Eduqas Physics GCSE
Topic 8.3: Induced potential and transformers
Mark Schemes for Questions by topic

1.

Sub-section	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	2	Responds to changes in demand / copes with power station failures (1) by bringing reserve or backup stations [online] (1)		Peak times	
(b)	3	$\frac{2 \times 10^8}{400\,000} = 500$ [A] (1 – manip. & subs.), (1-conversion from 400 kV to 400 000) (1- ans) **Alternative:** Input current calculated = 4 000 [A] (1) Voltage ratio is 1:8 **and** current ratio is 8:1 (1) so = 500 [A] (1)	Incompatible units to give an answer of 5×10^n gets 2 marks		
(c)	3	Transmission at 50 kV would produce a greater current [through the grid] (1) resulting in a bigger power/heat/energy loss [in the cables] (1) The energy wasted in the two transformers is less than the energy that would be wasted from operating at a lower voltage with no transformers (1) **All three marks can only be awarded if the 3rd mark is linked to the first two marks.**	Converse argument		Prevent heat loss
Total	8				

2.

Question			Marking details	Marks
4.	(a)	(i)	A network of [power] cables/ wires (1) that connect power stations to consumers / homes / schools / factories.(1)	2
		(ii)	lower current (1) to **reduce** energy / heat losses or to improve efficiency (1) **Either mark can be awarded on its own but only award 2 marks if they are linked.**	2
	(b)	(i)	step-down because output voltage is smaller / input voltage higher / reduces voltage **or** less turns on output coil / more turns on input coil / turns reduced. (Accept it supplies homes / schools / industry.)	1
		(ii)	[power = voltage x current] $I = \frac{10000000}{400000}$ (1 sub/manip, 1 conv) (for $\frac{10}{400}$ with answer = 1 mark, but with any compatible conversion gets both marks e.g. $\frac{10000}{400}$ – 2 marks) = 25[A] (1 ans)	3
		(iii)	$99 = \frac{\text{power output}}{10 \times 10^6} \times 100$ power output = $\frac{99}{100} \times 10 \times 10^6 = 9.9 \times 10^6$ W or 9.9 MW (1sub, 1 manip, 1 ans **with correct unit**)	3
			Question total	**[11]**

3.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)		2	Coil (1) – in right blank Magnet[s] (1) – in left blank	N pole / S pole		Wire Pole
	(ii)		1	Wires or coil or it cuts field [lines] **Or** magnetic flux through the coil changes	Passes through field lines		Splitting field lines Reference to electromagnetic induction
(b)	(i)		1	Amplitude doubled ± 1 small square tolerance **and** with one and a half cycles shown for whole of graph			
	(ii)		2	At least one peak and one trough but all drawn must have amplitude doubled (1) ± 1 small square tolerance 3 cycles shown for whole of graph (1)			
(c)	(i)	I	1	D			
		II	1	D			
		III	1	E			
		IV	1	6 [V]			
	(ii)		2	**HT only** e.g. $\frac{10}{150}=\frac{500}{N_2}$ **or** $\frac{150}{10}=\frac{N_2}{500}$ (1-subs) N_2 = 7500 (1)	Ratio of 1:15 on the turns award 1st mark		
TOTAL			FT = 10 HT =12				

4.

Question			Marking details	Mark
4.	(a)		U	1
	(b)	(i)	coil A because it has the bigger voltage of the two [both points required for the mark] or it's a step-down transformer or A has less current	1
		(ii)	to set up a changing magnetic field [in the iron core] don't accept moving	1
		(iii)	to transfer / link the field into coil B	1
		(iv)	The changing magnetic field induces a voltage in coil B (cutting is neutral)	1
		(v)	$\frac{230}{12}=\frac{18400}{N2}$ [1 sub] $N_2 = 18400 \times \frac{12}{230}$ $N_2 = 960$ (1)	2
			Question total	**[7]**

5.

Question			Marking details	Mark
4.	(a)		Correct substitution into $\frac{V_1}{V_2}=\frac{N_1}{N_2}\rightarrow\frac{132000}{V_2}=\frac{154000}{50}$ (1) Rearrangement i.e. $V_2=\frac{132000\times 50}{154000}$ (1) 429 [V] (1) accept 428 [V] or 430 [V] **Alternative method:** Substitution of 768 turns (1) Rearrangement to give 659 [V] (1) Subtraction of 230 [V] to give 429 [V] (1)	3
	(b)	(i)	Increased voltage (1) Because of increased number of [secondary] turns (1) **To award both marks both statements must be linked.**	2
		(ii)	Failure of electrical equipment / Overheating of equipment / Fire / fuse blows **ecf from (i)**	1
		(iii)	No effect. (1) Because the ratio of primary to secondary turns for the business remains the same / still connected to B and C (1) **Alternative:** The businesses lose their supply / the voltage falls to 0 (1) because B joins to C (1). **To award both marks both statements must be linked.**	2
	(c)		Alternating input current or voltage (1) creates changing magnetic field (1) links (or cuts) with output coil / induces an [alternating] current / induces an [alternating] voltage (1)	3
			Question total	**[11]**

6.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)			2	Full core drawn so as to pass inside both coils and labelled IRON CORE (1) Function is to take the magnetic field [from the primary coil] into the secondary coil / linking the magnetic field of primary and secondary coils (1)	To increase the field strength through the secondary coil		A half core drawn or a single line drawn Links the two coils for the 2nd mark
(b)	(i)		2	As the number of turns on the input coil increases, the output voltage decreases (1) at a decreasing rate (1)	Award 1 mark for negative correlation Award 2 marks for inversely proportional		….in a non-linear way / non-uniform way / reference to the gradient
	(ii)		2	$\frac{400}{60}=\frac{2000}{N_2}$ (e.g. using paired values from graph) (1-subs) $N_2=2000\text{ x }\frac{60}{400}=300$ (1-ans)			
	(iii)		3	(1-for 120 from graph) $P=VI$ so $I=\frac{480}{120}$ (1-substitution) I = 4 [A] (1-manipulation and answer)	480 = 120 × I gets first 2 marks Use of voltage value between 0 – 230 V		
	(iv)		1	Line drawn to the left and always below the line that is given in the question			Any touching of the original line
Total Mark			10				

