

OCR • GCSE CHEMISTRY J248

Higher Tier — Paper 4

June 2025 exam series

MARK SCHEME

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Higher

GCSE

Chemistry A Gateway Science

J248/04: Paper 4 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2025

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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 40% 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 and mark any responses using the annotations in section 11.
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 is not 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.**
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 **21(a)**

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).

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

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 Chemistry 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	D	1	2.2	
3	C	1	1.1	
4	C	1	1.1	
5	C	1	2.1	
6	A	1	1.1	
7	B	1	1.1	
8	C	1	1.1	
9	B	1	2.1	
10	C	1	1.1	
11	D	1	1.1	
12	A	1	2.2	
13	C	1	2.1	
14	A	1	2.1	
15	C	1	2.1	

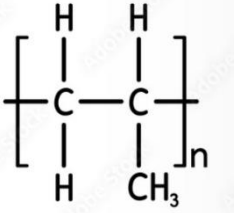
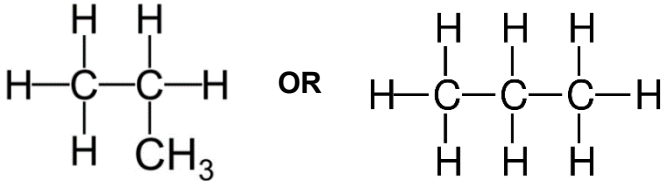
Question			Answer	Marks	AO element	Guidance
16	(a)		(Mistake) Delivery tube is in the (hydrochloric) acid / delivery tube should be above the (hydrochloric) acid ✓ (Problem) (hydrochloric) acid will travel up the (delivery) tube / no (hydrogen) gas will be collected ✓	2	2 × 3.3b	ALLOW solution, liquid, water or mixture for acid for MP1 & 2 BUT IGNORE reaction IGNORE delivery tube should be in the zinc IGNORE idea that gas syringe does not start at 0 cm³ ALLOW not all of the (hydrogen) gas will be collected / gas won't reach gas syringe
	(b)	(i)	First check the answer on the answer line If answer = 0.583 / 0.58 cm³/s or cm³s⁻¹ award 4 marks Volume of gas made between 0 s and 60 s = 35 cm³ ✓ Mean rate of reaction = 35 ÷ 60 ✓ = 0.583 ✓ (Unit) cm³/s or cm³ s⁻¹ ✓	4	3 × 2.2 1.2	ALLOW 0.6, BUT NOT 0.60 ALLOW ECF from incorrect volume of gas, but NOT from incorrect time, for MP2 ALLOW ECF Unit mark is independent of MP1, 2 & 3 IGNORE sec for s ALLOW correct answer in alternative units e.g. 5.8 × 10⁻⁴ dm³/s or 0.035 dm³/min

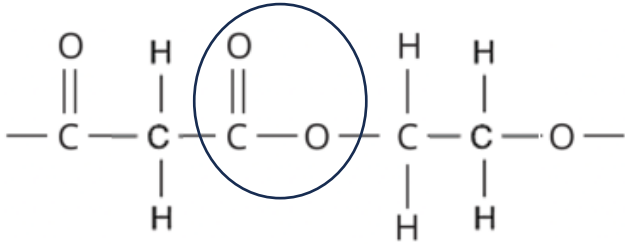
Question			Answer	Marks	AO element	Guidance
	(b)	(ii)	Curve starts at (0,0) but is steeper ✓ Levels off at 35 cm ³ ✓	2	2 × 2.2	
	(c)		Idea of more crowded particles / particles are closer together / more particles per unit volume ✓ Idea of more collisions per second / collisions more often / increased collision frequency / more chance of a collision ✓	2	2 × 1.2	ALLOW atoms/molecules/ions for particles ALLOW more particles in a given space/area IGNORE just more particles IGNORE just more collisions IGNORE faster collisions

Question			Answer	Marks	AO element	Guidance
17	(a)		Reaction is reversible / reaction can reach equilibrium ✓	1	1.1	ALLOW reaction goes both ways / reaction is at equilibrium
	(b)	(i)	Iron ☒ ✓ Manganese(IV) oxide ☐ Nickel ☐ Platinum ☐	1	1.1	
	(b)	(ii)	Provides an alternative (reaction) pathway ✓ With a lower activation energy ✓	2	2 × 1.1	ALLOW provides an alternative (energy) pathway
	(c)	(i)	A ☒ B ☐ C ☐ D ☐ ✓	1	3.2b	
	(c)	(ii)	First check the answer on the answer line If answer = 4.25 / 4.3 (kg) award 2 marks Mass of potassium = $\frac{17}{100} \times 25$ ✓ = 4.25 (kg) ✓	2	2 × 2.1	ALLOW ECF from incorrect percentage of potassium

