Assessment Schedule – 2007

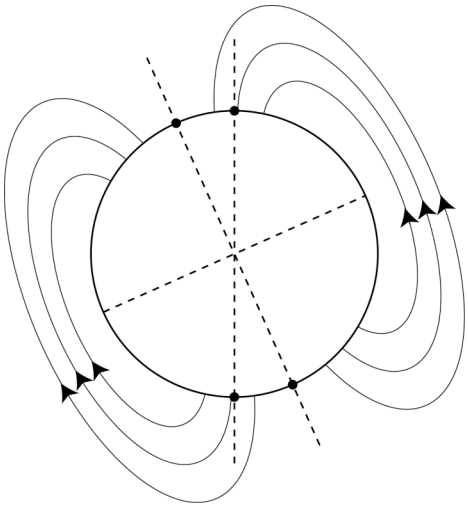
Physics: Demonstrate understanding of electricity and magnetism (90185)

Note: Minor computational errors will not be penalised. A wrong answer will be accepted as correct provided there is sufficient evidence that the mistake is not due to a lack of understanding. Such evidence includes:

- the last written step before the answer is given has no unexpanded brackets or terms and does not require rearranging
- the power of any number that is multiplied by a power of 10 is correct.

Correct units and significant figures are required only in the questions that specifically ask for them.

Q	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
1(a)	Resistance (calculated from the gradient of the line) = 10 Ω	[2] Correct answer.		
1(b)	1. $V_{\text{variable}} = 16 - 4.0 = 12.0$ V 2. From the graph, when $V = 4.0$ V, current = 0.40 A or $I = V/R = 4/10 = 0.40$ A 3. $R = \frac{V}{I} = \frac{12.0}{0.40} = 30\ \Omega$ Some students may use the ratio method. $\frac{V_{va}}{V_m} = \frac{R_{var}}{R_m}$ $\frac{12}{4} = \frac{R_{var}}{10}$ R_{var} $(10 \times 12) / 4 = 30\ \Omega$	[2] Correct answer for V_{variable}. or Use of ratio method or Correct answer with no working.	[2] Correct working and answer.	
1(c)	$V_{\text{bulb}} = \frac{6.0}{3} = 2.0$ V $P = VI = 2.0 \times 0.40 = 0.80$ W OR Total power = $6.00 \times 0.40 = 2.4$ W Power per bulb = $2.4 / 3 = 0.80$ W	[2] Correct answer for V_{bulb} OR correct total power (which must be clearly labelled as Total Power.) OR Correct answer with no working.	[2] Correct working and answer.	
1(d)	The bulbs B_1 and B_3 are bright(er) and B_2 is not lit (or is dim).	[1] Correct answer.		
1(e)	1. When the switch is closed, the bulb B_2 goes out because no current flows through it / it is short-circuited / electrons take the easiest path through the wire. Now, 6.0 V is shared between the two bulbs B_1 and B_3, so voltage across the bulbs increases. 2. The effective resistance of the circuit decreases, so the current increases. 3. Brightness is related to the power and power = VI. So increasing V and I increase the brightness.	[1] Explanation indicates either increase in voltage OR increase in current.	[1] Mentions (an increase in voltage AND increase in current) AND (gives cause as fewer bulbs in the circuit OR decreased total resistance.)	[1] Mentions decrease in resistance, increase in current and voltage, and cause and relates them to brightness and power.
1(f)	$V_{AB} = \frac{6.0}{2} = 3.0\ V$	[2] Correct answer.		

