Mark Scheme (Results)

Summer 2024

Pearson Edexcel GCSE
In Physics (1PH0)
Paper 2H

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Paper 2H 2406 – Final

Question Number	Answer	Mark
1(a)	**B** negative positive The only correct answer is B correlating with attraction of X to Y, and repulsion of Z from Y.	**(1)** **A01.1**

	Answer	**Additional guidance**	**Mark**
1(b)	(a region / place / area / volume) where (electric) **charge** experiences / feels a **force** (1)	(a region) where a **charge** experiences attraction / repulsion ignore 'electricity' accept where direction of **force** on a (positive) **charge** (is shown)	**(1)** **A01.1**

	Answer	**Additional guidance**	**Mark**
1(c) i	field lines / arrows point away from (positive) charge(s) (1)	field lines / arrows show the direction of force(s) on a positive charge accept (because) field lines / arrows point outwards ignore statements about charge flow / current	**(1)** **A01.1**

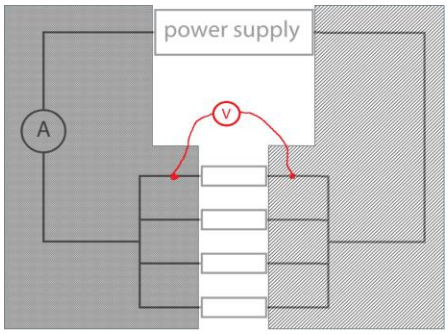
	Answer	**Additional guidance**	**Mark**
1(c) ii	field **lines** get further apart / diverge (as x increases) (1)	distance between field **lines** gets bigger concentration of **lines** gets smaller	**(1)** **AO2.1**

	Answer	**Additional guidance**	**Mark**
1(c)(iii)	rearrangement **and** substitution (1)		**(2)** **AO2.1**

	$A = 20\,000 \times 3^2$ evaluation (1) 180 000 (N cm^2 / C)	 award full marks for the correct answer without working. 1.8 to any other power of 10 scores 1 mark	

Question 1 total 6 marks

Question Number	Answer	Mark
2(a)	**The only correct answer is B** ***A, C*** *and* ***D*** *are not correct because they do not add up to the current entering the junction AND they do not equal the current coming from the battery*	**(1)** **AO1.1**

	Answer	**Additional guidance**	**Mark**
2(b)(i)	voltmeter in parallel with resistors (1)	 one voltmeter connection in each shaded region	**(1)** **A)1.2**

	Answer	**Additional guidance**	**Mark**
2(b)(ii)	36(.4) (mA) (1)	allow 36 to 37 inclusive may be seen in table in Figure 6	**(1)** **AO3.2**

	Answer	**Additional guidance**	**Mark**
2(b)(iii)	substitution into $V = IR$ (1) $6(.00) = 9.1 (\times 10^{-3}) \times R$	allow substitution and rearrangement in either order accept 18.2/2 or 27.3/3 or (36 to 37)/4 in place of 9.1 allow substitution of correct values into a	**(3)** **AO2.1**

	rearrangement (1) (R =) $\frac{6(.00)}{9.1 (\times 10^{-3})}$ evaluation (1) 660 (Ω)	visible, incorrectly rearranged algebraic equation for this mark only (R =) $\frac{V}{I}$ allow values that round to 660 e.g. 659.3 award full marks for the correct answer without working. value rounding to 660 to any other power of 10 scores 2 marks	

	Answer	**Additional guidance**	**Mark**
2(b)(iv)	an explanation linking: (total) resistance increases (1) (because) current decreases (1) (and) voltage stays the same (1)	 fewer paths for the current resistance calculations supporting increasing resistance	**(3)** **AO3.2**

Question 2 total 9 marks

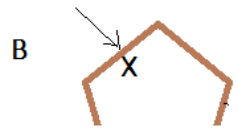
	Answer	Additional guidance	Mark
3(a)	substitution (1) $8.96 = \frac{14.1}{V}$ rearrangement (1) $(V =) \frac{14.1}{8.96}$ evaluation (1) $(V =)$ 1.57 (cm^3)	allow substitution and rearrangement in either order allow substitution of correct values into a visible, incorrectly rearranged algebraic equation for this mark only $(V =) \frac{m}{\rho}$ accept numbers that round to 1.57 allow 1.6 award full marks for the correct answer without working allow 1.6 or answers rounding to 1.57 to any other power of 10 scores 2 marks	**(3)** **AO2.1**

