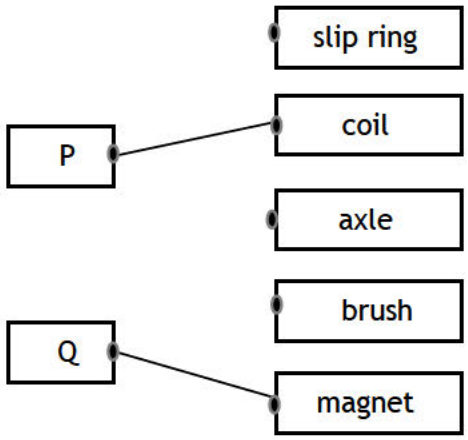
Question Number	Answer	Acceptable answers	Mark
1 (ai)	Substitution (1) 1.5 x 6 Evaluation (1) 9 (W) Ignore any unit given by candidate.	Power of 10 error max 1 mark Give full marks for correct answer with no working shown	**(2)**

Question Number	Answer	Acceptable answers	Mark
1 (aii)	• More turns on the coil (1) • More powerful/stronger magnet(s) (1)	Wrap coils on iron (core/former)/ more coils/twists/loops. Bigger coil is insufficient. More magnets. Bigger/larger magnet is insufficient. Ignore increase speed of rotation	**(2)**

Question Number	Answer	Acceptable answers	Mark
1 (aiii)	A description including • in one direction only for DC (1) • reversing direction for AC (1)	 'DC goes straight' is insufficient AC switches/changes direction OR moves to and fro 'AC goes different ways' is insufficient. Diagram with labelled arrows could get 2 marks.	**(2)**

Question Number		Indicative Content	Mark
QWC	*)	A comparison including some of the following ideas • Transformers can be used or {voltages/currents} can be {changed/transformed} • AC (can transmit) at lower current/high(er) voltage • National Grid is (usually) over ground (DC cables (were) underground) • Less energy lost in transmission • National Grid system can supply to customers further away • Possible to create a grid linking power stations • More flexibility in voltage for consumer • Consumer can draw large(r) current • More flexibility in power drawn • Great(er) range of devices can be powered Ignore methods of electricity production	**(6) Exp**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited (maybe implied) comparison giving one fact e.g: AC can be at high(er) voltage OR the National Grid can supply houses not close to a power station/ further (away/than the New York system.) • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple comparison including two ideas which may be linked or not eg Nat. Grid can supply whole country and can be used for more appliances (than just lighting). e.g: AC can be transmitted further (than DC) (because it) wastes less energy • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• A detailed comparison including at least three ideas, with at least one direct link between two of them. • e.g. AC can be transmitted further (than DC) because AC can be transformed to {lower current/high(er) voltages}. OR AC can be transformed to {lower current/high(er) voltages}. Greater range of devices used. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Total for Question 6 = 12 mark

Question Number	Answer	Acceptable answers	Mark
2(a)		More than one line from either P or Q (or both) loses the mark for that box	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)(i)	B		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	An explanation linking the following • increased brightness (1) • (due to) increased voltage (1)	'fuses' / 'blows' / gets hotter {increased / faster} current increased {power / energy}	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(c)	substitution (1) 2 x 12 evaluation (1) 24 unit (1) W	Give full marks (2) for correct answer, no working (accept bald 2.4 for substitution) = 1 watt(s), AV, VA, J/s If only one number and one unit their position is immaterial otherwise, mark the number in the power generated space and the unit in the unit space	**(3)**

Question Number	Answer	Acceptable answers	Mark
2(d)	A description including the following • voltage (1) • increases (1)	 current decreases (ignore speed of current) Accept for 1 mark • increases current AND reduces voltage • voltage higher and bigger {current/power} • power decreases 'it' increases/decreases = 0	 **(2)**

Question Number	Answer	Acceptable answers	Mark
3(a)	alternating current can take positive and negative values RA (1)	a.c. above and below zero /the line a.c. goes one way and then the other RA	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	substitution: (1) $\frac{55}{V} = \frac{200}{3000}$ transposition: (1) $V = \frac{3000}{200} \times 55$ evaluation / comment: (1) 825(V) / which is about 800 (V)	**Allow** substitution and transposition in either order if clear $\frac{55}{\mathbf{825}} = \frac{200}{3000}$ scores 3 $\frac{55}{\mathbf{800}} = \frac{200}{3000}$ scores 1 Correct comparison of ratios scores 3 (15 and 14.5, 0.067 and 0.069)	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	• power input = power output (1) • I = 0.033 (A) (1)	power input = 55 x 0.5 (W) power input = 27.5 (W) I = 0.034 (A) Give full marks for correct answer no working	**(2)**

