



Mark Scheme (Results)

November 2020

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

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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.

Question number	Answer	Additional guidance	Mark
1 (a)	Any two from smoke alarm (1) food irradiation (1) sterilising (1) detecting leaks/cracks (1) gauging thicknesses (1) in medicine diagnostic (1) in medicine therapeutic (1) dating (archaeological samples) (1)	 named named	(2)

Question number	Answer	Additional guidance	Mark
1 (b)	P – control rods (1) Q – graphite/moderator (1)	boron steel rods heavy water	(2)

Question number	Answer	Additional guidance	Mark
1 (c)	An explanation linking two of a neutron collides with/fired at a (uranium) nucleus (1) releasing (2/3) extra neutron(s) (1) which go on to collide with more nuclei (1)	 neutron absorbed by nucleus. accept atom for nucleus accept atom for nucleus	(2)

Total for Question 1 = 6 marks

Question number	Answer	Additional guidance	Mark
2 (a)	A description to include: mention relevant energy store such as GPE or chemical (1) 'correct' transfer in context (1)	allow KE or mechanical or thermal or heat chemical to (G)PE or chemical to KE (in lifting) allow misread GPE to KE/thermal on <u>slope</u> Allow KE to GPE in lifting	(2)

Question number	Answer	Additional guidance	Mark
2 (b)	A description to include: measurement of (relevant) distance (1) measurement of (relevant) time (1) use of speed = $\frac{\text{distance}}{\text{time}}$ (1) detail (1)	one of distance down slope or distance along bench or length of toy car/card 'record the distance the car travels and time it' scores 2 marks for example: speed down slope $\times 2$ <u>mark</u> distance along bench use a light gate speed gun at the bottom of the slope repeating AND averaging	(4)

Question number	Answer	Additional guidance	Mark
2 (c)	(vertical) height of slope (1) mass (of the toy car) (1)	allow (in this context) weight if no other mark scored allow 1 mark for quoting either equation (Δ)GPE = mgh OR KE = $\frac{1}{2} mv^2$	(2)

Question number	Answer	Additional guidance	Mark
2 (d)	(original) GPE – KE (at bottom) (1)	allow (idea of) input – output allow wrong way round (eg output-input)	(1)

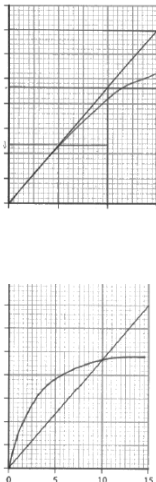
Total for Question 2 = 9 marks

Question number	Answer	Mark
3 (a)	☒ B force Options A, C and D are all scalars.	(1)

Question number	Answer	Additional guidance	Mark
3 (b)(i) CLIP WITH bii	acceleration = $\frac{\text{change in velocity}}{\text{time (taken)}}$	$a = \frac{v-u}{t}$ $a = \frac{\Delta v}{t}$ $\frac{v}{t}$ allow correct rearrangements seen here or in bii	(1) grad

Question number	Answer	Additional guidance	Mark
3 (b)(ii) CLIP WITH bi	substitution (1) $\frac{20 - 2}{12}$ evaluation (1) 1.5 (m/s ²)	$\frac{18}{12}$ -1.5 (m/s ²) award full marks (1 in bi and 2 in bii) for the correct answer without working, award 1 mark if 20-2 or 18 or 2-20 is seen and no other marks are scored If (incorrectly) $a = \frac{v^2 - u^2}{t}$ given in 3bi $a = \frac{20^2 - 2^2}{12}$ OR = 33 scores 1 mark	(2)

Question number	Answer	Additional guidance	Mark
3 (c)(i) CLIP WITH GRAPH	distance = area under graph (1) $\frac{1}{2} \times 7 \times 15$ (1) 52(.5) (m) (1)	attempt to find area seen on graph correct area(s) identified including calculation 53 (m) allow 7×15 or 105 for 1 mark only award full marks for the correct answer with no working	(3)