	Answer	Additional guidance	Mark
3(b)	an explanation linking: density of solid is greater (than density of liquid) (1) (because) distance between particles in solid is less (than distance between particles in liquid) (1)	 solids are dens**er** accept in solids, particles are clos**er** accept in solids, there are **more** particles per unit volume / particles are **more** (tightly) packed	**(2)** **AO1.1**

	Answer	Additional guidance	Mark
3(c)	substitution into $Q = m \times L$ (1) (Q =) 60 ($\times 10^{-3}$)$\times$ 2.26 ($\times 10^{6}$) evaluation (1) 1.36×10^{5} (J)	 136 000 (J) 135 600 (J) accept numbers that round to 1.4×10^{5} (J) award full marks for the correct answer without working any answer rounding to 1.4 to any other power of 10 scores 1 mark	**(2)** **AO2.1**

Question number	Answer	Additional guidance	Mark
3 (d)	estimation (1) reading off scale either 1750 **or** 1350 seen evaluation (1) 400 (cm^3)	 allow estimate in range 1300-1400 **or** 1700-1800 for 1 mark accept any answer between 350 and 450 (cm^3) award full marks for the correct answer without working if no other marks scored accept an answer between 350 and 450 to any other power of 10 for one mark	**(2)** **AO2.2**

Question 3 total 9 marks

Question number	Answer	Mark
4 (a)	 This shows the **only** direction normal to surface, acting towards surface	**1** **AO3.1**

Question number	Answer	Additional guidance	Mark
4 (b)	substitution (1) (force =) 4.8 (x 10^{7}) x 1.2 (x 10^{-5}) evaluation (1) 576 (N) their evaluation rounded to 2sf (1) 580 (N)	award full marks for the correct answer (580) without working award 1 mark for 5.76 to any other power of ten award 2 marks for 5.8 to any other power of ten	**(3)** **AO2.1**

Question number	Answer	Additional guidance	Mark
4 (c) (i)	a description including pressure increases as height decreases (1) OR as height increases pressure decreases (1)	negative correlation	**(2)** **AO3.2**

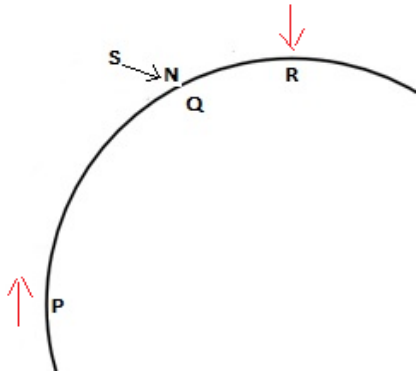
	non-linear (1)	implication of non-linear e.g. curved OR not proportional OR gradient increases as height increases OR gradient decreases as pressure increases	

Question number	Answer	Additional guidance	Mark
4 (c)(ii)	accept any answer from 30 to 34 (kPa) (1)		**(1) AO3.2**

Question number	Answer	Additional guidance	Mark
4 (c)(iii)	substitute into % calculation (1) $\frac{74 - 104}{104}$ (x 100) evaluation (1) (-) 29 (%)	 $\frac{104 - 74}{104}$ (x 100) any number rounding to (-)29(%) e.g. (-)28.8(%) award full marks for the correct answer without working award 1 mark for (-)0.29 OR (-)0.288 award 1 mark for (-)40(.54) (%) or (-)41 (%) award 1 mark for 71 (%)	**(2)** **AO2.1**

Question number	Answer	Additional guidance	Mark
4 (d)	an explanation linking: density decreases as height increases (1) with (because) particles are further apart (higher up) (1)	ignore gravity accept reverse arguments density decreases as you go higher accept fewer particles per unit volume accept particles more spaced out	**(2)** **AO3.2**

Total for question 4 -11 marks

Question number	Answer	Additional guidance	Mark
5 (a) i	arrow pointing up the page at P (1) arrow pointing down the page at R (1)	 judge directions by eye – within 10° acceptable as a guide allow arrows inside or outside the circle	**(2)** **AO3.1**

