Mark Scheme (Results)

November 2021

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.

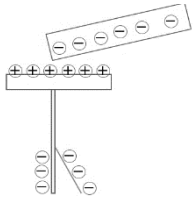
Mark schemes have been developed so that the rubrics of each mark scheme reflects the characteristics of the skills within the AO being targeted and the requirements of the command word. So for example the command word 'Explain' requires an identification of a point and then reasoning/justification of the point.
Explain questions can be asked across all AOs. The distinction comes whether the identification is via a judgment made to reach a conclusion, or, making a point through application of knowledge to reason/justify the point made through application of understanding. It is the combination and linkage of the marking points that is needed to gain full marks.
When marking questions with a 'describe' or 'explain' command word, the detailed marking guidance below should be consulted to ensure consistency of marking.

Assessment Objective		**Command Word**	
Strand	**Element**	**Describe**	**Explain**
AO1*		An answer that combines the marking points to provide a logical description	An explanation that links identification of a point with reasoning/justification(s) as required
AO2		An answer that combines the marking points to provide a logical description, showing application of knowledge and understanding	An explanation that links identification of a point (by applying knowledge) with reasoning/justification (application of understanding)
AO3	1a and 1b	An answer that combines points of interpretation/evaluation to provide a logical description	
AO3	2a and 2b		An explanation that combines identification via a judgment to reach a conclusion via justification/reasoning
AO3	3a	An answer that combines the marking points to provide a logical description of the plan/method/experiment	
AO3	3b		An explanation that combines identifying an improvement of the experimental procedure with a linked justification/reasoning

*there will be situations where an AO1 question will include elements of recall of knowledge directly from the specification (up to a maximum of 15%). These will be identified by an asterisk in the mark scheme.

Paper 2H

Question number	Answer	Additional guidance	Mark
1 (a) (i)	use friction (1)	rub (the plastic rod)	**(1)** **AO1**

Question number	Answer	Additional guidance	Mark
1 (a) (ii)	C  A and B are incorrect because the cap would become charged D is incorrect because the cap would have an opposite charge to that on the rod		**(1)** **AO1**

Question number	Answer	Additional guidance	Mark
1 (b)	An explanation linking: electrons move (1) with **one** from: (leaf and/or rod) have been discharged (1) (gold leaf) is no longer repelled (1)	 negative charges move reject positive electrons for this mark to the earth	**(2)** **AO1**

Question number	Answer	Additional guidance	Mark
1 (c) (i)	(size of) charge on Q is greater than (size of charge) on P (1) P has (overall) negative charge and Q has (overall) positive charge (1)	in any order Q has more charge / stronger field than P accept abbreviations such as +'ve, -'ve charge on P is opposite to charge on Q	**(2)** **AO3**

Question number	Answer	Additional guidance	Mark
1 (c)(ii)	(force of) attraction on (object) P from (object) Q (1)		**(1)** **AO1**

Total 7 marks

Question number	Answer	Additional guidance	Mark
8c(i)(F) 2(ai)(H)	A description including as the potential difference (voltage) increases so does the current (1) idea of gradient of graph decreasing as V increases (1)	 positive correlation at a decreasing rate non-linear not directly proportional	(2) AO3

Question number	Answer	Additional guidance	Mark
8(c)(ii)(F) 2(aii)(H)	Award one mark for each row of the table point P: voltage in V = 1(.00); current in mA = 20 point Q: voltage in V = 3.4 ±0.1; current in mA = 43 ±1	ignore any units added in the boxes	(2) AO2

Question number	Answer	Additional guidance	Mark
8(c)(iii)(F) 2(aiii) (H)	substitution (1) $(R=)\frac{4.5}{51(\times 10^{-3})}$ evaluation (1) 88.(2) (Ω)	 0.088(2) or 8.8(2) or 0.88(2) or 0.09 seen scores 1 mark 0.088(2) kΩ or 0.09 kΩ scores 2 marks award full marks for correct answer without working	(2) AO2

Question number	Answer	Additional guidance	Mark
8(c)(iv)(F) **2(aiv)(H)**	an explanation linking any three of: identification of resistance increasing (1) heating (of the filament) (1) because of more collisions (1) of electrons (with ions / atoms / other electrons) (1)	 temperature increases	**(3)** **AO1**

