OCR
Oxford Cambridge and RSA

Higher

GCSE

Combined Science Chemistry A Gateway Science

J250/10: Paper 10 (Higher 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. 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 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 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 **16**.

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

Question			Answer	Marks	AO element	Guidance
11	(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**A*l*(OH)$_3$ ✓ **3**H$_2$O ✓	**2**	**2 x 2.2**	

<table>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="3">Question</td><td>Answer</td><td>Marks</td><td>AO element</td><td>Guidance</td></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>

Question			Answer	Marks	AO element	Guidance
12			**Any four from:** The sun heats up the (muddy) water **/** metal tin ✓ Metal tin transfers heat (from sun) to (muddy) water ✓ The water evaporates ✓ (The water / vapour rises upwards and) touches the piece of glass ✓ The water vapour <u>cools</u> and condenses ✓ The curve of the glass means water (droplets) form at lowest point / water runs down (and drops into glass) ✓ Mud particles do not evaporate / are left behind (in metal tin) ✓	**4**	**4 x 2.2**	**ALLOW heat from sun causes water to evaporate for 2 marks for MP1 and 3** **ALLOW** idea liquid changes to vapour / gas **IGNORE** muddy water evaporates **ALLOW** gas (particles) touches piece of glass **IGNORE** muddy water **ALLOW** idea that vapour / gas <u>cools</u> and changes to liquid **IGNORE** steam **ALLOW** water vapour hits <u>cold</u> glass and condenses for 2 marks for MP4 and MP5

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>13</td><td>(a)</td><td></td><td>It's a naturally occurring finite resource. ☐
It's a source of environmentally friendly fuels. ☐
It's used to produce other chemicals. ☑ ✓</td><td>1</td><td>1.1</td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td>30 ✓</td><td>1</td><td>2.2</td><td>ALLOW answer anywhere but answer in table takes precedence</td></tr>
<tr><td></td><td>(c)</td><td></td><td><table><tr><th>Number of carbon atoms in the molecules</th><th>Name of fraction</th></tr><tr><td>1-4</td><td>X</td></tr><tr><td>5-11</td><td>U</td></tr><tr><td>12-14</td><td>Z</td></tr></table>✓✓</td><td>2</td><td>2 x 3.2b</td><td>All 3 correct = 2 marks
Any 1 or 2 correct = 1 mark</td></tr>
<tr><td></td><td>(d)</td><td></td><td>V ✓</td><td>1</td><td>2.1</td><td></td></tr>
<tr><td></td><td>(e)</td><td>(i)</td><td>C_nH_{2n+2} ✓</td><td>1</td><td>1.1</td><td>ALLOW $H_{2n+2}C_n$

DO NOT ALLOW superscripts e.g., CnH^{2n+2}</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>$C_{14}H_{30}$ ✓</td><td>1</td><td>2.1</td><td>ALLOW $H_{30}C_{14}$
ALLOW ECF from 13(e)(i) if C_{14} used
DO NOT ALLOW incorrect placement of subscripts e.g., $C14H^{30}$</td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
14	(a)		16.1 (°C) ✓	1	2.2	
	(b)		Magnesium Zinc Tin Iron ✓	1	2.2	
	(c)	(i)	Balance/scales	1	3.3b	**ALLOW** weighing scale **IGNORE** digital scale/scale
		(ii)	Temperature change lower than expected ✓ Less iron/metal available to react (with copper sulfate)✓	2	3.1b 1.1	**ALLOW** highest temperature lower than expected Answers must refer to idea of reacting **ALLOW** iron oxide / rust forms a barrier (so less reaction occurring)
	(d)		$Mg + Cu^{2+} \rightarrow \mathbf{Mg^{2+}} + \mathbf{Cu}$ ✓ ✓	2	2 x 2.1	**ALLOW** Mg^{2+} and Cu in either order **DO NOT ALLOW** incorrect placements of superscript e.g., Mg2+

