

# Higher

**GCSE** 

**Chemisty B Twenty First Century Science** 

J258/01: Breadth in Chemistry (Foundation Tier)

General Certificate of Secondary Education

Mark Scheme for June 2023

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.

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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. 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 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.

There are no Level of response questions on this paper

# Annotations available in RM Assessor

Annotation	Meaning
<b>✓</b>	Correct response
X	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
Li	Level 1
L2	Level 2
L3	Level 3
NBOD	Benefit of doubt not given
SEEN	Noted but no credit given
I	Ignore

11. Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	Meaning
1	alternative and acceptable answers for the same marking point
<b>√</b>	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 Chemistry B:

	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.

	Question		Answer	Marks	AO element	Guidance	
1	(a)		Potable water ✓	1	1.1		
	(b)		Any two from: Distillation ✓ Water evaporated/boiled ✓ (Water vapour) then condensed ✓  OR  Any two from:	2	1.2	IGNORE 'distillation' with incorrect detail IGNORE 'water heated'	
			Membrane filtration ✓ Salty water forced through membrane at high pressure ✓ Water molecules pass but dissolved salts don't ✓			IGNORE 'filtration' unqualified	
	(c)	(i)	To kill micro-organisms/bacteria ✓	1	1.1	ALLOW 'remove bacteria' ALLOW sterilises the water IGNORE 'stop disease' [too vague]  Answer must be in terms of bacteria, microorganisms etc. [Allow germs]	
		(ii)	Toxic / poisonous ✓	1	1.1	BOD taste IGNORE 'harmful' [too vague] / Cost	

Question	Answer	Marks	AO element	Guidance
(iii)	chlorine  relights a glowing spill.  oxygen  turns blue litmus paper red then bleaches it  turns limewater milky	3	1.2	
	$\checkmark\checkmark\checkmark$			

	Question	Answer	Marks	AO element	Guidance
2	(a)	First check answer on answer line If answer = 0.02025/2.025 x 10 <sup>-2</sup> award 3 marks	3		<b>ALLOW</b> 0.02
		40.5/2 ✓ = 20.25 ✓		2.2 x 2	
		$= 20.25 \checkmark$ $(20.25 \div 1000) = 0.02025/2.025 \times 10^{-2} \checkmark$		1.2	ECF correct conversion of any stated mg to g
	(b)	Labelled suitable container containing labelled water  ✓  Labelled heat source below ✓	2	3.3a	IGNORE test tube as a container IGNORE clamps, gauzes etc IGNORE list of apparatus
	(c)	Calcium hydroxide ✓	1	2.2	
	(d)	(LHS) silver ✓	2	1.2	<b>ALLOW</b> ECF from another metal wrongly used for first mark repeated in second.
		(RHS) silver chloride <b>AND</b> nitrate ✓		2.2	·
	(e)	Any three from: Greater sensitivity /can detect very small amounts of a substance ✓ Greater accuracy ✓ Greater speed /Data automatically recorded ✓ Can identify different elements in mixtures ✓	3	1.2	IGNORE cost / safety ALLOW reliable as an extra point

	Question	Answer	Marks	AO element	Guidance
3	(a)	energy ✓	2	2.2	ALLOW them in either slot
		mining 🗸			
	(b)	First check answer on answer line If answer = 72(%) award 3 marks	3		
		168 x 100/232 ✓		2.2 x 2	
		= 72.41 ✓			
		= 72 (to 2 sf) ✓		1.2	ECF allow calculated answer to 2 sf.
	(c)		2	1.1	
		Rusting can be prevented physical barrier 🗸	]		
		Rusting is a form of corrosion.	]		
		Rusting is a reduction reaction	]		
		Rusting is caused by oxygen alone	-		
	(d)		2	1.1	
		Iron forms coloured compounds			
		Iron forms ions with more than one charge.			
		Iron has a low density			
		Iron has a low melting point			