Total 9 marks

Question number	Answer	Additional guidance	Mark
9(a)(F) **3(a)(H)**	descriptions to include any **two** of particles / atoms in solid close(r) together (1) particles / atoms in solid (vibrate) in fixed positions but particles in liquid move (freely) (1) particles in a solid in regular arrangement but particles in liquid are randomly arranged (1) particles in a liquid have more (kinetic) energy (than in a solid) (1)	reverse argument difference asked for so **must compare** for subsequent marking points allow answers in terms of forces between particles	**(2)** **AO1**

Question number	Answer	Additional guidance	Mark
9(b)(F) **3(b)(H)**	volume substitution (1) 1.5 x 1.0 x 0.2(0) (= 0.3) substitution in equation (1) mass = 2100 x (0.3(0)) evaluation (1) = 630 (kg)	 ecf from calculated value of volume for this mark only award 2 marks for 6.3 x any other power of 10 5670 gains 1 mark from use of 1.5+1.0+0.2=2.7 award full marks for correct answer without working	**(3)** **AO2**

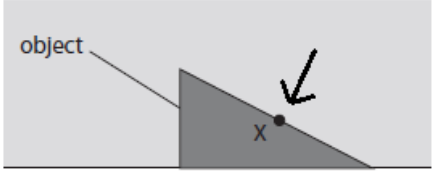
Question number	Answer	Additional guidance	Mark
9(c)(F) **3(C)(H)**	statements to include any **two** from use cladding / (extra) insulation (1) use double thicknesses of the concrete (1) use silver / reflective / white (paint) (1) plant trees around (wind break) (1) use double glazed windows (1) (properly) close window(s)/door	 create cavity draft exclusion	**(2)** **AO1**

Question number	Answer	Additional guidance	Mark
3 (d)	269 (K)	allow use of 273.14? 269.14 (K)	**(1) AO2**

Total 8 marks

Question number	Answer	Additional guidance	Mark
4 (H) 10(F) (ai)	recall (1) $P = \frac{F}{A}$ substitution (1) (p) $= \frac{2400}{0.8}$ evaluation (P) = 3000 (Pa) (1)	may be implied by a correct substitution award full marks for the correct answer without working	**(3) AO2**

Question number	Answer	Additional guidance	Mark
4 (H) 10(F) (aii)	an explanation linking greater pressure (on bottom of tank) (1) with greater force **due to water** (above bottom of tank) (1)	 more weight of water more depth/height of water ignore simply 'more water' or 'greater amount of water'	**(2) AO1**

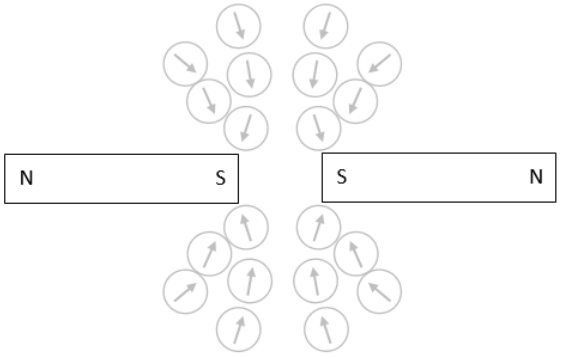
Question number	Answer	Additional guidance	Mark
10 aiii (F) **4(aiii)(H)**	 an arrow perpendicular to the sloping side **and** pointing towards X	judge by eye	**(1) AO1**

Question number	Answer	Additional guidance	Mark
10 bi (F) **4 bi (H)**	data points correctly identified (1) 50 ±2 80 ±2 evaluation (1) (-)30 ±4 kPa	award 1 mark if 80 and 50 seen ignore the lack of minus sign allow ecf from incorrect reading of either pressure at 2000m or pressure at 6000m for one mark	**(2)** **AO3**

Question number	Answer	Additional guidance	Mark
10 bii (F) **4 bii (H)**	any **one** suggestion of greater density of atmosphere (1) greater depth of atmosphere (above the aeroplane) (1) greater temperature (of the atmosphere) (1)	accept reverse argument more particles (per cubic metre) the air gets thicker greater weight of the atmosphere	**(1)** **AO1**

Question number	Answer	Additional guidance	Mark
10 (c) (F) **4 (c) (H)**	an explanation linking the area (of contact between person and bed) is smaller when standing up (1) same weight (over smaller area) so the pressure is greater when standing up (1)	accept reverse arguments weight is more concentrated / not distributed /not spread across bed (when standing up) uses p = F/A argument (as a consequence of the smaller area, pressure is bigger)	**(2)** **AO2**

Total for question 4(h), 10(F) = 11 marks

Question number	Answer	Additional guidance	Mark
5 (a)(i)	example:  rectangles in (approximately) correct position (1) all four poles correctly labelled (1)	judge by eye but do not allow rectangles in contact	**(2)** **AO3**