Question number	Answer	Additional guidance	Mark
3 (c)(ii) CLIP WITH GRAPH H paper	(curve) <u>starting</u> from 0,0 (1) of decreasing gradient (1)	curve can be above or below the line both of these are acceptable 	(2)

Total for Question 3 = 9 marks

Question number	Answer	Additional guidance	Mark
4 (a)	substitution (1) $\frac{3.4 \times 10^{29}}{2.0 \times 10^{30}}$ evaluation (1) 0.17	award 1 mark for 1.7 to any incorrect power of 10 ignore any units given award full marks for the correct answer without working	(2)

Question number	Answer	Additional guidance	Mark
4(b)(i)	accept any temperature between 5500 and 7500 (K) (1)		(1)

Question number	Answer	Additional guidance	Mark
4(b)(ii)	the greater the temperature the higher the brightness	or reverse argument allow luminosity for brightness allow heat for temperature	(1)

Question number	Answer	Additional guidance	Mark
4(b)(iii)	the greater the mass the higher the brightness	or reverse argument allow luminosity for brightness allow bigger/heavier for greater mass in this context	(1)

Question number	Answer	Additional guidance	Mark
4 (c)	A description to include any three of the following (smaller) nuclei / atoms / particles (1) come together / join (1) to produce a larger nucleus / atom / particle (1) needing high temperature / pressure (1) overcoming repulsion (between nuclei) (1) energy released (1)	two named eg hydrogen (nuclei) allow fuse not 'bond' helium for nucleus accept fast (moving) nuclei ignore energy created	(3)

Question number	Answer	Additional guidance	Mark
4 (d)	An explanation to include any three from: nebula as a cloud of gas/dust (1) gas / atoms pulled together / towards each other (1) by gravitational force (1) temperature increase (1) hot enough for nuclear fusion (1)	density increase gravity (acting) (resultant) heating	(3)

(Total for Question 4 = 11 marks)

Question number	Answer	Additional guidance	Mark
5 (a)	recall and rearrangement (1) $\lambda = \frac{v}{f}$ evaluation (1) 3.08 (m) (so) length of aerial = 1.54 m (1) check working $\frac{3 \times 10^8}{2} = 1.5 \times 10^8$ gets only 1 mark for ecf	$\frac{3.0 (\times 10^8)}{97.4 (\times 10^6)}$ accept 3.1 (m) award 1 mark for wavelength that rounds to 3.1 to any other power of 10 independent mark. allow ECF from candidate's wavelength accept 1.5 (m) award 2 marks for 1.5 to any other power of 10 award full marks for the correct answer without working Allow 1.46 rounded to 1.5 for 1 mark only if it is ecf from mp2	(3)

Question number	Answer	Additional guidance	Mark
5 (b)	A description including two from: trace / mark where the ray went into and out of(through) the glass block / line on either side of glass block(1) (remove block) join entry and exit points (of ray of light) (1) use the protractor to measure the angle between the refracted/drawn ray and the normal (1)	accept 90° line etc.	(2)

Question number	Answer	Additional guidance	Mark
5 (c)	explanation linking: wave P refracts (towards the normal) (1) because P slows down (1) AND wave Q is reflected (at an equal angle from the boundary) (1) without change of speed of Q (1)	accept 'upper layer' for 'P' accept 'wavelength decreases' accept 'bends' for 'refracts' in this instance accept 'lower layer' for 'Q' accept 'wavelength unchanged' accept 'wave Q bounces off' (at an equal angle) allow one mark for refraction and reflection if no other mark awarded	(4)

Total for Question 5 = 9 marks

Question number	Answer	Additional guidance	Mark
6 (a)(i)	substitution (1) $\% \text{ difference} = \frac{(240 - 343)}{343} \times 100$ evaluation (1) (-) 30 (%)	OR 343 – 240 in numerator award full marks for the correct answer without working allow 1 mark for division by 240 yielding 43% allow one mark for $\frac{240 \times 100}{343} = 70\%$	(2)