1(g)	$R_T = R_1 + R_2 = 3.5 + 2.5 = 6.0\ \Omega$ $I = \frac{V}{R} = \frac{12}{6.0} = 2\ \text{A}$ $V_{3.5\,\Omega} = IR = 2.0 \times 3.5 = 7.0\ \text{V}$ $P = VI = 7.0 \times 2.0 = 14\ \text{W}$	[2] Correct answer for R_T. OR Calc. of V using $\frac{3.5}{(3.5+2.5)} \times 12$	[2] Correct working and answer for *I*. OR Correct value for $V_{3.5\,\Omega}$ OR correct answer with no working.	[2] Correct working and answer.
2(a)	During rubbing, friction between the polythene rod and the woollen cloth transfers negative charges (electrons) from the woollen cloth to the rod.	[1]It must be clear that the electrons come from the cloth. (Movement of +ve charges not accepted; neither is negatively charged wool.)		
2(b)	1. The ends of the hair closer to the dome become negatively charged, leaving the ends further away from the dome positively charged. 2. Like charges repel, so the ends of the hair strands spread due to the force caused by repulsion.	[1] Hairs have the same charge so they repel each other (accept negative charge).	[1] As for A but states charge is positive. (Movement of positive charges not accepted).	[1]Correct explanation including induction (stated or implied) causes accumulation of positive charges on the hair tips and causes repulsion.
2(c)	The negative charges from the air or environs slowly neutralise the positive charges in the dome and the hair, so the strands eventually become uncharged.		[1] Clear and correct explanation. (Movement of +ve charges not accepted)	
3(a)	Magnetic field is the region where magnetic force is felt.	[1] A phrase with the same meaning.		
3(b)		[1] Correct direction.		
3(c)			[1] Correct winding. (Arrows not essential providing connections to battery are clear. Look at diagram carefully.)	

3(d)	Bring the north end of a compass needle or bar magnet near. If it repels then the end X is north / south end will be attracted. or Use a search compass to detect field lines alongside the rod. compass needle must point away from end X.		[1] Explanation must include expected result.	
4(a)	'60 W' means 60 joules of energy produced per second.	[1] Answer must include 60 joules (or units of energy) per second. The phrase "This is the number of …" to imply 60 is acceptable.		
4(b)	Total power = $(60 \times 2) + (21 \times 4)$ = 204 W	[2] Answer must show correct sum and/or products of 21 and 60.		
4(c)	$E = P \times t = 204 \times (20 \times 60)$ = 244 800 J	[2] Correct working and answer, using 20 minutes OR using incorrect calculation of seconds OR correct answer with no working.	[2] Correct working and answer.	
4(d)	$I_{total} = \frac{P}{V} = \frac{120}{12} = 10\ A$ $R_{total} = \frac{V}{I} = \frac{12}{10} = 1.2\ \Omega$ or *use of* $P = \frac{V^2}{R}$		[2] Correct working and answer for I_{total} = 10 A. OR I = 5 A for one headlamp OR Uses $P = \frac{V^2}{R}$ to calculate R for 1 lamp OR correct answer with no working.	[2] Correct working and answer.
4(e)	$I = \frac{P}{V} = \frac{540}{12} = 45$ A $B = \frac{\mu_0 I}{2\pi d} = \frac{1.26 \times 10^{-6} \times 45}{2 \times \pi \times 0.12}$ $= 7.5 \times 10^{-5}$ T	[2] Correct working and answer for *I*.	[2] Correct process, but used 12 cm to get an answer of 7.5×10^{-7} T or Correct working using incorrect value for *I* or correct answer with no working.	[2] Correct working and answer.

4(f)	When the switch is turned on, **current flows through the solenoid** circuit and **energises** the solenoid, (it becomes a magnet). The solenoid **attracts the soft iron, which moves** into the coil, (to the right) and the **conducting material** at the end of it **completes the circuit** of the starter motor **and turns it on**, (current flows to the starter motor).		[1] Explains that when the switch is turned on, the solenoid becomes a magnet and the starter motor is turned on.	[1]Explanation must include all underlined items. (If explanation is basically correct but omits one or two items, merit only.)

Judgement Statement

	Achievement	Achievement with Merit	Achievement with Excellence	
Criterion One	3 × A1	2 × M1 + 3 × A1	1 × E1 + 2 × M1 + 3 × A1	Plus 1 × E from either criterion.
Criterion Two	4 × A2	3 × M2 + 3 × A2	1 × E2 + 2 × M2 + 3 × A2	