Question number	Answer	Additional guidance	Mark
5 (a)(ii)	a description to include place a (plotting) compass on the paper (near to the magnet(s)) and mark direction of the field (at that point) (1) determine how the field continues from that point (1) connect field lines to reveal overall shape(1)	 place a (plotting) compass on the paper (near to the magnet(s)) and put a dot at each end of the needle move compass so that one end of the needle is over the mark (just made) join up the dots	**(3)** **AO1**

Question number	Answer	Additional guidance	Mark
5 (b) (i)	substitution of values (1) $1.2 = \frac{K}{4(.0)^2}$ rearrangement and evaluation (1) (*K*=) 19 unit (1) N cm^2	allow rearrangment before substitution (*K*=) 1.2 x 4(.0)^2 19.2 0.00192 award full marks for the correct answer without working independent mark N m^2	**(3)** **AO2**

Question number	Answer	Additional guidance	Mark
5 (b)(ii)	same magnitude **and** opposite direction (1)	allow (now) attraction for opposite direction	**(1)** **AO1**

Question 5 total 9 marks

Question number	Answer	Additional guidance	Mark
6 a	(sum of) the clockwise moments = (sum of) the anticlockwise moments	moment of magnet = moment of modelling clay moments are equal (size)	**(1)** **AO1**

Question number	Answer	Additional guidance	Mark
6 b	recall and substitution (1) (force x 12.0 =) 0.050 x 8.4 rearrangement (1) (force =) $\frac{0.050 \times 8.4}{12.0}$ evaluation (1) (force =) 0.035 (N)	allow substitution and rearrangement in either order award full marks for the correct answer without working. if no other marks scored then award 1 mark for answers that round to 29 (eg 28.57) (substitution mark)	**(3)** **AO2**

Question number	Answer	Additional guidance	Mark
6 c	a description to include **four** of the following measure the value of current (1) measure force or distance(1) vary the current (1) restore equilibrium of system (1) calculate ratio between force and current or distance and current (1) if ratio is the same then they are proportional (1)	 accept calculate for measure increase weight or move (existing) weight to new position plot a graph of force / distance against current graph would be a straight line (through the origin)	**(4)** **AO3**

Question number	Answer	Additional guidance	Mark
6 d	move the (position of) the (0.050 N) weight (1) to the other side of the pivot/3.6 cm from the magnet (1)	adjust mass of modelling clay reduce (mass of modelling clay) by taking some away add (additional) weight between pivot and magnet scores 2 marks	**(2)** **AO3**

Total for question 6 = 10 marks

Question number	Answer	Additional guidance	Mark
7 (a) (i)	D R and S A, B and C are incorrect because the difference in vertical positions are all less than that shown by R and S		**(1)** **AO1**

Question number	Answer	Additional guidance	Mark
7 (a)(ii)	recall (1) work done = force x distance substitution and evaluation (1) (work done =) 14,000 (J)	(work done) = 700 x 20 award full marks for the correct answer without working	**(2)** **AO1**

Question number	Answer	Additional guidance	Mark
7 (a)(iii)	substitution (1) 11250 = m x 10 x 15 rearrangement and evaluation (1) (mass=) 75 (kg)	 award full marks for the correct answer without working. if no other marks scored then award 1 mark for answers of 0.013 (substitution mark using h = 15)	**(2)** **AO2**

Question number	Answer	Additional guidance	Mark
7 (a)(iv)	An explanation linking some work is done to overcome friction/air resistance (1) energy is dissipated /transferred to the environment (1)	 allow energy is lost thermal energy	**(2)** **AO1**

Question number	Answer	Additional guidance	Mark
7 (a)(v)	C increase the efficiency of the cyclist and bicycle A is incorrect because lubrication has no effect on work done against gravity B is incorrect because lubrication will increase efficiency D is incorrect because the overall energy transfer will not increase		**(1)** **AO1**

Question number	Answer	Additional guidance	Mark
7 (b)	substitution (1) $2{,}800 = ½ \times 85 \times v^2$ rearrangement (1) $(v^2 =) \quad \frac{2800 \times 2}{85}$ evaluation (1) v = 8.1 (m/s)	allow substitution and rearrangement in either order 66 or 65.88 seen allow values that round to 8.1 e.g 8.1168 award full marks for the correct answer without working	**(3)** **AO2**

