



GCSE COMBINED SCIENCE: TRILOGY 8464/P/2F

Physics Paper 2F

Mark scheme

June 2025

Version: 1.0 Final



Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

No student should be disadvantaged on the basis of their gender identity and/or how they refer to the gender identity of others in their exam responses.

A consistent use of 'they/them' as a singular and pronouns beyond 'she/her' or 'he/him' will be credited in exam responses in line with existing mark scheme criteria.

Further copies of this mark scheme are available from aqa.org.uk

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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 typical answer or answers which are expected
- extra information to help the examiner make their judgement
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent (for example, a scientifically correct answer that could not reasonably be expected from a student's knowledge of the specification).

2. Emboldening and underlining

- 2.1** In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.
- 2.2** A bold **and** is used to indicate that both parts of the answer are required to award the mark.
- 2.3** Alternative answers acceptable for a mark are indicated by the use of **or**.
Alternative words in the mark scheme are shown by a solidus eg allow smooth / free movement.
- 2.4** Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that ‘right + wrong = wrong’.

Each error / contradiction negates each correct response. So, if the number of errors / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution?

[1 mark]

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name **two** magnetic materials.

[2 marks]

Student	Response	Marks awarded
1	iron, steel, tin	1
2	cobalt, nickel, nail*	2

3.2 Use of symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, or uses symbols to denote quantities in a physics equation, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Marks should be awarded for each stage of the calculation completed correctly, as students are instructed to show their working. At any point in a calculation students may omit steps from their working. If a subsequent step is given correctly, the relevant marks may be awarded.

Full marks should be awarded for a correct numerical answer, without any working shown. Full marks are **not** awarded for a correct final answer from incorrect working.

3.4 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.

3.5 Errors carried forward

An error can be carried forward from one question part to the next and is shown by the abbreviation 'ecf'.

Within an individual question part, an incorrect value in one step of a calculation does not prevent all of the subsequent marks being awarded.

3.6 Phonetic spelling

Marks should be awarded if spelling is not correct but the intention is clear, **unless** there is a possible confusion with another technical term.

3.7 Brackets

(.....) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Allow

In the mark scheme additional information, 'allow' is used to indicate creditworthy alternative answers.

3.9 Ignore

Ignore is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

3.10 Do not accept

Do **not** accept means that this is a wrong answer which, even if the correct answer is given as well, will still mean that the mark is not awarded.

3.11 Numbered answer lines

Numbered lines on the question paper are intended to support the student to give the correct number of responses. The answer should still be marked as a whole.

4. Level of response marking instructions

Extended response questions are marked on level of response mark schemes.

- Level of response mark schemes are broken down into levels, each of which has a descriptor.
- The descriptor for the level shows the average performance for the level.
- There are two marks in each level.

Before you apply the mark scheme to a student's answer, read through the answer and, if necessary, annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1: Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level.

The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer. Do **not** look to penalise small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level.

Use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 2 with a small amount of level 3 material it would be placed in level 2 but be awarded a mark near the top of the level because of the level 3 content.

Step 2: Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do **not** have to cover all of the points mentioned in the indicative content to reach the highest level of the mark scheme.

You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

An answer which contains nothing of relevance to the question must be awarded no marks.

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	1.3 s		1	AO3 6.5.4.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	A		1	AO2 6.5.4.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	friction		1	AO1 6.5.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	(air resistance) increased		1	AO1 6.5.1.2 6.5.4.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	$\Delta v = 60 \times 0.35$		1	AO2 6.5.4.1.5
	$\Delta v = 21 \text{ (m/s)}$	allow – 21 (m/s)	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	$F = 75 \times 60$		1	AO2 6.5.4.2.2
	$F = 4500 \text{ (N)}$	allow – 4500 (N)	1	

Total Question 1	8
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Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	colour of water		1	AO1 6.6.2.2 RPA 21

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	initial temperature of water		1	AO1 6.6.2.2 RPA 21

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	measuring cylinder		1	AO1 6.6.2.2 RPA 21

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	$\frac{80.0 - 65.0}{5.0}$	allow $\frac{65.0 - 80.0}{5.0}$	1	AO2 6.6.2.2 RPA 21
	$= 3 (^{\circ}\text{C} / \text{minute})$	allow $\frac{15.0}{5.0}$ allow $- 3 (^{\circ}\text{C} / \text{minute})$	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	y-axis labelled rate of change of temperature in $^{\circ}\text{C} / \text{minute}$	unit must be present	1	AO2 6.6.2.2 RPA 21
	y-axis scale of $1.0 ^{\circ}\text{C} / \text{minute}$ per cm		1	
	bars plotted correctly	allow a tolerance of $\pm \frac{1}{2}$ small square ignore width of bars	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	answer between 5.0 and 6.1 (°C / minute)	do not accept 5.0 (°C / minute) do not accept 6.1 (°C / minute)	1	AO3 6.6.2.2 RPA 21

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	infrared		1	AO1 6.6.2.2 6.6.2.4 RPA 21

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.8	energy		1	AO1 6.6.2.2 RPA 21

Total Question 2	11
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Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	distance travelled = 3.0×20	both marks may be awarded if a length in the range 2.9 to 3.1 cm is used	1	AO3 6.5.4.1.1
	distance travelled = 60 (m)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	weight = 15×9.8	allow weight = 150 (N)	1	AO2 6.5.1.3
	weight = 147 (N)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	the line has a constant gradient	allow the line is straight do not accept directly proportional	1	AO2 6.5.4.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	distance travelled = $\frac{4500}{250}$		1	AO2 6.5.2
	distance travelled = 18 (m)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	total distance travelled is greater than the displacement		1	AO1 6.5.4.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	distance has magnitude only		1	AO1 6.5.1.1 6.5.4.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	total distance = 158 (km)	allow 1 mark for 56, 40 and 62 read from graph allow 1 mark for a total distance calculated using two correct values and one incorrect value from the bar chart	2	AO3 6.5.4.1.4