Question Number		Indicative content	Mark
QWC	**3(c)**	An explanation linking some of the following points **Basic ideas** • transmission lines have resistance • the current warms the transmission wires • energy is wasted as heat • transformers change voltage and/or current • R increase the voltage / RA for S • R decrease the current / RA for S **Linked ideas** • the long transmission lines have high resistance • power depends on both current and voltage • power = current × voltage ($P = I \times V$) • at high voltage, the same power needs less current • correct mention of turns ratio related to voltage change • a smaller current in a wire produces less heat • high voltage transmission saves more energy than is lost in the transformers	**(6)**
Level	**0**	no rewardable material	
1	**-2**	• a limited explanation including some relevant details e.g. R steps up the voltage, S steps it down • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**-4**	• a simple explanation relating operation of transformers to heat loss in transmission lines and/or transformers e.g. R steps up the voltage so that less heat is lost in transmission lines **or** high voltage transmission saves more energy than is lost in the transformers • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed explanation relating operation of transformers to current and energy losses in transmission lines and/or transformers e.g. R steps up the voltage so that, for the same power, I is less meaning less heat is lost in transmission lines • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

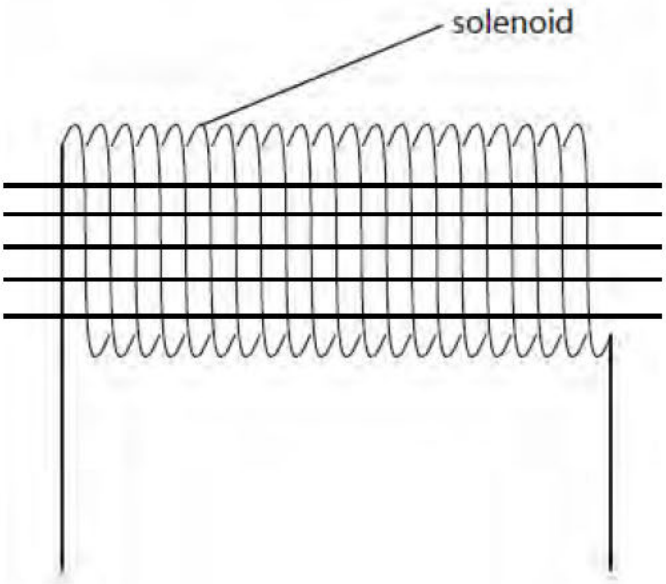
Question Number	Answer	wers	Mark
4(a)(i)	C		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	Any continuous line which has a section above and below the time axis without going (deliberately) back in time	Fractions of a cycle that meet the criteria Ignore anything appearing after the arrow on the time axis	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)	substitution (1) 2400/200 = 230/ V_s transposition (1) (V_s =) 230 x 200/2400 Evaluation (1) (V_s =) 19 (V)	 substitution and transposition in either order 230/12 = 2 marks (s&t) 200/10.43 = 2 marks (s&t) 19.2 (V) 19.17 (V) Give full marks for correct answer, no working 1.9 x any other power of 10 = 2	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(c)(i)	An explanation linking any **three** of the following • <u>step-up transformer</u>(s) (1) • increase voltages (1) • (this) reduces the current (1) • (which) reduces the {<u>heat</u> / <u>thermal</u>} {energy / power} losses (1)	 Assume 'they' refers to transformers 'steps up the voltage' scores second MP only Reject for MP2 and MP3: 'increases voltage <u>and</u> current.' but beware: 'increases voltage and current decreases' = 2 marks ignore unqualified energy losses Allow reverse arguments for last two points, e.g. high current wastes more heat energy = 2 marks Ignore references to efficiency ignore step-down statements except where they contradict	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(c)(ii)	An explanation linking **two** of the following • {kite / string} touching the power line (1) • {movement of charge / current} (1) • (electricity) {to earth / through the kite-flyer} (1) • giving (the kite-flyer) an <u>electric</u> shock (1)	anything which implies contact for touching eg 'caught up in' spark ignore energy ignore electricity to ground needs idea of 'through' not 'into' the person ignore 'completing the circuit' electrocution stopping heart	**(2)**

Question number	Answer	Additional guidance	Mark
5(a)(i)	magnetic lines of force closely packed AND (almost) parallel (1)	ignore any arrows as direction of field is not required ignore any lines outside the coil 	**(1)**

Question number	Answer	Additional guidance	Mark
5(a)(ii)	An answer that combines the following points of understanding to provide a logical description: • plotting compass placed on card near wire and pencil mark made near N pole of compass (1) • move compass so S pole is above pencil mark and keep repeating this until arrive at starting point (1)	allow sprinkle iron filings on card tap card to allow filings to align with field	**(2)**

Question number	Answer	Mark
5(b)	All three materials correctly identified (1) (rod A – wood, rod B – soft iron, rod C – steel) One mark for each reason: • rod B only attracts paper clips when there is a current in the coil (1) • rod C attracts paper clips when there is a current in the coil and for some time after (1)	**(3)**