OCR
Oxford Cambridge and RSA

Foundation

GCSE

Combined Science Chemistry A Gateway Science

J250/04: Paper 4 (Foundation Tier)

General Certificate of Secondary Education

Mark Scheme for June 2024

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

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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 the 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 questions on this paper is **15**.

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

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

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	1.1	
2	B	1	1.1	
3	A	1	2.1	
4	B	1	1.2	
5	B	1	1.1	
6	A	1	2.2	
7	C	1	2.1	
8	C	1	2.1	
9	D	1	1.2	
10	D	1	1.2	

Question			Answer	Marks	AO element	Guidance
11	(a)	(i)	Filtration / filtering ✓	1	1.2	**ALLOW** filter
		(ii)	Only small amounts of water are produced. ☐ The experiment takes too long. ☐ The water may contain bacteria. ✓ The water may contain tiny particles of mud. ✓ ✓✓	2	2 x 3.1b	If 3 boxes ticked: 3 ticks and two correct = 1 mark 3 ticks and one correct = 0 marks
	(b)		B → **C** → E → **F** → **D** → A ✓✓	2	2 x 2.2	C before F = 1 mark F before D = 1 mark

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>12</td><td>(a)</td><td></td><td>
<table>
<tr><th></th><th>Group 1</th><th>Group 7</th><th>Group 0</th></tr>
<tr><td>They are non-metals.</td><td></td><td>✓</td><td>✓</td></tr>
<tr><td>They are soft solids.</td><td>✓</td><td></td><td></td></tr>
<tr><td>They form coloured gases.</td><td></td><td>✓</td><td></td></tr>
</table>
✓✓✓</td><td>3</td><td>3 x 1.1</td><td>1 mark for each correct row</td></tr>
<tr><td></td><td>(b)</td><td></td><td>
<table>
<tr><th>Group 1 element</th><th>Time for piece of metal to disappear (s)</th></tr>
<tr><td>potassium</td><td>4</td></tr>
<tr><td>lithium</td><td>21</td></tr>
<tr><td>sodium</td><td>12</td></tr>
</table>
✓✓</td><td>2</td><td>2 x 2.1</td><td>All 3 correct = 2 marks
Any 1 correct = 1 mark</td></tr>
<tr><td></td><td>(c)</td><td></td><td>
<table>
<tr><th>Group 7 element</th><th>Observation</th></tr>
<tr><td>bromine</td><td>The iron glows brightly.</td></tr>
<tr><td>chlorine</td><td>The iron glows very brightly.</td></tr>
<tr><td>iodine</td><td>The iron only glows slightly.</td></tr>
</table>
✓✓</td><td>2</td><td>2 x 2.1</td><td>All 3 correct = 2 marks
Any 1 correct = 1 mark</td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
	(d)	**(i)**	(The boiling points) increase ✓	**1**	**3.1a**	**ALLOW** (become) higher **/** become less negative / more positive
		(ii)	Between -175 and -225 °C ✓	**1**	**3.2a**	**ALLOW** -153 to -245 **NOTE** if answer line is blank check the table, but the answer line takes precedence

Question			Answer	Marks	AO element	Guidance
13	(a)		**First check answer on the answer line** **If answer = 77.75 (%) award 2 marks** 20.95 + 0.38 + 0.92 = 22.25 ✓ 100 – 22.25 = 77.75 ✓	**2**	**2 x 2.2**	**NOTE** If there is **no** working or writing then 77.8 scores 1 mark **ALLOW ECF** for incorrect addition if working shown
	(b)	**(i)**	Contains ⇌ sign ✓	**1**	**1.1**	**ALLOW** arrows going both ways / by the arrows / sign between hydrogen and ammonia / by the equilibrium sign / by the symbol used / arrows point forwards and backwards **IGNORE** reversible / two lines unqualified / equals sign unqualified / sign unqualified
		(ii)	ammonia → nitrogen + hydrogen ✓	**1**	**2.1**	**ALLOW** nitrogen + hydrogen in either order **ALLOW** ⇌ instead of → **ALLOW** nitrogen + hydrogen ← ammonia **DO NOT ALLOW** and or - in place of + If a symbol equation is given it must be fully balanced $N_2 + 3H_2 \rightarrow 2NH_3$
	(c)	**(i)**	All 4 points plotted correctly scores 2 marks ✓✓ **But** 2 or 3 points plotted correctly scores 1 mark ✓	**2**	**2 x 2.2**	**ALLOW** ±½ square