Question number	Answer	Additional guidance	Mark
5 (a) ii	an explanation linking any **three** from: Earth has a magnetic field (1) (magnetic compass) needle/arrow points in the direction of the field (1) (Earth's magnetic) field goes into Earth at Q and/or R / comes out of Earth at T (1) (Earth's magnetic) field runs parallel to Earth's surface at P (1) Q and/or R are at (magnetic)	credit answers shown in Figure 13 the core is magnetic / (it is as if there were a) magnet inside the Earth (north pole of compass) needle/arrow points to south pole of magnet magnetic field lines go from north to south poles **of magnet** magnetic south pole of Earth is at (geographic) north pole or	**(3)** **AO3.1**

	south pole / T is at (magnetic) north pole (1)	RA	

Question number	Answer	Additional guidance	Mark
5 (b) i	arrow pointing vertically up (1)	seen anywhere judge direction by eye	**(1)** **AO2.1**

Question number	Answer	Additional guidance	Mark
5 (b) ii	statement (1) accept any clear **action** that will reverse the current **OR** accept any clear **action** that will reverse the poles	 swap the battery connections around turn the magnet around	**(1)** **AO2.2**

Question number	Answer	Additional guidance	Mark
5 (b)iii	rearrangement and substitution (1) (B =) $\frac{0.078}{3.2 \times 0.042}$ evaluation (1) 0.58 (T)	 (B =) $\frac{0.078}{0.1344}$ any number rounding to 0.6 (T) award full marks for the correct answer without working	**(2)** **AO2.1**

Total for Question 5 = 9 marks

Question number	Answer	Mark
6 (a)	the correct answer is **C** N m A, B and D are incorrect because they do not match the expression moment of a force = force x distance	**(1)** **AO1.1**

Question number	Answer	Additional guidance	Mark
6 (b) i	**sum** of the **clockwise moments** = **sum** of **anticlockwise moments** (about the same point) (1) for (a system in) **equilibrium** (1)	allow 'total' in place of 'sum'	**(2)** **AO1.1**

Question number	Answer	Additional guidance	Mark
6 (b)ii	choice of equation and rearrangement (1) $F_2 = \frac{F_1 \times d_1}{d_2}$ substitution (1) $(F_2 =) \frac{11.4 \times 24.5}{3.7}$ evaluation (1) 75 (N)	allow substitution and rearrangement in either order $F_2 \times 3.7 = 11.4 \times 24.5$ any number rounding to 75(.5) (N) e.g.75.486... (N) award full marks for the correct answer without working if no other mark scored, award one mark for **idea** of moment = force x distance	**(3)** **AO2.1**

Question number	Answer	Additional guidance	Mark
6 (c)i	calculation of rate in revs /min (1) = 3 (x 1.0) evaluation (1) 180 (revs / hr)	uses gear ratio (3 x) award full marks for the correct answer without working allow 1 mark for answer of 20 (revs/hour) (from inverse ratio)	**(2)** **AO2.1**

Question number	Answer	Additional guidance	Mark
6 (c) ii	an answer that provides a description by making reference to idea of linking with **Q** (only) (1) add a gearwheel with **10** teeth (1)	may be shown in diagram add / next to **Q** half the number of teeth of gearwheel Q	**(2)** **AO1.1**

Question 6 total 10 marks

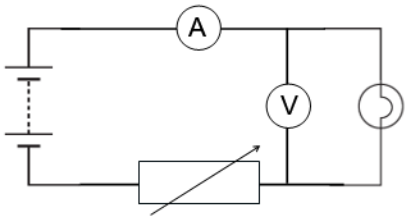
Question number	Answer	Additional guidance	Mark
7 (a)	substitution (1) 7440 = 645 x distance rearrangement (1) (distance =) $\frac{7440}{645}$ evaluation and rounding to 3sf (1) 11.5 (m)	rearrangement and substitution in either order allow substitution of correct values into a visible, incorrectly rearranged algebraic equation for this mark only (distance =) $\frac{\text{work done}}{\text{force}}$ 11.53 (m) scores 2 marks only award full marks for the correct answer without working	**(3)** **AO2.1**

Question number	Answer	Additional guidance	Mark
7 (b) i	a description to include **two** clear statements of what is measured plus further details use scales / a balance to measure mass(es) (1) use a (metre) rule to measure a distance / height (1) PLUS any **two** from set balance to zero / tare (before placing masses) (1) measure initial and final heights (1) use of same reference point for height measurements (1) clamp vertical rule / detail of checking rule is vertical (1) selects GPE = m g (∆)h (1)	marks may be scored from the diagram allow counts up the total mass on the hanger allow use newton meter / scale / balance to measure weight allow ruler / measuring tape ignore metre stick e.g. top of masses (GPE =) work done = weight x distance	**(4)** **AO1.2**

