

GCE

Chemistry B

H433/03: Practical skills in chemistry

A Level

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 or the RM Assessor messaging system, or by email.
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 a tick 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).

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 e-mail.

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 are **1(e) and 4(b)**.

The only annotation on a level of response question should be the indication of the level.

A level annotation should be used where all marks for a level have been achieved e.g. a candidate has 6 marks, so they would have this annotation on their script:

L3

If a candidate has achieved 5 marks then they have reached Level 3 but with one mark omitted. They should have the following annotations on their scripts:

L3 **A**

The same principle should be applied to Level 2 and Level 1.

No marks (0) should have a cross: **✗**

Place the annotations alongside the mark for the question.

On additional pages, annotate using **SEEN**

11. Annotations

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

Annotation	Meaning
	Ignore
	Blank page

12. Subject Specific Marking Instructions

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.

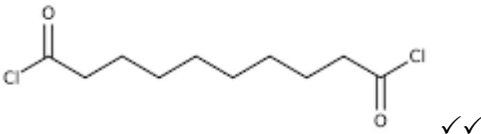
You should ensure that you have copies of these materials.

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.

Question			Answer	Marks	Guidance
1	(a)	(i)	Explanation: (Formation of) aqueous hydroxide ion (responsible for alkalinity) ✓ Equation: $\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca}^{2+} + 2\text{OH}^-$ ✓	2	Must mention 'aqueous' or 'in solution'/'in water'/dissolves IGNORE state symbols in equation for MP2 UNLESS aq used for OH^- (scores MP1 if not already gained)
		(ii)	Outermost/valance (2) electron(s) are in s (sub)shell/orbital ✓	1	ALLOW 'highest/final' subshell MUST mention electrons somewhere to score
1	(b)		FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 184 award 3 marks $E = 6.63 \times 10^{-34} \times 4.62 \times 10^{14} = 3.06 \times 10^{-19} \text{ (J)}$ ✓ Per mole above ans. $\times 6.02 \times 10^{23} = 1.84 \times 10^5 / 1000 = 184 \text{ (kJ mol}^{-1}\text{)}$ ✓ 3 sf ✓	3	Any calculated number to 3sf scores MP3
1	(c)	(i)	$\text{Ba}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{BaSO}_4(\text{s})$ ✓	1	BOTH equation and state symbols must be correct for mark.
		(ii)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = $1.0 \times 10^{-9} \text{ (mol dm}^{-3}\text{)}$ award 2 marks $[\text{Ba}^{2+}] = K_{\text{sp}}/[\text{SO}_4^{2-}]$ ✓ $[\text{Ba}^{2+}] = \frac{1.0 \times 10^{-10}}{0.1} = 1 \times 10^{-9} \text{ (mol dm}^{-3}\text{)}$ ✓	2	ALLOW 1 or more sf Second marking point subsumes first
1	(d)		Calcium delocalises two electrons to potassium's one (AW) ✓ Attraction of 2+ ion to delocalised electrons stronger than K^+ (AW) ✓	2	ALLOW MP1 Appropriate charges +2 and +1 MP2 Stronger attraction (of 2+) to <u>delocalised electrons/electrons</u> in lattice Any reference to ionic bonding scores 0

1	(e)*	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) There is some comment in all of the four areas in the Guidance, with good detail in at least two of the areas. <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) Some comment in three of the Guidance areas, which is mainly accurate with good detail in at least one. <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1–2 marks) There is some sensible comment on at least two of the Guidance areas. <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 Method <i>No response or no response worthy of credit.</i> Cannot be L3 unless some explanations about stability are given	6	The stem of the questions points students to discuss four areas in their outline of this investigation, namely... Method • Set up apparatus and heat one or two spatulas of a carbonate gently at first then more strongly • Observe any changes (if any) to lime water, noting time taken before changes • Repeat this procedure for other carbonates in the group NB observe formation of bubbles alone not sufficient for method or observations Observations • Lime water goes milky • More quickly for carbonates higher up group e.g. MgCO_3 Explanations • Quicker lime water goes cloudy, less thermally stable the carbonate • Smaller group 2 cation, more polarized carbonate ion becomes and easier to decompose • Cation size increases down group Health and safety • Remove tube from lime water when heating stopped to avoid 'suck-back' • Allow apparatus to cool before dismantling (apparatus gets very hot) IGNORE references to fume cupboards, gloves, eye protection.
		Total	17	