Total for question 7 = 11 marks

Question number	Answer	Additional guidance	Mark
8 (a) (i)	voltmeter connected in parallel with device (1) ammeter connected in series with device (1)	voltmeter connected in parallel with battery may be in top or bottom of circuit and could be inside or outside the voltmeter connections	**(2)** **AO1**

Question number	Answer	Additional guidance	Mark
8 (a) (ii)	recall and substitution (1) (power =) 12 x 4.8 evaluation (1) (power =) 58 (W)	voltmeter connected in parallel with battery allow values that round to 58 e.g. 57.6 award full marks for the correct answer without working	**(2)** **AO2**

Question number	Answer	Additional guidance	Mark
8 (a) (iii)	substitution (1) (power =) 12 x 600(/1000) x 7 (x60) evaluation (1) (energy =) 3000 (J)	 allow values that round to 3000 e.g 3024 allow 1 mark for any other values of 3(.024) to any power of ten. if no other marks scored then award 1 mark for answers of 50,400 or 50.4 (substitution mark) award full marks for the correct answer without working.	**(2) AO2**

Question number	Answer	Additional guidance	Mark
8 (b) (i)	17.7 (A)		**(1) AO1**

Question number	Answer	Additional guidance	Mark
8 (b) (ii)	(The resistance) increases		**(1) AO1**

Question number	Answer	Additional guidance	Mark
8 (b) (iii)	B 5 A fuse A is incorrect because it has a smaller value than the expected current C and D are incorrect because they have a much higher value than the expected current		**(1) AO1**

Question number	Answer	Additional guidance	Mark
8 (b)(iv)	An explanation linking **two** of thick(er) wires have low(er) resistance (1) less thermal energy transferred (in the wires)(1) less potential difference / voltage (drop) across the wires (1)	allow reverse argument allow so wires do not get hot allow less voltage is lost more current can be carried	**(2) AO1**

Total for question 8 = 11 marks

Question number	Answer	Additional guidance	Mark
9ai	D half the size of the voltage across the primary coil A and B are incorrect because the voltage will not necessarily be twice or half the value of the current C is incorrect because the voltage across secondary coil will be less than that across the primary coil		**(1)** **AO2**

Question number	Answer	Additional guidance	Mark
9 aii	an explanation linking **three** of magnetic field in primary / secondary coil / core (due to current) (1) magnetic field is alternating (1) (this magnetic) field cuts/links secondary coil (1) <u>induces</u> an alternating voltage (across secondary coil) (1)		**(3)** **AO1**

Question number	Answer	Additional guidance	Mark
9b	substitution into $\frac{Vp}{Vs} = \frac{Np}{Ns}$ (1) $\frac{230}{15} = \frac{600}{Ns}$ Rearrangement and evaluation (1) (Ns =) $\frac{600 \times 15}{230}$ = 39	allow substitution and rearrangement in either order accept values that round to 39 e.g. 39.13 award full marks for the correct answer without working. if no other marks scored then award 1 mark for answers of that round to 0.026 (eg 0.255) (substitution mark)	**(2)** **AO2**

Question number	Indicative content	Mark
***9(c)**	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. • coil moving/cuts through magnetic field • coil experiences changing magnetic field • induces a voltage/current in the coil • size of voltage/current depends on rate of change of magnetic field • rate of change depends on angle between direction of movement and direction of field. • greatest (rate of) change when coil moving perpendicular to field. • maximum current at Q and S • coil is horizontal at Q and S • coil moving vertically up at Q and down at S • direction of current at Q opposite to S. • no change when coil moving parallel to field. • zero current at P, R and T • coil vertical at P, R, and T Credit can be given for correctly labelled diagrams	**(6)** **AO2 and AO3**

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. Demonstrates limited synthesis of understanding. (AO3) • The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. (AO2)
Level 2	3–4	• Interpretation and evaluation of the information on both variables, synthesising mostly relevant understanding. (AO3) • The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. (AO2)
Level 3	5–6	• Interpretation and evaluation of the information, demonstrating throughout the skills of synthesising relevant understanding. (AO3) • The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. (AO2)

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	Additional guidance isolated facts about interaction of electric current and magnetic fields **or** one salient feature of the graph	Possible candidate responses the coil experiences a changing magnetic field as it rotates. Size of the (induced) current varies.
Level 2	3–4	Additional guidance simple description of why current changes (either in direction or magnitude) **and** reference to at least one relevant point on the graph.	Possible candidate responses at position R the (plane of the) coil is parallel to the field and there is no current **Or** at position Q the coil is moving quickly through the field and the current is large.
Level 3	5–6	Additional guidance Full description of why current changes in magnitude or direction **and** reference to at least two relevant points on the graph	Possible candidate responses At Q, the coil is horizontal and moving most quickly across the field so the current is at its greatest. At R the coils is vertical and moving parallel to the field so there is no current.

