



Mark Scheme (Results)

November 2020

Pearson Edexcel GCSE
In Combined Science (1SC0) Paper 1PH

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

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

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

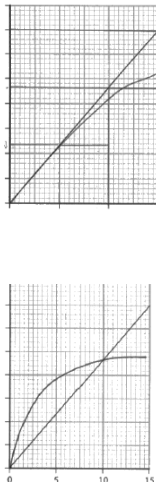
Total for Question 1 = 9 marks

Question number	Answer	Mark
2 (a)	<input checked="" type="checkbox"/> B force Options A, C and D are all scalars.	(1)

Question number	Answer	Additional guidance	Mark
2 (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
2 (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
2 (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
2 (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 2 = 9 marks

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

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

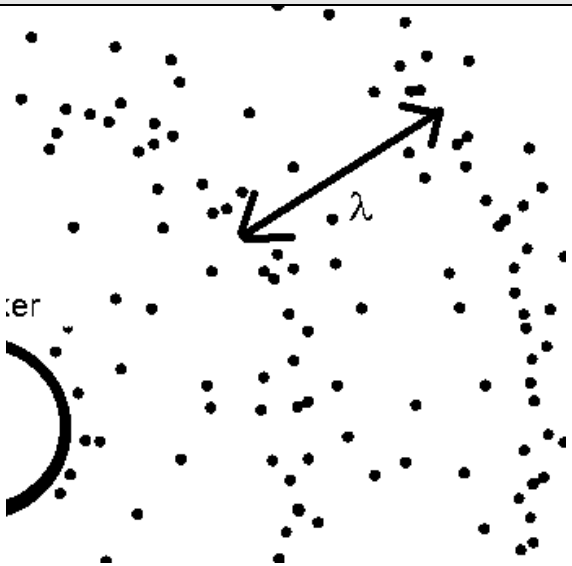
Question number	Answer	Additional guidance	Mark
3 (c)	<p>explanation linking:</p> <p>wave P refracts (towards the normal) (1)</p> <p>because P slows down (1)</p> <p>AND</p> <p>wave Q is reflected (at an equal angle from the boundary) (1)</p> <p>without change of speed of Q (1)</p>	<p>accept 'upper layer'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

Total for Question 3 = 9 marks

Question number	Answer	Additional guidance	Mark
4 (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
4 (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
4(a)(iii)	<p>explanation linking:</p> <p>use a (much) longer distance OR use electronic timer (1)</p> <p>with</p> <p>effect (1)</p> <p>reduces/eliminates the significance/impact of the reaction time OR gives a more manageable time to measure</p>	<p>all stand the same distance from the starting pistol (1)</p>	(2)

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

Question number	Answer	Additional guidance	Mark
4(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 4 = 9 marks

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

Question number	Answer	Mark
5 (b)	<input checked="" type="checkbox"/> C beta plus Options A, B and D are not represented by Figure 9.	(1)

Question number	Answer	Additional guidance	Mark
5 (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
5 (d)	<p>explanation linking two from:</p> <p>(damage to) cell(s) (1)</p> <p>(because gamma rays are) ionising / high frequency/very energetic (1)</p> <p>(causing / curing/diagnosing) cancer / mutation / chromosomal damage / dna damage/burns (1)</p>	(rapid/unwanted) division of cells	(2)

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

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

Total for Question 5 = 11 marks

Question number	Answer	Additional guidance	Mark
6 (a)(i)	C 7.7×10^9 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
6 (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) 9.4×10^3 / number that rounds to 9.4×10^3 (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
6 (b)	<p>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.</p> <p>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.</p> <p style="text-align: center;">AO2 (strand 2) (6 marks)</p> <p><u>Determining force</u></p> <ul style="list-style-type: none"> • Use of $F = (mv - mu)/t$ or $F = ma$ • mass (of trolley(s)) needed • and times during impact (t) <p><u>Showing effect of crumple zone</u></p> <ul style="list-style-type: none"> • 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 <p><u>Precautions or controls</u></p> <ul style="list-style-type: none"> • times repeated and average taken • careful controls – same starting position / same angle of slope / release without pushing etc. 		(6)Exp
Level	Mark	Descriptor	
	0	<ul style="list-style-type: none"> • No awardable content 	
Level 1	1-2	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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) 	

SUMMARY, for guidance

Level	Mark	Additional Guidance	General additional guidance – the decision within levels
	0	No rewardable material.	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.
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
6 (c)	<p>An explanation linking any four from</p> <p>force(s) associated with change(s) in momentum (use of Newton's second law) (1)</p> <p>detail of momentum changes, involving time (1)</p> <p>time of collision is same for both (1)</p> <p>(therefore) momentum change is the same for both (1)</p> <p>equal and opposite forces mean equal and opposite momentum changes (1)</p> <p>(total) momentum before a collision = (total) momentum after collision (1)</p> <p>(conservation of momentum requires) no external forces acting (1)</p>	$F = \frac{(mv - mu)}{t}$ $F = ma$ $\frac{m_1 v_1 - m_1 u_1}{t} = - \frac{(m_2 v_2 - m_2 u_2)}{t}$ <p>with explanation leading to $m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$ for both marks</p>	(4) Exp

Total for Question 6 = 13 marks

