GCSE

COMBINED SCIENCE: TRILOGY

Foundation Tier Physics Paper 2

Mark scheme Practice Paper Series – Set 2 SGC/S2/P/2F

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This mark scheme is an original resource written for sciencegcse.co.uk to accompany the Set 2 practice paper SGC/S2/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 section 6.5–6.7 (Paper 2 may also draw on section 6.1). 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
When a fixed number of responses is requested but extra responses are given, consider the whole list. Each incorrect response or contradiction cancels one otherwise available correct response, up to the mark limit; the score cannot fall below zero. Neutral material identified by **ignore** does not cancel a correct response. Do not apply this rule as a penalty for extra relevant detail in an extended answer.

3.2 Marking procedure for calculations
A correct final answer can receive the marks indicated in the question-specific scheme without every intermediate step being written. Do not award full marks if the working shown contradicts that answer. Where the question specifically requires a method, demonstration or working, apply that requirement. Credit correct stages when the final answer is wrong, including consequential steps where permitted. A printed unit may only be replaced by another unit when the numerical value is converted consistently.

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
Use an earlier incorrect value in a later part where ECF is allowed by the question-specific scheme. Within a calculation, credit later correct stages that use an earlier incorrect value consistently, subject to any stated limits. Do not repeatedly penalise the same error.

3.5 Phonetic spelling
Accept a misspelling when the intended scientific term is clear, including when a term is being recalled. Do not accept wording that could instead name a different scientific term.

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 08.1 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	Velocity	if more than one box is ticked, no mark	1	AO1 6.5.1.1
01.2	60 (m)		1	AO2 6.5.4.1.1
01.3	30 (m)		1	AO2 6.5.4.1.1
	east	allow to the right / towards **B** / towards **C** the two marks are independent	1	AO2 6.5.4.1.1
01.4	average speed = 60 ÷ 40	an answer of 1.5 (m/s) scores **2** marks allow ECF from 01.2	1	AO2 6.5.4.1.2 MS 3c
	= **1.5** (m/s)	an answer of 0.75 (m/s) (displacement used) scores 1 mark, unless 30 m was given in 01.2 (ECF: **2** marks)	1	AO2 6.5.4.1.2 MS 3c
01.5	3 m/s	if more than one box is ticked, no mark	1	AO1 6.5.4.1.2
01.6	she has travelled a non-zero distance, so distance divided by the total time is greater than zero	allow only her displacement / average velocity is zero ignore she returned to A on its own	1	AO3 6.5.4.1.1, 6.5.4.1.2
		Total	**8**	
02.1	a single force would make the strip move / accelerate (in the direction of the force)	allow a single force would just pull the strip along allow with one force the resultant force is not zero, so the strip would accelerate	1	AO1 6.5.3
	two forces are needed, acting on the strip in opposite directions / one at each end	allow the support pulls up on the strip while the weight pulls down	1	AO1 6.5.3
02.2	**A**		1	AO3 6.5.3
	it returned to its original length (100 mm) when the weight was removed	the reason mark depends on **A** being chosen allow strip **B** stayed longer than its original length	1	AO3 6.5.3
02.3	extension = 150 − 100 = 50 (mm)	an answer of 0.050 (m) scores **2** marks	1	AO2 6.5.3 MS 1a
	= **0.050** (m)	allow 0.05 (m) allow ECF from an incorrect extension in mm correctly converted an answer of 0.150 (m) or 0.020 (m) scores 1 mark	1	AO2 6.5.3 MS 1a

