

OCR • GCSE COMBINED SCIENCE A (GATEWAY) J250

Physics — Higher Tier, Paper 2

June 2025 exam series

MARK SCHEME

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Higher

GCSE

Combined Science Physics A Gateway Science

J250/12: Paper 12 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2025

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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MARKING INSTRUCTIONS

PREPARATION FOR MARKING

RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Online Training*; *OCR Essential Guide to Marking*.
2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are available in RM Assessor.
3. Log-in to RM Assessor and mark the **required number** of practice responses (“scripts”) and the **required number** of standardisation responses.

MARKING

1. Mark strictly to the mark scheme.
2. Marks awarded must relate directly to the marking criteria.
3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 50% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.
4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the RM Assessor messaging system.

5. Work crossed out:
- where a candidate crosses out an answer and provides an alternative response, the crossed-out response is not marked and gains no marks.
 - if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed-out answer and award marks appropriately.
6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there, then add the annotation SEEN to confirm that the work has been seen.
7. There is a NR (No Response) option. Award NR (No Response)
- if there is nothing written at all in the answer space
 - OR if there is a comment which does not in any way relate to the question (e.g., 'can't do', 'don't know')
 - OR if there is a mark (e.g., a dash, a question mark) which is not an attempt at the question.
- Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).
8. The RM Assessor **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
- If you have any questions or comments for your Team Leader, use the phone, the RM Assessor messaging system, or email.
9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:

Read through the whole answer from start to finish, using the Level descriptors to help you decide whether it is a strong or weak answer. The indicative scientific content in the Guidance column indicates the expected parameters for candidates' answers but be prepared to recognise and credit unexpected approaches where they show relevance. Using a 'best-fit' approach based on the skills and science content evidenced within the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer.

Once the level is located, award the higher or lower mark:

The higher mark should be awarded where the level descriptor has been evidenced, and all aspects of the communication statement (in italics) have been met.

The lower mark should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.

In summary:

The skills and science content determines the level.

The communication statement determines the mark within a level.

Level of response question on this paper is **14**.

11. Annotations available in RM Assessor

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
	Benefit of doubt given
	Contradiction
	Rounding error
	Error in number of significant figures
	Error carried forward
	Level 1
	Level 2
	Level 3
	Benefit of doubt not given
	Noted but no credit given
	Ignore

12. Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
✓	Separates marking points
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
()	Words which are not essential to gain credit
—	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

13. Subject-specific Marking Instructions

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

The breakdown of Assessment Objectives for GCSE (9-1) in Combined Science A:

	Assessment Objective
AO1	Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
AO2	Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.
AO2.1	Apply knowledge and understanding of scientific ideas.
AO2.2	Apply knowledge and understanding of scientific enquiry, techniques and procedures.
AO3	Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.
AO3.1	Analyse information and ideas to interpret and evaluate.
AO3.1a	Analyse information and ideas to interpret.
AO3.1b	Analyse information and ideas to evaluate.
AO3.2	Analyse information and ideas to make judgements and draw conclusions.
AO3.2a	Analyse information and ideas to make judgements.
AO3.2b	Analyse information and ideas to draw conclusions.
AO3.3	Analyse information and ideas to develop and improve experimental procedures.
AO3.3a	Analyse information and ideas to develop experimental procedures.
AO3.3b	Analyse information and ideas to improve experimental procedures.

For answers to Section A if an answer box is blank ALLOW correct indication of answer e.g. circled or underlined.

Question	Answer	Marks	AO element	Guidance
1	C	1	2.1	
2	C	1	2.1	A: $10 \div 2 = 5$ B: $10 \times 2 = 20$ C: $10 \times 2^2 = 40$ D: $10^2 \times 2 = 200$
3	A	1	2.1	
4	C	1	1.2	
5	C	1	1.2	
6	B	1	1.1	
7	A	1	2.1	A: $(3 \times 10^8) \div (320 \times 10^{12}) = 9.4 \times 10^{-7}$ B: $(320) \div (3 \times 10^8) = 1.1 \times 10^{-6}$ C: $(3 \times 10^8) \div (320) = 9.4 \times 10^5$ D: $(320 \times 10^{12}) \div (3 \times 10^8) = 1.1 \times 10^6$
8	D	1	1.1	
9	C	1	1.2	
10	C	1	2.2	

