GCE

Chemistry B

H433/03: Practical skills in chemistry

A Level

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.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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 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 posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to RM Assessor and mark the **required number** of practice responses ("scripts") and the **number of required** standardisation responses.

   YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

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. 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 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 **2(c)** and **3(b)**

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
I	Ignore
BP	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
I	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

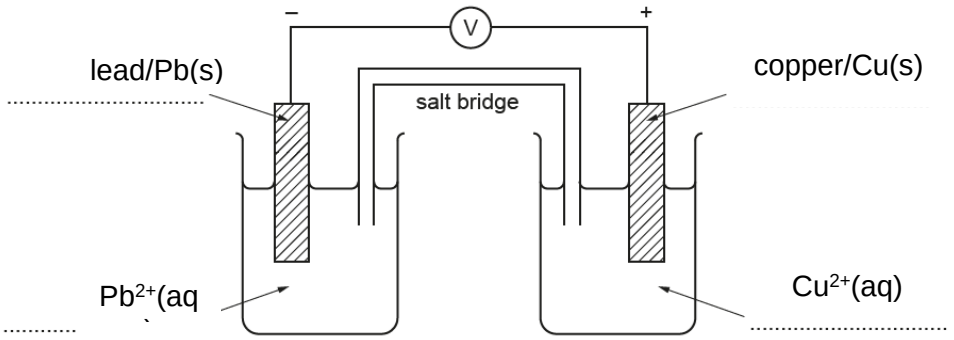
Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- 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)	Standard hydrogen electrode ✓	1	**ALLOW** standard hydrogen (half) cell **DO NOT ALLOW** SHE elctrode
		(ii)	(Conc ions/solutions) 1.0 mol dm^{-3} ✓ Temp 298K/25C ✓	2	**IGNORE** pressure **Allow** 1 molar solution NOT room temp but **ignore** if correct value give
	(b)	(i)	 ✓✓ see guidance	2	**MP1** must be correct metal in L & R half cell **MP2** correct ion associated with metal (even if metals wrong way round) or wrong metal used **and** correct charge and aq state. mark as ecf **ALLOW** half eqn as long as ion has (aq) state symbol
		(ii)	Use 'non-reacting/inert' electrolyte/salt e.g Potassium nitrate/sodium nitrate/ammonium nitrate either in tube or soaked on (filter) paper ✓	1	**Ignore** Chlorides/sulphates **Only allow the nitrates or general statement** shown in the answer column
		(iii)	0.47 (V) ✓	1	Do not need +ve but –ve is wrong
	(c)	(i)	Negative electrode $Zn \rightarrow Zn^{2+} + 2e^-$ ✓	3	**IGNORE** state symbols

Question			Answer	Marks	Guidance
			Positive $Ag_2O + H_2O + 2e^- \rightarrow 2Ag + 2OH^-$ ✓ Overall cell reaction $Zn + Ag_2O + H_2O \rightarrow Zn^{2+} + 2Ag + 2OH^-$ ✓ **Allow** $2Ag + Zn(OH)_2$ as alternative product representation		**ALLOW 1 mark** for correct half equations but at wrong electrode **ALLOW 1 mark for eqns all reversed (BOD)** Wrong metal/metal ions used score zero for that MP and MP3 (max 1 mark) No ecf
		(ii)	Act as a salt bridge **/to** allow diffusion/flow of ions/allows ions to pass/transfer/move through (AW) ✓	**1**	**Ignore** 'completes circuit'/prevents mixing **Reject electrons**
			Total	**11**	

Question			Answer	Mark	Guidance
2	(a)	(i)	Aromatic/arene ✓	1	
		(ii)	Ester(link) ✓	1	
	(b)		Add (neutral) iron (III) / ferric (chloride) ✓ purple colour ✓	2	

2	**(c)***		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 most of indicative scientific points from all potential reactions of both compounds as well as commenting on why aspirin to B cannot be made in one step *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)** Makes most of indicative scientific points from all potential reactions of both compounds *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)** Makes some points from one or both of compounds Small factual errors in a reaction can be regarded as errors of communication *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.*	**6**	**Indicative scientific discussion includes** **<u>Aspirin to B</u>** • *conc H_2SO_4 needed to form B* • *but will also hydrolyse ester* **<u>Reagents, conditions and products</u>** **Aspirin reaction:** **<u>Rn1.</u>** • to compound A by heating with **acid** • *other compound* ***CH_3COOH*** **Oil of wintergreen reactions** **<u>Rn2</u>** • to compound A by heating with **acid** • *other compound* ***CH_3OH*** **<u>Rn3</u>.** • to compound B by reacting with **ethanoic anhydride (not ethanoic acid) or ethanoyl chloride** • *other compound* ***CH_3COOH*** *(no other organic ignore HCl)* **<u>Type of reaction</u>** **Rn 1 and 2** hydrolysis **Rn 3** condensation