	Question		Answer	Marks	AO element	Guidance
4	(a)		Zinc is below carbon and Aluminium is above carbon in the reactivity series ✓  (so) aluminium oxide cannot be <u>displaced</u> by carbon <b>ORA</b> ✓	2	1.2	ie links all three reactivities  MUST MENTION DISPLACEMENT
	(b)	(i)	Al³+ ions move to the positive electrode  Oxygen is also formed  The aluminium oxide is molten ions  move.  The negative electrode is made of steel	2	1.2	DO NOT ALLOW any other ticks – these contradict those already scored
		(ii)	gain ✓ atoms ✓	2	1.1	
	(c)	(i)	energy is needed to melt/decompose aluminium oxide / energy is needed to provide the electricity ✓	1	2.1	IGNORE cost IGNORE unqualified heating, must link to melting ALLOW difficult to break bonds / forces [so long as not in terms of molecular / intermolecular forces] ('Energy to separate atoms etc' not quite enough, we need why it needs that energy, i.e. forces.)
		(ii)	Solution will contain positive aluminium and positive hydrogen ions (which compete) / aluminium more reactive than hydrogen (more stable)   (and/so) hydrogen gas forms at the (cathode) (instead of aluminium metal)   /	2	3.1b	<b>ALLOW</b> discussion of hydrogen or H <sup>+</sup>

	Question			Ar	nswer				Marks	AO element	Guidance
5	(a)		Formula	Melting point	Does it conduct electricity when molten?	Does it conduct electricity when solid?	Struc	cture	4	2.1	Any two correct in melting point/conducting electricity columns = 1 mark All four correct in these columns = 2 marks
		Magnesium oxide	(MgO)	(high)	(yes)	no	(Giar	•			
		Magnesium	(Mg)	(high)	(yes)	<u>yes</u>	Meta	ıllic ✓			
		Silicon dioxide	(SiO <sub>2</sub> )	<u>high</u>	<u>no</u>	(no)	(gian				
			✓ ✓								
	(b)								2	2.1	Any two correct = 1 mark
							True	False			All correct = 2 marks
		Chlorine and silicon dioxide have atoms joined by shared pairs of electrons									
		Forces between	Forces between chlorine molecules are strong								
		Bonds between	en silicon ato	ms and oxyg	en atoms are s	trong	✓				
					<b>√</b> √						
	(c)								2	1.1	
				Particles that o	conduct electricity	/					
		Magnesium	oxide	lons ✓							
		Magnesium		Electrons 🗸	•						
			1								

	Question	Answer	Marks	AO element	Guidance
6	(a)		1	1.1	
		Greenhouse gases absorb infrared radiation.			
		Greenhouse gases emit infrared radiation in all directions.			
		The Earth emits infrared radiation.			
		The Sun warms the Earth. (1)			
		✓			
	(b)		3	1.1	Two correct = 1 mark Three correct = 2 marks
		True False			Four correct = 3 marks
		The proportion of greenhouse gases in the atmosphere has increased over the last 200 years			
		The greenhouse effect is only caused by carbon dioxide and methane			
		The Earth would be too hot to support life without the greenhouse effect			
		Most scientists think that recent climate change can be explained by increased greenhouse gas emissions ✓			

	Question		Answer		AO element	Guidance	
7	(a)		Nitrogen and oxygen in the air ✓ React at <u>high</u> temperature of the engine. ✓	2	1.1		
	(b)	(i)	carbon dioxide ✓ carbon monoxide has gained oxygen ✓	2	2.1	IGNORE 'nitrogen and carbon dioxide'  ALLOW carbon has gained oxygen	
		(ii)	Any two from: Catalytic converter doesn't remove ALL the gases (CO and NO) ✓  CO₂/carbon dioxide is formed / not removed (which is a greenhouse gas) ✓  Doesn't remove sulfur (dioxide) and/or other particulates ✓	2	3.1b		

(c) (i)	Any three from: Petrol engines produce more carbon monoxide than nitrogen monoxide ✓  Petrol engines produce 3 times more CO than NO ✓  More CO produced than NO even with catalytic converter ✓  A catalytic converter decreases the concentration of both gases ✓  Any correct calculation ✓	3	3.2b	Conclusions must go beyond statements about numbers from the graph, they must be in context 'the chart shows more CO than NO' = 0  IGNORE statements about 'nitrogen' or 'carbon', must be about the oxides.  References to gases refer to 'polluting gases' from the stem, so 'Less gas is produced using the converter' = 1 mark  'Petrol engines produce 3 times more CO than NO' as a stand-alone answer = 2 marks
(ii)	First check the answer on answer line If answer = 3/1 or 3 award 2 marks  840/280 ✓  = 3 / 1 or 3 ✓	2	2.2	
(d)	N₂O ✓	1	1.2	DO NOT ALLOW superscript