Question number	Answer	Additional guidance	Mark
6 (a) (ii)	explanation linking any two of: reaction time is significant (with 0.5s or less) (1) the reaction time will be different for each of the students (1) effects on reaction times (1) students are at different distances (from starting pistol) (1) anticipation of flash / bang (1)	accept reaction time is large compared with travel time differences in perception / acuity of light and sound	(2)

Question number	Answer	Additional guidance	Mark
6(a)(iii)	explanation linking: use a (much) longer distance OR use electronic timer (1) with effect (1) reduces/eliminates the significance/impact of the reaction time OR gives a more manageable time to measure	all stand the same distance from the starting pistol (1)	(2)

Question number	Answer	Additional guidance	Mark
6 (b)(i)	(1)	any similar distance labelled wavelength / λ between the equivalent of 2 consecutive compressions	(1)

Question number	Answer	Additional guidance	Mark
6(b)(ii)	description including any two from: particles vibrate / oscillate/ move backwards and forwards (1) along a radius/ parallel to direction of travel/ energy transfer (1) about mean /fixed positions (1)	allow air for particles in same direction as wave allow one mark for 'sound is a longitudinal wave' if no other mark awarded	(2)

Total for Question 6 = 9 marks

Question number	Answer	Mark			
7 (a)	<table border="1"> <tr> <td>A</td><td>same atomic number</td><td>different number of neutrons</td></tr> </table> Options B, C and D have wrong combinations	A	same atomic number	different number of neutrons	(1)
A	same atomic number	different number of neutrons			

Question number	Answer	Mark
7 (b)	☒ C beta plus Options A, B and D are not represented by Figure 9.	(1)

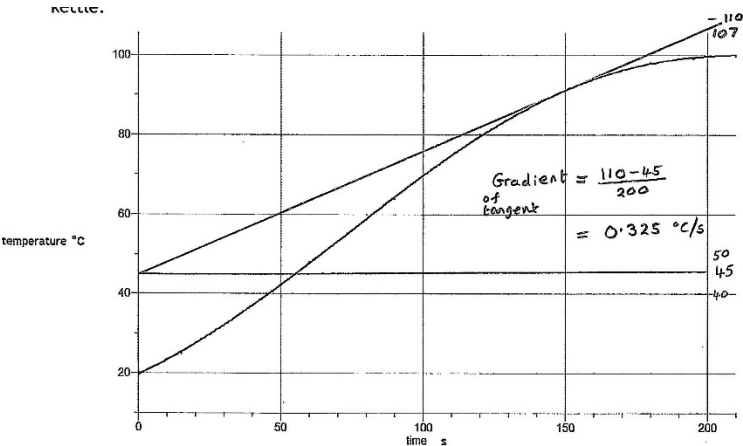
Question number	Answer	Additional guidance	Mark
7 (c)	recognition of there being 4 half lives involved (1) so fraction of 1 / 16 involved (1) evaluation (1) 2.4 (kBq)	allow 2 marks for 4.8 (kBq) (used three instead of 4 half lives) allow 1 mark for any other $(1/2)^n$ being involved i.e. for answers that round to 19.3 (kBq), 9.63 (kBq), 1.2(kBq) award full marks for the correct answer without working	(3)

Question number	Answer	Additional guidance	Mark
7 (d)	explanation linking two from: (damage to) cell(s) (1) (because gamma rays are) ionising / high frequency/very energetic (1) (causing / curing/diagnosing) cancer / mutation / chromosomal damage / dna damage/burns (1)	(rapid/unwanted) division of cells	(2)

Question number	Answer	Additional guidance	Mark
7 (e) (i)	use of gradient on graph (1) $= \frac{1480}{97}$ evaluation (1) 15.3 (counts /s)	look for a triangle / line going up allow $\frac{1480}{100}$ accept other data from the graph allow numbers between 12.0 and 16.0 award full marks for answers in the correct range without working	(2)