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	4.0 = k × 0.040	allow k = 4.0 ÷ 0.040 allow 4.0 = k × 40 (extension in mm) for this mark only an answer of 100 (N/m) scores **2** marks	1	AO2 6.5.3 MS 3b, 3c
	k = **100** (N/m)	an answer of 0.1 (N/m) (extension in mm) scores 1 mark an answer of 28.6 (N/m) (total length used) scores 0 marks	1	AO2 6.5.3 MS 3b, 3c
		Total	**8**	
03.1	air resistance / friction	allow drag ignore weight / gravity / driving force	1	AO1 6.5.1.2
03.2	0 (N)	allow zero / the forces are balanced	1	AO2 6.5.4.2.1
03.3	90 (N)		1	AO2 6.5.1.4
	forwards / in the direction of the driving force	allow in the direction of motion / to the right	1	AO2 6.5.1.4
03.4	90 = 75 × a	an answer of 1.2 (m/s^2) scores **2** marks allow a = 90 ÷ 75 allow ECF from 03.3	1	AO2 6.5.4.2.2 MS 3b, 3c
	a = **1.2** (m/s^2)	an answer of 1.47 (m/s^2) (110 N used) scores 1 mark	1	AO2 6.5.4.2.2 MS 3b, 3c
03.5	an object remains at rest or continues at a constant velocity	allow constant speed in a straight line	1	AO1 6.5.4.2.1
	unless a non-zero resultant force acts on it	allow when the resultant force is zero	1	AO1 6.5.4.2.1
	the moving cyclist continues at constant speed in a straight line because the forces are balanced	ignore comes to rest / slows down	1	AO2 6.5.4.2.1
		Total	**9**	
04.1	48 (m)	allow 47 to 49 (m)	1	AO3 6.5.4.3.1 MS 4a
04.2	the thinking distance is directly proportional to the speed	allow as the speed increases the thinking distance increases for 1 mark	1	AO3 6.5.4.3.1 MS 4a

Question	Answers	Extra information	Mark	AO / Spec. Ref.
	use of data that shows proportionality, e.g. doubling the speed from 10 m/s to 20 m/s doubles the thinking distance from 8 m to 16 m	allow thinking distance ÷ speed is the same (0.8 s) for every speed data that only shows an increase does not score this mark	1	AO3 6.5.4.3.1 MS 4a
04.3	4 (times)	allow 72 ÷ 18 shown	1	AO3 6.5.4.3.1 MS 1c
04.4	s = 25 × 1.2	allow 20 × 1.2 ÷ 0.8 / 20 × 1.5 (scaling the thinking distance read from the chart) an answer of 30 (m) scores **2** marks	1	AO2 6.5.4.3.2 MS 3c
	s = **30** (m)	an answer of 10 (m) (25 × 0.4, the extra distance only) scores 1 mark	1	AO2 6.5.4.3.2 MS 3c
04.5	any **one** from: • tiredness • alcohol • drugs • other distractions, e.g. talking to passengers	ignore mobile phone (given in the question) ignore speed / weather / road conditions	1	AO1 6.5.4.3.2
04.6	there is less friction / grip between the tyres and the road	allow the tyres are more likely to skid	1	AO1 6.5.4.3.3
	so the deceleration is smaller / the car takes a longer time to stop	allow the braking force must be smaller to stop the car skidding	1	AO1 6.5.4.3.3
		Total	**9**	
05.1	(the bus travels at a) constant velocity of 10 m/s	allow constant / steady speed allow it is not accelerating	1	AO3 6.5.4.1.5
05.2	a = 10 ÷ 5	an answer of 2 (m/s^2) scores **2** marks	1	AO2 6.5.4.1.5 MS 4a, 3c
	a = **2** (m/s^2)	allow 2.0 (m/s^2)	1	AO2 6.5.4.1.5 MS 4a, 3c
05.3	s = 10 × 15	an answer of 150 (m) scores **2** marks allow the area under the graph between 5 s and 20 s	1	AO2 6.5.4.1.2 MS 3c
	s = **150** (m)	an answer of 200 (m) (10 × 20) scores 1 mark	1	AO2 6.5.4.1.2 MS 3c

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	20 (s) and 24 (s)	both times are needed for the mark answers can be in either order	1	AO3 6.5.4.1.5 MS 4a
		Total	**6**	
06.1	compression		1	AO1 6.6.1.1
06.2	the coil vibrates / moves backwards and forwards	allow oscillates / moves left and right do not accept moves up and down	1	AO1 6.6.1.1
	parallel to the direction the wave travels / it does not travel along with the wave	allow it returns to its starting position moves left and right alone scores the first mark only	1	AO1 6.6.1.1
06.3	Sound wave	if more than one box is ticked, no mark	1	AO1 6.6.1.1
06.4	$340 = 250 \times \lambda$	an answer of 1.36 (m) scores **2** marks allow $\lambda = 340 \div 250$	1	AO2 6.6.1.2 MS 3b, 3c
	$\lambda =$ **1.36** (m)	allow 1.4 (m)	1	AO2 6.6.1.2 MS 3b, 3c
06.5	$T = 1 \div 250 = 0.004$ (s)	an answer of 4 (ms) scores **2** marks	1	AO2 6.6.1.2 MS 1a, 3c
	= **4** (ms)	allow ECF: the student's period in seconds × 1000	1	AO2 6.6.1.2 MS 1a, 3c
06.6	sound waves need a medium / particles to travel through	allow sound is a vibration of particles	1	AO1 6.6.1.1, 6.6.2.1
	space is a vacuum / has no particles	do not accept microwaves travel faster than sound as the only point	1	AO1 6.6.1.1, 6.6.2.1
		Total	**10**	
07.1	(at least two) concentric circles centred on the wire	circles must not touch each other or the wire allow approximately circular	1	AO1 6.7.2.1
	arrows anticlockwise on the circles	the direction mark depends on circles being drawn at least one arrow is needed and all arrows must be anticlockwise any clockwise arrow loses this mark	1	AO1 6.7.2.1

