

GCSE

COMBINED SCIENCE: TRILOGY

Physics Paper 2 Foundation Tier

Mark scheme Practice Paper Series – Set 1 SGC/S1/P/2F

Version 1.1

This mark scheme is an original resource written for sciencegcse.co.uk to accompany the Set 1 practice paper SGC/S1/P/2F. It is not an AQA mark scheme and has not been produced or endorsed by AQA. It follows the structure and conventions of AQA GCSE science mark schemes so that students and teachers can mark the practice paper in the same way that a real paper is marked.

Marking should be carried out using the Information to Examiners on the following pages. The paper has not been standardised, so raw marks should not be converted into grades using any published grade boundaries.

Specification references are to the AQA GCSE Combined Science: Trilogy (8464) specification, Physics sections 6.5–6.7. AO = assessment objective; WS = working scientifically; MS = mathematical skills; RP = required practical.

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the answer(s) expected, including alternative acceptable wording, in the **Answers** column
- guidance on which answers are and are not creditworthy in the **Extra information** column
- the assessment objective (AO) and specification reference for each marking point.

Award marks positively. Do not deduct marks for incorrect additional material unless it contradicts a correct answer (see 3.1). Marks are awarded for what the student has written, not for what they might have meant.

2. Emboldening and underlining

- 2.1 Where a list of acceptable answers is given and more than one mark is available, **any two from** (or similar) is used, followed by the acceptable answers.
- 2.2 A bold **and** indicates that both parts of the answer are needed to gain the mark.
- 2.3 Alternative answers acceptable for the same mark are separated by **or**. Different words that are acceptable within a marking point are separated by a forward slash (/).
- 2.4 Words in bold in the Answers column are the essential words that must be present, or their equivalent, for the mark to be awarded.

3. Marking points

3.1 Marking of lists

For a question asking for a fixed number of responses, consider the whole answer, including extra responses. Each incorrect or contradictory response cancels one correct response; ignore neutral additions. Numbered answer lines do not limit marking to the first responses. This rule does not apply to extended answers.

3.2 Marking procedure for calculations

Full marks can be awarded for a correct numerical answer without working, unless the question asks for working to be shown. If the answer is incorrect, marks may be awarded for the correct stages of working shown in the mark scheme. Anything shown in brackets in the Answers column (for example the unit) is not required for the mark.

3.3 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.4 Errors carried forward

Any error in the answer to a structured question causes the loss of the mark(s) for that part only. Later parts should be marked on the assumption that the incorrect answer was correct, where the mark scheme indicates that error carried forward (ECF) applies.

3.5 Phonetic spelling

Accept misspelled or phonetic scientific terms when the intended answer is clear, unless the spelling could be confused with a different technical term. This also applies when the question asks for the name of a process or structure.

3.6 Brackets

Words shown in brackets in the Answers column are not required to gain the mark but help to set the context.

3.7 Allow

Answers that are acceptable but which would not normally be expected are shown as **allow**.

3.8 Ignore

Statements shown as **ignore** are neither creditworthy nor penalised. Mark the rest of the answer normally.

3.9 Do not accept

Statements shown as **do not accept** are incorrect and, where they contradict or replace the expected answer, mean the mark is not awarded.

4. Level of response marking instructions

Extended-response questions (question 08.4 in this paper) are marked using a level of response mark scheme. The scheme has three levels, each covering two marks, plus a level descriptor and indicative content.

Step 1 – Determine a level. Read the whole answer and decide which level descriptor best fits it. Use a 'best-fit' approach: an answer does not need to meet every part of a descriptor to be placed in that level, and a weak part of the answer need not prevent it from reaching the higher level if the overall quality matches the descriptor.

Step 2 – Determine a mark within the level. Award the higher mark in the level if the answer meets the descriptor fully and the points made are well linked; award the lower mark if the answer only just meets the descriptor or contains minor errors or omissions.