Question			Answer	Mark	Guidance
2	(a)	(i)	Nylon/polyamide 6,10 ✓	1	ALLOW numbers and text swapped
		(ii)		2	MP1 correct functional group MP2 correct skeletal structure i.e. 10 C in the zigzag ALLOW acyl chloride mark even if not skeletal, one or two structure of acyl chloride given as long as not CON ned
2	(b)		nylon - condensation ✓ polystyrene - addition ✓ Condensation involves loss of/makes a small molecule ✓ Addition has an unsaturated monomer/ monomers just add together/polymer formula is multiple of monomer formula ✓	4	Assume that if the polymers are not named the answer refers first to polystyrene and then nylon ALLOW loss of HCl or even loss HCl or H ₂ O but NOT H ₂ O on its own DO NOT ALLOW answers just saying double bond breaks and chain formed
2	(c)	(i)	Structure A suggests short and longer bonds (alternating) / bonds differ in length ✓ Actual benzene ring/ has all C-C bond lengths same ✓	2	DO NOT ALLOW irregular lengths
		(ii)	Delocalised electrons/electron density spread (evenly) around (ring)/molecular orbital/π orbital (AW) ✓ not attached to specific carbons/atoms/elements ✓	2	Sideways overlapping of p orbitals DO NOT ALLOW 'free to move throughout molecule' NB Can score 1 mark from diagram
2	(d)	(i)	1.Mixture of <u>conc</u> sulfuric and <u>conc.</u> nitric acid ✓ 2.Sn/ <u>conc</u> HCl ✓ 3.Sodium nitrite/nitrate(III) and (dil) nitric acid ✓	3	ALLOW only one acid concentrated. MP3. ALLOW nitrous acid/nitric(III) acid or HNO ₂ or HCl or H ₂ SO ₄ IGNORE conc in refence to the acid

Question			Answer	Mark	Guidance
		(ii)	Diazonium (ion) ✓	1	IGNORE compound
		(iii)	(Azo) dye ✓	1	
			Total	16	

Question			Answer	Mark	Guidance
3	(a)	(i)	More moles of product than reactants ✓	1	ALLOW more moles of gas on RHS/products
		(ii)	(Incorrect) $\Delta_{\text{total}}S$ must be positive ✓ Only works at higher temps ✓ If temperature too low entropy of surroundings more negative than $216 / \Delta_{\text{sys}}S$ (ora) OR $\Delta H/T$ must be smaller than $216 / \Delta_{\text{sys}}S$ (ora) ✓	3	FIRST CHECK FOR A CALCULATION OF 953.7K if found give 3 marks Calc of T(953.7K) gives zero S_{total} Calculation of temp. giving total entropy of zero and then comments on total entropy must be positive and therefore temp can't be less scores all three marks.
	(b)	(i)	FIRST CHECK ANSWER ON ANSWER LINE If answer = 0.310 award 4 marks If answer = 0.077 award.3 marks Mark units separately Eqm.concns: $\text{CO} = (3.20 - 0.488) \div 2 = 1.356$ ✓ $\text{H}_2 = (2.50 - 0.976) \div 2 = 0.762$ ✓ $K_c = \frac{[\text{CH}_3\text{OH}]}{[\text{CO}] [\text{H}_2]^2}$ ✓ $= \frac{0.244}{(1.356)(0.762)^2} = 0.31(0)$ ✓ units $\text{dm}^6 \text{mol}^{-2}$ ✓	5	ALLOW 2 or more sf ALLOW ecf If equation correctly used allow MP 3 <i>To</i> ALLOW any sig above 2 Mark units separately ALLOW ecf from MP3 ALLOW ecf on sig fig if expression is wrong
		(ii)	fewer moles (of gas) on R.H.S (ora) ✓ equm position moves to right on increasing pressure ✓ cost /safety/(increased risk of) explosion ✓	3	IGNORE '(more) dangerous'
		(iii)	Catalyst increases rate of forward and backward reactions ✓ by equal/same amount ✓	2	
			Total	12	

Question			Answer	Mark	Guidance
4	(a)		$5\text{IO}_4^- + 2\text{Mn}^{2+} + 3\text{H}_2\text{O} \rightarrow 5\text{IO}_3^- + 2\text{MnO}_4^- + 6\text{H}^+$ ✓✓	2	One mark for correct 'species' One mark for balancing the correct equation , allow multiples and fractions
4	(b)*		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) Makes all main points and most fine detail points <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) Makes most of main and detail points <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1–2 marks) There is some sensible comment on at least two of the main points with detail in at least one <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 Method <i>No response or no response worthy of credit.</i>	6	Indicative Scientific points <i>(fine detail in italics)</i> • use (100 cm³) volumetric flask • pour in solution • <i>use funnel and glass rod</i> • rinse (funnel, rod, beaker) • <i>use deionised/distilled water;</i> • make up to mark • <i>use wash bottle/dropper/ pipette near end</i> • stopper • invert/shake flask
	(c)		Complementary colour to purple ✓ Gives maximum/highest absorption ✓	2	ALLOW 'opposite' (colour wheel) DO NOT ALLOW higher/greater/more

Question			Answer	Mark	Guidance
	(d)		FIRST CHECK ANSWER ON ANSWER LINE If answer = 0.40/ 0.402% % award 3 marks. If answer = 0.4 award 2 marks. If answer = 4, 4.0 or 4.02 % award 1 mark From graph, concentration = $14.5 \times 10^{-5} \text{ mol dm}^{-3}$ ✓ $n = c \times v(0.1) = 14.5 \times 10^{-5} \times 0.1$ ✓ % in paperclip = $14.5 \times 10^{-6} \times 54.9 \times 100 / 0.198$ = 0.40 % ✓	3	ALLOW 2 or more sf AWARD 2 marks for 0.87 (Manganate molar mass error) ALLOW ecf NB accept any form e.g. $1.45 \times 10^{-4} \text{ mol dm}^{-3}$ NB if no score from value on answer line could get MP1 if units mol dm⁻³ provided
			Total	13	

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