2	**(d)**	**(i)**	Any (sulfuric) acid/acidic impurities ✓ Effervescence/bubbling/fizzing ✓	**2**	Mark MP1 and 2 separately **NOT** 'gas' seen
		(ii)	Methanol / alcohol ✓ Water denser than ether/most dense layer **ORA**✓	**2**	Independent marks **Reject** 'heavier'
		(iii)	Evaporate solvent (ether) from top layer over (hot) water bath/electric heater ✓	**1**	**DO NOT ALLOW** Bunsen **Ignore** distillation (NBOD) **Ignore** boil (NBOD) **ALLOW** leave ether to evaporate (BOD)
	(e)		**FIRST CHECK ANSWER ON ANSWER LINE** **If pecentage = 92(…) award 3 marks** moles aspirin = 0.90/180 = 0.005 ✓ mass 0.005 moles of product = 0.005 x 152=0.76✓ % yield = 0.70/0.76 x 100 = 92% ✓	**3**	**ALLOW** 2 or more sf **ALLOW** ecfs **Alternative method:** mass of product = 0.90 x 180/152 = 0.76 % = 0.70/0.76 x 100 = 92(…) % MP1 correct M_r's MP2 correct evaluation (0.76) MP3 % calc. ecfs on wrong M_r **Molar alternative method** look for 0.0046/0.005
			Total	**18**	

Question			Answer	Mark	Guidance
3	(a)		$Cl_2 + 2e^- \rightarrow 2Cl^-$ ✓	1	**ALLOW** equilibrium or = sign **Ignore** any state symbols
	(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)** Species present causing a particular colour in wells **AND** Correctly explains, with at least two balanced redox equations any reactions taken place in particular wells **AND** Recognise pattern in oxidising ability of halogens *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)** Attempts all three scientific points but explanations may be incomplete. **OR** Explains two scientific points thoroughly with very few omissions. *e.g. Describes cause of colour **and identifies key reaction**. Key terminology used appropriately.* *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)** A simple explanation based on at least two of the main scientific points. **OR** Explains one scientific point thoroughly with few omissions *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.	6	Remember to check any diagrams for points which might add to complete answer. **Indicative scientific points may include, with bulleted detail…….** **Explanation of colours in wells** • Iodine present in any well will give blue black colour (complex with the starch) A3, B3, C1,2 and 3 • Bromine present gives pale orange A2, B1and2 • Chlorine present well colourless A1 **Identification appropriate redox reactions** • Any reactions taking place involves a particular halide ion being oxidised by another halogen • Reactions taking place in A3, A2, B3 • At least two appropriate balanced redox reactions given E.g. $Cl_2 + 2I^- \rightarrow I_2 + 2Cl^-$ $Br_2 + 2I^- \rightarrow I_2 + 2Br^-$ **Identification of pattern in reactions** • Both bromide and iodide ions oxidised to bromine and iodine respectively by chlorine(water/aq) • Iodide ion oxidised to iodine by bromine (water/aq)) • Chloride ion not oxidised by either bromine or iodine • Oxidising ability in order chlorine, bromine, iodine **NB**: question stem includes "adds four drops of different sodium halide solutions to columns **1**, **2** and **3**" but the diagram shows column **3** with the more common potassium iodide(aq) being added. Accept references to both NaI(aq) and KI(aq).

