PEARSON EDEXCEL GCSE COMBINED SCIENCE (HIGHER) · 1SC0

PHYSICS



MARK SCHEME

TOPIC 13: ELECTROMAGNETIC INDUCTION (PAPER 2)

SCORE	PERCENTAGE
/31	%

STEMUP

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Mark Scheme

Q1.

Question number	Answer	Additional guidance	Mark
	substitution (1) $\frac{15 \times 3.1}{230}$ evaluation (1) 0.20 (A)	 allow any value that rounds to 0.20; e.g. 0.2022 award full marks for the correct answer without working	**(2)**

(**Q01c 1SC0/2PF, Nov 2020**)

Q2.

Question number	Answer	Additional guidance	Mark
		rearrangement and substitution in either order	**(3) AO2**
	substitution (1) $(I_p) \times 230 = 19 \times 2.37$	allow numerical values written above equation	
	rearrangement (1) $(Ip\ ) = (19.0 \times 2.37) \div 230$	$input\ voltage = (output\ voltage \times output\ current) \div input\ voltage$	
	evaluation (1) input current = 0.196 (A)	award full marks for any answer that rounds to 0.2(00) (A) award 1 mark for 5.1(07) (substitution with upside down rearrangement) award full marks for correct answer without working	

(**Q03c 1SC0/2PF, Nov 2021**)

Q3.

Question number	Answer	Additional guidance	Mark
(i)	substitution (1) (power =) 12000 x 0.64 evaluation (1) R = 7700 (W)	 allow (power =) 240 x 32 any answer that rounds to 7700 (W) e.g. 7680 (W) award full marks for the correct answer without working	**(2)** **AO3**

Question number	Answer	Additional guidance	Mark
(ii)	substitution (1) ($\frac{\text{number of turns in secondary coil}}{\text{number of turns in primary coil}}$ =) $\frac{1600}{80000}$ or $\frac{1}{50}$ evaluation (1) 0.02(0)	 0.02(0) to any other power of 10 scores 1 mark award full marks for correct answer without working accept for 1 mark (seen anywhere) $\frac{50}{1}$, $\frac{80000}{1600}$, 50 **or** (from counting turns) $\frac{4}{15}$, 0.27	**(2)** **AO2**

Question number	Answer	Additional guidance	Mark
(iii)	(ratio =) 240 : 12000 (1) 1 : 50 (1)	 0.02 : 1 award full marks for correct answer without working	**(2)** **AO2**

(**QU03c 1SC0/2PF, June 2023**)

Q4.

	Answer	Acceptable answers	Mark
	transformer	Step-up transformer Step-down transformer	**(1)**

(**Q01 1SC0/2PH, June 2013**)

Q5.

Question number	Indicative content	Mark
*	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive, and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. AO1 / AO3 **Distribution** • voltage at power station higher than in homes • transformers change voltages • electrical energy is transferred on overhead power lines • overhead power lines are at 132 kV **Action of transformers** • step-up transformers convert 25 kV to 132 kV • step-up transformers reduce the current • step down transformers convert high voltages of power lines to 230 V for use in homes • low voltage is safer for use in homes	**(6)** **AO1.1 AO3.3a**
	Efficiency • transformers make the distribution of electricity more efficient • high currents cause heating effect • dissipation of thermal energy/heat to the atmosphere • increasing the voltage/ reducing the current in the overhead power lines reduces energy / heat loss	

Level	Mark	Descriptor
	0	• No awardable content
Level 1	1–2	• Interpretation and evaluation of the information attempted but will be limited with a focus on mainly just one variable (AO3) • Presents an explanation with some structure and coherence(AO1)
Level 2	3–4	• Interpretation and evaluation of the information on both variables synthesises mostly relevant understanding (AO3) • Presents an explanation that has structure, which is mostly clear coherent and logical.(AO1)
Level 3	5–6	• Interpretation and evaluation of the information, demonstrating throughout the skills of synthesising relevant understanding(AO3) • Presents an explanation that has a well-developed structure which is clear, coherent and logical.(AO1)

Level	**Mark**	**Additional Guidance**	**General additional guidance – the decision within levels** e.g. - At each level, as well as content, the scientific coherency of what is stated will help place the answer at the top, or the bottom, of that level.
	0	No rewardable material.	
Level 1	1–2	<u>Additional guidance</u> Isolated facts about power distribution at any point.	<u>Possible candidate responses</u> power lines are at 132000V homes get electricity at 230V transformers change voltages improves efficiency
Level 2	3–4	<u>Additional guidance</u> Limited explanation giving link between voltage change and type of transformer OR link between high voltage and power lines and energy loss OR link between current and transformer / energy loss	<u>Possible candidate responses</u> the step-up transformer increases the voltage the step-down transformer changes the voltage from 132000 V to 230V A is a step-up transformer and B is a step-down transformer the high voltage in overhead power lines reduces heat losses it is more efficient because the power lines are at a high voltage transformers can reduce current low current means less energy loss

Level 3	5–6	Additional guidance Detailed explanation linking role of transformer WITH current decrease to reduce energy loss	Possible candidate responses transformer A decreases the current to reduce heat loss

(**QU06d 1SC0/2PF, June 2025**)

Q6.