Question			Answer	Marks	AO element	Guidance
	(c)	(iii)	Idea that larger amounts of fertiliser can be made / idea that process operates all the time or 24/7 / smaller number of workers needed / lower wage bill / idea of fewer shut-down periods ✓	1	1.1	ALLOW idea that supply (of fertiliser) will not run out as more is always being made IGNORE higher yield IGNORE fast(er) BUT ALLOW higher rate of production IGNORE cheaper

Question			Answer	Marks	AO element	Guidance
18	(a)		Any two from: Manufacture / AW ✓ Use / AW ✓ Transport / AW ✓ Disposal / AW ✓	2	2 × 1.1	
	(b)		Material: Polystyrene ✓ AND Any three from: Explanation Idea of (equal) <u>smallest</u> mass of raw materials ✓ Idea of <u>least</u> energy use (in manufacture) ✓ <u>Lowest</u> cost ✓ Idea that the percentage recycled is higher than poly(propene) / even though a greater percentage of aluminium is recycled ✓ OR Material: Aluminium ✓ AND Any three from: Explanation: Idea of (equal) <u>smallest</u> mass of raw materials ✓ Idea of <u>highest</u> percentage recycled ✓ Idea of not the highest energy use ✓ (Even though) cost per kg is the <u>highest</u> (for aluminium) ✓	4	4 × 3.2a	If poly(propene) chosen, 0 marks for question Explanation must be comparative IGNORE just values quoted from the table ALLOW <u>smaller</u> mass of raw materials ALLOW the percentage recycled is not the lowest ALLOW <u>smaller</u> mass of raw materials

Question	Answer	Marks	AO element	Guidance
(c)	 Only single bond(s) between C atoms (in place of C=C) ✓ Rest of structure correct ✓	2	2 × 2.1	ALLOW CH₃ group in any position ALLOW structure of CH₃ group correctly shown ALLOW square or round brackets ALLOW with or without 'n' ALLOW correct structure with more than one repeat unit, but must include brackets MP2 is dependent on MP1
(d)	 All single bonds ✓ Rest of structure correct ✓	2	2 × 2.1	ALLOW CH₃CH₂CH₃ or C₃H₈ for both marks MP2 is dependent on MP1

Question			Answer	Marks	AO element	Guidance
19	(a)		Molecule X – carboxylic acid / carboxyl ✓ Molecule Y – alcohol / hydroxyl ✓	2	2 × 1.1	IGNORE just carboxylic / acid ALLOW hydroxy DO NOT ALLOW hydroxide
	(b)		 ✓	1	1.1	
	(c)		Idea that nylon forms where solution A meets solution B / between the two solutions ✓ Idea that the nylon is removed by being picked up with a pair of tweezers ✓ and wrapped around a glass rod ✓	3	3 × 1.2	ALLOW stick/rod/pencil for glass rod
	(d)		HCl ✓	1	1.1	
	(e)		DNA / deoxyribonucleic acid ✓	1	1.1	ALLOW RNA

Question			Answer	Marks	AO element	Guidance
20	(a)	(i)	(Volumetric) pipette ✓	1	1.2	IGNORE dropping pipette / measuring cylinder / burette
	(a)	(ii)	phenolphthalein / methyl orange ✓ ✓	1	1.2	DO NOT ALLOW universal indicator / litmus ALLOW phonetic spelling of phenolphthalein
	(a)	(iii)	Swirl the (conical) flask while adding the acid / add the acid dropwise (near the end-point) / place the conical flask on a white tile / rinse the burette with sulfuric acid before filling ✓	1	3.3b	IGNORE idea of doing a rough titration
	(b)		24.7 <u>0</u> (cm ³) ✓	1	3.2b	
	(c)		(Choice of titrations used) Idea that the mean of titration numbers 2 to 5 only is calculated / titration 1 or 24.80 cm ³ is not included in the calculation ✓ (Reason for choice) (because) titration 1 or 24.80 cm ³ is an anomalous result or an outlier / titration 1 or 24.80 cm ³ is not concordant ✓	2	2 × 2.2	MP2 is dependent on MP1 ALLOW the mean is calculated using all the concordant values / ORA / the mean is calculated using the values within 0.10 cm ³ IGNORE titration 1 or 24.80 cm ³ is a rough titration

Question		Answer	Marks	AO element	Guidance
21	(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) Demonstrates detailed knowledge and understanding of scientific techniques and procedures to plan a series of experiments, and their results, to prove the identity of the white solid. <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) Demonstrates clear knowledge and understanding of scientific techniques and procedures to plan some experiments, and their results, to identify some types of ions. <i>There is a line of reasoning presented with some structure.</i> <i>The information presented is relevant and supported by some evidence.</i> Level 1 (1–2 marks) Demonstrates limited knowledge and understanding of scientific techniques and procedures to plan an experiment, and its results, to identify a type of ion. <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.	6	2 × 1.2 4 × 3.3a	AO1.2 Demonstrate knowledge and understanding of scientific techniques & procedures and AO3.3a Analyse information and ideas to develop experimental procedures Test for lithium / sodium ions • Flame test • Moisten splint with water, dip into solid, put in blue Bunsen flame OR use of nichrome wire cleaned with hydrochloric acid • A red flame indicates lithium ions / lithium bromide or lithium iodide • A yellow / orange flame indicates sodium ions / sodium bromide Test for halide (bromide / iodide) ions • Add a few drops of dilute nitric acid (and shake) • Add a few drops of silver nitrate solution • A cream precipitate indicates bromide ions / sodium bromide or lithium bromide • A yellow precipitate indicates iodide ions / lithium iodide Test for carbonate ions • Add dilute (nitric or hydrochloric) acid • If bubbling / fizzing is observed the solid is sodium carbonate

