

# Higher

**GCSE**

**Combined Science Chemistry A Gateway Science**

**J250/10: Paper 10 (Higher Tier)**

General Certificate of Secondary Education

**Mark Scheme for June 2023**

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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:
  - a. where a candidate crosses out an answer and provides an alternative response, the crossed-out response is not marked and gains no marks
  - b. 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 read.
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 isn't 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).

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

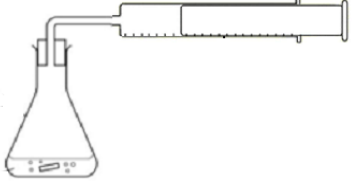


The breakdown of Assessment Objectives for GCSE (9-1) in Combined Science A:

	<b>Assessment Objective</b>
<b>AO1</b>	<b>Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.</b>
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
<b>AO2</b>	<b>Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.</b>
AO2.1	Apply knowledge and understanding of scientific ideas.
AO2.2	Apply knowledge and understanding of scientific enquiry, techniques and procedures.
<b>AO3</b>	<b>Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.</b>
<b>AO3.1</b>	Analyse information and ideas to interpret and evaluate.
AO3.1a	Analyse information and ideas to interpret.
AO3.1b	Analyse information and ideas to evaluate.
<b>AO3.2</b>	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.
<b>AO3.3</b>	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	1.1	
2	B	1	1.1	
3	D	1	1.1	
4	A	1	1.2	
5	D	1	1.2	
6	A	1	2.2	
7	C	1	2.2	
8	C	1	1.1	
9	B	1	1.2	
10	D	1	2.2	

Question		Answer	Marks	AO element	Guidance
11	(a)	(Gas) syringe ✓  Gas syringe drawn correctly ✓ Gas syringe connected to conical flask ✓	3	3 x 3.3b	<b>DO NOT ALLOW</b> gas chamber
	(b)	$\text{Mg(s)} + 2\text{HCl(aq)} \rightarrow \text{MgCl}_2\text{(aq)} + \text{H}_2\text{(g)}$ ✓✓	2	1.2 2.2	1 mark for (aq) 1 mark for $\text{MgCl}_2$
	(c)	Volume (of hydrogen / $\text{H}_2$ / gas) ✓  $\text{cm}^3$ / ml ✓	2	2.2  1.2	<b>ALLOW</b> volume of H <b>IGNORE</b> bubbles <b>IGNORE</b> amount
	(d)	Line starting at origin but steeper than original line ✓  Levels off / stops at exactly $82 \text{ cm}^3$ ✓	2	2 x 2.2	<b>ALLOW</b> +/- ½ small square
	(e)	<b>Any three from:</b>  Particles gain (kinetic) energy / move faster / kinetic energy gained ✓  More successful collisions ✓  More particles / collisions have the activation energy ✓  Higher frequency / rate of collisions / <b>AW</b> ✓	3	3 x 1.1	<b>IGNORE</b> move more / react faster  <b>IGNORE</b> more chance of successful collisions  <b>ALLOW</b> collide more often <b>IGNORE</b> quicker collisions/more collisions quicker <b>IGNORE</b> more chance of collisions

Question		Answer	Marks	AO element	Guidance
12	(a)	Bar for nitrogen drawn at 78% ✓  Bar for oxygen drawn at 21% ✓	2	2 x 2.2	<b>ALLOW</b> +/- ½ small square  <b>ALLOW</b> nitrogen drawn at 21% <b>AND</b> oxygen drawn at 78% for 1 mark
	(b)	Water vapour - (condensed to) form the oceans ✓  Carbon dioxide – (absorbed/taken in/used) by plants / photosynthesis / dissolved in the oceans / became trapped in sedimentary rocks ✓	2	2 x 1.1	<b>IGNORE</b> trees planted <b>ALLOW</b> the idea of photosynthesising bacteria
	(c)	(Released by plants during) photosynthesis ✓	1	1.1	<b>DO NOT ALLOW</b> (released by plants during) respiration
	(d)	Water vapour / carbon dioxide are <u>greenhouse gases</u> ✓	1	2.1	<b>IGNORE</b> ozone layer
	(e)	<b>First check answer on answer line</b> <b>If answer = 0.041% award 3 marks</b>  (409.8 ÷ 1 x 10 <sup>6</sup> ) x 100  OR  409.8 x 0.0001 ✓  = 0.04098 ✓  = 0.041(%) ✓	3	2.2  2.2  1.2	<b>ECF</b> from M1 for transcription errors  M3 can be scored from an evaluation of an incorrect calculation using 409.8 and 0.0001 given to 3 decimal places correctly rounded

