Energy and Voltage in circuits

Mark Scheme 1

Level	IGCSE(9-1)
Subject	Physics
Exam Board	Edexcel IGCSE
Module	Double Award (Paper 1P)
Topic	Electricity
Sub-Topic	Energy and Voltage in circuits
Booklet	Mark Scheme 1

Time Allowed: **74 minutes**

Score: **/61**

Percentage: **/100**

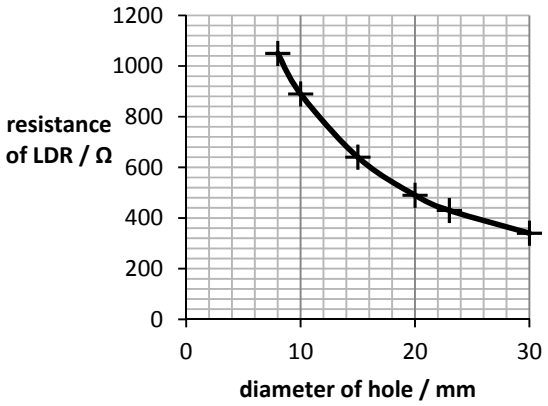
Grade Boundaries:

A*	A	B	C	D	E	U
>85%	775%	70%	60%	55%	50%	<50%

Question number	Answer	Notes	Marks
1 (a) (i)	Voltmeter connected in parallel with a component; component is LDR;	not in parallel with wire	2
(ii)	measure current / take current reading; divide voltage (reading) by current (reading);	accept • number of amps for current • p.d. or number of volts for voltage • R = V/I Ignore triangle mnemonics	2
(b) (i)	B – the diameter of the hole;		1
(ii)	C – the distance from the card to the LDR;		1
(iii)	Any one of - Move ruler to cover half the hole/halfway down the hole; Draw guide lines; Use set square;	idea of measuring across/over the diameter at right angles to ruler Placed against ruler Ignore: move ruler nearer the hole/start from 0 on the ruler	1

Continued

Question number	Answer	Notes	Marks
1 (c) (i)	suitable scales; axes labelled; Plotting of points;;	Must use > half width and half height of grid units on axis labels ignore orientation of graph to nearest ½ square, up to two marks available for this, -1 each error	4
(ii)	line of best fit;	reject dot to dot allow a reasonably smooth curve, points should be evenly distributed about the line	1



diameter /mm	resistance /Ω
8	1050
10	890
15	640
20	490
23	430
30	340

(iii)	MP1	Idea of an inverse relationship; OR Pattern sentence linking resistance and diameter;	ignore ‘negative correlation’ e.g. “the bigger the diameter, the lower the resistance”	2
	MP2	Idea of a non-linear relationship;	allow exponential decrease	

Total 14 marks

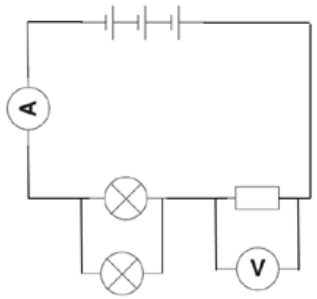
Question number	Answer	Notes	Marks
2 (a) (i)	P = I x V;	accept standard symbols or in words or rearranged	1
(ii)	substitution and rearrangement; evaluation; e.g. (I =) 110/230 (I =) 0.48 (A)	 allow 0.5, 0.47826 (A) condone 0.47, 0.4782	2
(b) (i)	any suitable suggestion; e.g. carries a high(er) <u>current</u> has low(er) <u>resistance</u>	ignore references to cable overheating/melting	1
(ii)	L or live;		1
(iii)	any suitable suggestion; e.g. double insulated does not have a metal case / has a plastic case	 case is not a conductor / is an insulator	1

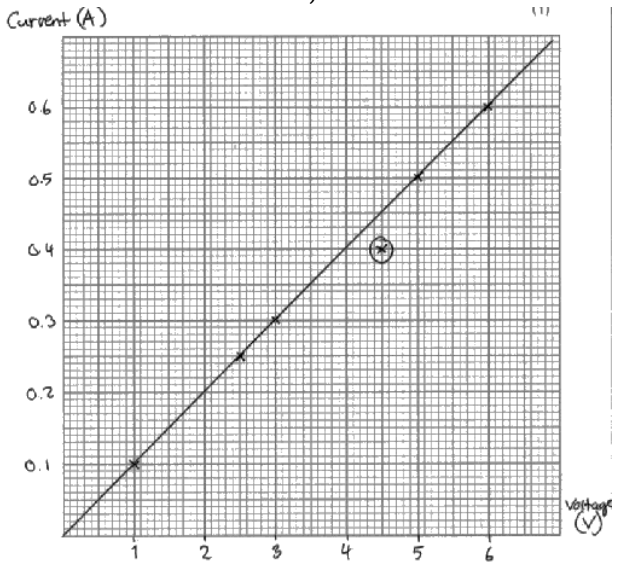
(c)	substitution into a suitable equation; time in correct units; evaluation; e.g. (E = I x V x t) (E =) 0.17 x 230 x 55……1 mark (E =) 0.17 x 230 x 55 x 60…2 marks (E =) 130 000 (J)……3 marks OR (E = P x t) (E =) 40 x 55……1 mark (E =) 40 x 55 x 60……2 marks (E =) 130 000 (J)……3 marks	no mark for the equation as given in the paper allow if x60 / 3300 seen anywhere in working 129 030 (J) allow 131 835 for use of V = 235V 132 000(J) total marks = 9	3

