Assessment Schedule – 2014

Physics: Demonstrate understanding of electricity and electromagnetism (91173)

For questions 1,2,4 :

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	1a	2a	3a	4a	2m + 1a	2m + 2a	2m + 1e	1e + 2m + 1a

Other combinations are also possible. However, for M5 or M6 at least one Merit question needs to be correct. For E7 or E8 at least one Excellence needs to be correct.

For question 3 :

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	Relevant evidence	1a	2a	3a	1m+2a	2m + 1a	1e+1m+1a	2m + 1e

Other combinations are also possible. However, for M5 or M6 at least one Merit question needs to be correct. For E7 or E8 at least one Excellence needs to be correct.

Evidence Statement

Q	Evidence	Achieved	Merit	Excellence
ONE (a)	**Electric** force upwards. Gravitational force downwards.	**Electric** force **upwards**. Gravitational force downwards.		
(b)	$F_{el} = Eq = 610 \times 24 \times 10^{-10}$ $= 1.464 \times 10^{-6}$ N Electric force upwards = mg $m = \dfrac{1.464 \times 10^{-6}}{9.8} = 1.49 \times 10^{-7}$ kg	Correct answer to electric force. 1.464×10^{-6}	Correct answer for mass. 1.49×10^{-7}	
(c)	The oil drop would accelerate (move) towards the positive plate. The field strength would increase when distance between plates is decreased, so the force on the oil drop would increase.	The oil drop would accelerate (move) towards the positive plate.	The field strength would increase when distance between plates is decreased, so the force on the oil drop would increase.	

(d)	They would both experience the same electric force, since the electric field strength is the same, and both have the same sized charge on them. The electron would experience a greater acceleration, since it is much lighter (has smaller mass) than the proton.	They would both experience the same electric force. OR The electron would experience a greater acceleration.	They would both experience the same electric force, since the electric field strength is the same, and both have the same sized charge on them. OR The electron would experience a greater acceleration, since it is much lighter (has smaller mass) than the proton.	They would both experience the same electric force, since the electric field strength is the same, and both have the same sized charge on them. AND The electron would experience a greater acceleration, since it is much lighter (has smaller mass) than the proton.

TWO (a)	$R_{parallel} = \left(\dfrac{1}{6.8} + \dfrac{1}{3.5}\right)^{-1}$ $R_{parallel} = 2.31\,\Omega$ $R_{T} = 3.0 + 2.3 = 5.3\,\Omega$	Recognition that the 3 Ω resistor is in series with a parallel combination.	$R_{parallel} = \left(\dfrac{1}{6.8} + \dfrac{1}{3.5}\right)^{-1}$ $R_{parallel} = 2.3\,\Omega$ $R_{T} = 3.0 + 2.3 = 5.3\,\Omega$	
(b)	Voltage across battery $V = IR$ $= 6.0 \times 5.3 = 31.8$ V Voltage across 3.5 Ω resistor $= 31.86 - 18 = 13.8$ V $= 14$ V	Voltage across battery $V = IR$ $= 6.0 \times 5.3 = 31.8$ V Or consistency from part (a).	Voltage across 3.5 Ω resistor $= 31.8 - 18 = 14$ V	
(c)	2sf. The final answer cannot be any more accurate than the least number of significant figures in the question.	2sf. The final answer cannot be any more accurate than the least number of sf in the question.		
(d)	(The energy per second is its power output.) Power depends on voltage and current. Since both resistors are on the same branch, they both have the same current through them. Since voltage is directly proportional to resistance, when current is the same ($V = IR$), the 4.6 Ω resistor would have a greater voltage across it. Hence the 4.6 Ω resistor would use greater energy per second.	• (The energy per second is its power output.) • Power depends on voltage and current.	Since both resistors are on the same branch, they both have the same current through them. OR Since voltage is directly proportional to resistance, when current is the same ($V = IR$), the 4.6 Ω resistor would have a greater voltage across it.	• (The energy per second is its power output.) • Power depends on voltage and current. • Since both resistors are on the same branch, they both have the same current through them. • Since voltage is directly proportional to resistance, when current is the same ($V = IR$), the 4.6 Ω resistor would have a greater voltage across it. • Hence the 4.6 Ω resistor would use greater energy per second.