Question			Answer	Marks	AO element	Guidance
13	(a)	(i)	Carbon is more reactive (than copper) / <b>AW</b> ✓	1	1.2	<b>ORA</b> <b>ALLOW</b> carbon is higher than copper in reactivity series
		(ii)	Idea that carbon dioxide / CO <sub>2</sub> causes global warming / climate change ✓	1	1.1	<b>ALLOW</b> description of global warming / climate change <b>ALLOW</b> an example of an effect of climate change <b>ALLOW</b> enhanced greenhouse effect <b>ALLOW</b> ideas based upon copper / Cu ending up landfill <b>DO NOT ALLOW</b> acid rain or damage to ozone <b>IGNORE</b> affects global warming / climate change <b>IGNORE</b> just greenhouse effect
	(b)	(i)	It uses bacteria ✓	1	1.2	
		(ii)	<b>Any two from:</b>  Low energy requirements / doesn't use electricity ✓  Less emissions (from combustion of fuels during production of electricity) ✓  Can use recycled / scrap iron ✓	2	2 x 3.1b	<b>ORA</b>  <b>IGNORE</b> cost / speed / complicated equipment  <b>ALLOW</b> less gases / pollutants (from combustion of fuels during production of electricity) <b>ALLOW</b> less named pollutants (such as CO <sub>2</sub> )

Question		Answer	Marks	AO element	Guidance
	(c)	<p><b>Any two from:</b></p> <p>Idea that high-grade ores contain more metal than low-grade ores ✓</p> <p>1 (kg) of high-grade ore contains 0.03 (kg) of /3(%) copper ✓</p> <p>1 (kg) of low-grade ore contains 0.016 (kg) of /1.6(%) copper ✓</p>	2	2.2  3.2b	<p>ORA</p> <p><b>ALLOW</b> 500(kg) of high grade gives 15 (kg)</p> <p><b>ALLOW</b> 50(kg) of low grade gives 0.8 (kg)</p> <p><b>ALLOW</b> a valid numerical comparison e.g., there is 0.7 (kg) less in 50 (kg) of low grade (than high grade) for 2 marks</p>

Question	Answer	Marks	AO element	Guidance
14*	<p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p><b>Level 3 (5–6 marks)</b>  <b>Detailed description and explanation accurately using the tables to support ideas</b>            Describes a range of observations for the reaction of barium with cold water  <b>AND</b>            Describes the reactivity of barium using the tables accurately  <b>AND</b>            Explains the reactivity of barium using the tables accurately</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p><b>Level 2 (3–4 marks)</b>  <b>Clear description and analysis using some of the data from the tables to support idea(s)</b>            Describes an observation for the reaction of barium with cold water  <b>AND</b>            Describes the reactivity of barium with a partial explanation using the tables with some accuracy</p> <p><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p>	6	4 x 2.1 2 x 3.2a	<p><b>AO2.1 Apply knowledge and understanding of scientific ideas e.g.,</b></p> <p>Describes reactivity: Trends in observations</p> <ul style="list-style-type: none"> <li>• reactivity with cold water increases from Mg to Sr</li> <li>• reactivity increases down the group / Ba is more reactive than Sr</li> <li>• Ba would react more vigorously with cold water</li> <li>• more heat given off/more exothermic</li> </ul> <p>Explains reactivity:</p> <ul style="list-style-type: none"> <li>• energy required to form 2+ ions decreases from Mg to Sr</li> <li>• the ease of loss of electrons / oxidation increases (going down the group).</li> <li>• weaker attraction between nucleus and outer electrons</li> <li>• the idea that barium requires less energy to form a 2+ ion.</li> <li>• barium has more electrons/electron shells/ outer electrons further from nucleus</li> </ul> <p><b>AO3.2a Analyse information and ideas to make judgements</b>            Observations e.g.,</p> <ul style="list-style-type: none"> <li>• metal disappears <u>very</u> quickly</li> <li>• it fizzes <u>very</u> quickly</li> <li>• it forms a colourless solution</li> </ul>