Total Question 3	11
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Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	pole X south and pole Y north	allow X is S allow Y is N	1	AO3
	opposite poles attract or a north pole and a south pole attract	MP2 dependent on MP1	1	AO1 6.7.1.1

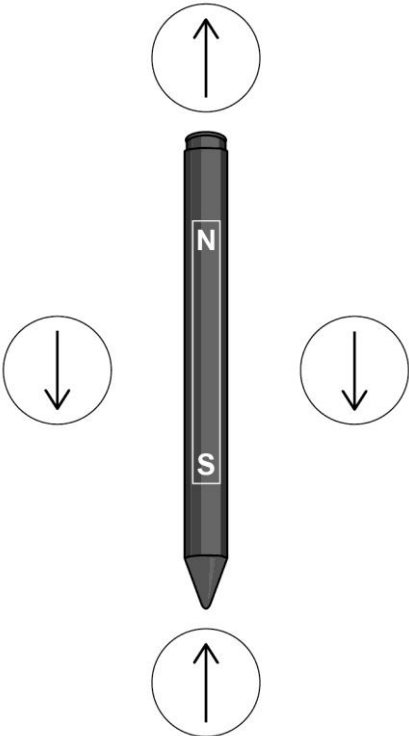
Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	from 3.5 to 4.5 cm	either order	1	AO3 6.7.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	$\frac{4.0 + 3.5 + 4.0 + 3.5 + 4.5}{5}$	allow $\frac{19.5}{5}$	1	AO2 6.7.1.2
	3.9 (cm)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	random errors		1	AO1 6.7.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	(the magnetic force) decreased		1	AO1 6.7.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	steel		1	AO1 6.7.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	arrow in circle next to south pole pointing upwards		1	AO3 6.7.1.2
	arrows in circles next to the middle of pen pointing downwards		1	
				

Total Question 4	10
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Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	microwaves		1	AO1 6.6.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	gamma rays		1	AO1 6.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	the time taken for one wave to pass a fixed point		1	AO1 6.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	48 GHz = 48 000 000 000 Hz	allow 48 GHz = 48×10^9 Hz	1	AO2
	$T = \frac{1}{48\,000\,000\,000}$	subsequent marks may be awarded if an incorrectly / not converted value of f is used	1	AO2
	$T = 2.08... \times 10^{-11}$	allow 0.000 000 000 0208... allow 0.000 000 000 021 allow 2.1×10^{-11}	1	AO2
	s	allow seconds	1	AO1 6.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	any one from: • speed (in a vacuum / air) • they can travel through a vacuum • they transfer energy • they are transverse		1	AO1 6.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	cables may not go to remote areas or it is expensive to lay cables	allow satellites may give faster data transfer	1	AO3 6.6.2.4

Total Question 5	9
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Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	distance travelled = speed $\times$ time		1	AO1 6.5.4.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	$1\,500\,000 = v \times 670\,000$		1	AO2 6.5.4.1.2
	$v = \frac{1\,500\,000}{670\,000}$		1	
	$v = 2.2... \text{ (m/s)}$		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	$F = (6 \times 370) - 520$		1	AO2 6.5.1.4
	$F = 1700 \text{ (N)}$		1	
		if no other mark awarded allow 1 mark for $370 - 520 = (-)150 \text{ (N)}$		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	speed	allow velocity	1	AO1 6.5.4.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	friction + air resistance = pull of the rope on the sled		1	AO1 6.5.1.4 6.5.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	the force of the sled on the rope		1	AO1 6.5.4.2.3

Total Question 6	9
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Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	$(0^2 -) 18^2 = 2 \times a \times 24$	allow $18^2 = 2 \times a \times 24$	1	AO2 6.5.4.1.5
	$a = \frac{(-)18^2}{2 \times 24}$		1	
	$a = (-) 6.75 \text{ (m/s}^2\text{)}$	allow $(-) 6.8 \text{ (m/s}^2\text{)}$	1	

Question	Answers	Mark	AO / Spec. Ref.
07.2	Level 3: Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO2
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	AO1
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	AO1
	No relevant content	0	6.5.4.2.2 6.5.4.3.1 6.5.4.3.3 6.5.4.3.4
	Indicative Content Thinking distance - condition of brakes and tyres does not affect thinking distance - speed does not affect reaction time - decreased speed decreases thinking distance Braking distance - condition of tyres affects friction between tyres and road - poor condition of tyres and brakes increases braking distance - decreased speed decreases braking distance Safety - stopping distance = thinking distance + braking distance - poor condition of brakes and tyres increases stopping distance - decreased speed decreases stopping distance - decreased speed decreases the chance of the driver losing control of the vehicle - decreased speed decreases the chance of a collision - decreased speed decreases the risk of injury during a collision for Level 3, answers must include references to brakes / tyres, speed, thinking distance, braking distance, and safety.		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	frictional / braking force is greater (for the faster car) or the faster car has more kinetic energy		1	AO1
	(so) more work done (by the brakes to stop the faster car)	allow so more energy is transferred (by the brakes to stop the faster car) ignore more heating	1	AO3
	(so) the risk of the brakes overheating is greater (for the fast car)	allow (at greater speed) there is a risk of overheating MP3 dependent on MP1 or MP2	1	AO3 6.5.4.3.4

Total Question 7	12
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