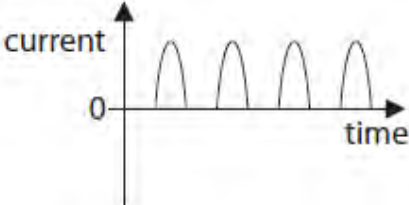


Question number	Answer	Notes	Marks
1 (a) (i)	MP1. series circuit containing lamp and some form of power supply;  MP2. ammeter in series (with lamp/battery);  MP3. voltmeter in parallel across lamp;	correct symbols only condone cell for battery	(3)
(ii)	$V = I.R$ ;	accept in words rearrangements NOT the 'triangle'	(1)
(iii)	current reading from graph; calculation; unit; e.g. 1.5 (A) 4 $\Omega$ /ohms	do not accept V/A for $\Omega$	(3)
(iv)	correct shape; correct end position/size;		(2)
(b)	 D ;		(1)

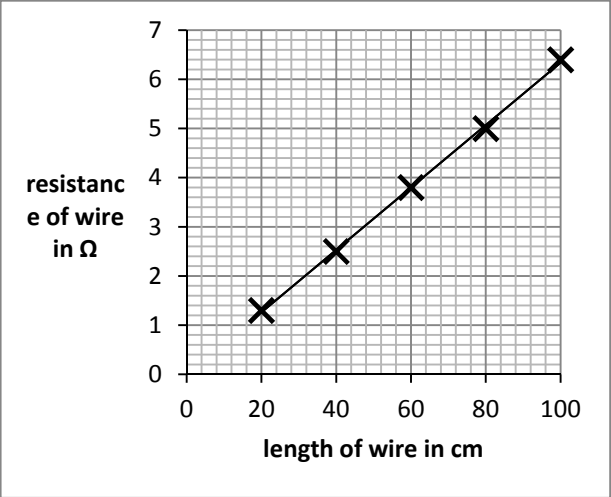
**Total for Question 1 = 10 marks**

Question number	Answer	Notes	Marks
2 (a)	B (no earth connection);		1
(b)	C (the circuit cannot overheat if there is a fault);		1
(c)	A (in parallel);		1

**Total 3 marks**

Question number	Answer	Notes	Marks
3	(a) CIRCUIT DIAGRAM – Correct symbols for ammeter, voltmeter and battery; Ammeter in series with cells;	ALLOW three separate cells in series	1
	Voltmeter in parallel with wire / as shown in photograph;	ALLOW anything reasonable for the wire (e.g. straight line, variable resistor, resistor)	1
	(b) (i)	BOTH NEEDED	1
	(ii)	IGNORE references to calculating resistance, plotting graphs –	5
	ANY FIVE APPROPRIATE, e.g. Connect the circuit / connect (crocodile) clip to wire; Read ammeter; Read voltmeter; For known /particular / quoted value length; measure length with a ruler; Repeat readings / average (in different places along the wire); Take readings for different lengths; Check meters for zero errors; Disconnect/switch off between readings; To avoid heating the wire;		

Question Number	Answer		Marks
3 (c) (i)	Voltage = current x resistance;	ALLOW standard symbols, $V = I \times R$ ALLOW correct rearrangements DO NOT ALLOW equation given as unit symbols	1
(ii)	6.4;	ALLOW correct answer if it follows an equation given in unit symbols IGNORE s.f. BUT must be correctly rounded from 6.4285...	1

Question Number	Answer		Marks										
3 (d) (i)	<p>Sample graph –</p>  <p>scale; at least half the paper axes labelled including units; Plotting; Plotting; Best fit line;</p>	<table border="1" data-bbox="1270 275 1486 484"> <tbody> <tr> <td>20</td> <td>1.3</td> </tr> <tr> <td>40</td> <td>2.5</td> </tr> <tr> <td>60</td> <td>3.8</td> </tr> <tr> <td>80</td> <td>5.0</td> </tr> <tr> <td>100</td> <td>6.4</td> </tr> </tbody> </table> <p>Points to plot</p> <p>IF AXES REVERSED, LOSE THE AXES MARK Ignore (100 cm, 6.4) ALLOW as length increases resistance increases ALLOW conclusions in terms of resistance per metre etc</p>	20	1.3	40	2.5	60	3.8	80	5.0	100	6.4	5
20	1.3												
40	2.5												
60	3.8												
80	5.0												
100	6.4												

Question Number	Answer		Marks
3 (d) (ii)	MARK (ii) and (iii) together, credit points wherever seen (directly) proportional;	IGNORE 'as length increases current decreases' / conclusions relating to current	1
MARK tog With		ALLOW constant gradient ALLOW positive correlation	1
(iii)	any TWO of Straight line; Through (0,0); line slopes upwards; quoting appropriate values from the graph;		1
		<b>Total</b>	<b>19</b>