Question	Answer	Marks	AO element	Guidance
	<p><b>Level 1 (1–2 marks)</b> <b>Basic description of observations for the reaction of barium with cold water</b> <b>OR</b> Basic description of the reactivity of barium</p> <p>Attempts to use data from the tables</p> <p><i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p><b>0 marks</b> <i>No response or no response worthy of credit.</i></p>			



Question		Answer	Marks	AO element	Guidance
15	(a)	Gains electron(s) ✓	1	1.1	<b>DO NOT ALLOW</b> molecules / compounds gain electron(s)
	(b)	$2\text{I}^- \rightarrow \text{I}_2 \checkmark + 2\text{e}^- \checkmark$	2	1.2 2.2	<b>ALLOW</b> multiples <b>DO NOT ALLOW</b> e for e <sup>-</sup> <b>DO NOT ALLOW</b> - 2e <sup>-</sup>
	(c)	Purple / violet ✓	1	1.1	<b>IGNORE</b> black
	(d)	<b>First check answer on answer line</b> <b>If answer = 2.6 (%) award marks</b>  (0.13 ÷ 5) x 100 ✓  = 2.6 (%) ✓	2	2 x 2.2	<b>ALLOW</b> 1 mark for $5 \div 0.13 \times 100 = 3846.15$ correctly rounded

Question		Answer	Marks	AO element	Guidance
16	(a)	$(\text{Fe}^{3+}(\text{aq}) + \text{SCN}^{-}(\text{aq})) \rightleftharpoons (\text{FeSCN}^{2+}(\text{aq}))$ ✓	1	1.1	<b>ALLOW</b> $\rightleftharpoons$ , $\rightleftharpoons$ <b>DO NOT ALLOW</b> $\longleftrightarrow$
	(b)	(i)	2	2 x 2.2	<b>ALLOW</b> $\pm \frac{1}{2}$ small square 3-4 points plotted correctly scores 1 mark
		(ii)	1	1.2	<b>ECF</b> from <b>b(i)</b>
		(iii)	2	2 x 3.2b	<b>ALLOW ECF</b> from <b>(b)(i)</b>  <b>ALLOW</b> rates of the forward and reverse reactions are equal <b>DO NOT ALLOW</b> reaction has stopped
	(c)	Idea that the equilibrium moves to reduce concentration of $\text{SCN}^{-}(\text{aq})$ ions / reactants ✓  Moves to forward reaction / right-hand side/products ✓	2	2 x 2.1	<b>IGNORE</b> to oppose change  <b>IGNORE</b> endothermic / exothermic
	(d)	Heat / warm the equilibrium mixture ✓ (Equilibrium mixture would move left) become lighter red / (more) yellow ✓  <b>OR</b>  Cool the equilibrium mixture ✓ (Equilibrium mixture would move right) become (darker) red / less yellow ✓	2	2 x 3.3a	<b>2nd mark is dependent on 1st mark</b> <b>ALLOW</b> increase temperature <b>ALLOW</b> lighter  <b>ALLOW</b> decrease temperature <b>ALLOW</b> darker  <b>ALLOW</b> change the temperature for a maximum of one mark

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