

EDEXCEL · GCSE COMBINED SCIENCE 1SC0

Physics — Higher Tier, Paper 1

June 2024 exam series

MARK SCHEME

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Mark Scheme (Results)

Summer 2024

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

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Summer 2024

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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.

Question number	Answer	Additional guidance	Mark
1(a)	Substitution or rearrangement (1) $980 = 35 \times 10 \times h$	$(\Delta h =) \frac{\Delta GPE}{m \times g}$ or $(\Delta h =) \frac{980}{35 \times 10}$ allow use of 9.8 N/kg or 9.81 N/kg allow substitution into visible incorrectly rearranged algebraic expression	2 AO2.1
	evaluation (1) (h =) 2.8 (m)	allow 2.85/2.86/2.9 for use of g = 9.8 N/kg or 9.81 N/kg ignore use of negative for decrease in GPE award full marks for the correct answer without working	

Question number	Answer	Additional guidance	Mark
1 (b)	substitution (1)		3 AO2.1
	$(v^2) = \frac{950 \times 2}{35}$	$\frac{1900}{35}$	
	evaluation of v^2 (1) 54(.29)		
	evaluation of v (1) ($v =$) 7.4 (m/s)	accept values that round to 7.3 (m/s) or 7.4 (m/s)	
		accept answer of 7 (one sig. fig.) award 2 marks for an answer that rounds to 54 (m/s) if no other mark scored, allow 1 mark for an answer that rounds to 0.23 (m/s) (use of mass in g) award full marks for correct answer without working	

Question number	Answer	Additional guidance	Mark
1(c i)	thermal (energy/store) (1)	energy dissipated energy wasted energy lost energy transferred to surroundings energy transferred due to friction energy transferred due to air resistance allow heat (energy)	1 A02.1
		ignore sound / not useful energy	

Question number	Answer	Additional guidance	Mark
1 (cii)	30 (J) (1)	accept -30 (J)	1 A02.1

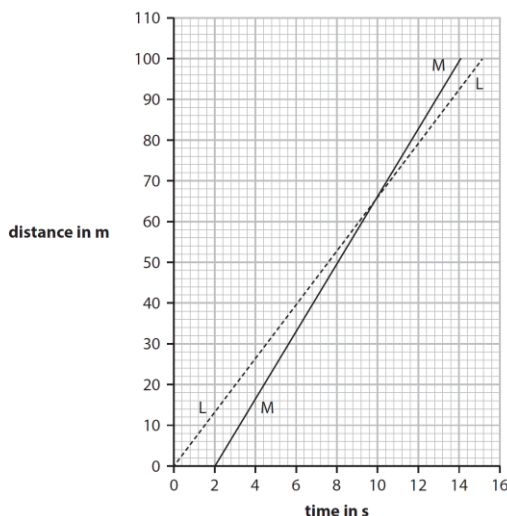
Question number	Answer	Additional guidance	Mark
1 (ciii)	substitution (1) $\frac{950}{980} (\times 100)$		2 A02.1
	evaluation (1) 0.97 OR 97%	allow answers that round to 0.97 or 97% for 2 marks allow 1 mark for answers that round to 97 or 0.97%	

		allow 1 mark for answers of 0.96 or 96% (truncated) award full marks for correct answer without working	
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Total Question 1 = 9 marks

Question number	Answer	Additional guidance	Mark
2 (ai)	66 (m)	allow values between 64 and 68 inclusive	1 A03.2
		allow values between 32 and 36 inclusive as the distance L has to run after M overtakes in this context	