		(i)	Curved line of best fit drawn ✓	**1**	**1.2**	Curve within 1 square of **all** the points including the origin unless plotting is incorrect where best fit curve should be judged **IGNORE** line after 500 atmospheres **DO NOT ALLOW** feathery line / multiple lines / line drawn dot to do with a ruler / 1 square thick
	(d)	**(i)**	2 / two ✓	**1**	**2.1**	
		(ii)	Test: Idea of the use of universal indicator / pH meter ✓ Result: Idea that pH of acid rain is lower than normal rainwater ✓	**2**	**2 x 3.3a**	**ALLOW** pH probe / pH paper / pH indicator / pH strip **DO NOT ALLOW** other indicators for M1 **ALLOW** pH is lower / pH lower than 5 / pH value 3/4 **ALLOW** idea that universal indicator goes (more) orange/red in acid rain **IGNORE** universal indicator goes more yellow / higher acid level / more acidic / orange in (normal) rainwater **DO NOT ALLOW** in (normal) rainwater/acid rain universal indicator goes green / blue / purple

Question			Answer	Marks	AO element	Guidance
14	(a)		Crude oil is a **compound / feedstock / renewable resource** used by the petrochemical industry. ✓	1	1.1	
	(b)	(i)	(g) ☑ ✓ (l) ☐ (s) ☐	1	1.2	
		(ii)	**X** drawn at the top of the column ✓	1	1.2	**ALLOW X** anywhere above the petrol fraction level including the exit pipe **DO NOT ALLOW** X outside of the column or pipe
	(c)	(i)	R ✓	1	3.2b	**ALLOW** 36
		(ii)	Q ✓	1	3.2b	**ALLOW** 126
	(d)	(i)	$C_{10}H_{22}$ ✓	1	2.2	**ALLOW** $H_{22}C_{10}$ **DO NOT ALLOW** incorrect placements of subscripts e.g., C10H^{22} / h
		(ii)	Alkanes ✓	1	2.1	**IGNORE** hexane
		(iii)	C_nH_n ☐ CnH_{2n} ☑ ✓ $C_{2n}H_n$ ☐	1	3.2b	

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)** States that Experiment 1 has the greater rate with an accurate explanation of graphical information. **AND** Describes in detail the conditions and explains why Experiment 1 has the greater rate. *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)** States that Experiment 1 has the greater rate with clear explanation of graphical information or conditions. **AND** Some explanation on why Experiment 1 has the greater rate. **OR** States that Experiment 1 has the greater rate with some explanation of graphical information or conditions. **AND** Clear explanation on why Experiment 1 has the greater rate. **OR** States that Experiment 2 has the greater rate with a detailed and albeit inaccurate explanation.	**6**	**1.1 x 2** **2.1 x 2** **3.1a x 2**	Please refer to the Appendix at the end of this mark scheme for further guidance on how to mark this question. **AO3.1a Analyse information and ideas to interpret and evaluate** States and explains that Experiment 1 has the greater rate because e.g., • it has a steeper gradient • it produces carbon dioxide more quickly • it levels off / finishes earlier **AO2.1 Apply knowledge and understanding of scientific ideas** Describes why Experiment 1 has the greater rate because e.g., • it was carried out at a higher temperature • the concentration of acid was higher • the pieces of marble were smaller • a catalyst was used **AO1.1 Demonstrate knowledge and understanding of scientific ideas** Explains why Experiment 1 has the greater rate than Experiment 2 because e.g., • at a higher temperature the acid particles have more energy so collisions are more frequent / successful • at a higher concentration there are more acid particles so collisions are more frequent

			There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence. **Level 1 (1–2 marks)** States that Experiment 1 has the greater rate. **AND** Some explanation on why Experiment 1 has the greater rate than Experiment 2. **OR** States that Experiment 2 has the greater rate with some explanation of conditions or why experiment 2 has the greater rate *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.*			• smaller pieces of marble have a larger surface area • a catalyst lowers the activation energy

Question			Answer	Marks	AO element	Guidance
16	(a)		**Any one from:** Idea about the use of (raw) materials or energy ✓ Idea about environmental impact (of waste products or using product or pollution) ✓ Idea about lifespan of the product ✓ Idea about disposal / recycling of the product ✓ Ideas about sustainability ✓	1	1.1	**ALLOW** any valid reason for carrying out a life-cycle assessment **ALLOW** idea reducing impact of raw material and energy on environment e.g., use of mining to extract the ore / energy use of extracting ore / energy use purifying ore / using up finite resources / damaging habitats / felling trees **ALLOW** ideas about assessing efficiency **ALLOW** idea reducing impact of waste products on environment e.g. visual/noise pollution caused by mining /dust/ CO_2 from burning fossil fuels for energy / CO_2 causing enhanced greenhouse effect/global warming/climate change **ALLOW** ensures that as little waste as possible is created **ALLOW** idea about recycling being better than using raw materials / recycling reduces landfill **ALLOW** leaving resources for future generations **ALLOW** Idea of product being viable **IGNORE** cost

