Assessment Schedule – 2017

Physics: Demonstrate understanding of electricity and electromagnetism (91173)

Evidence Statement

Q	Evidence	Achievement	Merit	Excellence
ONE (a)	$E = \frac{V}{d} = \frac{6000}{0.03} = 200\,000\ \text{V m}^{-1}$	• SHOW question, evidence must be provided.		
(b)	$q = 3.70 \times 10^{-12} \times -1.60 \times 10^{-19} = -5.92 \times 10^{-7}$ C $F = Eq = 200\,000 \times -5.92 \times 10^{-7}$ $F = -0.1184 = 0.118$ N to the right (B)	• Correct charge. • OR • Correct direction. OR • Correct force.	• Correct force AND direction.	
(c)	Force is constant, as electric field strength is constant ($E = \frac{V}{d}$). Force acts uniformly across diaphragm as the charge is uniformly distributed; each part of the diaphragm will experience the same force ($F = Eq$), so no bending will occur. <u>More detail not expected:</u> The electric field (E) between the plates is uniform, as the distance (d) between each plate and voltage across the plates is constant $E = \frac{V}{d}$.	• Electric field strength is constant. OR Uniform distribution of charge linked to bending.	• Electric field strength is constant. AND EITHER Uniform distribution of charge linked to bending. OR Explanation why the field is constant.	
(d)	$E_p = Eqd = 200\,000 \times 4.2 \times 10^{-5} \times 0.005$ $E_p = 0.042$ J of potential energy Assume energy conservation, $\therefore E_p = E_k$ $E_k = \frac{1}{2}mv^2 \rightarrow v = \sqrt{\frac{2E}{m}}$ $v = \sqrt{\frac{2 \times 0.042}{5.8 \times 10^{-5}}} = 38.1\ \text{m s}^{-1}$	• States Ep=Ek. OR States energy conservation / no losses due to friction.	Assume energy conservation. AND Attempt at finding v using $E_k = \frac{1}{2}mv^2$. Or Correct $v = 38.1$	• $v = 38.1$ and assumption stated in words.

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 the Achievement level, but most is at the Not Achieved level.	A majority of the evidence is at the Achievement level.	Most evidence is at the Achievement level.	Some evidence is at the Merit level.	A majority of the evidence is at the Merit level.	Evidence is provided for most tasks. The evidence at the Excellence level may have minor errors, or the evidence is weak.	Evidence is provided for most tasks and the evidence at the Excellence level is accurate.

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TWO (a)	$P = IV \rightarrow I = \frac{P}{V} = 1.33 \text{ A (3SF)}$	CAO of 1.33 A		
(b)	As the resistance of the rheostat increases, a larger voltage drop is experienced across the rheostat. As both bulbs are in parallel, they both receive the same amount of voltage from: $V_{bulbs} = V_{supply} - V_{rheostat}$, the voltage across the bulbs decreases.	• Voltage across bulb(s) decreases. OR Voltage across rheostat increases.	• Voltage across BOTH bulbs decreases LINKED to $V_{rheostat}$ increasing AND bulbs are in parallel.	
(c)	Total current is twice 1.33 A, as two bulbs in parallel: $I_{total} = 2.67$ A Voltage across rheostat is 12 – 9 = 3 V. So: $V = IR \rightarrow R = \frac{V}{I} = \frac{12-9}{2.667} = \frac{3}{2.667} = 1.125\ \Omega$ $R = 1.13\ \Omega$ (3SF)	THIS IS A SHOW QUESTION! 1 of: $I_{total} = 2.67$ A $V_{rheostat} = 3.00$ V	Correct answer 1.125 Ω with correct working showing I_{total} and $V_{rheostat}$.	
(d)	• The addition of bulb 3 increases the total resistance. • Total current goes down ($I = \frac{V}{R}$). • Less current through the rheostat means less voltage is lost across the rheostat ($V = IR$). • As bulb 1 and bulbs 2 & 3 are in parallel, they all receive the same voltage ($V_{supply} - V_{rheostat}$), which was greater than before. • So V_{bulb1} increases, $P = \frac{V^2}{R}$ • As bulbs 2 and 3 are in series, they get only half of what bulb 1 receives. • More voltage causes more power dissipation, causing bulb 1 to become brighter. • Bulb 1 is more likely to blow, as it is now receiving more than its initial 9.00 V. ADDITIONAL NOT REQUIRED: $V_{rheostat} = IR = 2.13 \times 1.125 = 2.41 \text{ V} \rightarrow$ $V_{bulb} = V_{supply} - V_{rheostat} = 12 - 2.41 = 9.59$ V. As 9.59 > 9, bulb 1 has a greater likelihood of blowing. OR Using unrounded answers: $V_{rheostat} = IR = 2.13333 \times 1.125 = 2.40 \text{ V} \rightarrow$ $V_{bulb} = V_{supply} - V_{rheostat} = 12 - 2.40 = 9.60$ V. As 9.60 > 9, bulb 1 has a greater likelihood of blowing, as it is receiving more than its stated 9.0 V (getting more energy per second than it should). $P = \frac{V^2}{R} = \frac{9.60^2}{6.75} = 13.7 \text{ W} > 12.0 \text{ W}$	• Bulb 1 is brighter plus attempt at reasoning.	• Correct answer with ideas not linked, or 1 omission / error. E.g.: Bulb 1 is brighter, as it receives more power, as V_{bulb1} increases. Therefore bulb 1 is more likely to blow.	• Correct answer linked.

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THREE (a)	$I = \frac{V}{R} = \frac{12}{2.4} = 5$ A $F = BIL = 30 \times 10^{-6} \times 5.0 \times 1.6$ $F = 2.4 \times 10^{-4}$ N to the left	Correct current. AND Correct direction. OR Correct force.	Correct force. AND Correct direction.	
(b)	• The force on the wire connected to the positive terminal is **equal and opposite** the force on the wire connected to the negative terminal. • As the magnetic force has no effect (no net force), it will not change the time to complete the flying fox. • Also the force is so small, even if it was not cancelled out it would be negligible.	1 bullet point from evidence.	2 bullet points from evidence. • Must state force on each wire will be equal in magnitude and opposite in direction, so no effect.	
(c)	$V = Bvl = 30 \times 10^{-6} \times 12.0 \times 1.6$ $V = 5.76 \times 10^{-4}$ V	Correct answer.		
(d)	The wires Sam has used to connect the light are composed of free-to-move charges, which are moving across (90° to) a magnetic field. From $F = Bvq$, these charges experience a force. Positive charges experience a force to the top of the wire, and negative charges to the bottom of the wire. Work is done to separate these charges, creating a voltage. Although a voltage is induced, the polarity is the same in both wires (positive at the top), meaning no current will flow, so the bulb cannot glow. <u>Components of answer:</u> • Charges experience a force. • Because moving 90° to B-field. • Top is positive; bottom is negative. • Effect is same in both wires. • No current will flow; bulb can't glow.	2 bullet points from evidence.	3 bullet points from evidence.	Well linked answer

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Cut Scores

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0 – 7	8 – 13	14 – 18	19 – 24