Question number	Answer	Additional guidance	Mark
2 (aii)	select (1) $v = \frac{x}{t}$	allow any identifiable distance from graph divided by any identifiable time from graph e.g. $\frac{100}{15.2}$	2 A02.1
	evaluation (1) 6.6 (m/s)	allow values that round to between 6.5 (m/s) and 6.7 (m/s) for example 6.666 (m/s) or 6.579 (m/s)	



		award full marks for correct answer without working	
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Question number	Answer	Additional guidance	Mark
2 (bi)	substitution (1) (t =) $\frac{10 - 6.2}{2.5}$	$\frac{3.8}{2.5}$ allow $\frac{6.2 - 10}{2.5}$ or $\frac{-3.8}{2.5}$	2 AO2.1
	evaluation (1) (t =) 1.5 (s)	1.52 (s) allow -1.5(2) (s) award full marks for correct answer without working	

Question number	Answer	Additional guidance	Mark
2 (bii)	substitution OR rearrangement (1) (-)10 ² = 2 × (-) 4.4 × x	(x =) $\frac{v^2 - u^2}{2 \times a}$ (x =) $\frac{(-)10^2}{2 \times (-) 4.4}$	2 AO2.1
	evaluation (1) (x =) 11 (m)	allow values that round to 11 (m) e.g. 11.36 (m)	

		ignore negative sign in answer line accept 1.1(36) for one mark award full marks for correct answer without working	
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Question	Answer	Additional guidance	Mark
2 (c)	explanation linking mass/(change of/initial/final) velocity/(change of) momentum (1) with a consistent equation linking chosen factor to force (1)	accept speed/acceleration do not accept weight second marking point dependent on first marking point relevant equations are: $F = ma$ $F = \frac{mv - mu}{t}$ $F = \frac{\Delta p}{t}$ $F = \frac{m\Delta v}{t}$	2 AO2.1

Total question 2=9 marks

Question	Answer	Additional guidance	Mark
3a (i)	An explanation linking UVC/it has the smallest wavelength / highest frequency/ highest energy/most ionising (1) (it doesn't cause harm to people because) 100% absorbed by the Earth's atmosphere/no UVC reaches the Earth's surface/people (1)	allow shortest wavelength allow smaller for smallest / higher for highest / more for most	2 AO3.2

Question	Answer	Additional guidance	Mark
3(a)(ii)	wavelength 280(nm) (1) substitution and rearrangement (1) $f = \frac{3.0 \times 10^8}{280 \times 10^{-9}}$ evaluation (1) $1.07 \times 10^{15} \text{ (Hz)}$	allow 2.8 to any power of ten accept numbers that round up to $1.1 \times 10^{15} \text{ (Hz)}$ award 2 marks for values that round up to 1.1 to any other power of ten if no other mark scored allow substitution and rearrangement	3 AO2.1

		using an incorrect wavelength for 1 mark award full marks for correct answer without working	
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Question	Answer	Additional guidance	Mark
3(b)	an explanation linking any four of the following:- UV/energy absorbed by electrons (1) electrons change orbit/energy level/shell (1) electrons in an 'excited' state (1) electrons emit energy/ move to lower energy level/fall down/de-excite (1) (energy) emitted as (visible) light / at a different frequency/wavelength (1) (process is called) fluorescence / (light emitted is) fluorescent (1)	a labelled diagram can score up to 4 marks	4 AO1.1

Total Question 3= 9 marks

Question	Answer	Additional guidance	Mark
4(a)(i)	from 20 s to 45 s		1 AO1.1

Question	Answer	Additional guidance	Mark
4(a)(ii)	use of area from graph (1) process (1) EITHER calculation of area of trapezium OR calculation of area triangle and rectangle and triangle e.g. $\text{area} = \frac{[25 + 70]}{2} \times 15$ OR e.g. area triangle = $\frac{15 \times 20}{2} = 150$ (m) area rectangle = $15 \times 25 = 375$ (m) area triangle = $\frac{15 \times 25}{2} = 187.5$ (m) evaluation (1) 712.5 (m)	allow evidence of counting squares and area of one square accept 712 (m) or 713 (m) do not accept 710 (m) award full marks for the correct answer without working	3 AO2.1

