

# Mark Scheme (Results)

# Summer 2023

Pearson Edexcel GCSE In Combined Science (1SCO) 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	За	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)	<b>B</b> distance <b>A</b> , <b>C</b> and <b>D</b> are incorrect as these are vector quantities		(1) AO1

Question	Answer	Additional guidance	Mark
number			
1 (b)(i)	A description to include any 4 from:		(4) AO1
	measure height (1)	allow 'keep same height' allow in this context hold against (fixed point on) metre rule	
	measure time of fall (1)	allow 'time it'	
	use (average) speed=distance ÷ time (1)		
	repeat with different number of cupcake cases in the stack/more cupcake cases (1)	accept cupcakes for cupcake cases	
	repeat <b>and</b> average time (of fall for each stack of cupcake cases) (1)		
	plot a graph (speed of fall against number of cupcake cases dropped) (1)		

Question	Answer	Additional guidance	Mark
Number			
1 (b)(ii)	substitution (1)		(2)
	(W=)0.005 x 10		AO2
	evaluation (1)		
	0.05 (N)	5 x 10 <sup>-2</sup> (N)	
		do not allow power of ten	
		error	
		award full marks for the	
		correct answer with no	
		working	
		give full credit for use of	
		g=9.8 or 9.81 N/kg	

Question number	Answer	Additional guidance	Mark
1 (b)(iii)	air resistance weight air resistance arrow (1)	Judge by eye any vertical upward arrow outside or inside the cupcake case ignore length of arrow arrow need not touch cupcake holder ignore label on arrow	(1) AO2

Question number	Answer	Additional guidance	Mark
1 (b) (iv)	zero / there is none / 0 / it has no acceleration	ignore 'constant'	(1) AO2

### Total for question 1 = 9 marks

Question number	Answer	Additional guidance	Mark
2 (a) (i)	substitution (1) $11 = 0.42 \times 10 \times \Delta h$ rearrangement (1) $(\Delta h =) \frac{11}{0.42 \times 10}$	accept substitution and rearrangement in either order ( $\Delta$ h =) $\Delta$ GPE m x g	(3) AO2
	evaluation (1) 2.6 (m)	accept any value which rounds	
		award 2 marks for 2.6 to any other power of 10 allow 1 mark for 0.38 allow 1 mark for 46(.2)	
		award full marks for the correct answer with no working give full credit for use of g=9.8	
		or 9.81 N/kg (gives 2.7 (m))	

number	Allswei	Additional guidance	Mark
2 (a) (ii)	substitution(1) (KE=) <sup>1</sup> / <sub>2</sub> x 0.42 x 12 <sup>2</sup>		(2) AO2
	evaluation (1) 30(J)	allow 30.2(4) (J) award 1 mark for 30240(J) award 1 mark for 2.52(J) award 1 mark for 60.5(J) award full marks for the correct	

Question number	Answer	Additional guidance	Mark
2 (a)(iii)	A description including: KE/kinetic (energy store) (1)	allow mechanically / mechanical transfer	(2) AO2
	(transfers to)		
	and <b>one</b> of:		
	elastic (potential energy store) (1)	ignore reference to gravitational potential energy	
	OR		
	thermal (energy of ball/wall/surroundings) (1)	allow heat for thermal allow sound in this context	
	OR		
	<u>dissipates</u> (to surroundings) (1)	ignore reference to the ground	

Question number	Answer	Additional guidance	Mark
2 (b)	selection <b>and</b> substitution (1)	use of either $v^2 - u^2 = 2ax$ or $v^2 = 2gh$	(2) AO2
	17 <sup>(2)</sup> = 2 x 10 x distance	17 <sup>(2)</sup> = 2 x a x distance allow 289 for 17 <sup>2</sup>	
	evaluation (1) 14(.45) (m)	award full marks for the correct answer without working	
		give full credit for use of g=9.8 or 9.81 m/s² gives 14.7 (m)	

## Total for question 2 =9 marks

	Answer Additional guidance	Mark
3(a)	<b>B</b> 3.0 s	(1) AO3
	<b>A</b> , <b>C</b> and <b>D</b> are incorrect as they are the wrong time.	