Question			Answer	Marks	AO element	Guidance
11	(a)		Alternating voltage is (constantly) changing direction and direct voltage has one direction ✓	1	1.1	ALLOW potential difference or current instead of voltage. ALLOW a.c. and d.c. for of alternating and direct ALLOW alternating switches between + and –, but direct does not switch and stays + or – ALLOW alternating current changes direction, direct current does not change direction ALLOW alternating voltage goes back and forth, forwards and backwards but d.c just goes one way IGNORE a.c. alternates, varies, oscillates, changes IGNORE d.c. stays the same
	(b)	(i)	First check the answer on the answer line If answer = 1.1 (MW) award 4 marks (power =) $730^2 \times 2.0$ ✓ (power =) 1 065 800 (W) ✓ (power =) 1 100 000 (W) ✓ or 1.07 (MW)✓ (power =) 1.1 MW ✓	4	2.1 2.1 1.2 2.1	ALLOW 1.07 or 1.0658 for 3 marks ALLOW 1 100 000 (W) for 3 marks Accurate substitution Correct evaluation answer Correct conversion to MW Correct conversion given to 2 significant figures

Question			Answer	Marks	AO element	Guidance
11	(b)	(ii)	First check the answer on the answer line If answer = 0.98 award 3 marks If answer is incorrect then maximum 2 from: (useful output =) $8000 - 160$ (W) ✓ (useful output =) 7840 (W) ✓ (efficiency =) $(7840) \div 8000$ ✓	3		ALLOW 98% ALLOW other simple fractions e.g. 49/50 2.1 Method for useful output energy 2.1 Correct value for useful output energy 1.2 Substitute correctly for total input into efficiency equation
		(iii)	Increase the voltage/p.d. ✓ Decreases/ lower current ✓ Less energy lost / less energy dissipated / less heating of wires/less power loss ✓	3	3 × 1.2	ALLOW high voltage (output) ALLOW low current (output) ALLOW less heat lost IGNORE save energy IGNORE references to speed of transfer DO NOT ALLOW no energy loss
	(c)		Completes the circuit (allowing current in the circuit) / AW ✓	1	1.1	IGNORE it is at 0V or it does not supply energy ALLOW carries current from the appliance ALLOW carries current to the source

Question			Answer	Marks	AO element	Guidance
12	(a)	(i)	First check the answer on the answer line If answer = 1.4 (s) award 2 marks (mean time =) $(1.1 + 1.6 + 1.5) \div 3$ ✓ (mean time =) 1.4 (s) ✓	2	2 × 1.2	
		(ii)	First check the answer on the answer line If answer = 0.21 (m/s) award 3 marks (select and apply and rearrangement): (average) speed = distance ÷ time ✓ (average speed =) $0.30 \div 1.4$ ✓ (average speed =) 0.21 (m/s) ✓	3	1.2 2.1 2.1	ALLOW 0.2 for 3 marks ALLOW 1 mark for correct substitution into unarranged equation ALLOW ECF from (a)(i)
		(iii)	Random ✓ Reaction ✓	2	2 x 3.1b	IGNORE words used in the incorrect order
		(iv)	Any one from: Measure the time over a longer distance (between A and B) ✓ Use light gates (and a data logger) (to measure time) ✓	1	3.3b	IGNORE filming ALLOW timing gates

Question			Answer	Marks	AO element	Guidance
12	(b)	(i)	First check the answer on the answer line If answer = 95 (N/m) award 3 marks (rearrangement) (spring constant) = $2 \times \text{energy transferred} \div (\text{amount spring is compressed})^2$ ✓ (substitution) (spring constant =) $(2 \times 1.9 \times 10^{-2}) \div 0.02^2$ ✓ (spring constant =) 95 (N/m) ✓	3	1.2 2.1 2.1	ALLOW 2 marks for 95 000 (N/m) (no unit change) ALLOW 1 mark for correct substitution into unarranged equation ALLOW rearrangement (spring constant) = energy transferred $\div (1/2 \times (\text{amount spring is compressed})^2)$ If no other marks scored: ALLOW 1 mark for 47.5 N (for making one calculation error)
		(ii)	(Effect on spring constant is) it would be greater ✓ Some of the energy is dissipated / some of the energy is transferred to a thermal store ✓	1 1	3.1b 2.2	ALLOW lost as heat energy to surroundings ALLOW energy lost due to friction

Question			Answer	Marks	AO element	Guidance
13	(a)		Frequency = Hz Wavelength = m Wave speed = m/s ✓✓	2	2 × 1.1	3 correct = 2 marks 1 or 2 correct = 1 mark ALLOW mm or cm ALLOW mm/s or cm/s
	(b)		Any two from: (Use a ruler to) measure several wavelengths ✓ Divide by the number of waves or calculate the mean ✓ Ensure ruler is perpendicular to the wave front ✓ One wavelength is the total width of one bright band and one dark band or from one point to the identical point on the next wave ✓	2	2 × 3.3a	ALLOW answers from annotations on Fig.13.2 ALLOW indication of several wavelength used on diagram and then divided by this number e.g. 14 wavelengths divided by 14 ALLOW correct distance on diagram e.g. middle of dark band to middle of next dark band DO NOT ALLOW distance between dark bands
	(c)		Wavelength is decreasing (from deep to shallow) / ORA from shallow to deep ✓ And any one from: The wave speed is decreasing (from the deep end to the shallow end) ✓ Frequency is constant ✓	2	3.1a 2.1	ALLOW speed decreases as wavelength decreases for 2 marks ALLOW wave speed is proportional to wavelength