Question	Answer	Additional guidance	Mark
4(a)(iii)	substitution and evaluation (1) (average speed =) $\frac{712.5}{70} = 10(.2) \text{ (m/s)}$	allow $\frac{710}{70} = 10(.1) \text{ (m/s)}$ allow ecf from their 7(a)(ii) award full marks for the correct answer without working	1 AO2.1

Question	Answer	Additional guidance	Mark
4(b)	identification of equation and substitution (1) $450 = m \times 0.35$ rearrangement and evaluation (1) (m=) $\frac{450}{0.35}$ 1300 (kg)	 accept values which round to 1300 (kg) e.g. 1286 (kg) award full marks for the correct answer without working	2 AO2.1

Question	Answer	Additional guidance	Mark
4c (i)	x represents time OR t y represents velocity OR v	both correct in correct place for 1 mark ignore units	1 AO1.1

Question	Answer	Additional guidance	Mark
4c(ii)	attempt to find a gradient of the line that would give an answer between 0.18 and 0.24 (1) evaluation(1) 0.21 (m/s ²)	e.g. $\frac{12.5}{60}$ or $\frac{10}{42}$ values that are between 0.20 and 0.22 (m/s ²) e.g. 0.2083 do not allow fractions in the answer line for evaluation mark award full marks for the correct answer without working	2 AO2.1

Question	Answer	Additional guidance	Mark
4c (iii)	0	zero	1 AO2.1

Total question 4=11 marks

Question	Answer	Mark
5(a)	D +2 A , B and C do not apply to an alpha particle	1 AO1.1

Question	Answer	Additional guidance	Mark
5(b)	loss / gain of electrons (from atoms)	accept knock electrons out (of atoms)	1 AO1.1

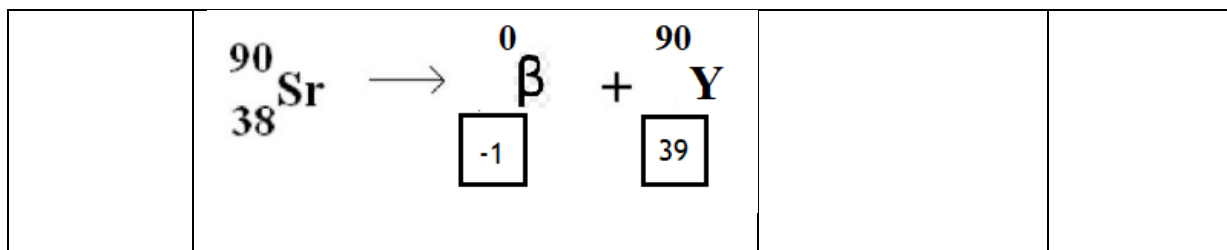
Question	Answer	Additional guidance	Mark
5(c)	an explanation linking three from use of G-M tube (with counter) (1) no (obvious) radioactive sources present (1) measure (number of) counts in a given time (1) divide number of counts by time (1) repeat readings (1) calculate the average value (1)	allow Geiger counter / rate meter allow measure count rate / activity if rate meter used take readings in different positions in laboratory	3 AO3.3

Question	Answer	Additional guidance	Mark
5(d)(i)	sketch with at least three objects labelled (1) allowed labels: G-M tube counter aluminium piece(s)/sheet(s)/foil (metre) rule β/beta/source aluminium / sheets between source and G-M tube with all three labelled (1)	ignore beta particles / beta drawn as particles or waves	2 A03.3

Question	Answer	Additional guidance	Mark
5(d)(ii)	one from number of pieces/sheets (of aluminium/foil)(1) thickness of aluminium (between source and G-M tube) (1)	allow amount for number	1 A03.3

Question	Answer	Additional guidance	Mark
5(d)(iii)	one from distance between the source and the G-M tube (1) distance between source and aluminium pieces (1) distance between G-M tube and pieces of aluminium (1) activity of source (1) direction / angle of source (1) duration/time of measurement (1)	ignore background radiation / temperature accept beta / beta radiation for source for 1st, 2nd and 4th marking points do not allow 'distance of aluminium' accept (same) strength/intensity of source ignore amount of beta radiation	1 AO3.3