	Answer	Additional guidance	Mark
3(b)	4.6 (m/s)	allow any value between 4.5 and 4.7 (m/s) inclusive	(1) AO3

	Answer	Additional guidance	Mark
3(c)		allow MP1 and MP2 in either order	(3) AO3
	correct data point(s) seen (1)	any data point(s) on the line e.g. (1.4,4)	
	(accel =) <u>Δν</u> (1) <i>t</i>	allow 'gradient' allow e.g. $\frac{4}{1.4}$ for 2 marks	
	evaluation (1) 2.9 (m/s²)	allow values that round to 2.9 (m/s²) (e.g. 2.857)	
		award full marks for the correct answer without working	

	Answer	Additional guidance	Mark
3d)	(distance =) area (under graph) (1)	may be seen on graph	(3) AO3
	substitution (1)		
	1/2(1.4 x 4) + (3.6 x 4) + 1/2(1x 4)	2.8 + 14.4+ 2.0 ½ x [3.6+6] x 4	
	evaluation (1) 19 (m)	allow values that round to 19 (m) (e.g. 19.2)	
		award full marks for the correct answer without working	
		if no other marks scored allow (4 x 6 =)24 (m) for 1 mark	

	Answer	Additional guidance	Mark
3(e)	graph continued below time axis, starting at 18 s	do not accept vertical line do not accept line extending to left of 18 s	(1) AO3

Total for Question 3 = 9 marks.

	Answer	Additional guidance	Mark
4(a)(i)	calculation of time of travel (1) (120/330 =) 0.36(36) (s)		(3) AO2
	substitution (1)	ecf from MP1 for MP2&3	
	<u>0.23 x 100</u> 0.36(36)		
	evaluation (1) 63 (%)	accept values that round to 64 or 63	
		accept values that round to 0.64 or 0.63 for 2 marks	
		award full marks for the correct answer without working	

	Answer	Mark
4(a)(ii)	<b>C</b> Increase the distance between L and M.	(1) AO3
	<b>A</b> , <b>B</b> and <b>D</b> are incorrect as these would not improve the technicians' measurement	

	Answer	Additional guidance	Mark
4(b)	an explanation linking: (refraction caused by) change in speed (1)	allow 3 marks for sound speeds up and light slows down (when entering water)	(3) AO1
	sound speeds up (when entering water) (1) light slows down (when entering water) (1)	allow 2 marks for sound speeds up (when entering water) OR light slows down (when entering water)	
		if no other marks scored allow 1 mark for description of any speed change (when entering water) if no other marks scored allow 1 mark for wavelength changes	
		ignore references to transverse, longitudinal.	

	Answer	Additional guidance	Mark
4(c)	Answer example 1 e-m wave (1) corresponding result of energy transfer (1) example 2 e-m wave (1) corresponding result of energy transfer (1)	Additional guidance e.g. radio waves: communication, oscillations (of electrons) in wires microwaves: cooking, communications and satellite transmissions, internal heating of body cells, increase KE/vibration of water molecules infrared: cooking, thermal imaging, optical fibres, television remote controls, skin burns ultraviolet: security marking, fluorescent lamps, detecting forged bank notes and disinfecting water, damage to surface cells and eyes, skin cancer x-rays: observing the internal structure of objects, airport security scanners and medical x-rays, mutation or damage to cells in the body, cancer gamma rays: including sterilising food and medical equipment, and the detection of cancer and its treatment, mutation or damage to cells in the body, cancer additional effect for visible light scores 1 mark e.g. : including vision, photography and illumination	Mark (4) AO1

Total for Question 4 = 11 marks.

	Answer	Mark
5(a)(i)	C <sup>245</sup> Am <sub>95</sub>	(1) AO1
	<b>A</b> , <b>B</b> and <b>D</b> are incorrect as these are not isotopes of americium.	

	Answer	Mark
5(a)(ii)	[x] B 5 cm	(1) AO1
	<b>A</b> , <b>C</b> and <b>D</b> are incorrect as these are not the correct range of an alpha particle in air.	