Question number	Answer	Additional guidance	Mark
7 (e) (ii)	explanation the process (of radioactive decay) is unpredictable / (occurs) random(ly) (1) so the count rate would not be constant / there will be variations with each reading (1)	do not allow 'difficult to predict' ignore background results (expected to) scatter	(2)

Total for Question 7 = 11 marks

Question number	Answer	Additional guidance	Mark
8 (a)	 drawing tangent attempt (1) correct data points from graph (1) 60,60 and 150,92 evaluation (1) $0.33 \pm 0.07 \text{ (}^{\circ}\text{C / s)}$	accept other data from the graph award full marks for the correct answer without working	(3)

Question number	Answer	Additional guidance	Mark
8 (b)	rearrangement and substitution (1) energy supplied = $\frac{\text{useful energy}}{\text{efficiency}}$ = $\frac{3.3 \times 10^5}{0.91}$ evaluation (1) 3.6×10^5 (J)	(3.626×10^5) number that rounds to 3.6×10^5 (J) 3600 or 3626 scores 1 mark award full marks for the correct answer without working no marks for 91% of $3.3 \times 10^5 = 3.0 \times 10^5$ (J)	(2)

Question number	Indicative content	Mark
8 *(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. AO1 1 (6 marks) <u>Arguments for using nuclear power</u> • we are running out of fossil fuels SO the use of nuclear can play its part where we have previously used fossil fuels • no carbon emissions SO does not contribute towards global warming, rise in sea-levels etc. • low running costs SO a good economical alternative to other power sources • with reprocessing can last hundreds of years • large power output compared with wind farms / solar etc. <u>Arguments against using nuclear power</u> • expensive to set up and decommission SO the use of other sources could be more economical • nuclear disasters possible SO there could be a loss of life / contamination of an area • nuclear toxic waste lasts a long time • waste storage issues – contamination of ground water • terrorism / bomb making	(6)Exp

Level	Mark	Descriptor
	0	• No rewardable material.
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)

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> Unbalanced incomplete argument Elements of physics present isolated knowledge for or against	<u>Possible candidate responses</u> no CO ₂ emissions high cost
Level 2	3–4	<u>Additional guidance</u> Argument linked with evidence, but not entirely coherent or balanced Uses evidence for or against but lacks balance / focus / with logical connections made on one side and statement from the other	<u>Possible candidate responses</u> no CO ₂ emissions so no contribution to global warming large power output compared with wind farms
Level 3	5–6	<u>Additional guidance</u> Developed detailed arguments, including use of evidence, advanced both for and against the use of nuclear power	<u>Possible candidate responses</u> no CO ₂ emissions so no contribution to global warming large power output compared with wind farms nuclear toxic waste lasts a long time

Question number	Answer	Additional guidance	Mark
9 (a)(i)	C $7.7 \times 10^9 \text{ kg m/s}$ Only one correct power of 10. The other answers are all distractors involving students misappropriating 'kilos' in some way, either in <u>kilograms</u> or form <u>kilometres</u>		(1) comp

Question number	Answer	Additional guidance	Mark
9 (a)(ii)	rearrangement and substitution (1) $v = \frac{\text{momentum change}}{\text{mass}}$ $= \frac{7.5 (\times 10^{10})}{8(.0) (\times 10^6)}$ evaluation (1) $9.4 \times 10^3 \text{ / number that rounds to } 9.4 \times 10^3 \text{ (m/s)}$	$v = \frac{p}{m}$ e.g. 9375, 9.375×10^3 9400 (m/s) 9.4 km / s award full marks for the correct answer without working award 1 mark for 9.4 to any other power of 10	(2) exp

Question number	Indicative content		Mark
9 (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. AO2 (strand 2) (6 marks) <u>Determining force</u> • Use of $F = (mv - mu)/t$ or $F = ma$ • mass (of trolley(s)) needed • and times during impact (t) <u>Showing effect of crumple zone</u> • experiment repeated with and without the spring • (note) difference in contact times • use of spring as crumple zone • with spring, time for contact greater, less impact force <u>Precautions or controls</u> • times repeated and average taken • careful controls – same starting position / same angle of slope / release without pushing etc.		(6)Exp
Level	Mark	Descriptor	
	0	• No awardable content	
Level 1	1-2	• The explanation 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. • Lines of reasoning are unsupported or unclear. (AO2)	
Level 2	3-4	• The explanation 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. • Lines of reasoning mostly supported through the application of relevant evidence. (AO2)	
Level 3	5-6	• The explanation 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.	