Question number	Answer	Additional guidance	Mark
7 (b) ii	rearrangement and substitution (1) $\frac{5.8}{320\ (\times 10^{-3}) \times 10}$ evaluation (1) 1.8 (m)	 $\frac{5.8}{0.320 \times 10}$ any number rounding to 1.8 e.g. 1.8125 award full marks for the correct answer without working	**(2)** **AO2.1**

Question number	Answer	Additional guidance	Mark
7 (b) iii	award **one** mark for any stated reason from: friction (in the motor) (1) heating (electrical or from frictional effects) (1)	other valid answers possible allow 'it needs oiling' etc. to thermal (energy store) / energy transferred to surroundings / energy dissipated allow it gets hot ignore sound	**(1)** **AO1.1**

Question 7 total 10 marks

Question number	Answer	Additional guidance	Mark
8 (a)	a complete circuit diagram with a correct symbol for a variable resistor added in series with a lamp (1) ammeter connected in series with a lamp (1) voltmeter added in parallel with a lamp (1)	allow inclusion of this lamp symbol in series with the power supply  allow potential divider or potentiometer alternative allow ammeter and voltmeter symbols to be shown in square boxes example: 	**(3)** **AO1.2**

Question number	Answer	Additional guidance	Mark
8 (b) i	any **one** suggestion from (collect data in a) **short time** (1) simultaneous measurement (of current and voltage) (1) gives an immediately **accessible graph** to analyse / think about (1) greater number of / more data pairs collected (1) **improves reliability** (1)	 allow saves time allow it is fast ignore 'accuracy' ignore 'precision'	**(1)** **AO2.2**

Question number	Answer	Additional guidance	Mark
8 (b) ii	a description to include as potential difference increases current increases (1) non-linear (1)	 curve / changes gradient / changes steepness	**(2) AO3.2**

Question number	Answer	Additional guidance	Mark
8 (b) iii	an explanation linking any attempt at calculating resistance using data from the graph **and** R=V/I (1) with a second pair of values used to give another value for **resistance showing that resistance increases as p.d. increases** (1)	alternative as potential difference increases resistance increases with shown by gradient of graph decreasing as p.d. increases	**(2) AO1.2**

Question Number	*Answer*	Mark
8(c)	**The only correct answer is A** time = charge / current ***B, C and D are incorrect expressions not yielding time as the subject of an equation e.g. B would be 'Coulomb Amps', not recognisable as a physical quantity. Similar arguments for C and D***	**(1) AO1.1**

Question Number	Answer	Additional Guidance	Mark
8(d)	an explanation linking (potential difference) is energy (transferred) per unit charge (passed) (1) so units of p.d. = J/C **or** Nm/C (1)	 allow pd = $\frac{\text{energy}}{\text{charge}}$	**(2)** **AO1.1**

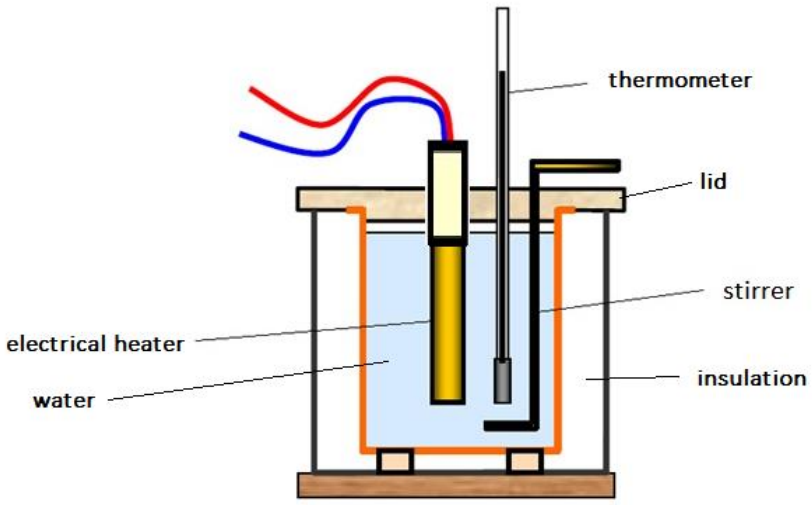
Question 8 total 11 marks

Question Number	Answer	Mark
9(a)	**The only correct answer is** **C** from solid to gas ***A** is 'condensation'* ***B** is 'freezing'* ***D** is 'melting'*	**(1)** **AO1.1**

