

## Assessment Schedule – 2012

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

#### Assessment Criteria

Question	Achievement	Merit	Excellence					
ONE (a)	When the voltage across the lamp is 12 V, the power output is 5 W.							
(b)	The 18 W lamp will be brighter as it has a greater power output. OR The brightness of a lamp depends on its power output.	The 18 W lamp will be brighter as it has a greater power output. AND [The brightness of a lamp depends on its power output. OR both get 12V.]						
(c)	$P = VI \rightarrow I_1 = 5 / 12 \rightarrow I_1 = 0.42 \text{ A}$ OR $I_2 = 18 / 12 \rightarrow I_2 = 1.5 \text{ A}$	$P = VI \rightarrow I_1 = 5 / 12 \rightarrow I_1 = 0.42 \text{ A}$ $I_2 = 18 / 12 \rightarrow I_2 = 1.5 \text{ A}$ $I_{\text{total}} = 1.92 \text{ A}$	$P = VI \rightarrow I_1 = 5 / 12 \rightarrow I_1 = 0.42 \text{ A}$ $I_2 = 18 / 12 \rightarrow I_2 = 1.5 \text{ A}$ $I_{\text{total}} = 1.92 \text{ A}$ $R_{\text{total}} = 12 / 1.92 = 6.25 \Omega$					
(d)	$P = E / t$ Energy calculated using incorrect value for time.	$E = 18 \times 3 \times 60 = 3240 \text{ J}$						
NØ	N1	N2	A3	A4	M5	M6	E7	E8
No evidence	1a	2a	3a	4a	1a + 2m	2a + 2m	2m + 1e	1a + 2m + 1e
TWO (a)	Since the lamps are connected in series, they will have the same current through them. OR Since the lamps are identical, they will have the same resistance.	<b>Any two of:</b> Since the lamps are connected in series, they will have the same current through them. OR Since the lamps are identical, they will have the same resistance, hence voltage across each one is the same. OR Since $P=VI$ , each will have the same power output and hence the same brightness.	Since the lamps are connected in series, they will have the same current through them. AND Since the lamps are identical, they will have the same resistance, hence voltage across each one is the same. AND Since $P=VI$ , each will have the same power output and hence the same brightness.					
(b)	Resistance of each lamp = $\frac{12 \times 12}{5} = 28.8 \Omega$	Resistance of each lamp = $\frac{12 \times 12}{5} = 28.8 \Omega$ Effective resistance = $28.8 + (28.8^{-1} + 28.8^{-1})^{-1} = 43.2 \Omega$	Resistance of each lamp = $\frac{12 \times 12}{5} = 28.8 \Omega$ Effective resistance = $28.8 + (28.8^{-1} + 28.8^{-1})^{-1} = 43.2 \Omega$ Circuit current = $I = \frac{V}{R} = \frac{12V}{43.2 \Omega} = 0.28 \text{ A}$					

