

Question	Answer	Marks	Guidance
1 a i	<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">iron / soft iron / laminated (core)</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">secondary (coil)</div> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px; margin-left: 40px;">primary (coil)</div> <div style="border: 1px solid black; padding: 5px; margin-left: 100px;">step-down</div>	2	4 correct = 2 marks 2 or 3 correct = 1 mark
ii	375 (V) (2) but if calculation incorrect $\frac{10\,000}{\text{output}} = \frac{4000}{150} \quad (1)$	2	Allow 374.5 to 376 [2] $\left[\frac{4000}{150} \right] = 26.6(67) / 26.7 \quad [1]$ allow correct versions of this substituted equation e.g. output x 4000 = 10 000 x 150 (1)
b	AC produces a changing magnetic field (1) a changing magnetic field produces a changing voltage / current in the coil (1) if no marks scored electromagnetic induction (only happens with AC) [1]	2	allow DC does not produce a changing magnetic field (1) allow idea of changing magnetic field needed for any voltage / current to be induced (1)

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c	<p>Reduced chance of a shock [1]</p> <p>provides isolation from 230V / mains (1)</p>	2	<p>eg. mains shavers can safely be used in (wet) bathroom [1] eg. Can protect workers using appliances outside (in wet conditions) [1] ignore merely 'safer'</p> <p>touching live does not complete a circuit [1] allow 'safer' if qualified eg. but if isolated from mains will make it safer [2]</p>
	Total	8	

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2 a	<p>coil is rotated / moves (in a magnetic field) to produce current in the coil [1]</p> <p>induction / (current or voltage) induced [1]</p> <p>slip rings / brushes keep circuit complete or make sure the current continues to flow (in the external circuit) [1]</p> <p>brushes make good / continuous contact (between the coil and the external circuit) [1]</p>	2	<p>If motor is described award a maximum of [1] available for last two marking points</p> <p>Eg coils break magnetic field lines to produce current [1] Eg magnets make coil spin and a current is induced [0] BUT magnets make coil spin and a current is induced and the slip rings pass current into the circuit [1]</p> <p>Eg. coil spins and induces current [2]</p> <p>Eg. Slip rings keep current flowing [1] ignore Slip rings prevent wires tangling</p> <p>Eg. brushes / slip rings carry / pass on current to (external) circuit [1]</p>
b	<p>increase the speed / frequency of rotation of the coils (1)</p> <p>and any one from</p> <p>decrease the number / area of coils (1)</p> <p>reduce the magnetic field strength / AW (1)</p>	2	<p>Allow weaker / less powerful magnet [1] Allow move magnets apart [1] ignore size of magnet</p>
Total		4	

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3	<p>[Level 3] Answer includes both similarities and differences AND calculates output voltage and turns ratio AND explains how transformers work Quality of written communication does not impede communication of the science at this level (5 – 6 marks)</p> <p>[Level 2] Answer includes one difference and one similarity AND calculates one output voltage or turns ratio Quality of written communication partly impedes communication of the science at this level (3 – 4 marks)</p> <p>[Level 1] Answer includes the basic construction of a transformer OR one difference and one similarity Quality of written communication impedes communication of the science at this level (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targeted at grades up to grade A.</p> <p>Indicative scientific points may include:</p> <p>Similarities (in order of increasing demand) both have an iron core / same input voltage / 20 volts AC both change the output voltage (compared to the input voltage)</p> <p>Differences transformer A is a step-up transformer transformer B is a step down transformer both have different ratio of turns on the primary compared to the secondary</p> <p>Differences in output voltage the output of transformer A will be more than 20 V the output of transformer A calculated using transformer equation as 40V the output of transformer B will be less than 20 V the output of transformer B calculated using transformer equation as 10V</p> <p>How transformers work changing current in primary coil produces a changing magnetic field in core changing magnetic field in the core induces a changing voltage in the secondary coil</p> <p>Construction</p> <ul style="list-style-type: none"> two coils on an (iron) core <p>Use the L1, L2, L3 annotations in scoris. Do not use ticks.</p>
Total		6	

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4 a	Clockwise anticlockwise clockwise [1]	1	allow appropriately drawn curly arrows
b i	(idea of using) variable resistor [1] (idea of using) more or less or changing the: voltages / pd / current / power (input) [1]	1	ignore stronger current ignore changes to coils ignore changes to field / magnets
ii	any two from: when switched on the motor's speed increases [1] when switched off the motor's speed decreases [1] the motor doesn't stop spinning [1]	2	Allow high voltage for 'switched on' Allow low voltage for 'switched off' Ignore reference to constant speed If no mark scored allow one mark for 'speed varies'
iii	any one from: (idea of) smoother speed / less jerky [1] (idea that) variation in motor speed will be less [1]	1	
Total		5	

Question		Answer	Marks	Guidance
5	(a)	0.115 (kW) (2) but if answer incorrect 0.5 x 230/1000 (1) or 115 (1)	2	allow 0.11/0.12 (kW) (2)
	(b)	5 (hours) (2) but if answer incorrect 0.45 / 0.09 (1)	2	allow 0.45 / 90 or 0.005 (1)
	(c)	monitor desktop PC (keyboard) mouse (1)	1	all 3 correct = 1 mark
	(d)	Correct idea from Fatima AND a correct idea from Claire (1) AND any one from <ul style="list-style-type: none"> • idea that it depends on the number of people taking up these initiatives (1) • Claire's idea is impractical (1) 	2	Eg. Fatima's and Claire's idea <ul style="list-style-type: none"> • reduce global warming • or use less energy • or use less (fossil) fuels or resources used • or reduce greenhouse gases / CO₂ eg. would only apply to short / local journeys (1) eg. unrealistic that people would give up using cars (1) eg. some vehicles essential, eg health reasons / jobs / living in country (1)
		Total	7	

Question		Answer	Marks	Guidance
6	(a)	(at least one complete wave) drawn on A with higher frequency (1)	1	ignore amplitude differences
	(b)	yes (no mark) (voltage) changes from above to below (time) line (as in graph A) (1)	1	if answer is 'no' then award zero marks for explanation eg 'yes' - changes from positive to negative (1) eg 'yes' - changes direction (1) allow correct references to ac current eg changes direction (1)
		Total	2	

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7	(a)	500 000 (MJ) (1)	1	
	(b)	idea that readings change each side of the 0 / idea that readings are positive and negative or flow in two directions (during a cycle) / AW (1)	1	ignore merely up and down / same frequency, etc. ignore merely 'all have peaks and troughs' allow all change (in) direction (1) allow all change from + to – (1)
		Total	2	