	Answer	Additional guidance	Mark
5(a)(iii)	α 2α (1)	both correct for the mark	(3) AO2
	237 <b>NI</b> (1)	ecf from mp1	
	<mark>93</mark> ۱۷۲ (1)	ecf from mp1	
	<mark>93۱۷۲</mark> (1)	ecf from mp1 ecf from mp1	

	Answer	Additional guidance	Mark
5(b)	plots at three of: 17,64 (1) 34,32 (1) 51,16 (1) 68,8 (1) tolerance ±1 s ±4 Bq	activity in Bq activity e g activity e g activity e g activity e g activity e g activity in Bq activity in Bq activity in Bq activity e g activity in Bq activity e g activity in Bq activity e g activity e g activity e g activity e g activity in Bq activity in Bq activi	(3) AO3

	Answer	Additional guidance	Mark
5(c)	description to include: proton (1)		(2) AO1
	becomes a neutron (1)	award 2 marks for $p \rightarrow n$	
		award 2 marks for answers in terms of quarks: $u \rightarrow d$ or $up \rightarrow down or uud \rightarrow udd$	
		if no other mark scored, allow 1 mark for any <b>one</b> of	
		neutron becomes proton	
		$n \rightarrow p$	
		d→u	
		decrease in atomic number <u>by</u> <u>one</u>	
		mass number stays the same	
		gains a neutron	
		reduce charge (of nucleus) <u>by</u> <u>one</u>	
		responses referring to emission of gamma or neutrino	

Total for Question 5 = 10 marks.

	Answer	Additional guidance	Mark
6(a)	selection (1)	allow	(3)
	$p = m \times v$	mom(entum) = mass x velocity	AUZ
	substitution (1)		
	6.6 (× 10 <sup>-26</sup> ) × 480		
	evaluation (1)		
	3.2 × 10 <sup>-23</sup> (kgm/s)	allow numbers that round to	
		$3.2 \times 10^{-23}$ e.g. $3.168 \times 10^{-23}$	
		award full marks for the correct	
		answer without working	
		6 6 (x 10 <sup>-26</sup> ) x 480 seen scores	
		MP1 and MP2, 2 marks	
		3.2 to any other power of ten scores MP1 and MP2, 2 marks	

	Answer	Additional guidance	Mark
6(b)	attempt to find momentum	± 0.8 ± 0.6	(3)
	change (Δp) (1)		AUZ
	(Δp) =± 1.4	allow (Δp) =± 0.2	
	substitution in to F = $\Delta p$ (1)	allow	
	± 1.4	± 0.2	
	70 x 10 <sup>-3</sup>	70 x 10 <sup>-3</sup>	
	evaluation (1)		
	(±) 20 (N)	answers which round to	
		(±) 20 to any other power	
		of 10 score 2 marks	
		answers which round to	
		(+) 2 9 scores 2 marks	
		(±) 2.9 300103 2 marks	
		answers which round to	
		(±) 2.9 to any other	
		power of 10 score 1 mark	
		award full marks for the	
		correct answer without	
		working	

6c       Answers will be credited according to candidate's       (6)         Action       Action       Action         Action       Ac	Question number	Indicative content	Mark
<ul> <li>interrupter card for time through gate</li> <li>final speed = 2 x average speed</li> </ul>	6c	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 isolated statements • weights on hanger • weights added to trolley • light gate(s) / ticker(tape) timer / ultrasonic transducer • datalogger • (interrupter) card on trolley • sloping runway • weigh trolley • use newtonmeter • use a = (v-u)/t • measure distance and time • use stopclock and ruler • use (average) speed = distance / time • use a = $(v^2-u^2)/2s$ • plot graph of F against a detail of procedure • keeping mass constant by moving weights between hanger and trolley • light gates/ticker(tape) timer/ultrasonic transducer used to measure acceleration/velocity/time • runway on slope so no (effect of) friction /so trolley rolls at constant speed (with no weights/force) • increase angle of slope to increase force • interrupter card for time through gate • final speed = 2 x average speed	<b>(6)</b> AO1

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)

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	Possible candidate responses
		isolated facts mention at least 2 isolated statements	add weights and use light gates
		evidence may be seen in the diagram	
Level 2	3-4	Additional guidance	Possible candidate responses
		limited procedure 1 detail of procedure <b>and</b> mention 1 other isolated statement	use light gates to measure acceleration/velocity/time and add weights
		evidence may be seen in the diagram	
Level 3	5-6	Additional guidance	Possible candidate responses
		detailed procedure 2 details of procedure <b>and</b> mention 1 other isolated	use light gates to measure acceleration/velocity/time and suspend weights from weight hanger to
		statement	produce force and
		evidence may be seen in the diagram	sloping runway

Total for Question 6 = 12 marks