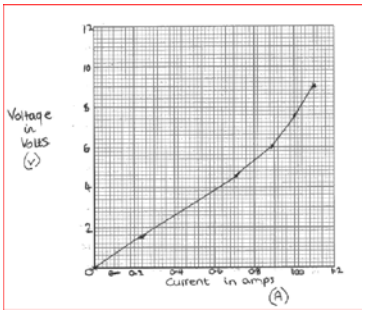
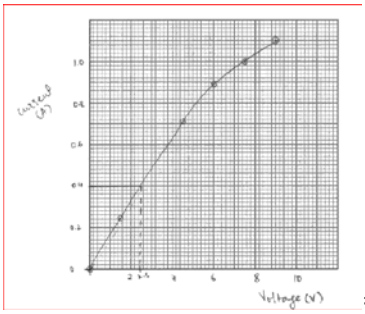
Question number	Answer	Notes	Marks
1 (a) (i)	Reference to a (magnetic) field / flux / field lines; Which changes in the coil / cuts the coil ORA ;	MUST refer to relative motion between coil / wire and (magnetic) <u>field</u> – references to moving magnet insufficient (and repeat of stem) 'wire cuts (magnetic) 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
(b) (i)	suitable scale chosen (> 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;  = 4 not curve mark  = 5	only scales in 1,2,5,10 or 8 acceptable orientation unimportant points must be shown clearly i.e. two plotting errors = no marks for plotting i.e. smooth curve I V 0.0 0. 0.2 1. 0.7 4. 0.8 6. 1.0 7. 1.1 9.	5
(ii)	0.40 A	range 0.39 A to 0.41 A	1
(iii)	One of - MP1. Temperature (of wire) was not constant; MP2. Resistance (of wire) was not constant;		1

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 ɑ 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	2
(ii)	Either of - (voltage/current) changes direction; Positive <u>and</u> negative (voltage/current);	Ignore "wave"	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 1
(ii)	Using E = V x I x t (formula given on sheet) Time conversion; Substitution; Answer; e. 20 minutes = 20 x 60 seconds = 1200 seconds E = 12 x 2 x 1200 28 800 (J)	ecf from a i If time conversion not done / incorrect then ALLOW E = V x I x 20 with subs of V and I for 1 mark ALTERNATIVE APPROACH (using power) Calculate power of heater = V x I; Calculate 30000 ÷ (20 x 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 heater / Time for energy to transfer between heater and thermometer;		1
(ii)	Heat transfers through block by conduction; 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
		Total	**10**

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 –		1
	(plastic) insulator / does not conduct;	(double) insulated / no current (through) / cannot become live	1
	Comment on user -		
	no risk of shock / electrocution;	No electricity reaches user / person cannot touch live parts	