total current will decrease. | Current decreases. | Correct answer and reason. | |
| (d) | Resistance of parallel lamps is:<br>$R = \frac{R_1 \times R_2}{R_1 + R_2} = 2.0\ \Omega$<br>Total resistance = 6.0 Ω<br>Total current is $I = \frac{V}{R} = \frac{9.0}{6.0} = 1.5\text{ A}$<br>Resistor voltage is $V = IR = 1.5 \times 4.0 = 6.0\text{ V}$ | Correct total resistance. | Correct total resistance and current. | Correct answer and working. |

## Cut Scores

| Not Achieved | Achievement | Achievement with Merit | Achievement with Excellence |
|---|---|---|---|
| 0 – 9 | 10 – 18 | 19 – 25 | 26 – 32 |