Question			Answer	Mark	Guidance
3	(c)		NaCl ionic/ionically bonded/(giant) ionic structure✓ strong (electrostatic) attractions <u>between cation/anion/ions</u> (AW) ✓ PCl_3 has simple molecular structure/covalent ✓ intermolecular forces (between molecules) relatively weak ✓ electrical conduction caused by ions acting as charge carriers in NaCl but no ions present in PCl_3✓	**5**	**ALLOW** correctly labelled diagram for relevant marking points Mp2 Allow any correctly named interactions e.g. id:id :pd;pd dipole:dipole London,van der Waals
3	(d)		**FIRST CHECK ANSWER ON ANSWER LINE** **If x = 76 award 4 marks, if x = <u>38</u> give 3 marks** Dead sea bromide conc.($moldm^{-3}$) = 5.1 ÷ 79.9 = **0.0638** ✓ 'Normal' bromide conc.($moldm^{-3}$).= 0.546 ÷ 650 = **0.00084**✓ **x** = 0.0638 ÷ 0,00084 = 75.9 ✓ 76 to 2 sig figs ✓	**4**	**ALLOW** ecf's from wrong concns **ALLOW 80** M_r of bromine MP3 for correct quotient value (ecf's on conc's) MP4 for sf, including ecf on MP3 **Must** have some working for the sig fig mark to be scored 76.0 scores 3
			Total	**16**	

Question			Answer	Mark	Guidance
4	(a)		Labelled axes (temp/^{0}C and time/min)✓ Appropriate scale ✓	2	Y axis starts at 13 or implied Check y axis is linear **don't allow** 
	(b)		endothermic ✓	1	
4	(c)	(i)	Follows warming curve back to initial addition ✓ Maximum temp change shown from initial addition to give 5.5±0.1^{o}C ✓	2	MP1 is the extrapolation of the warming line See dotted line on graph scan above 4.9±0.1^{o}C with no extension line scores MP2 **ALLOW** ecf **from student graph** MPs are independent
		(ii)	**FIRST CHECK ANSWER ON ANSWER LINE** **If energy = 24(.4…) (kJ mol^{-1}) award 2 marks** molar mass ammonium nitrate = 80 energy (absorbed) per mole = 2200 x 80/7.2 ✓ kJ mole^{-1} = (+)24(…) ✓	2	**ALLOW** 2 or more sf **ALLOW** ecf **Ignore** no sign but -ve is wrong
4	(d)	(i)	ΔH_1 = lattice enthalpy (of ammonium nitrate/ NH_4NO_3)✓ ΔH_2 = enthalpy change of hydration of the nitrate ion/NO_3^- ✓ ΔH_3 = enthalpy change of hydration of the ammonium ion/ NH_4^+ ✓	4	**ALLOW** $\Delta_{LE}H$ etc **See brackets**

Question			Answer	Mark	Guidance
			ΔH_4 enthalpy change of solution (of ammonium nitrate/ NH_4NO_3) ✓		
		(ii)	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = +26 award 2 marks** 647 – 314 – 307 ✓ = +26 ✓	**2**	**must have plus sign** 26 or -26 scores 1. **No ecf.** No mark for correct sign but wrong value
		(iii)	Breaking of <u>H-bonds</u> between water molecules to form ion-water/dipole bonds ✓ Formation of ion-water bonds gives out more energy / are stronger than bonds broken✓	**2**	Need to watch energy required to make bonds **CON** **Ignore** references to lattice enthalpy **Do not allow** generic more energy released from bond making than is absorbed in bond breaking. There has to be a comparison between bonds
			Total	**15**	

Need to get in touch?

If you ever have any questions about OCR qualifications or services (including administration, logistics and teaching) please feel free to get in touch with our customer support centre.

Call us on

01223 553998

Alternatively, you can email us on

support@ocr.org.uk

For more information visit

ocr.org.uk/qualifications/resource-finder

ocr.org.uk

Twitter/ocrexams

/ocrexams

/company/ocr

/ocrexams

CAMBRIDGE
UNIVERSITY PRESS & ASSESSMENT

OCR is part of Cambridge University Press & Assessment, a department of the University of Cambridge.

OCR operates academic and vocational qualifications regulated by Ofqual, Qualifications Wales and CCEA as listed in their qualifications registers including A Levels, GCSEs, Cambridge Technicals and Cambridge Nationals.

OCR provides resources to help you deliver our qualifications. These resources do not represent any particular teaching method we expect you to use. We update our resources regularly and aim to make sure content is accurate but please check the OCR website so that you have the most up-to-date version. OCR cannot be held responsible for any errors or omissions in these resources.

Though we make every effort to check our resources, there may be contradictions between published support and the specification, so it is important that you always use information in the latest specification. We indicate any specification changes within the document itself, change the version number and provide a summary of the changes. If you do notice a discrepancy between the specification and a resource, please contact us.

Whether you already offer OCR qualifications, are new to OCR or are thinking about switching, you can request more information using our Expression of Interest form.

Please get in touch if you want to discuss the accessibility of resources we offer to support you in delivering our qualifications.