	Question		Answer	Marks	AO element	Guidance
8	(a)		O <sub>2</sub> ✓	2	1.1	
			<u>2</u> SO <sub>2</sub> <b>AND</b> <u>2</u> SO <sub>3</sub> ✓		2.2	
	(b)		Rate of forward reaction = rate of reverse reaction  The reaction stops when equilibrium is reached  The reaction stops when there is 100% SO <sub>2</sub> There will always be some SO <sub>2</sub> present at equilibrium	2	1.1	
	(c)	(i)	As the temperature rises, the percentage falls (AW, ORA) ✓	1	3.1a	ALLOW negative correlation ALLOW reversed causality answers
		(ii)	90 🗸	1	2.2	ALLOW 91
		(iii)	First check the answer on answer line If answer = 83±1 award 2 marks  Percentage converted 17±1 ✓	2	2.2	
			Percentage converted 17±1 ✔  Percentage remaining 100 – 17±1 = 83±1 ✔			ECF from percentage converted
		(iv)	First check the answer on answer line If answer = 50(%) award 3 marks	3	2.2	
			Rearrangement % = SO <sub>3</sub> x 80/SO <sub>2</sub> ✓			Mark point 1 will be scored if mark point 2 is correct.
			% = 20 x 80/32 ✓			
			= 50(%) <b>✓</b>			

	Question		Answer			Marks	AO element	Guidance
9	(a)		low boiling/melting point / does not conduct heat conductor / low density / colourless / o	• •			1.1	IGNORE non-metal / full outer shell ALLOW gas (at room temperature) / insulator
	(b)		Argon has a full outer shell / has 8 electrons has a stable electronic structure/arrangement.  Chlorine gains one electron (to give a full (continuous))	ent		2	2.1	IGNORE argon does not gain/lose electrons  IGNORE chlorine has 7 electrons in the outer shell alone / chlorine does not have a full outer shell / is missing an electron  DO NOT ALLOW chlorine loses or gains electrons  ALLOW chlorine needs to gain electrons
	(c)	(i)				2	3.2a	All 4 correct = 2 marks
				True	False			Any 2 correct = 1 mark
			<b>X</b> is a metal.	✓				
			<b>X</b> is in the first period of the Periodic Table.		<b>✓</b>			
			X forms X <sup>-</sup> ions.		<b>✓</b>			
			X loses one electron when it reacts.	✓				
			11					
		(ii)	Sodium / potassium ✓			1	3.2b	ALLOW rubidium / caesium /francium IGNORE hydrogen/ Group II IGNORE fluorine
	(d)		22 ✓			1	1.2	<b>ALLOW</b> 21.9

	Question		Answer	Marks	AO element	Guidance
10	(a)	(i)	H C O H	1	1.2	DO NOT ALLOW -OH
		(ii)	Methanoic acid ✓	1	1.1	
	(b)		1 - 6.9 🗸	1	1.1	ALLOW 0
	(c)	(i)	Carbon dioxide ✓	1	1.2	ALLOW CO <sub>2</sub> DO NOT ALLOW CO <sup>2</sup>
		(ii)	Ca(HCOO)₂ ✓	1	2.1	ALLOW correct formula in any attempt at an equation  ALLOW CaH <sub>2</sub> C <sub>2</sub> O <sub>4</sub> / Ca(HCO <sub>2</sub> ) <sub>2</sub> / Ca <sup>2+</sup> (HCOO <sup>-</sup> ) <sub>2</sub>
	(d)		Filtration/filter ✓  to remove calcium carbonate from the mixture ✓	2	3.3b	ALLOW filtration given in explanation but DO NOT ALLOW 'filter to remove crystals' (=0)  IGNORE to remove solids/insoluble solids/excess substances  Mark point 2 for identifying calcium carbonate as the impurity to be removed
	(e)	(i)	Evaporation/evaporate (AW) 🗸	1	1.2	IGNORE filtration / boiling / heating / crystallisation / put in an oven

(ii)	First check the answer on answer line If yield = 30(%) award 3 marks	3	2.2	
	20g of calcium carbonate gives 26g of calcium formate / actual yield for 10g is 3.9 g ✓			
	% = 7.8/26 x 100 or 3.9/13 x 100 ✓			
	= 30(%) <b>✓</b>			ALLOW (2) for 60 ALLOW (2) for 0.3 ALLOW (1) for 0.6

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