Higher

GCSE

Combined Science Physics A Gateway Science

J250/12: Paper 12 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2024

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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.

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. **Crossed Out Responses**
   Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

Rubric Error Responses – Optional Questions

Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

Multiple Choice Question Responses

When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).
When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses

When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only one mark per response)

Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth two or more marks)

If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

Longer Answer Questions (requiring a developed response)

Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

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 annotation 'SEEN' to confirm that the work has been seen.

7. Award No Response (NR) if:

   - there is nothing written in the answer space

   Award Zero '0' if:

   - anything is written in the answer space and is not worthy of credit (this includes text and symbols).

   Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.

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 **15**.

11. Annotations available in RM Assessor

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
BOD	Benefit of doubt given
CON	Contradiction
RE	Rounding error
SF	Error in number of significant figures
ECF	Error carried forward
L1	Level 1
L2	Level 2
L3	Level 3
NBOD	Benefit of doubt not given
SEEN	Noted but no credit given
I	Ignore

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

Annotation	Meaning
I	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

12. **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.

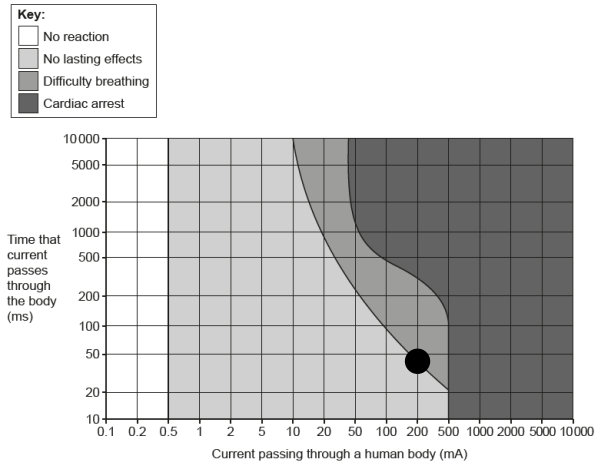
The breakdown of Assessment Objectives for GCSE (9-1) in Combined Science A:

	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	B	1	1.2	
2	C	1	1.2	
3	A	1	2.1	**ALLOW** 8.5 (m)
4	C	1	2.1	**ALLOW** 12 000 (kg)
5	D	1	1.1	
6	B	1	1.2	
7	C	1	1.2	
8	B	1	1.2	
9	D	1	2.1	
10	C	1	1.1	

Question			Answer	Marks	AO element	Guidance
11	(a)		Live and neutral ✓	1	1.1	
	(b)		**Any one from:** May cause a (loud) bang/pop/noise/sound ✓ May cause wires to get hot / may cause insulation/wires to melt / may cause smoke / may cause fire ✓ May cause fuse(s) to blow / may cause RCD(s) to trip ✓	1	2.2	**IGNORE** explosion **ALLOW** causes sparks / causes a (burning) smell **IGNORE** removes the safety of the earth wire / causes damage / appliance melt **IGNORE** causes a power cut **IGNORE** changes in current / overpower the electrics
	(c)		**First check the answer on the answer line** **If answer = 42 (kWh) award 2 marks** (E =) 2.4 × 2.5 × 7 ✓ (E =) 42 (kWh) ✓	2	2 × 2.1	 **ALLOW** 2.4 x 17.5 **ALLOW** 2.4 x 2.5 = 6 for 1 mark **ALLOW** 4.2×10^{n} as the final answer for 1 mark
	(d)	(i)	**Any one from:** As current increases, danger increases / **ORA** ✓ As time for current to flow increases, danger increases / **ORA** ✓	1	3.1a	 **ALLOW** alternative wording for danger e.g., cardiac arrest / difficulty breathing / effects more serious / effects get worse / risks increase / becomes fatal **IGNORE** as the current increases the time decreases (so danger increases) **IGNORE** ideas that are not trends e.g. no danger at low currents / no effects until past 500 mA

Question			Answer	Marks	AO element	Guidance
11	(d)	(ii)	10 000 (ms) ✓	1	2.2	**ALLOW** 10 seconds / 10 s **DO NOT ALLOW** incorrect unit e.g., 10 000 m/s or 10 000 s
		(iii)	**First check the answer on the answer line** **If answer = 0.045 (C) award 3 marks**	3		
			Unit conversion: 150 mA = 0.15 A ✓		1.2	
			(charge =) 0.15 × 0.3 ✓		2.1	**ALLOW** (1.5 x 10^n) x 0.3 for 1 mark
			(charge =) 0.045 (C) ✓		2.1	**ALLOW** 4.5 x 10^n as the final answer for 2 marks
		(iv)	To prevent difficulty breathing / no lasting effects ✓	1	3.2a	**IGNORE** to prevent cardiac arrest **IGNORE** to prevent electrocution 