Question			Answer	Marks	AO element	Guidance
15	(a)		0.04% ✓ 0.4% 4% ✓	1	1.1	
	(b)	(i)	As carbon dioxide emissions increase, carbon dioxide in atmosphere increases ✓ (Carbon dioxide) emissions have risen faster (than atmospheric carbon dioxide) in the last 100 years ✓	2	2 x 3.1a	**IGNORE** positive correlation **ALLOW** last 80 - 120 years
		(ii)	Idea that the rise in carbon dioxide emissions is due to an **increase** in use of fossil fuels ✓	1	1.1a	**ALLOW** ideas such as more industry / more people have (petrol/diesel) cars / higher population
	(c)	(i)	Carbon dioxide traps heat in atmosphere ✓ Increase in trapped heat increases (global) temperature ✓	2	2 x 1.1	**ALLOW** carbon dioxide absorbs infrared radiation/reemits absorbed heat **DO NOT ALLOW** ozone layer Answer must refer to both ideas of increasing **IGNORE** increases global warming
		(ii)	Reduce use of fossil fuels / use biofuels / use renewable energy sources / idea of carbon capture ✓	1	1.1	**ALLOW** answer based upon specific examples e.g., use more solar energy/walk rather than use cars **IGNORE** plant more trees/cut down less trees

Question			Answer	Marks	AO element	Guidance
16*	(a)		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)** Describes in detail the method used by the student **AND** Describes the variable the student changed **and** links this to the results from experiments 1 – 3 **AND** Describes in detail the variables the student controlled *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)** Reasonable description of the method used by the student **AND** Describes the variable the student changed from experiment 1 – 3 **AND** Describes a variable the student controlled *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.*	**6**	**2.2 x 4** **3.3a x 2**	**AO3.3a Analyse information and ideas to develop experimental procedures** Describes the method used by the student e.g.: • measure acid into a beaker / conical flask • measure temperature of acid • use magnesium pieces of same length • add magnesium to acid and start a timer • stop timer when all magnesium has disappeared / stopped fizzing **AO2.2 Apply knowledge and understanding of scientific enquiry, techniques and procedures** Describes the variable the student changed e.g.: • increased temperature from experiment 1 to 3 • increased concentration of acid from experiment 1 to 3 Describes the variables the student controlled e.g.: • same volume of acid • same concentration of acid if temperature changed • same temperature of acid if concentration changed

			Level 1 (1–2 marks) Limited description of the method used by the student **OR** Describes the variables the student changed from experiment 1 to 3 **OR** Describes variable(s) the student controlled *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.*			**ALLOW** answers based on only changing surface area or using a catalyst level 1 marks only for method and control variable points

Question			Answer	Marks	AO element	Guidance
17	(a)		(Diameter) increases going down (the group) / from lithium to potassium ✓ (Diameter increases / as go down group) number of energy levels/shells increases ✓	2	3.1a 1.1	 **ALLOW** outer electron in a higher energy level / further from the nucleus **IGNORE** more electrons
	(b)		$4.55 \times 10^{-10} - 5.5 \times 10^{-10}$ ✓	1	3.2a	
	(c)		Reactivity increases as diameter increases ✓ Outer electron/shell further from the nucleus (with increased diameter/reactivity) ✓ Less attraction from nucleus**/**protons (with increased diameter/reactivity) ✓ Loses electron(s) more easily (with increased diameter/reactivity) ✓	1 1 1 1	3.1a 1.1 1.1 1.1	**ORA** throughout **ALLOW** more energy levels/shells **ALLOW** outer electron in a higher energy level Answer must refer to idea of attraction **ALLOW** more shielding **DO NOT ALLOW** intermolecular forces **ALLOW** less pull between outer shell and nucleus**/**protons **IGNORE** less force **IGNORE** loses electrons faster MPs 2, 3 and 4 must be comparative

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