Question number	Indicative content	Mark
*	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO1 (6 marks)** • the sequence of events is voltage change, conversion to direct current, followed by current limiting • the battery is the load in the secondary circuit, not a store of energy for the primary circuit • a transformer is needed to increase (or step up) the voltage • so a diode is needed to change a.c. to d.c. • the charging current can be limited to 15 A using a fuse (or circuit breaker) • a circuit breaker may be preferable to a fuse, since a fuse would need to be replaced after use • the transformer primary coil is connected between the live and neutral in the primary circuit • the diode is connected in the secondary circuit of the transformer • the battery(which is to be charged), diode, fuse and secondary coil should be connected in series in the secondary circuit	**(6)**

Level	Mark	Descriptor
	0	No awardable content.
Level 1	1–2	• Demonstrates elements of physics understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • Presents an explanation with some structure and coherence. (AO1)
Level 2	3–4	• Demonstrates physics understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • Presents an explanation that has a structure which is mostly clear, coherent and logical. (AO1)
Level 3	5–6	• Demonstrates accurate and relevant physics understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • Presents an explanation that has a well-developed structure which is clear, coherent and logical. (AO1)

(**Q08c 1SC0/2PH, SAM 2016**)

Q7.

Question number	Answer	Additional guidance	Mark
	explanation linking any two from: (smaller currents) reduce heating effect (in cables) (1) less energy / power wasted (in cables) (1) increases efficiency (1)	accept thermal energy for heat energy allow will not get (as) hot / heat loss is reduced allow 2 marks for 'reduce(s) heat energy loss'	**(2)** **AO1**

(**QU03b 1SC0/2PF, June 2023**)

Q8.

Question Number:	Answer	Mark
(i)	a power station	(1) AO 1 1

Question Number:	Answer	Mark
(ii)	the national grid	(1) AO 1 1

Question Number:	Answer	Mark
(iii)	heat loss is reduced	(1) AO 1 1

(**Q01 1SC0/2PF, June 2018**)

Q9.

Question Number:	Answer	Additional Guidance	Mark
	substitution (1) $(I_s) = \frac{230 \times 0.02}{5.0}$ evaluation (1) 0.9(A)	accept 0.92 (A) award full marks for the correct answer without working	(2) AO 2 1

(**Q03 1SC0/2PF, June 2018**)

Q10.

		Indicative Content	
		A comparison including some of the following ideas • Transformers can be used or {voltages/curren {changed/transformed} • AC (can transmit) at lower current/high(er) vol • National Grid is (usually) over ground (DC cabl	

		underground) • Less energy lost in transmission • National Grid system can supply to customers • 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 electric	
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	

(**Q08 1SC0/2PF, Mar 2013**)

Q11.

Question Number:	Answer	Mark
	D transformers have primary and secondary coils. **The only correct answer is D** ***A*** *is not correct because transformers can step-up and step-down voltages* ***B*** *is not correct because transformers can step-up and step-down voltages* ***C*** *is not correct because transformers only work with alternating current*	**(1)** AO 1 1

(**Q02 1SC0/2PF, June 2018**)

Q12.

	Answer	Acceptable answers	Mark
(a)	transformer	Step-up transformer Step-down transformer	**(1)**
(b)	A suggestion to include any 2 of the following • (LED) turns on and off • as voltage/current {changes direction/from +ve to –ve/ twice each second } (1) • (LED) on for (+ve) part of cycle (1) • (LED) off for (-ve) part of cycle (1)	Flash(es) / flicker(s) (on and off) current changes every 0.25 s /4 times each second Turns on twice each second = 2 marks Only on when voltage/current is +ve gains both marks	**(2)**
(c)	substitute (1) 3 = I × 12 transformation (1) I = 3 ÷ 12 evaluation (1) 0 .25 (A) Ignore any unit given by candidate	Subst. and transform. either order 1 mark only can be scored for correct substitution after incorrect transposition. Accept any number of sig. figs. that rounds to 0.25 (A) 250 mA gains 3 marks give full marks for correct answer, no working 2.5 × any	**(3)**

		other power of ten = 2 marks eg 25 (A) gains 2 marks	

		Indicative Content	
QWC	***(d)**	A discussion including some of the following points • improved lighting levels for LEDs • energy savings per year for LEDs or calculatio time • calculation of energy savings over lifetime of L calculation of monetary savings by using LEDs • link to savings in fossil fuels for LEDs or link to LEDs and reduced global warming • comparison of lifetimes and maintenance cost	
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited discussion of benefits using some pieces of the information provided, e.g. LEDs last 40 000 hours longer and the lighting levels are 200% brighter. • 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 discussion of benefits using some pieces of the information and processing one of them OR 2 processed pieces of information. e.g. LEDs save 3000 kW h of energy each year and are much brighter. The money they save each year compared to fluorescents is £420. OR The payback time for the LEDs is about 5 years and in that time they would have to pay for the fluorescent lights to be replaced 5 times. • 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 discussion of benefits using processed information covering more than half of the data points in the table e.g. LEDs use less energy each year and this means that fossil fuel reserves are not used up as quickly. The LEDs save £420 each year and have a payback time of about 5 years. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

(**Q02 1SC0/2PH, June 2013**)