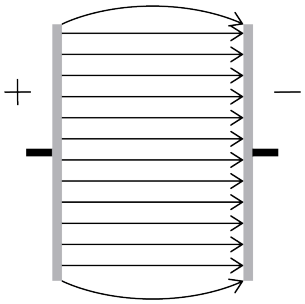
Assessment Schedule – 2018

Physics: Demonstrate understanding of electricity and electromagnetism (91173)

Evidence Statement

Q	Evidence	Achievement	Merit	Excellence
ONE (a)	$E = \frac{V}{d} \rightarrow V = Ed = 2.50 \times 10^{6} \times 0.08 = 200\,000$ V	Correct answer.		
(b)	Electric field shown, including curved arrows: *Field lines must be perpendicular to the plates, parallel to each other and equally spaced.* 	Electric field without curved lines.	Electric field with curved lines. AND Positive plate correctly identified.	
(c)	$E_{p} = Eqd = 2.5 \times 10^{6} \times 6.52 \times 10^{-13} \times 0.04$ $E_{p} = E_{k} = \frac{1}{2}mv^{2}$ $6.52 \times 10^{-8} = \frac{1}{2}mv^{2} \rightarrow$ $v = \sqrt{\frac{6.52 \times 10^{-8}}{\frac{1}{2} \times 4.5 \times 10^{-6}}} =$ $v = 0.170$ m s^{-1}	Correct substitution but wrong answer. OR $E_{p} = 6.52 \times 10^{-8}$	Correct answer	

(d)(i)	• Increase its charge ($F = Eq$). (ii) Increasing the charge, causes the force acting on the charge to increase from $F = Eq$, links to more acceleration and negligible mass [causing it to accelerate more quickly (assuming the increase in charge adds negligible mass), causing it to have a faster velocity]. • Increase E by decreasing the distance between plates. • Increase E by increasing voltage across plates. (ii) Increasing the electric field strength by…, causes the charged smoke to experience a greater force from $F = Eq$. Links to greater acceleration and higher top speed for E. • Decrease its mass of smoke particle. (ii) Causes a force of the same magnitude to accelerate the particle by a greater proportion from $F = ma$, links to higher velocity for E.	**Any one change** • increase V(oltage) • increase q (charge) • decrease mass of smoke particle • increase the distance AB, (move candle right) • increase the electric field (E).	Any one change explained incompletely. E.g. increasing the voltage increases the E and the force so it goes faster.	Any change and **linked** explanation. E.g. increasing charge, increases the force, causing it to have a higher acceleration, so a higher v. E.g. Increasing voltage, causes a larger E-field, which from $F = Eq$ causes a larger force, so a higher acceleration, so a higher velocity. Eg Increasing voltage, E increases, and so E_k increases, and then v increases.
(iii)	• Rotate the magnet so it is 90° to the motion of the smoke particles. Magnetic fields need to be 90° to the direction of the motion of a charged particle to have the most force acting. Currently the magnetic force will have little to no effect. Needs to describe direction and link force to acceleration for E.			

Not Achieved			Achievement		Achievement with Merit		Achievement with Excellence	
NØ	**N1**	**N2**	**A3**	**A4**	**M5**	**M6**	**E7**	**E8**
No response; no relevant evidence. (e.g. 0A)	Very little Achievement evidence. (e.g. 1A)	Some evidence at the Achievement level, but most is at the Not Achieved level. (e.g. 2A OR 1M)	A majority of the evidence is at the Achievement level. (e.g. 3A OR 1M + 1A)	Most evidence is at the Achievement level. (e.g. 4A OR 2A + 1M)	Some evidence is at the Merit level. (e.g. 1A + 2M or 3A + 1M)	A majority of the evidence is at the Merit level. (e.g. 3M OR 2A + 2M)	Evidence is provided for most tasks. The evidence at the Excellence level may have minor errors, or the evidence is weak. (e.g. 1E + 2M OR 1E + 1M + 2A)	Evidence is provided for most tasks and the evidence at the Excellence level is accurate. (e.g. 1E + 2M + 1A)