Question	Answer	Additional guidance	Mark
5(d)(iv)	-1 for beta β (1) correctly balanced equation with numbers in boxes adding to 38 (1)		2 AO1.1



Total question 5= 11 marks

Question	Answer	Mark
6(a)(i)	D A is not correct there is no vertical force B the centripetal force acts inward C is not correct there is no force acting at right angles to the radius	1 AO1.1

Question	Answer	Additional guidance	Mark
6(a)(ii)	any one from:- direction (of ball is) (continuously) changing (1) there is a resultant force acting on the ball (1) velocity/it is a vector (1)	ignore changing force /acceleration / centripetal force velocity/it has direction	1 AO1.1

Question	Answer	Additional Guidance	Mark
6 (b)	substitution or rearrangement (1) $3500 = \frac{53 \times 4 (- 53 \times 0)}{\text{time}}$ or (time=)<u>change in momentum</u> force evaluation (1) 6.06×10^{-2} (s) or 0.0606 (s) rounded to 2sf (1) 6.1×10^{-2} (s) or 0.061 (s)	in either order $3500 = \frac{212}{\text{time}}$ (time =) $\frac{53 \times 4}{3500}$ (time =) $\frac{212}{3500}$ (t =) $\frac{mv - mu}{F}$ accept 0.06057 (s) 0.06 (s) accept their calculation rounded to 2sf 0.060 scores 2 marks (truncation) award three marks for the correct answer given to 2sf without working	3 AO2.1

Question number	Indicative content	Mark
*6(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. momentum • momentum is product of mass and velocity • $p=mv$ • momentum is a vector quantity • momentum of P = mv • momentum of Q = $-mv$ • total momentum before collision is zero • $mv_p + (-mv_q) = 0$ • momentum after collision must be zero • total momentum before = total momentum after energy • before collision each trolley has kinetic energy • $KE = \frac{1}{2}mv^2$ • total KE before collision is sum of KE of both trolleys • KE after collision is zero • KE transferred to thermal (store) • KE transferred by heating and by sound • energy dissipated to surroundings Ignore references to equal and opposite forces and the laws of motion	6 AO1.2 AO2.2

Command verb: Explain

AO targeting 3 marks AO1 strand 1 and 3 marks AO2 strand 1

Level	Mark	Descriptor
	0	No awardable content
Level 1	1-2	• Demonstrates elements of physics understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • 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	• Demonstrates physics understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • 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	• Demonstrates accurate and relevant physics understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • 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	<u>Additional guidance</u> isolated fact(s) about the momentum and/or energy of trolleys, before or after collision	<u>Possible candidate responses</u> momentum before collision equals momentum after collision momentum is mass x velocity momentum is a vector energy cannot be created or destroyed $KE = \frac{1}{2}mv^2$
Level 2	3–4	<u>Additional guidance</u> limited description of conservation of momentum and limited description of conservation of energy OR detailed description of either conservation of energy or conservation of momentum	<u>Possible candidate responses</u> momentum/velocities of trolleys is equal and opposite before collision / zero before collision/zero after collision. trolleys have kinetic energy before collision OR the trolleys have kinetic energy before the collision which is transferred to thermal energy after the collision.
Level 3	5–6	<u>Additional guidance</u> detailed description of conservation of momentum before and after collision and limited description of conservation of energy OR detailed description of energy conservation and limited description of conservation of momentum	<u>Possible candidate responses</u> momentum of trolleys before collision is equal and opposite giving zero, and momentum is zero after collision so momentum is conserved energy is dissipated thermally after collision OR the trolleys have kinetic energy before the collision which is transferred to thermal energy after the collision. momentum of trolleys is equal and

			opposite before collision / zero before collision/zero after collision.
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Total for question 6 =11 marks

Total for paper = 60 marks