

Question Number	Answer	Acceptable answers	Mark
<b>1 (ai)</b>	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	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>1 (aii)</b>	<ul style="list-style-type: none"> <li>• More turns on the coil (1)</li> <li>• More powerful/stronger magnet(s) (1)</li> </ul>	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	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>1 (aiii)</b>	A description including <ul style="list-style-type: none"> <li>• in one direction only for DC (1)</li> <li>• reversing direction for AC (1)</li> </ul>	'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.	<b>(2)</b>

Question Number		Indicative Content	Mark
<b>QWC</b>	* )	<p>A comparison including some of the following ideas</p> <ul style="list-style-type: none"> <li>Transformers can be used or {voltages/currents} can be {changed/transformed}</li> <li>AC (can transmit) at lower current/high(er) voltage</li> <li>National Grid is (usually) over ground (DC cables (were) underground)</li> <li>Less energy lost in transmission</li> <li>National Grid system can supply to customers further away</li> <li>Possible to create a grid linking power stations</li> <li>More flexibility in voltage for consumer</li> <li>Consumer can draw large(r) current</li> <li>More flexibility in power drawn</li> <li>Great(er) range of devices can be powered</li> </ul> <p>Ignore methods of electricity production</p>	<b>(6) Exp</b>
<b>Level</b>	<b>0</b>	No rewardable content	
<b>1</b>	<b>1 - 2</b>	<ul style="list-style-type: none"> <li>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.)</li> <li>the answer communicates ideas using simple language and uses limited scientific terminology</li> <li>spelling, punctuation and grammar are used with limited accuracy</li> </ul>	
<b>2</b>	<b>3 - 4</b>	<ul style="list-style-type: none"> <li>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</li> <li>the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately</li> <li>spelling, punctuation and grammar are used with some accuracy</li> </ul>	
<b>3</b>	<b>5 - 6</b>	<ul style="list-style-type: none"> <li>A detailed comparison including at least three ideas, with at least one direct link between two of them.</li> <li>e.g. AC can be transmitted further (than DC) because AC can be transformed to {lower current/high(er) voltages}.</li> <li>OR AC can be transformed to {lower current/high(er) voltages}.</li> <li>Greater range of devices used.</li> <li>the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately</li> <li>spelling, punctuation and grammar are used with few errors</li> </ul>	

Total for Question 6 = 12 mark

Question Number	Answer	Acceptable answers	Mark
<b>2(a)</b>	<p>The diagram shows a vertical stack of five rectangular boxes: 'slip ring', 'coil', 'axle', 'brush', and 'magnet'. To the left of the 'coil' box is a box labeled 'P', and to the left of the 'magnet' box is a box labeled 'Q'. Lines connect 'P' to the 'coil' box and 'Q' to the 'magnet' box.</p>	More than one line from either P or Q (or both) loses the mark for that box	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>2(b)(i)</b>	B		<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>2(b)(ii)</b>	<p>An explanation linking the following</p> <ul style="list-style-type: none"> <li>increased brightness (1)</li> <li>(due to) increased voltage (1)</li> </ul>	<p>'fuses' / 'blows' / gets hotter</p> <p>{increased / faster} current increased {power / energy}</p>	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>2(c)</b>	<p>substitution (1) 2 x 12</p> <p>evaluation (1) 24</p> <p>unit (1) W</p>	<p>Give full marks (2) for correct answer, no working (accept bald 2.4 for substitution) = 1</p> <p>watt(s), AV, VA, J/s</p> <p>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</p>	<b>(3)</b>

Question Number	Answer	Acceptable answers	Mark
2(d)	A description including the following <ul style="list-style-type: none"> <li>• voltage (1)</li> <li>• increases (1)</li> </ul>	current decreases (ignore speed of current) Accept for 1 mark <ul style="list-style-type: none"> <li>• increases current AND reduces voltage</li> <li>• voltage higher and bigger {current/power}</li> <li>• power decreases</li> </ul> 'it' increases/decreases = 0	<b>(2)</b>



Question Number	Answer	Acceptable answers	Mark
<b>3(a)</b>	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	<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>3(b)(i)</b>	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)	<b>Allow</b> substitution and transposition in either order if clear $\frac{55}{825} = \frac{200}{3000}$ scores 3 $\frac{55}{800} = \frac{200}{3000}$ scores 1 Correct comparison of ratios scores 3 (15 and 14.5, 0.067 and 0.069)	<b>(3)</b>

Question Number	Answer	Acceptable answers	Mark
<b>3(b)(ii)</b>	<ul style="list-style-type: none"> <li>power input = power output (1)</li> <li><math>I = 0.033</math> (A) (1)</li> </ul>	power input = $55 \times 0.5$ (W) power input = 27.5 (W)  $I = 0.034$ (A)  Give full marks for correct answer no working	<b>(2)</b>

