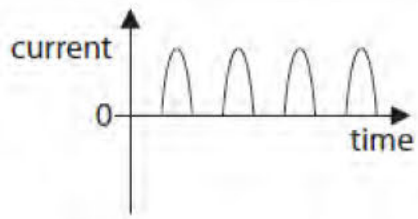
Question number	Answer	Notes	Marks
1 (a) (i)	MP1. series circuit containing lamp and some form of power supply; MP2. ammeter in series (with lamp/battery); MP3. voltmeter in parallel across lamp;	correct symbols only condone cell for battery	(3)
(ii)	V=I.R;	accept in words rearrangements NOT the 'triangle'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

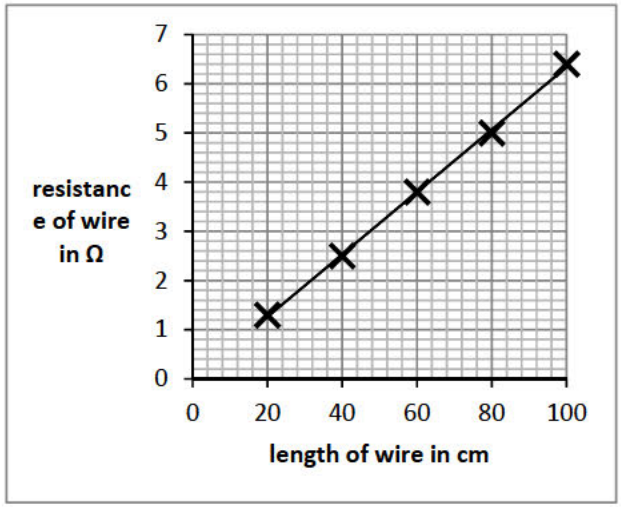
Total for Question 1 = 10 marks

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;	ALLOW three separate cells in series	1
	Ammeter in series with cells;	ALLOW anything reasonable for the wire (e.g. straight line, variable resistor, resistor)	1
	Voltmeter in parallel with wire / as shown in photograph;		1
(b) (i)	(independent variable) – length (of wire) (dependent variable) - resistance	BOTH NEEDED	1
(ii)	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;	IGNORE references to calculating resistance, plotting graphs –	5

Question Number	Answer		Marks
3 (c) (i)	Voltage = current x resistance;	ALLOW standard symbols, V = I X 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)	Sample graph –  scale; at least half the paper axes labelled including units; Plotting; Plotting; Best fit line;	<table><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>.4)</td></tr></table> Points to plot 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	5

Question Number	Answer		Marks
3 (d (ii) MARK tog With	MARK (ii) and (iii) together, credit points wherever seen (directly) proportional;	IGNORE 'as length increases current decreases' / conclusions relating to current	1
		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
		Total	**19**

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

Question number	Answer	Notes	Marks
4 (b) (i)	P= I x V ;	Allow • rearrangements • standard abbreviations • equation in words	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 1.09 (A)	3
(iii)	value 3 (A); fuse (value should only be) a little bigger than the current;	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 **current** (in the wire/coil); MP2 idea that (the coil has) a **magnetic field**; MP3 idea that coil's magnetic field **interacts** with field of permanent magnet; MP4 idea that there is a **force** on the coil/wire; MP5 Idea that current or force **reverses** 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

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

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