

OCR • GCSE COMBINED SCIENCE A (GATEWAY) J250

Chemistry — Higher Tier, Paper 2

June 2024 exam series

MARK SCHEME

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Higher

GCSE

Combined Science Chemistry A Gateway Science

J250/10: Paper 10 (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.

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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 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
	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	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/ CO₂ from burning fossil fuels for energy / CO₂ 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/conserves 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 $7500 \times \frac{18}{100}$ ✓ = 1350 ✓ to 2 sig figs = 1400 ✓	3	2 x 2.2 1.2	ECF from M2 provided calculation shown
	(d)	$2\text{Al}(\text{OH})_3$ ✓ $3\text{H}_2\text{O}$ ✓	2	2 x 2.2	

Question			Answer	Marks	AO element	Guidance												
	(e)	(i)	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.															
			<u>Aluminium oxide</u> / <u>Al₂O₃</u> loses oxygen ✓	1	3.1b	ALLOW <u>aluminium ions</u> / <u>Al³⁺</u> gain electrons IGNORE oxygen has been separated from aluminium DO NOT ALLOW aluminium loses oxygen / gains electrons												
		(ii)	<table><tr><td></td><td>True</td><td>False</td></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> ✓✓		True	False	Aluminium oxide is melted at a high temperature.	✓		The electrolysis produces impure aluminium.		✓	The electrolysis uses large amounts of electricity.	✓		2	2 x 1.2	All 3 correct = 2 marks Any 1 or 2 correct = 1 mark
	True	False																
Aluminium oxide is melted at a high temperature.	✓																	
The electrolysis produces impure aluminium.		✓																
The electrolysis uses large amounts of electricity.	✓																	
		(iii)	<u>Aluminium</u> is more reactive (than carbon) / ORA ✓	1	1.2	ALLOW <u>aluminium</u> 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												

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

Question			Answer	Marks	AO element	Guidance								
13	(a)		It's a naturally occurring finite resource. ☐ It's a source of environmentally friendly fuels. ☐ It's used to produce other chemicals. ☒ ✓	1	1.1									
	(b)		30 ✓	1	2.2	ALLOW answer anywhere but answer in table takes precedence								
	(c)		<table><tr><td>Number of carbon atoms in the molecules</td><td>Name of fraction</td></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> ✓✓	Number of carbon atoms in the molecules	Name of fraction	1-4	X	5-11	U	12-14	Z	2	2 x 3.2b	All 3 correct = 2 marks Any 1 or 2 correct = 1 mark
Number of carbon atoms in the molecules	Name of fraction													
1-4	X													
5-11	U													
12-14	Z													
	(d)		V ✓	1	2.1									
	(e)	(i)	C _n H _{2n+2} ✓	1	1.1	ALLOW H _{2n+2} C _n DO NOT ALLOW superscripts e.g., C _n H ²ⁿ⁺²								
		(ii)	C ₁₄ H ₃₀ ✓	1	2.1	ALLOW H ₃₀ C ₁₄ ALLOW ECF from 13(e)(i) if C ₁₄ used DO NOT ALLOW incorrect placement of subscripts e.g., C ₁₄ H ³⁰								

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 <u>lower</u> than expected ✓ Less iron/metal available to react (with copper sulfate)✓	2	3.1b 1.1	ALLOW highest temperature <u>lower</u> than expected Answers must refer to idea of reacting ALLOW iron oxide / rust forms a barrier (so less reaction occurring)
	(d)		$\text{Mg} + \text{Cu}^{2+} \rightarrow \underset{\checkmark}{\text{Mg}^{2+}} + \underset{\checkmark}{\text{Cu}}$	2	2 x 2.1	ALLOW Mg^{2+} and Cu in either order DO NOT ALLOW incorrect placements of superscript e.g., $\text{Mg}2+$

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 <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) 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 <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i>	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 <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 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
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Question			Answer	Marks	AO element	Guidance
17	(a)		(Diameter) increases going down (the group) / from <u>lithium to potassium</u> ✓	2	3.1a	
			(Diameter increases / as go down group) number of energy levels/shells increases ✓		1.1	ALLOW <u>outer</u> electron in a higher energy level / further from the nucleus IGNORE more electrons
	(b)		4.55×10^{-10} - 5.5×10^{-10} ✓	1	3.2a	
	(c)		Reactivity increases as diameter increases ✓	1	3.1a	ORA throughout
			<u>Outer</u> electron/shell further from the nucleus (with increased diameter/reactivity) ✓	1	1.1	ALLOW more energy levels/shells ALLOW <u>outer</u> electron in a higher energy level
			Less attraction from nucleus/protons (with increased diameter/reactivity) ✓	1	1.1	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
			Loses electron(s) more easily (with increased diameter/reactivity) ✓	1	1.1	IGNORE loses electrons faster MPs 2, 3 and 4 must be comparative

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