		Lines of reasoning are supported by sustained application of relevant evidence. (AO2)
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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> Elements of physics present i.e. isolated knowledge of techniques and procedures – two unconnected statements from any section	<u>Possible candidate responses</u> Use $F = (mv - mu)/t$ Use $F = ma$ keep slope the same repeat and average use spring as crumple zone
Level 2	3–4	<u>Additional guidance</u> Some knowledge of techniques and procedures with a logical connection made in one section and statement from one more section	<u>Possible candidate responses</u> Measurements (difference in contact times) with and without the spring Use $F = ma$ in finding the force
Level 3	5–6	<u>Additional guidance</u> Detailed knowledge of techniques and procedures with logical connections made in two sections and statement from one more section	<u>Possible candidate responses</u> Measure the trolley mass(es)/ velocities/ impact time(s) and use $F = ma$ in finding the force Measurements (difference in contact times) with and without the spring Same starting place for trolley each time.

Question number	Answer	Additional guidance	Mark
9 (c)	An explanation linking any four from force(s) associated with change(s) in momentum (use of Newton's second law) (1) detail of momentum changes, involving time (1) time of collision is same for both (1) (therefore) momentum change is the same for both (1) equal and opposite forces mean equal and opposite momentum changes (1) (total) momentum before a collision = (total) momentum after collision (1) (conservation of momentum requires) no external forces acting (1)	$F = \frac{(mv - mu)}{t}$ $F = ma$ $\frac{m_1 v_1 - m_1 u_1}{t} = - \frac{(m_2 v_2 - m_2 u_2)}{t}$ with explanation leading to $m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$ for both marks	(4) Exp

Total for Question 9 = 13 marks

Question number	Answer	Additional guidance	Mark
10(a)(i)	Any two valid differences e.g. mice are (more) sensitive to higher frequencies (than humans) (1) humans are (more) sensitive to lower frequencies (than mice) humans have a lower intensity of sound (threshold) to just hear (1) mice have two minima on the graph, humans one (1)	humans more sensitive (overall / for lower frequencies) two particularly sensitive frequencies	(2) grad

Question number	Answer	Additional guidance	Mark
10(a)(ii)	number and unit must both be correct to get the mark 2.5 kHz OR 2.5 kilohertz	acceptable range 2.0 to 3.0 kHz 2.0 to 3.0 kilohertz	(1) cler

Question number	Answer	Additional guidance	Mark
10(a)(iii)	(this frequency corresponds with) most sensitive / the minimum (frequency) (1)		(1) grad

Question number	Answer	Additional guidance	Mark
10 (b)	description including: infrasound < 20 Hz (1) ultrasound > 20 000 Hz (1)	award 1 mark for infrasound lower frequency than ultrasound OR reverse argument	(2) grad

Question number	Answer	Additional guidance	Mark
10 (c)	recall and substitution (1) $D = \frac{1}{2} v \times t = \frac{1}{2} 1500 \times 0.048$ evaluation (1) 36 (m)	award full marks for the correct answer without working award 1 mark only for 72 m (i.e. $\frac{1}{2}$ ignored)	(2) grad

Question number	Answer	Additional guidance	Mark
10 (d)	An explanation linking any four from use of seismometers (1) waves can be refracted in the interior of the earth (1) (showing) different densities (1) some seismic waves are longitudinal and some transverse (1) S/transverse waves cannot pass through liquid (1) S wave / transverse wave shadow zone shows part of the earth must be liquid (1) P / longitudinal waves can go through the core/liquid (1) mention S and P waves (1)	S/transverse waves can only pass through solids	(4) exp

Total for Question 10 = 12 marks