Question Number	Answer	Mark
9(b)	**The only correct answer is** C the mean distance between the particles inside the can ***A, B and D have physical quantities which will all increase upon heating***	**(1)** **AO3.1**

Question number	**Answer**	**Additional guidance**	**Mark**
9 (c) i	rearrangement **and** substitution (1) $(\Delta\theta =) \frac{210 \times 10^3}{5.8 \times 860}$ evaluation (1) 42 (°C)	$(\Delta\theta =) \frac{210 \times 10^3}{4988}$ accept any value which rounds to 42 e.g. 42.10 award full marks for the correct answer without working 4.2 to any other power of 10 scores 1 mark	**(2) AO2.1**

Question number	Answer	Additional guidance	Mark
9 (c) ii	an explanation linking any **two** from not **all** the energy supplied goes to the <u>brick</u> (1) not all the energy supplied stays in the <u>brick</u> (1) energy transferred to the storage heater parts (1) energy transferred to the surroundings (1) argument linking Δθ to ΔQ **using** $\Delta\theta = \frac{\Delta Q}{m \times c}$ (1)	ignore: • energy is lost / wasted, unqualified • not 100% efficient • arguments about sound energy accept heat for energy throughout less (thermal) energy given to <u>brick</u> energy transfers from the <u>brick</u> energy dissipated from the equation, if energy supplied to the block is smaller the change of temperature will be smaller 'brick transfers (thermal) energy to the surroundings' scores 2 marks	**(2)** **AO2.1**

SSQ NO:	CS NO:	Answer	Mark
* 9(d)		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. (Accept the method of cooling a heated object in water but consult your TL.) **AO1 strand 2 (6 marks)** **Details of the apparatus to include:**  (resourcefulphysics.org) • credit all elements seen in diagram or stated • may also include power supply / electrical circuitry • other apparatus – balance / scales ; stopwatch ; voltmeter / ammeter / joulemeter	**(6)** **AO1.2**

		• ignore bunsen burner *(continued ...)* **Steps taken with the procedure and calculation including:** • measure mass of water (with a balance) • measure initial temperature (with thermometer) • switch on for a (set) time / use of stopwatch • measure final / highest temperature (reached) • measure energy input on joulemeter / measure V, I and t • extra detail e.g. stirring / how to get final maximum temperature • rearrange $\Delta Q = m \times c \times \Delta\theta$ to find c $c = \frac{\Delta Q}{m \times \Delta\theta}$ • correct use of graph to determine c	

Level	Mark	Descriptor
	0	• No rewardable material.
Level 1	1-2	• Demonstrates elements of physics understanding, some of which is inaccurate. Understanding of scientific, enquiry, techniques and procedures lacks detail. (AO1) • Presents a description which is not logically ordered and with significant gaps. (AO1)
Level 2	3-4	• Demonstrates physics understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas, enquiry, techniques and procedures is not fully detailed and/or developed. (AO1)

		• Presents a description of the procedure that has a structure which is mostly clear, coherent and logical with minor steps missing. (AO1)
Level 3	5-6	• Demonstrates accurate and relevant physics understanding throughout. Understanding of the scientific ideas, enquiry, techniques and procedures is detailed and fully developed. (AO1) • Presents a description that has a well-developed structure which is clear, coherent and logical. (AO1)