Question number	Answer	Notes	Marks
3 (a) (i)	Voltmeter connected in parallel with any circuit component; Component chosen is the thermistor;	Ignore a line through the voltmeter symbol	2
(ii)	(because voltage is) a controlled variable;	Allow idea of fair test	1
(iii)	Any one of - MP1. Idea of adjustment (of current or **circuit** resistance); MP2. To control the current;		1

(b)	Any three of - **references to the data:** MP1. (yes it works) when the temps are high, the current almost matches the temperature; MP2. (no it's not OK) when the temps are lower, the current value does not match the temperature; MP3. It is only right at 10 (and 100); **Practicality ideas:** MP4. The current cannot be **negative** when the temperature is negative; MP5. Idea that **Voltage** will not be constant/ voltage has to be adjusted to keep it constant; **line ideas** MP6. Line/ graph is curved /eq; MP7. **Line / graph** does not pass through the origin;	however expressed e.g. About t same from 80 °C to 100 °C; e.g. not equal at 20mA 20 °C allow (graph shows that) current not **directly** proportional to temperature allow 0,0	3

Total 7 marks

Question number	Answer	Notes	Marks
4 (a)	mark each of these independently: MP1. a **resistor** in series with the lamp only; MP2. a second lamp in parallel with the first lamp; MP3. a voltmeter that measures the voltage across the **resistor**; MP4. an ammeter that measures the total current in the circuit;	circuit symbols used must be correct (no square voltmeter/ammeter etc.)  	4
(b) (i)	labels on axes including units; scales on axes; plotting;;	axes can be either way round must occupy >50% in each direction -1 for each error	4
(ii)	I = 0.4, V = 4.5 clearly indicated;		1

(iii)	Suitable line of best fit;  	<table><tr><th>Voltage in V</th><th>Current in A</th></tr><tr><td>1.0</td><td>0.10</td></tr><tr><td>2.5</td><td>0.25</td></tr><tr><td>3.0</td><td>0.30</td></tr><tr><td>4.5</td><td>0.40</td></tr><tr><td>5.0</td><td>0.50</td></tr><tr><td>6.0</td><td>0.60</td></tr></table>	1
(iv)	voltage = current x resistance;	in words or standard symbols	1
(v)	substitution into correct equation using any suitable pair of values taken from the graph line or table; evaluation of R = 10 (Ω);	allow (0.1,1), (0.6,6) etc	2

Total 13 marks

Question number	Answer	Notes	Marks
5 a	MP1. series circuit containing lamp and some form of power supply; MP2. ammeter in series with lamp; MP3. voltmeter in parallel across lamp; MP4. variable resistor in series OR use of variable power supply;	incorrect symbols or substantial gaps =- 1 ONCE allow either symbol for lamp ignore other components e.g. switch	4
b i	idea that gradient changes; e.g. voltage increases more rapidly than the current	look for a rate change expressed in student terms Accept • line is curved • not a straight line • V is not proportional to I	1
ii	MP1. Lamp heats up; MP2. Greater chance of electron collisions; MP3. (hence) resistance increases;	do not award marks for a description of the shape of the graph	3

(Total for question 5 = 8 marks)

Question number	Answer	Notes	Marks
6 (a) i	MP1 Any circuit including **correct circuit symbols** for • battery /cell / d.c. power supply • ammeter • voltmeter ;	ignore other components for MP1	3
ii	MP2 ammeter clearly measures current through the wire; MP3 voltmeter clearly across wire;	allow even if voltmeter in series with ammeter allow circuit line drawn through meter allow voltmeter across a section of the test wire	3
	Idea of measuring current through the wire; Idea of measuring voltage across the wire; Idea of a range of values (of I and V); e.g. alter variable resistor OR repeat for different voltages		
(b) i	any one of resistance changes (with temperature) ;	Reject incorrect relationship between R and Θ	1 1
ii	wire gets hot **and** melts/burns/catches fire/dangerous;	Ignore damage to wire Reject insulating the wire	1
(c)	V proportional to I only at constant temperature; Ohms Law is only true if temperature constant;	Allow to return to room temperature	
i	any one of putting the wire in a water bath ; taking the reading quickly; switching off between readings; using only small currents; voltage = current × resistance ;	Allow V = I × R and rearrangements	
ii	horizontal line above axis;		1

		Total	10