The indicative content is not a checklist: students need not include every point to reach the top level, and other relevant, correct points should be credited. An answer that lists points without linking them into a coherent answer should be placed in a lower level than one that develops and connects them.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	weight	if more than one box is ticked, no mark	1	AO1 6.5.1.2
01.2	(W =) 15×9.8	an answer of 147 scores 2 marks	1	AO2 6.5.1.3 MS 3c
	(W =) 147 (N)	allow 150 (N) an answer of 1.5 ($15 \div 9.8$) scores 0 marks	1	AO2 6.5.1.3 MS 3c
01.3	(size =) 15 (N)	an answer of 105 ($60 + 45$) scores 0 marks for the size	1	AO2 6.5.1.4
	(direction =) to the right or in the direction of the pushing force	allow forwards allow an arrow drawn pointing to the right mark the direction independently of the size	1	AO2 6.5.1.4
01.4	(W =) 60×4.0	an answer of 240 scores 2 marks	1	AO2 6.5.2 MS 3c
	(W =) 240 (J)	allow 240 N m an answer of 15 ($60 \div 4.0$) scores 0 marks	1	AO2 6.5.2 MS 3c
01.5	(the temperature) increases	allow it gets hotter / warmer ignore references to energy being wasted or lost	1	AO1 6.5.2
Total			8	
02.1	to avoid a parallax error or so that the reading (of the pointer on the metre rule) is accurate	allow so that the reading is not too high or too low ignore so it is a fair test ignore so it is precise / reliable	1	AO1 6.5.3 RP 18
02.2	(k =) $2.0 \div 0.050$	an answer of 40 scores 2 marks	1	AO2 6.5.3 MS 3b MS 3c RP 18
	(k =) 40 (N/m)	an answer of 0.1 (2.0×0.050) or 0.025 ($0.050 \div 2.0$) scores 0 marks	1	AO2 6.5.3 MS 3b MS 3c RP 18

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	$(E_e =) 0.5 \times 40 \times 0.050^2$	an answer of 0.05 scores 2 marks allow ECF from an incorrect answer to 02.2 allow $(E_e =) 0.5 \times 2.0 \times 0.050$ (area under a force–extension graph)	1	AO2 6.5.3 MS 3c
	$(E_e =) 0.05$ (J)	allow 0.050 (J) or 5×10^{-2} (J)	1	AO2 6.5.3 MS 3c
02.4	both points plotted correctly (to within $\pm$ half a small square)	allow 1 mark for one point plotted correctly points: (5.0, 13.5) and (6.0, 18.0)	2	AO2 6.5.3 MS 4c RP 18
02.5	a straight line from the origin through the points up to 4.0 N, then a smooth curve (bending upwards) through the points at 5.0 N and 6.0 N	allow a ruled straight line from the origin to between 4.0 N and 4.5 N that continues as a smooth curve allow ECF for the student's own plotted points do not accept a single straight line through all of the points do not accept a line that joins the points dot-to-dot	1	AO2 6.5.3 MS 4c RP 18
02.6	4.0 (N)	allow any value from 4.0 to 4.5 (N) allow ECF: the force at which the student's line of best fit stops being straight	1	AO3 6.5.3 MS 4a RP 18
Total			9	
03.1	B		1	AO2 6.5.4.1.4 MS 4a
03.2	$(v =) 150 \div 100$	an answer of 1.5 scores 2 marks allow any correct distance and time read from section A , e.g. $75 \div 50$	1	AO2 6.5.4.1.4 MS 4a MS 4d
	$(v =) 1.5$ (m/s)	an answer of 0.67 ($100 \div 150$) scores 0 marks	1	AO2 6.5.4.1.4 MS 4a MS 4d
03.3	C	the reason mark can only be awarded if C is chosen	1	AO3 6.5.4.1.4 MS 4d