Question			Answer	Marks	AO element	Guidance
11	(d)	(v)	**If RCD A** **Any two from:** (Safer as) current lower ✓ Current is 10/low so no lasting effects ✓ Time is 100/high but no lasting effects ✓ Very sensitive ✓ **If RCD B** **Any two from:** (Safer as) switches off faster ✓ Current is 30/high but no lasting effects ✓ Time is 40/low so no lasting effects ✓ Will not keep shutting off supply accidentally ✓	2	2 × 3.1b	Both marks for RCD **A** or both marks for RCD **B**, maximum 1 mark if RCD **A** and RCD **B** selected Answer must be comparative **ALLOW** any time at a current of 10 has no lasting effects for 2 marks **ALLOW** calculation to demonstrate a smaller charge flow e.g., RCD **A** charge flow is 0.001 C, but RCD **B** charge flow is 0.0012 Answer must be comparative **ALLOW** time up to 500 at a current of 30 has no lasting effects for 2 marks

Question			Answer	Marks	AO element	Guidance
12	(a)		(Energy transferred) From chemical (store) ✓ To kinetic (store) / to gravitational (potential) (store) ✓	2	2 × 1 .1	**ALLOW** chemical decreases **ALLOW** kinetic/gravitational increases **ALLOW** kinetic (store) as ball is moving **ALLOW** gravitational (potential) (store) as increasing in height **ALLOW** chemical to kinetic/gravitational for 2 marks **IGNORE** thermal / heat / sound / nuclear
	(b)	(i)	**Any two from:** Start timing when see flash/light/explosion / start timing when he sees it fired ✓ Stop timing when hear bang/sound ✓ Use $s = \frac{d}{t}$ to calculate speed ✓	2	2 × 3.3a	**IGNORE** just 'when it is fired' **DO NOT ALLOW** counting **DO NOT ALLOW** counting **ALLOW** (measure/calculate) time between flash/light/fired and bang/sound for 2 marks equation with speed/velocity as the subject only **ALLOW** (speed =) distance divided by time **ALLOW** v = s ÷ t

Question			Answer	Marks	AO element	Guidance
12	(b)	(ii)	Smaller percentage error / the effect of the (reaction) time error is smaller / (reaction) time error has a smaller effect ✓	1	3.3b	**ALLOW** to make the uncertainty in the time measurement small / to make time (value more) accurate **ALLOW** idea that a short time is too difficult to measure if the cannon was closer / sound needs to be a long distance away to be measured **IGNORE** references to safety
	(c)	(i)	**First check the answer on the answer line** **If answer = 364.65 (m/s) award 2 marks** (1122 feet / s =) 1122 × (32.5 ÷ 100) ✓ (1122 feet / s =) 364.65 (m / s) ✓	2	2 × 1.2	 **ALLOW** 364.7 or 365 (m / s)

Question			Answer	Marks	AO element	Guidance
12	(c)	(ii)	(% difference =) (1122 – 1056) ÷ 1056 × 100 ✓ (% difference =) 6.25 (%) ✓ **Either**: Accurate as % difference is small/<10% **Or** Inaccurate as % difference is large/>5% ✓	**3**	**2 × 1.2** **3.1b**	**ALLOW** (36465 – 34320) ÷ 34320 × 100 **ALLOW** 6.25 on its own for 2 marks **ALLOW** 0.0625 for 1 mark **ALLOW** quite accurate as % difference is small/<10%
	(d)		 Air particles vibrate/oscillate (parallel to direction of energy transfer) ✓ Compressions and rarefactions ✓	**2**	**2 × 1.1**	**ALLOW** answers in description or on a labelled diagram anywhere in the answer space **ALLOW** they/it vibrate/oscillate **IGNORE** waves vibrate/oscillate