Question	Answer	Marks	AO element	Guidance
14 *	Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. Level 3 (5–6 marks) Detailed quantitative comparison including processing of information on thinking and braking distance for both cars and detailed reasons for the differences. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3–4 marks) Clear qualitative comparison of thinking and braking distance of both cars and clear reasons for the differences Or Simple quantitative comparison of thinking and braking distance for both cars and detailed reasons for the differences Or Detailed quantitative comparison including processing of information on thinking and braking distance for both cars <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1–2 marks) Basic comparison of thinking and braking distance for both cars Or Basic reasons for the differences	6	2 × 2.1 2 × 3.2a 2 × 3.2b	Indicative content may include: AO2.1 Apply knowledge and understanding of ideas to compare thinking and braking distances from a velocity-time graph: - Thinking distance: $A = 12 \times 1 = 12\text{m}$ - Braking distance: $A = 0.5 \times 12 \times 2 = 12\text{m}$ - Stopping distance: $A = 24\text{m}$ - Thinking distance: $B = 15 \times 2 = 30\text{m}$ - Braking distance: $B = 0.5 \times 15 \times 4 = 30\text{m}$ - Stopping distance: $B = 60\text{m}$ - Stopping distance: = thinking distance + braking distance - Thinking time of A is 1s - Thinking time of B is 2s - Deceleration of A is 6m/s^2 - Deceleration of B is 3.75m/s^2 The graph could be annotated to show these AO3.2a Analyse information and ideas to make judgments about thinking distances and braking distances: - The area under the graph is equal to the stopping/thinking/braking distance - The horizontal part of the line occurs during reaction time - The slope occurs during braking

		<i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i> 0 marks <i>No response or no response worthy of credit.</i>		• Reaction time of A is twice as long as B AO3.2b Analyse information and ideas to draw conclusion about thinking distances and braking distances: • Stopping distance of B is greater than A • Initial speed of B is greater than A • Reaction time of B is greater than A • Braking force of B is less than A • Suggestion for reaction time being longer (i.e., driver is tired, distracted or intoxicated) • Suggestion for braking force being less (i.e., water/ice/mud/gravel on road, worn brakes, worn tyres) • Car B may be older • Car B may be heavier or have more passengers or more luggage
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Question			Answer	Marks	AO element	Guidance
15	(a)	(i)	Electron(s) ✓	1	1.1	
		(ii)	(The electron) moves further from the nucleus ✓	1	1.1	ALLOW idea of moves to a higher energy level e.g. excited and jumps energy levels IGNORE just change energy shells or energy levels ALLOW released from the atom
		(iii)	Ions are formed ✓ An atom/molecule loses or gains an electron ✓	2	2 × 1.1	ALLOW atom becomes charged ALLOW idea that short wavelength EM waves transfer a lot of energy
	(b)	(i)	Radio waves have lower frequency than microwaves / ORA ✓	1	1.1	
		(ii)	(Both are used in wireless) communications ✓	1	1.1	ALLOW reasonable example e.g. mobile phones, TV or satellites

Question			Answer	Marks	AO element	Guidance
16	(a)		Similarity: Both have 53 protons (and electrons) ✓ Difference: (I-127 has) 74 neutrons and (I-131 has) 78 neutrons ✓	2	2 × 2.1	ALLOW same number of protons ALLOW I-131 has 4 more neutrons than I-127 DO NOT ALLOW I-127 has 78 neutrons and I-131 has 74 neutrons
	(b)	(i)	Workings on the graph that show half-life is at 8 days ✓	1	3.1a	Check the graph and answer space for workings
		(ii)	First check the answer on the answer line If answer = 32 (days) award 2 marks 4 half-lives (needed to get from 4 to 0.25 MBq) ✓ (4 × 8 =) 32 (days) ✓	2	2 × 2.1	ALLOW working to show halving 4 times
		(iii)	Any two from: Contamination is prevented by gloves ✓ Irradiation is monitored using the badge ✓ (Contamination and/or irradiation) cause damage to living tissue ✓	2	2 × 2.1	IGNORE explanations that do not match the equipment. ALLOW radiation sickness or cancer as potential harm

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