Question	Answers	Extra information	Mark	AO / Spec. Ref.
	(the line / gradient in section C is the) steepest	allow it has the greatest gradient / slope allow the greatest distance is travelled in the shortest time allow a correct comparison of speeds, e.g. 3.0 m/s in C compared with 1.5 m/s in A	1	AO3 6.5.4.1.4 MS 4d
03.4	speed is a scalar (quantity) or speed has magnitude (size) only		1	AO1 6.5.4.1.3 6.5.1.1
	velocity is a vector (quantity) or velocity has magnitude and direction or velocity is speed in a given direction	'velocity has a direction but speed does not' on its own scores 1 mark	1	AO1 6.5.4.1.3 6.5.1.1
Total			7	
04.1	0.8 (s)	allow 0.80 (s)	1	AO2 6.5.4.3.2 MS 4a
04.2	(s =) 20×0.8	an answer of 16 scores 2 marks allow ECF from an incorrect answer to 04.1	1	AO2 6.5.4.3.1 MS 3c
	(s =) 16 (m)		1	AO2 6.5.4.3.1 MS 3c
04.3	(a =) $20 \div 4.0$	an answer of 5 scores 2 marks an answer of 4.2 ($20 \div 4.8$) scores 1 mark	1	AO2 6.5.4.1.5 MS 4a MS 4d
	(a =) 5.0 (m/s^2)	allow -5.0 (m/s^2)	1	AO2 6.5.4.1.5 MS 4a MS 4d
04.4	any two from: - a wet / icy road (surface) - worn brakes / brakes in poor condition - worn tyres / tyres with little tread - a greater speed (of the car) - a greater mass of the car (e.g. more passengers or a heavy load)	allow a slippery road / rain, snow or leaves on the road allow tyres in poor condition / under-inflated tyres allow a smaller braking force ignore bad weather unless it is linked to the road surface do not accept factors that affect only the thinking distance, e.g. tiredness, alcohol, drugs, distractions	2	AO1 6.5.4.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	work is done by the friction (force) between the brakes and the wheels	allow friction between the brake pads and the wheel / disc allow friction (in the brakes) causes heating	1	AO1 6.5.4.3.4
	(this) reduces the kinetic energy of the car or energy is transferred from the kinetic (energy) store of the car to the thermal (energy) store of the brakes	allow kinetic energy is transferred to thermal energy / internal energy (of the brakes) ignore heat is produced / energy is lost, without reference to kinetic energy	1	AO1 6.5.4.3.4
Total			9	
05.1	(amplitude =) Q		1	AO1 6.6.1.2
	(wavelength =) R		1	AO1 6.6.1.2
05.2	in a transverse wave the oscillations / vibrations are perpendicular to the direction of energy transfer	allow at right angles to allow the direction the wave travels for the direction of energy transfer (both marking points)	1	AO1 6.6.1.1
	in a longitudinal wave the oscillations / vibrations are parallel to the direction of energy transfer	allow in the same direction as the energy transfer a description of one type of wave only scores a maximum of 1 mark	1	AO1 6.6.1.1
05.3	3.0 (Hz)	allow 3 (Hz) an answer of 0.33 ($10 \div 30$) scores 0 marks	1	AO2 6.6.1.2 MS 3c RP 20
05.4	($v =$) 3.0×0.040	an answer of 0.12 scores 2 marks allow ECF from an incorrect answer to 05.3	1	AO2 6.6.1.2 MS 3c RP 20
	($v =$) 0.12 (m/s)	allow 12 cm/s if the unit is changed	1	AO2 6.6.1.2 MS 3c RP 20
05.5	any one from: - one wavelength is very small, so it is difficult to measure accurately - it reduces the (effect of the) uncertainty / error in the measurement	allow the error in measuring is shared between 10 waves ignore it is more reliable / a fair test	1	AO3 6.6.1.2 RP 20
Total			8	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	(between radio waves and infrared) microwaves (between visible light and X-rays) ultraviolet (after X-rays) gamma rays	all three correct = 2 marks two correct = 1 mark allow UV	2	AO1 6.6.2.1
06.2	they all travel at the same speed through a vacuum	if more than one box is ticked, no mark	1	AO1 6.6.2.1
06.3	electrical heaters → infrared sun tanning → ultraviolet television and radio broadcasts → radio waves	all three lines correct = 2 marks two lines correct = 1 mark if more than one line is drawn from a use, that use scores 0	2	AO1 6.6.2.4
06.4	any one from: • (causes) the skin to age prematurely • increases the risk of skin cancer	allow sunburn / damage to skin cells allow damage to the eyes ignore it is ionising, unqualified	1	AO1 6.6.2.3
06.5	matt black	the reason mark can only be awarded if matt black is chosen	1	AO3 6.6.2.2 RP 21
	the water (in this can) had the lowest temperature (after 10 minutes) or the temperature of the water fell the most	the reason must use the results: ignore 'black surfaces are good emitters' on its own allow it cooled the fastest / the most allow the temperature fell by 28 °C	1	AO3 6.6.2.2 RP 21
06.6	any one from: • the size / shape / surface area of the cans • the material / thickness of the cans • the temperature of the room / surroundings • (all) with a lid or (all) without a lid • the surface the cans stand on • the position of the cans, e.g. the same distance apart / away from heaters and draughts	ignore the volume or starting temperature of the water, or the time (these are given in the question)	1	AO3 6.6.2.2 RP 21 WS 2.2
Total			9	
07.1	field lines drawn around the magnet going from one pole to the other, with the correct shape	at least two lines above and two lines below the magnet, each starting and ending on the poles lines must not cross ignore lines meeting at a pole	1	AO1 6.7.1.2
	arrows on the lines pointing from N to S (outside the magnet)	this mark depends on at least one correct field line all arrows drawn must point the correct way	1	AO1 6.7.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	the (compass) needle is a (small) magnet	allow the needle is magnetised / is a permanent magnet	1	AO1 6.7.1.2