Question			Answer	Marks	AO element	Guidance
13	(a)		Step-up Potential difference Step-down Decreases ✓	1	1.1	
	(b)	(i)	**First check the answer on the answer line** **If answer = 9.6 (A) award 2 marks** $240 \times 0.8 = 20 \times I_S$ **OR** $(I_S =) (240 \times 0.8) \div 20$ ✓ $(I_S =)$ 9.6 (A) ✓	2	2 × 2 .1	**ALLOW** equation in any form e.g., 192 ÷ 20
		(ii)	**First check the answer on the answer line** **If answer = 0.8 award 3 marks** Efficiency = useful E output ÷ total E input ✓ (Efficiency =) 140 ÷ 175 ✓ (Efficiency =) 0.8 ✓	3	 1.2 2.1 2.1	 **ALLOW** equation in any form **ALLOW** 80% for 3 marks **ALLOW** 0.8% or 80 for 2 marks **ALLOW** unit added e.g. 0.8 J or 80 J for 2 marks
		(iii)	**First check the answer on the answer line** **If answer = 50 (W) award 3 marks** $P = I^2R$ ✓ $(P =) 0.25^2 \times 800$ ✓ (P =) 50 (W) ✓	3	 1.2 2.1 2.1	

Question			Answer	Marks	AO element	Guidance
14	(a)		**Either** circles around: ^{238}U **AND** ^{234}U **Or** ^{234}Th **AND** ^{230}Th ✓ **Reason:** Same charge (on nucleus) / same proton number / same atomic number / same number of protons ✓ **Or** Different mass (number) / different number of neutrons ✓	**2**	**2.1** **1.1**	**ALLOW** correct isotopes identified on answer lines but graph takes precedence Needs to be clear that U and U connected and/or Th and Th connected **IGNORE** both thorium / both uranium / same element
	(b)	**(i)**	(Charge) increases by 1 ✓ (Mass) stays the same ✓	**2**	**2 × 1.1**	**IGNORE** just quoting numbers from the graph **IGNORE** just 'it goes up' / it increases
		(ii)	Beta ✓	**1**	**2.1**	
	(c)		222 218 **4** Rn → Po + He **86** **84** **2** ✓ ✓	**2**	**1.2** **2.2**	**ALLOW** He correct for 1 mark **ALLOW** atomic numbers for Rn and Po correct for 1 mark

Question			Answer	Marks	AO element	Guidance
14	(d)		(Nucleus is) stable / (isotope) not radioactive ✓	1	1.1	
	(e)		**First check the answer on the answer line** **If answer = 1 : 15 award 3 marks** $1.8 \times 10^{10} \div 4.5 \times 10^{9}$ **or** 4 half-lives ✓ $\frac{1}{16}$ **or** $\frac{15}{16}$ seen ✓ (Ratio =) 1 : 15 ✓	3	 2.1 2.1 1.2	

Question			Answer	Marks	AO element	Guidance
15	*		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 description of the relationship shown in the data which includes analysis **AND** Detailed explanation of what the student sees *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Detailed description of the relationship shown in the data **AND** Basic explanation of what the student sees **OR** Basic description of the relationship shown in the data **AND** Detailed explanation of what the student sees *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.*	**6**	**2 × 2.2** **2 × 3.1a** **2 × 3.2b**	**AO2.2 – Apply knowledge and understanding of scientific enquiry, techniques and procedures to describe what the student sees.** • Ray refracts towards normal in glass • Red refracts least / violet refracts most / correct colour labelled on diagram • Different colours spread out/disperse • Order of colours correctly identified / correct colours labelled on diagram **AO3.1a - Analyse information and ideas to describe relationship between wavelength and speed in glass.** • Each colour has a different wavelength • Different colours/wavelengths are slowed by different amounts / different colours/wavelengths have different speeds in glass • As wavelength decreases, speed in glass decreases / **ORA** • Red light travels fastest (in glass) • Violet light travels slowest (in glass)

			Level 1 (1–2 marks) Basic description about wavelength, speed or refraction **AND** Basic description or explanation of what the student sees *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant***.** **0 marks** *No response or no response worthy of credit.*			**AO3.2b - Analyse information and ideas to draw conclusions about how changes in speed explain what the student sees.** • Speed of light decreases in glass • Change in speed causes refraction • Violet light slows down more than red light (in the glass) • Shorter wavelengths slow down more than longer wavelengths (in the glass) • Each colour or wavelength refracts by a different amount **ALLOW** answers in terms of optical density e.g. speed of light decreases as light moves to a more dense medium / light refracts as it moves to a more dense medium **IGNORE** references to frequency throughout

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