

# Energy and Voltage in circuits

## Mark Scheme 2

<b>Level</b>	IGCSE(9-1)
<b>Subject</b>	Physics
<b>Exam Board</b>	Edexcel IGCSE
<b>Module</b>	Double Award (Paper 1P)
<b>Topic</b>	Electricity
<b>Sub-Topic</b>	Energy and Voltage in circuits
<b>Booklet</b>	Mark Scheme 2

**Time Allowed:** 59 minutes

**Score:** /49

**Percentage:** /100

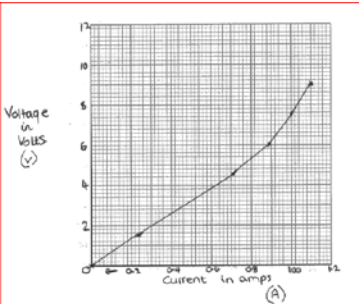
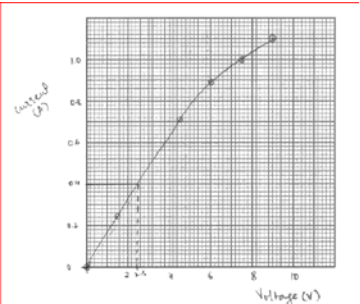
**Grade Boundaries:**

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

Question number	Answer	Notes	Marks
1 (a) (i)	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
2(a)	any 3 mistakes identified from MP1. cells are connected with wrong polarity; MP2. ammeter is connected in parallel (with wire); MP3. voltmeter is connected in series (with wire); MP4. circuit has not got a switch;	allow RA for any MP  allow idea that meters should be swapped for two marks (MP2 and MP3)	3

<p>(b) (i)</p>	<p>suitable scale chosen (&gt; 50% of grid used);                      axes labelled with quantities and unit;                      plotting correct to nearest half square (minus one for each plotting error) ;;                      line of best fit through zero;</p> <div style="text-align: center;">  <p>= 4 not curve mark</p>  <p>= 5</p> </div>	<p>only scales in 1,2,5,10 or 8 acceptable                      orientation unimportant</p> <p>points must be shown clearly                      i.e. two plotting errors = no marks for plotting                      i.e. smooth curve</p> <table border="1" data-bbox="1115 540 1266 771"> <thead> <tr> <th>I</th> <th>V</th> </tr> </thead> <tbody> <tr> <td>0.0</td> <td>0.</td> </tr> <tr> <td></td> <td>1.</td> </tr> <tr> <td>0.7</td> <td>4.</td> </tr> <tr> <td>0.8</td> <td>6.</td> </tr> <tr> <td>1.0</td> <td>7.</td> </tr> <tr> <td>1.1</td> <td>9.</td> </tr> </tbody> </table>	I	V	0.0	0.		1.	0.7	4.	0.8	6.	1.0	7.	1.1	9.	<p>5</p>
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<p>(ii)</p>	<p>0.40 A</p>	<p>range 0.39 A to 0.41 A</p>	<p>1</p>														
<p>(iii)</p>	<p>One of -                      MP1. Temperature (of wire) was not constant;                      MP2. Resistance (of wire) was not constant;</p>		<p>1</p>														

Question number	Answer	Notes	Marks
2 (b) (iv)	Any four of -  MP1. instrument to measure temperature; MP2. means to maintain constant temperature (of wire);  MP3. use of $V = IR$ ; MP4. idea of repeating / averaging (at same temperature); MP5. idea of additional (interpolated) points; MP6. use linear part of the graph;  MP7. use of gradient;	ignore all details about the circuit already given  e.g. water bath, switch off and allow wire to cool $V \propto I$ obtain a range of values (of V, I)  Allow reference to candidate's graph, e.g. current below 0.6 A Orientation unimportant	4

**Total 14 marks**

Question number	Answer	Notes	Marks
3 (a) (i)	any two ideas from:- MP1. voltage / current is <u>induced</u> ; MP2. (because) field in coil is changing / field (lines) cut; MP3. current/voltage changes direction when magnet does; MP4. magnet slows down causing decrease in amplitude;	allow voltage for amplitude  Ignore "wave"	2
	(ii) Either of - (voltage/current) changes direction; Positive <u>and</u> negative (voltage/current);		1
	(iii) any two of - MP1. direction of magnet changes; MP2. amount of field (lines) cut changes / rate of flux cutting; MP3. direction of flux cutting changes; MP4. speed of magnet changes / slows down; MP5. as movement diminishes, so does voltage;		2
(b)	Any three of - MP1. Alternating trace that diminishes; MP2. Amplitude is larger; MP3. Frequency is lower;		3

Total 8 marks

Question number	Answer	Notes	Marks
4 (a) (i)	Current – 2(.0) (A); Voltage – 12(.0) (V);		1
(ii)	Using $E = V \times I \times t$ (formula given on sheet) Time conversion; Substitution; Answer; e. 20 minutes = 20 x 60 seconds = 1200 seconds $E = 12 \times 2 \times 1200$ 28 800 (J)	ecf from a i  If time conversion not done / incorrect then ALLOW $E = V \times I \times 20$ with subs of V and I for 1 mark  ALTERNATIVE APPROACH (using power) Calculate power of heater = $V \times I$ ; Calculate $30000 \div (20 \times 60)$ ; to show comparability;	1 1 1

Question number	Answer		Marks
4 (b) (i)	Efficiency = useful energy output / total energy input;		1
(ii)	Substitution into correct equation; Calculation; e. $22\ 000 / 30\ 000 = 0.73$	ALLOW values calculated using their answer to (a) (ii) e.g $2\ 000 / 28\ 800 = 0.76$  ALLOW percentages	1 1
(iii)	Calculation of useful energy doesn't allow for energy lost;		1
(iv)	Insulate the block (to reduce energy loss);		1
(c) (i)	Energy raising temperature of the <u>heater</u> / Time for energy to transfer between heater and thermometer;		1
(ii)	Heat transfers through block by <u>conduction</u> ; input (energy) greater than output (energy);		1 1
(iii)	ANY TWO of Energy lost to surroundings; by radiation; at higher rate; most of the heat supplied is lost / energy input and output nearly equal;		2
		<b>Total</b>	<b>10</b>



Question number	Answer	Notes	Marks
5 (a) (i)			1
(ii)	B		1
(b) (i)	C		1
(ii)	nearest above (DOP)		1
(iii)	Comment on device – (plastic) insulator / does not conduct;  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 1