Question number	Answer	Notes	Marks
4 (a)	(i) can all be switched separately ; others stay alight when 1 bulb blows/eq;  (ii) One of - to prevent overheating in the circuit / appliance/ wiring/ lamps; to switch off the circuit; to prevent current exceeding a certain value;  (iii) (if or when) current exceeds stated value/current too high; the fuse (over heats and) melts;  this breaks the circuit/stops the current/ turns the circuit off;	IGNORE live wire/plug          allow "fuse blows" ignore burns ignore 'stops the electricity'	2          1          3

Question number	Answer	Notes	Marks
4 (b) (i)	$P = I \times V$ ;	Allow <ul style="list-style-type: none"> <li>rearrangements</li> <li>standard abbreviations</li> <li>equation in words</li> </ul>	1
(ii)	rearrangement; sub into equation; evaluation; e.g. $I = P/V$ $= 250 / 230$ $= 1.1$ (A)	rearrange and sub in either order allow a power of ten (POT) error for -1	3
(iii)	value 3 (A); fuse (value should only be) a little bigger than the current;	1.09 (A) Allow ecf from bii	2
(iv)	In ANY order Any two from: - MP1. circuit breakers are resettable/eq; MP2. circuit breakers work instantly/ fuses do not work instantly; MP3. doesn't require earth wire; MP4. Circuit breakers are more sensitive;		2
(c)	D		1

(Total for Question 4 = 15 marks)



Question number		Answer	Notes	Marks
5 (a)		any three of  MP1 idea that there is <b>current</b> (in the wire/coil);  MP2 idea that (the coil has) a <b>magnetic field</b> ;  MP3 idea that coil's magnetic field <b>interacts</b> with field of permanent magnet;  MP4 idea that there is a <b>force</b> on the coil/wire;  MP5 Idea that current or force <b>reverses</b> every half turn;	Allow ideas of electromagnetic field, electromagnet  Allow - 'magnetic fields touch / overlap' Ignore - 'cutting of magnetic fields'  Allow ideas of LHM rule, Fleming's LHR, catapult field, attraction, repulsion  Allow action of a commutator described	3

<p>(b) (i)</p>		<p>any two of</p> <p>MP1 increase magnetic field( e.g. stronger magnets or magnets closer or magnets curved round coil);</p> <p>MP2 increase current OR voltage Or more cells;</p> <p>MP3 increase number of turns (on coil);</p> <p>MP4 a sensible alternative suggestion e.g. use two or more sets of coils at angles, lubricate axle;</p>	<p>Allow “use thicker wire”</p> <p>Ignore “stronger battery”</p> <p>Allow idea of 3 phase supply, iron stator</p>	<p>2</p>
<p>(ii)</p>		<p>Suggestion that clearly results in reversal of the current OR the cell connections OR the magnet’s field;</p>		<p>1</p>
<p>(c)</p>		<p>any two of</p> <p>MP1 Idea that force is increased (by stronger field);</p> <p>MP2 Idea of radial magnetic field (rather than a uniform one);</p> <p>MP3 Coil remains in the field for a longer time;</p>	<p>Allow idea that iron is magnetised</p> <p>Allow idea that magnetic field acts “all the way around”</p> <p>Allow idea that force acts over a larger part of a cycle</p>	<p>2</p>

Question number	Answer	Notes	Marks
6 (a) (i)	Reference to a (magnetic) field / flux / field lines; Which changes in the coil / cuts the coil ORA ;	MUST refer to relative motion between coil / wire and (magnetic) <u>field</u> – references to moving magnet insufficient (and repeat of stem)  'wire cuts (magnetic) field' = 2 marks	2
(ii)	Faster/more energetic movement (shaking);	ACCEPT More <u>turns</u> on the coil (not bigger coil);  ACCEPT Stronger magnet / magnetic field (not bigger magnet);  REJECT 'more coils' / 'more loops' REJECT 'add another magnet'	1
(b) (i)	C (there is a current in the circuit)		1
(ii)	LED wastes less energy / produces less heat (than a filament lamp); ORA Useful energy output ÷ total energy input is larger for the LED / useful output is closer to total (energy) input; ORA		2

**Total 6 Marks**

Question number	Answer	Notes	Marks
7 (a) (i)	A		1
	(ii) B		1
(b) (i)	nearest above (DOP)		1
(ii)	Comment on device – (plastic) insulator / does not conduct;		1
(iii)	Comment on user - no risk of shock / electrocution;	(double) insulated / no current (through) / cannot become live	1
		No electricity reaches user / person cannot touch live parts	