Question Number		Indicative content	Mark
<b>QWC</b>	<b>3(c)</b>	<p>An explanation linking some of the following points</p> <p><b>Basic ideas</b></p> <ul style="list-style-type: none"> <li>• transmission lines have resistance</li> <li>• the current warms the transmission wires</li> <li>• energy is wasted as heat</li> <li>• transformers change voltage and/or current</li> <li>• R increase the voltage / RA for S</li> <li>• R decrease the current / RA for S</li> </ul> <p><b>Linked ideas</b></p> <ul style="list-style-type: none"> <li>• the long transmission lines have high resistance</li> <li>• power depends on both current and voltage</li> <li>• power = current <math>\times</math> voltage (<math>P = I \times V</math>)</li> <li>• at high voltage, the same power needs less current</li> <li>• correct mention of turns ratio related to voltage change</li> <li>• a smaller current in a wire produces less heat</li> <li>• high voltage transmission saves more energy than is lost in the transformers</li> </ul>	<b>(6)</b>
<b>Level</b>	<b>0</b>	no rewardable material	
<b>1</b>	<b>-2</b>	<ul style="list-style-type: none"> <li>• a limited explanation including some relevant details e.g. R steps up the voltage, S steps it down</li> <li>• the answer communicates ideas using simple language and uses limited scientific terminology</li> <li>• spelling, punctuation and grammar are used with limited accuracy</li> </ul>	
<b>2</b>	<b>-4</b>	<ul style="list-style-type: none"> <li>• 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 <b>or</b> high voltage transmission saves more energy than is lost in the transformers</li> <li>• the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately</li> <li>• spelling, punctuation and grammar are used with some accuracy</li> </ul>	
<b>3</b>	<b>5 - 6</b>	<ul style="list-style-type: none"> <li>• 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</li> <li>• the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately</li> <li>• spelling, punctuation and grammar are used with few errors</li> </ul>	

Question Number	Answer	Acceptable answers	Mark
<b>4(a)(i)</b>	C		<b>(1)</b>

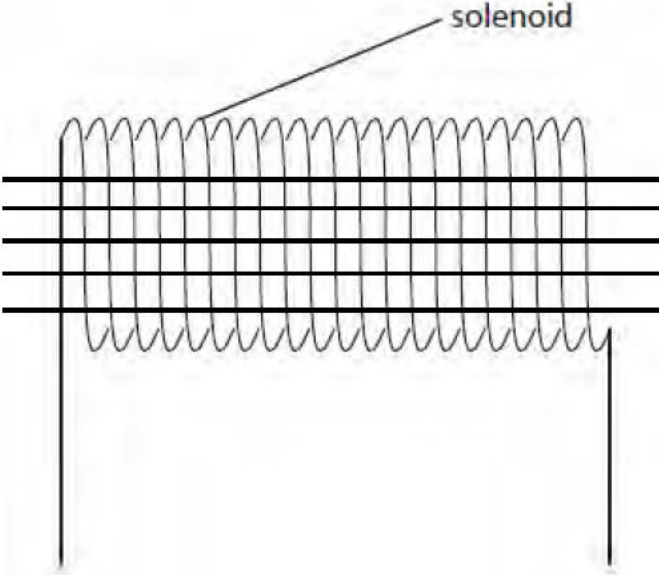
Question Number	Answer	Acceptable answers	Mark
<b>4(a)(ii)</b>	Any continuous line which has a section above and below the time axis without going (deliberately) back in time	Fractions of a cycle that meet the criteria  Ignore anything appearing after the arrow on the time axis	<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>4(b)</b>	substitution (1) $2400/200 = 230/V_s$  transposition (1) ( $V_s =$ ) $230 \times 200/2400$  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 $1.9 \times \text{any other power of } 10 = 2$	<b>(3)</b>

Question Number	Answer	Acceptable answers	Mark
<b>4(c)(i)</b>	An explanation linking any <b>three</b> of the following <ul style="list-style-type: none"> <li>• <u>step-up transformer</u>(s) (1)</li> <li>• increase voltages (1)</li> <li>• (this) reduces the current (1)</li> <li>• (which) reduces the {<u>heat / thermal</u>} {energy / power} losses (1)</li> </ul>	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	<b>(3)</b>

Question Number	Answer	Acceptable answers	Mark
<b>4(c)(ii)</b>	<p>An explanation linking <b>two</b> of the following</p> <ul style="list-style-type: none"> <li>• {kite / string} touching the power line (1)</li> <li>• {movement of charge / current} (1)</li> <li>• (electricity) {to earth / through the kite-flyer} (1)</li> <li>• giving (the kite-flyer) an <u>electric</u> shock (1)</li> </ul>	<p>anything which implies contact for touching eg 'caught up in'</p> <p>spark ignore energy ignore electricity</p> <p>to ground needs idea of 'through' not 'into' the person ignore 'completing the circuit'</p> <p>electrocution stopping heart</p>	<b>(2)</b>



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

Question number	Answer	Additional guidance	Mark
5(a)(ii)	<p>An answer that combines the following points of understanding to provide a logical description:</p> <ul style="list-style-type: none"> <li>plotting compass placed on card near wire and pencil mark made near N pole of compass (1)</li> <li>move compass so S pole is above pencil mark and keep repeating this until arrive at starting point (1)</li> </ul>	<p>allow</p> <p>sprinkle iron filings on card</p> <p>tap card to allow filings to align with field</p>	(2)

Question number	Answer	Mark
5(b)	<p>All three materials correctly identified (1) (rod A – wood, rod B – soft iron, rod C – steel) One mark for each reason:</p> <ul style="list-style-type: none"> <li>rod B only attracts paper clips when there is a current in the coil (1)</li> <li>rod C attracts paper clips when there is a current in the coil and for some time after (1)</li> </ul>	(3)