Total for question 9 = 12 marks

Question number	Answer	Additional guidance	Mark
10ai	substitution into $\Delta Q = m \times s \times \Delta T$ (1) $(\Delta Q) = 1.41 \times 4200 \times (100-25)$		**(3)** **AO2**

	evaluation (1) (energy =) 444,150 (J) answer to 2 sf (1) 440,000 (J)	ignore POT error for this mark independent mark allow 3 sf 444,000 award full marks for the correct answer without working award 1 mark for answers with values 148,050 or 592,200 (incorrect temp and sf) award 2 marks for answers with values 150,000 or 148,000 or 590,000 or 592,000 (incorrect temp but allowed sf)	

Question number	Answer	Additional guidance	Mark
10aii	substitution into $\Delta Q = m \times L$ $450{,}000 = (1.41 - 1.21) \times L$ (1) rearrangment $L = \frac{450{,}000}{0.2}$ (1) evaluation (L) = 2 200 000 (J/kg) (1)	allow substitution and rearrangement in either order accept 2 250 000 award full marks for the correct answer without working award 1 mark for answers that round to 330,000 or 370,000 (incorrect mass used)	**(3)** **AO2**

Question number	Indicative content	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. Procedure • Measure the temperature of the boiling water • Allow sufficient time for block to reach temperature of boiling water • Measure temperature of cold water in beaker • Using a thermometer • Transfer (hot) aluminium block to cold water in the beaker. • Work quickly to avoid thermal energy loss during transfer • Measure temperature of water • Stir to ensure even distribution • Measure maximum temperature reached by water • Calculate temp rise of water by subtracting initial from final temperature. • Calculate temp drop of aluminium by subtracting final temperature from 100. • Find mass of beaker and water and aluminium • Use a balance • Empty water from beaker and dry beaker and block • Weigh beaker and block alone • Find mass of water by subtraction. • Allow plausible method of finding mass of water before putting block in. Process results • Calculate thermal energy gained water using $\Delta Q = m \times c \times \Delta\theta$ • Thermal energy gained by water = thermal energy lost by aluminium • Specific heat capacity of aluminium = $\frac{\text{thermal energy transferred}}{\text{mass of Al} \times \text{temp drop of Al}}$	**(6)** **AO2 and AO3**

Level	Mark	Descriptor
	0	• No awardable content
Level 1	1–2	• The plan attempts to link and apply knowledge and understanding of scientific enquiry, techniques and procedures, flawed or simplistic connections made between elements in the context of the question. (AO2) • Analyses the scientific information but understanding and connections are flawed. An incomplete plan that provides limited synthesis of understanding. (AO3)
Level 2	3–4	• The plan is mostly supported through linkage and application of knowledge and understanding of scientific enquiry, techniques and procedures, some logical connections made between elements in the context of the question. (AO2) • Analyses the scientific information and provides some logical connections between scientific enquiry, techniques and procedures. A partially completed plan that synthesises mostly relevant understanding, but not entirely coherently. (AO3)
Level 3	5–6	• The plan is supported throughout by linkage and application of knowledge and understanding of scientific enquiry, techniques and procedures, logical connections made between elements in the context of the question. (AO2) • Analyses the scientific information and provide logical connections between scientific concepts throughout. A well-developed plan that synthesises relevant understanding coherently. (AO3)

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	Additional guidance Partially complete description of a suitable procedure with at least one measurement	Possible candidate responses Heat up the block in the boiling water. Then put the block into the cold water. Measure the temperature reached by the water.
Level 2	3–4	Additional guidance Mostly complete description of a suitable procedure with at least two measurements and some description of processing the results.	Possible candidate responses As above with Measure mass of water. Use $\Delta Q = m \times c \times \Delta\theta$ to find thermal energy transferred
Level 3	5–6	Additional guidance Detailed description of a suitable procedure with most of the necessary measurements and a clear description of processing the results.	Possible candidate responses As above with Calculate temperature changes by subtraction. Calculate thermal energy lost by Al as being equal to thermal energy gained by water. Specific heat capacity of Al = $\frac{\text{thermal energy transferred}}{\text{mass of Al} \times \text{temp drop of Al}}$

Question 10 = 11 marks

Total for paper = 100 marks