Question			Answer	Marks	AO element	Guidance
	(b)		**Any two from:** Idea that recycling conserves (raw) materials / (natural) resources ✓ Idea that recycling reduces environmental impact of mining ✓ Idea that recycling uses less energy ✓ Idea that recycling releases less named polluting substances into the environment ✓ Idea that less / no waste (products) /less (goes into) landfill ✓	**2**	**2 x 1.2**	**IGNORE** cost / saves the planet / helps environment / littering **ALLOW** reduce the need to extract finite resources/conserve finite resources **ALLOW** less fossil fuels used **ALLOW** less impact from mining on habitats / less removal trees / less visual/noise pollution e.g., carbon dioxide/greenhouse gases **ALLOW** reduces climate change / reduces global warming / less toxic waste
	(c)		**First check answer on the answer line** **If answer = 1400 (kg) award 3 marks** 7500 x $\frac{18}{100}$ ✓ = 1350 ✓ to **2** sig figs = 1400 ✓	**3**	**2 x 2.2** **1.2**	 **ECF** from M2 provided calculation shown
	(d)		**2**Al(OH)$_3$ ✓ **3**H$_2$O ✓	**2**	**2 x 2.2**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td></td><td>(e)</td><td>(i)</td><td colspan="4">There was an issue with this question and affected candidates' ability to answer it. To make sure all candidates were treated fairly, we have awarded the mark to all candidates for this question.</td></tr>
<tr><td></td><td></td><td></td><td>Aluminium oxide / Al_2O_3 loses oxygen ✓</td><td>1</td><td>3.1b</td><td>ALLOW aluminium ions / Al^{3+} gain electrons
IGNORE oxygen has been separated from aluminium
DO NOT ALLOW aluminium loses oxygen / gains electrons</td></tr>
<tr><td></td><td></td><td>(ii)</td><td><table><tr><th></th><th>True</th><th>False</th></tr><tr><td>Aluminium oxide is melted at a high temperature.</td><td>✓</td><td></td></tr><tr><td>The electrolysis produces impure aluminium.</td><td></td><td>✓</td></tr><tr><td>The electrolysis uses large amounts of electricity.</td><td>✓</td><td></td></tr></table>✓✓</td><td>2</td><td>2 x 1.2</td><td>All 3 correct = 2 marks
Any 1 or 2 correct = 1 mark</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>Aluminium is more reactive (than carbon) / ORA ✓</td><td>1</td><td>1.2</td><td>ALLOW aluminium is higher in the reactivity series (than carbon)
IGNORE unless a comparison of reactivity is given
DO NOT ALLOW aluminium oxide/it/oxygen is more reactive than carbon
IGNORE aluminium is very reactive</td></tr>
</table>

Appendix for Level of Response, Q15

Amplification of indicative material

Graphical comments

- Steeper curve / gradient for experiment 1
- Comparison of amounts of CO_2 at a given time / CO_2 given off more quickly for experiment 1
  IGNORE more CO_2 given off unqualified by time
- Reaction finishes earlier for experiment 1 / comparison of times for levelling off

Conditions for greater rate

- Higher T
- Higher concentration / more acid particles **IGNORE** more acid unqualified
- Smaller pieces of marble / higher surface area **IGNORE** more marble chips
- Catalyst / lower activation energy

Explanations of why the conditions result in a greater rate

- More collisions (condoned for L1 and L2) **IGNORE** faster collisions / slower collisions
- More frequent collisions
- More successful collisions
- Smaller pieces of marble have larger surface area
- Catalyst lowers AE
- Higher temperature particles have more KE / move faster

Amplification of level descriptors

Level 1
Experiment 1 or 2 has greater rate

- If experiment 1 is chosen / no choice, comments can be graphical or conditions or explanations.
- If experiment 2 is chosen, there are no graphical comments which are not contradictions, so comments must be conditions or explanations.

Level 2
Experiment 1 or 2 has greater rate

- If experiment 1 is chosen, answers need to address at least 2 from graphical / explanation / conditions to ensure they have matched their response to the AOs being assessed to meet Level 2 criteria.
- If experiment 2 is chosen, answers need to include explanation / conditions clearly linked and relevant to meet Level 2 criteria.

Level 3
Experiment 1 has greater rate

- Experiment 1 is chosen AND comments must include graphical and conditions and the explanation and these must be linked. If collisions are discussed, they must be more successful and/or more frequent.

To achieve Level 3: Ideas of Collisions must be more frequent / more successful collisions not just more collisions must be seen

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