THREE (a)	Lamp A would be dimmer.	Lamp A would be dimmer.		
(b)	Adding another lamp in parallel will mean effective resistance decreases. This means the circuit current will increase. Hence voltage across lamp A will increase. The voltage across lamps B, C, and D will decrease.	Effective resistance decreases. Voltage across B / C / D will decrease. V across A increase	Adding another lamp in parallel will mean effective resistance decreases. This means the circuit current will increase.	Adding another lamp in parallel will mean effective resistance decreases. This means the circuit current will increase. Hence voltage across lamp A will increase. The voltage across lamps B, C, and D will decrease.
(c)	$V = IR$ $V = 0.5 \times 6.0 = 3.0$ V	$V = IR$ $V = 0.5 \times 6.0 = 3.0$ V		
(d)	Voltage across each branch $= 12 - 3 = 9.0$ V. Current through bottom branch $= V / R = 9.0 / 6.0 = 1.5$ A Current through middle branch $= 6.0 - 1.5 = 4.5$ A Resistance of middle branch $= V / I = 9.0 / 4.5 = 2.0\ \Omega$ Resistance of resistor $= 2.0\ \Omega$	Voltage across each branch $= 12 - 3 = 9.0$ V.	Current through bottom branch $= V / R = 9.0 / 6.0 = 1.5$ A Current through middle branch $= 6.0 - 1.5 = 4.5$ A	Resistance of middle branch $= V / I = 9.0 / 4.5 = 2.0\ \Omega$ Resistance of resistor $= 2.0\ \Omega$

FOUR (a)	$F = Bqv$ $= 0.65 \times 1.6 \times 10^{-19} \times 4.8 \times 10^3$ $= 4.992 \times 10^{-16}$ N	$F = Bqv \rightarrow$ $0.65 \times 1.6 \times 10^{-19} \times 4.8 \times 10^3$ $= 4.992 \times 10^{-16}$ N		
(b)	Conventional current will be anticlockwise (up the rod).	Conventional current will be anticlockwise (up the rod).		
(c)	• The magnetic force on the electrons causes charge separation. • Charge separation results in the formation of an electric field. • This results in an induced voltage across the ends of the wire. • Since it is a complete circuit, there will be a current. OR (Alternate answer) • The motion of the rod causes electrons in the rod to move to the bottom of the rod. • Top of rod is positive and bottom of rod is negative. • This means there is a voltage. • This causes electrons to flow around the loop (or causes a current to flow around the loop).	• The magnetic force on the electrons causes charge separation. • Charge separation results in the formation of an electric field. OR (Alternate answer) • The motion of the rod causes electrons in the rod to move to the bottom of the rod.	• The magnetic force on the electrons causes charge separation. • Charge separation results in the formation of an electric field. • This results in an induced voltage across the ends of the rod. OR (Alternate answer) • The motion of the rod causes electrons in the rod to move to the bottom of the rod. • Top of rod is positive and bottom of rod is negative. • This means there is a voltage.	• The magnetic force on the electrons causes charge separation. • Charge separation results in the formation of an electric field. • This results in an induced voltage across the ends of the wire. • Since it is a complete circuit, there will be a current. OR (Alternate answer) • The motion of the rod causes electrons in the rod to move to the bottom of the rod. • Top of rod is positive and bottom of rod is negative. • This means there is a voltage. This causes electrons to flow around the loop (or causes a current to flow around the loop).

(d)	$V = BvL$ $V = 0.85 \times 0.40 \times 4.6$ $= 1.564$ V $I = \dfrac{V}{R} = \dfrac{1.564}{0.68}$ $I = 2.3$ A $F = BIL$ $F = 0.85 \times 2.3 \times 0.40 = 0.782$ N $F = 0.78$ N	$V = BvL \rightarrow$ $V = 0.85 \times 0.40 \times 4.6$ $= 1.564$ V	$I = \dfrac{V}{R} \rightarrow \dfrac{1.564}{0.68}$ $I = 2.3$ A	$F = BIL$ $F =$ $0.85 \times 2.3 \times 0.40$ $= 0.782$ N $F = 0.78$ N

Cut Scores

	Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
Score range	0 – 8	9 – 16	17 – 24	25 – 32