Question			Answer	Marks	AO element	Guidance
	(b)		Any two from: (More) sensitive / can analyse small(er) amounts ✓ (More) accurate ✓ Fast(er) / can run all the time ✓ ✓	2	2 × 1.1	ALLOW reliable IGNORE precise / avoids human error
	(c)	(i)	$\text{Cl}_2 + 2\text{LiBr} \rightarrow 2\text{LiCl} + \text{Br}_2$ Formulae ✓ Balancing ✓	2	2 × 2.2	ALLOW any correct multiple, including fractions DO NOT ALLOW and / & instead of '+' Balancing mark is dependent on the correct formulae but ALLOW 1 mark for a balanced equation with a minor error in subscripts / formulae e.g. $\text{CL}_2 + 2\text{LiBr} \rightarrow 2\text{LiCl} + \text{Br}_2$
	(c)	(ii)	Iodine is less reactive than bromine / iodine is a weaker oxidising agent / ORA ✓ So (iodine) cannot displace bromine (from lithium bromide) ✓	2	2 × 2.2	IGNORE iodine is less reactive than bromide ALLOW (iodine) cannot displace bromide (from lithium bromide)

Question			Answer	Marks	AO element	Guidance
	(b)	(ii)	Any four from: Advantages of phytoextraction: Phytoextraction is less expensive / uses less energy (to extract small amounts of copper) ✓ Plants remove carbon dioxide from the atmosphere as they grow / phytoextraction is carbon neutral / releases less CO₂ than heating copper ore in a furnace ✓ Plants can release energy when they burn / idea that energy can be used to generate electricity ✓ Requires less energy than heating copper ore in a furnace ✓ Conserves resources of high-grade ores ✓ Less noise / dust pollution (than traditional method) ✓ Idea of less destruction of habitats / idea of less damage to the landscape ✓ Does not release sulfur dioxide ✓ Disadvantages of phytoextraction: Takes a long time for plants to grow / it is a slow process ✓ Releases carbon dioxide into the atmosphere (when the plants burn) ✓ Low yield of copper ✓	4	4 × 3.1b	ALLOW ORA for quarrying and heating copper ore in a furnace throughout ALLOW idea that quarrying and heating copper ore in a furnace release lots of CO₂ IGNORE just idea of better for the environment

Question			Answer	Marks	AO element	Guidance
	(c)	(i)	(Metal oxide) loses oxygen ✓	1	2.1	Assume unqualified answer refers to metal oxide DO NOT ALLOW <u>metal X</u> loses oxygen BUT ALLOW metal X gains electrons IGNORE metal oxide gains electrons
	(c)	(ii)	$3 \times M_r \text{ of } \text{H}_2\text{O} = 3 \times 18 = 54 \checkmark$ $A_r \text{ of } \text{X} = 149.9 - 54 = 95.9 \checkmark$ X = Molybdenum / Mo ✓ OR $M_r \text{ of } \text{XO}_3 = 149.9 - 6 = 143.9 \checkmark$ $A_r \text{ of } \text{X} = 143.9 - 48 = 95.9 \checkmark$ X = Molybdenum / Mo ✓	3	2×2.1 $1 \times 3.2b$	ALLOW ECF from incorrect A_r of X

Question			Answer	Marks	AO element	Guidance
23	(a)		EITHER Idea of (increased population so) more energy required ✓ (so) more (fossil) fuels burned ✓ OR Idea of (increased population so) more farmland or land for housing / industry required ✓ (so) more deforestation ✓	2	2 × 1.1	ALLOW idea of more electricity required / more transport required / more manufacturing required ALLOW a named fossil fuel IGNORE answers in terms of increased population leading to more respiration
	(b)		Global warming or idea of increased greenhouse effect / climate change or extremes of weather or altered weather patterns / melting ice caps / rising sea levels / flooding / loss of habitats ✓	1	1.1	DO NOT ALLOW acid rain or references to the ozone layer
	(c)		First check the answer on the answer line If answer = 23 160 (dm³) award 2 marks Moles of CO ₂ = $\frac{\text{mass}}{M_r} = \frac{42\,460}{44} = 965$ ✓ Volume of CO ₂ = moles × 24 = 965 × 24 = 23 160 (dm ³) ✓	2	2 × 2.2	ALLOW ECF from incorrect moles of CO ₂

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