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td>07.2</td><td>Q</td><td></td><td>1</td><td>AO2
6.7.1.2, 6.7.2.1</td></tr>
<tr><td></td><td>the field lines outside the solenoid point away from end Q</td><td>the reason mark depends on Q being chosen
allow the field lines go from Q to P outside the solenoid
allow the field inside the solenoid points towards Q</td><td>1</td><td>AO2
6.7.1.2, 6.7.2.1</td></tr>
<tr><td>07.3</td><td>the field lines (inside the solenoid) are parallel</td><td>allow straight lines in the same direction</td><td>1</td><td>AO1
6.7.1.2, 6.7.2.1</td></tr>
<tr><td></td><td>the field lines are equally spaced</td><td>allow the same distance apart</td><td>1</td><td>AO1
6.7.1.2, 6.7.2.1</td></tr>
<tr><td>07.4</td><td>iron core: the magnetic field becomes stronger</td><td>allow the solenoid becomes a stronger magnet</td><td>1</td><td>AO1
6.7.2.1</td></tr>
<tr><td></td><td>reversing the current: the direction of the magnetic field reverses</td><td>allow the poles swap / P becomes the north pole</td><td>1</td><td>AO1
6.7.2.1</td></tr>
<tr><td colspan="3">Total</td><td>8</td><td></td></tr>
<tr><td>08.1</td><td>
<table>
<tr><td>Level 3
(5–6 marks)</td><td>The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.</td></tr>
<tr><td>Level 2
(3–4 marks)</td><td>The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.</td></tr>
<tr><td>Level 1
(1–2 marks)</td><td>The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.</td></tr>
<tr><td>0 marks</td><td>No relevant content.</td></tr>
</table>
</td><td></td><td>6</td><td>AO1
6.6.2.2
RP</td></tr>
</table>

Question	Answers	Extra information	Mark	AO / Spec. Ref.
	Indicative content • place the plates the same distance from the heater • switch on the heater • record the starting temperature of each plate • record the temperature of each plate at regular intervals, e.g. every minute • for the same time, e.g. 5 minutes • calculate the temperature increase of each plate • the plate with the greater temperature increase in the same time is the better absorber • use plates of the same metal, size and thickness • the plates should start at the same temperature • repeat, swapping the positions of the plates • do not touch the heater or the plates when they are hot To reach Level 3 the method must keep both plates the same distance from the heater (this may be implied by using the set-up shown in the figure), measure the temperature of each plate over the same time and compare the temperature increases.			
08.2	**A** / matt black		1	AO3 6.6.2.2 RP
	its temperature increased more than plate **B** in the same time, e.g. 14.0 °C compared with 4.4 °C in 5 minutes	the reason mark depends on **A** being chosen the reason must use data from the table allow a comparison of any pair of temperatures at the same time	1	AO3 6.6.2.2 RP
08.3	$\Delta E = 0.080 \times 900 \times 14.0 = 1008$ (J)	an answer of 3.36 (W) scores **3** marks	1	AO2 6.1.1.3, 6.1.1.4 MS 3c
	time = 5 × 60 = 300 (s)		1	AO2 6.1.1.3, 6.1.1.4 MS 3c
	P = 1008 ÷ 300 = **3.36** (W)	allow 3.4 (W) an answer of 201.6 (W) (time in minutes) scores **2** marks allow ECF from an incorrect energy	1	AO2 6.1.1.3, 6.1.1.4 MS 3c
08.4	as plate **A** gets hotter it transfers energy to the surroundings at a greater rate	allow it emits more (infrared) radiation as its temperature increases allow it loses more energy to the air ignore it absorbs less radiation	1	AO3 6.6.2.2 RP
		Total	**12**	
		TOTAL FOR PAPER	**70**	