Question	Answer	Marks	Guidance
1 a i	iron / soft iron / laminated (core) secondary (coil) primary (coil) step-down	2	4 correct = 2 marks 2 or 3 correct = 1 mark
ii	375 (V) (2) **but if calculation incorrect** $\frac{10\,000}{\text{output}} = \frac{4000}{150}$ (1)	2	Allow 374.5 to 376 [2] $\left[\frac{4000}{150}\right]$ = 26.6(67) / 26.7 [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)

Question	Answer	Marks	Guidance
c	Reduced chance of a shock [1] provides isolation from 230V / mains (1)	2	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' touching live does not complete a circuit [1] **allow** 'safer' if qualified **eg**. but if isolated from mains will make it safer [2]
	Total	**8**	

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

Question	Answer	Marks	Guidance
3	**[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) **[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) **[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) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to grade A.** **Indicative scientific points may include:** **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) **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 **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 **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 **Construction** • two coils on an (iron) core **Use the L1, L2, L3 annotations in scoris.** **Do not use ticks.**
	Total	**6**	

Question	Answer	Marks	Guidance
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 • 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 • reduce global warming • or use less energy • or use less (fossil) fuels or resources used • or reduce greenhouse gases / CO_2 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**	

Question			Answer	Marks	Guidance
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**	