7.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)	i		2	4 (1) 20 (1)			
	ii		3	Plots ± ½ small square division (2) -1 mark for each incorrect plot to a maximum of 2 Straight line through origin – no tolerance (1)	**ecf** for the input voltage value "4" for plotting treated as an anomalous point when drawing line If all points are misplotted can award **ecf** for line mark		Thick, whispy, double, wobbly lines
	iii		2	Input voltage increases so does output (1) It doubles (1) Award 1 mark for - [Directly] proportional to each other	Positive correlation = 1 mark When the input voltage increases by 1 the output voltage increases by 2 = 2 marks Output = 2 × input (award 2 marks)		Linear unless qualified
	iv		1	C			
	v		1	A			
(b)			2	Decreases voltage (1) To make it safe[r] (1) **The 2nd mark needs to be linked to the 1st mark**	For safety reasons Less dangerous Step down voltage	References to energy and power Increases the current	Decreases the electricity
Total			11				

8.

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

Question Number	Answer	Acceptable answers	Mark
2(b)(i)	an explanation linking **three** of the following • (waves cause) float to move (up and down)(1) • (this causes) magnet to move (in and out of coil) (1) • (hence) magnetic field (of magnet) (1) • cuts across/links/ interacts wire in coil (1) • <u>inducing/generating</u> potential difference across ends of coil (1)	magnet moves (in the coil) **Allow**{current/voltage/volts/amps} <u>induced/generated</u> in coil	**(3)**

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	a description including **two** of the following • increase the number of turns on the coil (1) • use a more powerful magnet (1) • use full scale device (1)	more coils (of wire) ignore bigger coil stronger/more magnets **Ignore** bigger magnet **Allow** idea of more/bigger/ faster waves	**(2)**

9.

Question Number	Answer	Acceptable answers	Mark
1(a)(i)	Any one from portable (1) not weather dependent (1) takes up less space (1)	Reverse argument (RA) in each case can be {moved/used} anywhere ignore convenient/costs does not need wind condone (source) {(more) reliable/ always available/used any time} condone smaller 'It' refers to generator/petrol	**(1)**

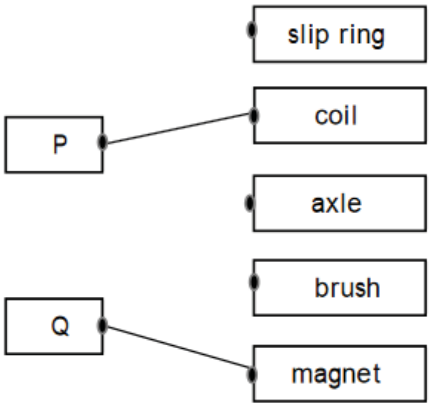
Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	Any one from uses {fossil fuel/petrol} (1) {non-renewable/finite/limited} resource (1) (exhaust) {fumes/gases} are {polluting /damage environment}(1)	RA in each case fuel costs ignore unqualified references to cost {petrol/fuel} may run out/not sustainable needs refilling constantly produces pollutants /condone pollutes emits named gases e.g.$C0_2$,CO, SO_2 contributes to acid rain/greenhouse effect/global warming not eco-friendly ignore references to noisy/ harmful 'It' refers to generator/petrol	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b) (i)	8000 (J)	(if answer wrong, give mark) for 5200 + 2800 (J) 8 **k**J (note k must be added)	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b) (ii)	Substitution (1) $\frac{2800}{8000}$ (× 100 %) Evaluation (1) 35 %	ecf from 1(b)(i) 0.35 if 0.35 seen in working but rounded to 0.4 - award mark award full marks for correct answer even with no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)	explanation linking any **three** of: • (idea of relative) movement(1) • (between) magnet/field/flux (1) • (and) coil/conductor/wire (1) • {emf/voltage } (produced) (1) • without { battery / contact }(1)	cut/cutting/change (of field/flux) the induced voltage makes current flow in a circuit =1 mark	**(3)**

10.

Question Number	Answer	Acceptable answers	Mark
4(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
4(b)(i)	B		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(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
4(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**
4(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)**

11.

(b) (i)	Y= magnet; Z = coil (of wire);		(2)
(ii)	(±)1.6 (V);		(1)
(iii)	reading of time for 1 cycle ; evaluation; e.g. 0.04s 25 (Hz)	no mark for eqn as it is given time can be assumed if f= 1/0.04 seen allow for 1 mark 50, 12.5 (Hz)	(2)
(iv)	C higher higher ;		(1)
(v)	any one from stronger magnet; more turns on the coil;	ignore bigger magnet condone more coils	(1)

(c) (i)	rearrangement of eqn; substitution; evaluation; e.g. work done (energy output) = power x time (=) 3.1 x 290 900 (W)	Accept 899 (W)	(3)
(ii)	$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy input}}$	accept standard abbreviations rearrangements with factor of X 100	(1)
(iii)	substitution; rearrangement of eqn; evaluation; e.g. input energy = $\frac{\text{output energy}}{\text{efficiency}}$ = $\frac{899\ (W)}{0.72}$ = 1200 (J)	ECF from ci allow 900 for 899 1245, 1250, 1300 (J)	(3)