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TWO (a)	AB: Down BC: No force DE: Up	TWO of three.	All three	
(b)	$F = BIL \rightarrow L = \frac{F}{BI} = \frac{0.60}{0.20 \times 2.5} = 1.2$ m $L_{AB} = \frac{1}{2} L_{total} = \frac{1}{2} \times 1.2 = 0.60$ m	1.2 m (7.5 calculator error no brackets on denominator.)	0.60 m	
(c)	$V = BvL$ $V = 3.5 \times 7.5 \times 0.16 = 4.2$ V End A is positive.	Correct voltage. OR: Correct end.	Both.	
(d)(i)	Yes a voltage is induced in both cases.	Yes to one voltage (no rubbish). OR One current correct with reason	ONE voltage statement correct, with **linked** correct, **justified** current statement. OR THREE current statements, two of which are justified.	One voltage statement correct. AND THREE current statements, TWO of which are **justified**. OR for Max E7 One voltage statement correct. AND TWO current statements justified.
(ii)	In Experiment 1, as one conductor is outside the B-field, no voltage is induced in this wire. A voltage is induced in the moving rod moving across a magnetic field ($V = Bvl$), so a current would flow (clockwise). In Experiment 2, both conductors are the same length, moving at the same speed in the same magnetic field, creating the same induced voltage in both lengths of wire, causing no current to flow. In Experiment 3, as one conductor is not moving, no voltage ($V = BvL$) is induced in this rod, but a voltage is induced in the second moving wire. So a current does flow (in a clockwise direction).			

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THREE (a)	$R_T = 7.00 + \left(\frac{1}{4.80} + \frac{1}{7.00}\right)^{-1} = 9.85\ \Omega$	9.84746 Ω Rounding NOT important.		
(b)	Current: $I = \frac{V}{R} = \frac{12}{9.85} = 1.22\ A$ $V_{bulb1} = IR = 1.22 \times 7.00 = 8.53\ \text{V}$ $V_{bulb2} = V_{supply} - V_{bulb1}$ $V_{bulb2} = 12 - 8.53 = 3.47\ \text{V}$ Accept use of 10 Ω.	Correct current. OR Correct bulb 1 OR bulb 2 voltage.	Both voltages correct.	
(c)	The voltage across each bulb is the same, however the current though bulb 2 is higher, due to having a lower resistance ($I = \frac{V}{R}$). Bulb 2 uses more power (2.51W vs 1.72 W) and is therefore brighter from $P = IV$. OR Power = $\frac{V^2}{R}$, the same voltage but different resistances will mean different power consumptions. Bulb 2: $P = \frac{3.47^2}{4.8} = 2.51\ \text{W}$ Bulb 3: $P = \frac{3.47^2}{7.0} = 1.72\ \text{W}$	One correct statement. E.g. the same voltage in parallel (could be implied make sure they are not referring to the circuit voltage). OR Bulb 2 is brighter. OR Bulb 2 has more current. Power = brightness	Two correct linked statements.	Complete argument.
(d)	Adding the ammeter short circuits bulb 1 (all current goes through the ammeter and none through bulb 1, 0 V across bulb 1), causing bulb 1 to go out. This causes the total resistance to drop (R_{total} = 2.85 Ω from 9.85 Ω), increasing the total current ($I = \frac{V}{R} = \frac{12}{2.85} = 4.2\ \text{A}$ from 1.22 A. Voltage across bulbs 2 and 3 is now higher (12 V from 3.74 V). More current passes through bulbs 2 and 3, and a larger voltage is across bulbs 2 and 3, causing their respective brightnesses to increase.	Bulb 1 goes out. OR Bulbs 2 and 3 get brighter.	Bulb 1 goes out because no current through bulb 1. AND Bulbs 2 and 3 get brighter.	Merit + linked answer to voltage or current for brightness of all 3 bulbs.

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Cut Scores

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