	(the needle) lines up with / points along the Earth's magnetic field	allow the Earth has a magnetic field / the Earth's core is magnetic ignore references to gravity	1	AO1 6.7.1.2
07.3	any two from: - a permanent magnet produces its own magnetic field, but an induced magnet only becomes a magnet when it is placed in a magnetic field - an induced magnet loses most / all of its magnetism (quickly) when it is removed from the magnetic field, but a permanent magnet does not - the force between a permanent magnet and an induced magnet is always attraction, but permanent magnets can attract or repel each other	allow converse statements allow a statement about one type of magnet only if the difference is clear, e.g. an induced magnet is only magnetic while it is in a magnetic field	2	AO1 6.7.1.1
07.4	as the number of turns (on the coil) increases, the number of paper clips (picked up) increases	allow positive correlation do not accept (directly) proportional	1	AO3 6.7.2.1 WS 3.5
07.5	increase the current (in the coil)	allow increase the potential difference of the power supply / use more cells allow wind the same turns closer together / make the coil shorter ignore add more turns (given in the question) ignore use an iron core (already used) / a bigger nail	1	AO1 6.7.2.1
07.6	the electromagnet can be switched off (to drop / release the scrap metal)	allow it can be turned on and off allow the strength of the magnet can be changed / controlled ignore an electromagnet is stronger	1	AO2 6.7.2.1
Total			9	
08.1	the resultant force on the trolley is zero	if more than one box is ticked, no mark	1	AO1 6.5.4.2.1
08.2	(size =) 4.9 (N)		1	AO1 6.5.4.2.3
	(direction =) upwards	allow vertically up / away from the bench do not accept downwards	1	AO1 6.5.4.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.								
08.3	(a =) $1.2 \div 0.50$	an answer of 2.4 scores 2 marks	1	AO2 6.5.4.2.2 MS 3b MS 3c RP 19								
	(a =) 2.4 (m/s ²)	an answer of 0.6 (1.2×0.50) or 0.42 ($0.50 \div 1.2$) scores 0 marks	1	AO2 6.5.4.2.2 MS 3b MS 3c RP 19								
08.4	<table><tr><td>Level 3 (5–6 marks)</td><td>A detailed and coherent plan covering all the major steps is given. The steps are set out in a logical order that another person could follow to obtain valid results. The plan describes how the mass of the trolley is changed over a suitable range, how the force is kept constant and how valid (repeated) measurements of acceleration are obtained.</td></tr><tr><td>Level 2 (3–4 marks)</td><td>The main steps of a method are given, with some relevant detail. The plan may not be in a completely logical order, or may be missing some detail, for example how the force is kept constant.</td></tr><tr><td>Level 1 (1–2 marks)</td><td>Simple statements about some relevant steps are made. The response lacks a logical structure and would not lead to valid results.</td></tr><tr><td>0 marks</td><td>No relevant content.</td></tr></table> Indicative content • measure the mass of the trolley (using a balance) • keep the hanging mass the same, so that the (accelerating) force stays the same • release the trolley from the same starting position each time • the card on the trolley passes through the light gate and the data logger calculates the acceleration • add masses to the trolley to increase its mass, e.g. 0.10 kg at a time • use at least five different masses • repeat each measurement (at least three times) and calculate a mean acceleration • keep other variables the same, e.g. the same bench and surface, the same position of the light gate, the same length of string • plot a graph of acceleration against the mass of the trolley to find the relationship • safety: put something soft (e.g. a box with padding) under the hanging masses and keep feet clear; stop the trolley before it hits the pulley Credit other correct, relevant points, e.g. using two light gates, or a stopwatch and metre rule, to determine the acceleration. To reach Level 3 the plan must state that the hanging mass (force) is kept constant, and describe how the mass of the trolley is changed over a suitable range with repeat readings.		Level 3 (5–6 marks)	A detailed and coherent plan covering all the major steps is given. The steps are set out in a logical order that another person could follow to obtain valid results. The plan describes how the mass of the trolley is changed over a suitable range, how the force is kept constant and how valid (repeated) measurements of acceleration are obtained.	Level 2 (3–4 marks)	The main steps of a method are given, with some relevant detail. The plan may not be in a completely logical order, or may be missing some detail, for example how the force is kept constant.	Level 1 (1–2 marks)	Simple statements about some relevant steps are made. The response lacks a logical structure and would not lead to valid results.	0 marks	No relevant content.	6	AO3 6.5.4.2.2 RP 19 WS 2.2
Level 3 (5–6 marks)	A detailed and coherent plan covering all the major steps is given. The steps are set out in a logical order that another person could follow to obtain valid results. The plan describes how the mass of the trolley is changed over a suitable range, how the force is kept constant and how valid (repeated) measurements of acceleration are obtained.											
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Level 1 (1–2 marks)	Simple statements about some relevant steps are made. The response lacks a logical structure and would not lead to valid results.											
0 marks	No relevant content.											
Total			11									
TOTAL FOR PAPER			70									