(c)	Voltage across Lamp A = $V = IR \rightarrow V = 0.28 \times 28.8 \rightarrow V = 8.064 \text{ V}$  Lamp A gets twice the current	Voltage across Lamp A = $V = IR \rightarrow V = 0.28 \times 28.8 \rightarrow V = 8.064 \text{ V}$ Voltage across lamps in parallel = $12 - 8.064 = 3.94 \text{ V}$  Lamp A gets twice the current because current splits / R the same	Voltage across Lamp A = $V = IR \rightarrow V = 0.28 \times 28.8 \rightarrow V = 8.064 \text{ V}$ Voltage across lamps in parallel = $12 - 8.064 = 3.94 \text{ V}$ Power output of Lamp A = $P = VI = 8.064 \times 0.28 = 2.25 \text{ W}$ Power output of parallel lamps = $P = VI = 3.94 \times (3.94 / 28.8) = 0.54 \text{ W}$ Hence lamp A has a greater power output and hence is brighter than Lamps B and C. Lamp A gets twice the current because / current splits / resistances the same and $P = I^2R$					
NØ	N1	N2	A3	A4	M5	M6	E7	E8
No evidence	1 point correct	1a	2a	3a	1a + 2m	3m	2m + 1e	1m + 2e
THREE (a)	The upper plate has to be positive to prevent the negatively charged oil drop from falling down. OR Electric field is directed downwards, so the electrons will be attracted upwards.	The upper plate has to be positive to prevent the negatively charged oil drop from falling down OR electric field is directed downwards, so the electrons will be attracted upwards. AND The force of gravity acts downwards, so the oil drop is held stationary by an equal force acting upwards.						
(b)	The gravity force(weight force) should be equal in size and opposite in direction to the electric force.							
(c)	$F_g = mg = 2.54 \times 10^{-5} \times 9.8 = 2.4892 \times 10^{-4} \text{ N}$	$F_{el} = Fg = 2.4892 \times 10^{-4} \text{ N}$ $E = F / q = 2.4892 \times 10^{-4} / (3.6 \times 10^{-9}) = 69\,144 \text{ N C}^{-1}$	$F_g = mg = 2.54 \times 10^{-5} \times 9.8 = 2.4892 \times 10^{-4} \text{ N}$ $F_{el} = Fg = 2.4892 \times 10^{-4} \text{ N}$ $E = F / q = 2.4892 \times 10^{-4} / (3.6 \times 10^{-9}) = 69\,144 \text{ NC}^{-1}$ $E = V / d \rightarrow V = Ed \rightarrow V = 69144 \times 4.8 \times 10^{-4} = 33.18$ $V = 33 \text{ V}$					
(d)	33	2sf Since the final answer cannot be any more accurate than the least number of sf in the question. OR The least number of sf in the question is 2.						
NØ	N1	N2	A3	A4	M5	M6	E7	E8
No evidence	1a	2a	3a	4a	1a + 2m	2a + 2m	2m + 1e	1a + 2m + 1e

FOUR (a)	The rod will move to the right.		The rod will move to the right because the current through the rod which is in the magnetic field will cause the electrons in the rod to experience a force to the right causing the rod itself to move. OR Power supply causes electrons to move through the rod. The electrons are cutting across a magnetic field, so have a force on them.					
(b)	$I = V/R \rightarrow I = 12.0 / 35.4 \rightarrow 0.34 \text{ A}$		$I = V/R \rightarrow I = 12.0 / 35.4 \rightarrow 0.34 \text{ A}$ $F = BIL \rightarrow$ $F = 0.85 \times 10^{-3} \times .34 \times 18.5 \times 10^{-2}$  OR $= 0.85 \times 10^{-3} \times .34 \times 25 \times 10^{-2}$ $F = 7.2 \times 10^{-5} \text{ N}$			$I = V/R \rightarrow I = 12.0 / 35.4 \rightarrow 0.34 \text{ A}$ $F = BIL \rightarrow F$  $= 0.85 \times 10^{-3} \times .34 \times 18.5 \times 10^{-2}$ $F = 5.4 \times 10^{-5} \text{ N}$		
(c)	$V = BvL \rightarrow$ $V = 0.85 \times 10^{-3} \times 2.5 \times 25 \times 10^{-3} \rightarrow$ $V = 5.3 \times 10^{-4} \text{ V}$							
(d)	The rod slows down and stops.		The rod slows down and stops because the induced current in the rod causes an electromagnetic force.			The rod slows down and stops because the induced current in the rod causes an electromagnetic force. This force is in the opposite direction to the movement, causing the rod to slow down and stop.		
NØ	N1	N2	A3	A4	M5	M6	E7	E8
No evidence	1a	2a	3a	4a	1a + 2m	2a + 2m	2m + 1e	1m + 2e

### Judgement Statement

	Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
Score range	0 – 10	11 – 19	20 – 24	25 – 32