Summary for guidance

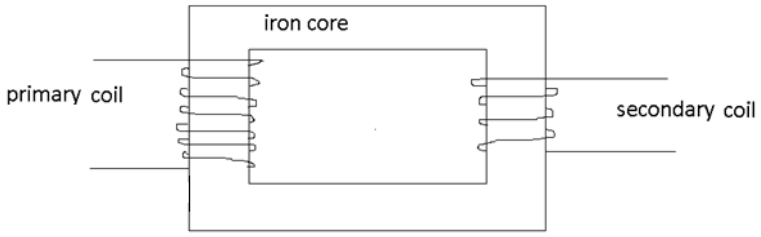
Level	Mark	Additional Guidance	General additional guidance – the decision within levels e.g. - At each level, as well as content, the scientific coherency of what is stated will help place the answer at the top, or the bottom, of that level.
	0	No rewardable material.	
Level 1	1–2	<u>Additional guidance</u> list of relevant apparatus: at least 2 items AND at least one reasonable step described OR gives equation to find c	<u>Possible candidate responses</u> some apparatus named e.g. thermometer, balance, stirrer, joulemeter, ammeter, voltmeter, beaker diagram with some labels measure mass of water use a thermometer use of $\Delta Q = m \times c \times \Delta\theta$
Level 2	3–4	<u>Additional guidance</u> list of apparatus for measurements AND logical steps including how to find $\Delta\theta$ **OR** ΔQ	<u>Possible candidate responses</u> balance / thermometer together with joulemeter / stopwatch etc. measure initial and final temperatures with a thermometer realistic use of joulemeter
Level 3	5–6	<u>Additional guidance</u> understanding is detailed and fully developed. includes detail about apparatus used to obtain measurements **AND** details in steps taken, including how to find $\Delta\theta$ **AND** ΔQ	<u>Possible candidate responses</u> (use of) balance / thermometer / stopwatch / insulated can / electrical heater etc. measure mass of water (with a balance) / measure initial and final temperatures with a thermometer + electrical heating applied

		AND how to determine c	for a (set) time + realistic use of joulemeter (or power (VI) and time) $c = \frac{\Delta Q}{m \times \Delta\theta}$

Question 9 total 12 marks

Question number	Answer	Additional guidance	Mark
10 a i	an explanation linking any **three** from (magnetic) field lines cut / intercepted by coil (1) **induces** a voltage / current (in the coil) (1) voltmeter measures (induced) voltage / potential difference (1) electrons (in the wire) experience a force / move in response to (a changing) field (1) (induced) voltage / current changes magnitude / direction as magnet passes through (1)	(magnetic) field lines interact with coil / act on coil coil experiences changing (magnetic) field / flux (linkage) produces magnetism or magnetic poles in the coil voltmeter reads / shows current voltmeter measures induced voltage scores 2	**(3)** **AO2.2**

Question number	Answer	Additional guidance	Mark
10 a ii	practical suggestions to include any **four** from drop magnet from different heights (1) **use** of metre rule (1) change height in steps (e.g. of 5 cm) (1) **record** (maximum) meter reading / voltage (1) repeat readings for each drop **and** take an average (1) set the digital voltmeter on a.c. (1) plot an appropriate graph – e.g. voltmeter reading against height (1)	 move the coil to different positions use different length tubes allow ruler / tape measure	**(4) exp AO3.3**

SSQ NO:	CS NO:	Answer	Mark
10(b)*		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 strand 1 (6 marks)** **Elements of physics understanding included in explaining the design:** **details of structure**  credit diagram for **construction** as part of the explanation • (closed) iron core • primary and secondary coils • primary coils number (considerably) different from secondary coils number **how a transformer works** • a.c. in primary • causes changing magnetic field in (iron) core • induces a.c. voltage in secondary coil	**(6)** **Exp** **AO1.1**

		• stepping down or reducing the voltage / more turns on primary than secondary **how 230V is obtained** • achieved by same ratios of $\frac{V_P}{V_S}$ and $\frac{N_P}{N_S}$ • ratio 11 000:230 i.e. ≈ 48:1	

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1-2	• Demonstrates elements of physics understanding, some of which may be 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)

Level	Mark	Additional Guidance	General additional guidance – the decision within levels Eg - 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> basic ideas about construction OR how transformer works OR use of ratio equation	<u>Possible candidate responses</u> use of primary and secondary coils on iron core use of a.c. / iron core and (changing) magnetic field step down transformer with smaller number of turns for secondary
Level 2	3–4	<u>Additional guidance</u> more developed ideas about construction AND how transformer works OR use of ratio idea	<u>Possible candidate responses</u> use of different sized primary and secondary coils and iron core use of a.c. in primary which causes changing magnetic field in (iron) core use of $\frac{V_p}{V_s} = \frac{N_p}{N_s}$

Level 3	5–6	<u>Additional guidance</u> understanding is detailed and fully developed. includes detail about construction **AND** how transformer works **AND** use of ratio idea for transformers one aspect of the three treated weakly may be tolerated	<u>Possible candidate responses</u> use of primary and secondary coils and iron core with primary coils number (considerably) bigger than secondary coils number AND (alternating) current in primary coil produces changing magnetic field in (iron) core inducing an a.c. voltage in the secondary coil AND ratio is 11000 / 230 or 48:1

Summary for guidance

Total question 10 = 13 marks