OCR
Oxford Cambridge and RSA

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.

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.

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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
✓	Correct response
✗	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
L1	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
/	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.

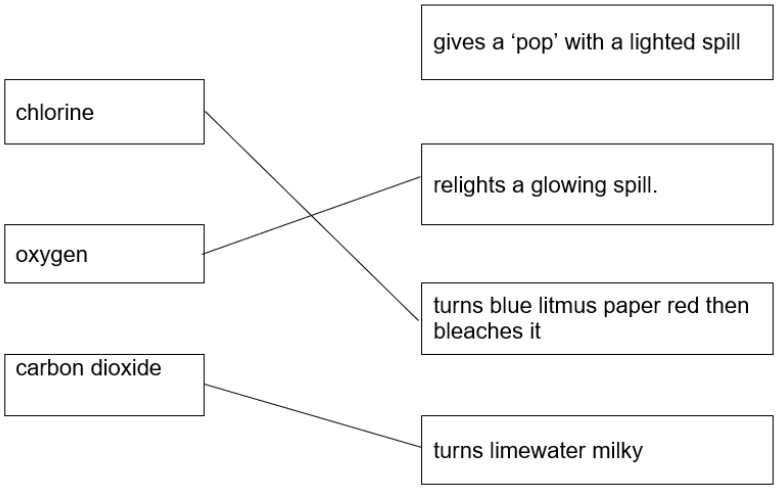
You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New 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 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:** Membrane filtration ✓ Salty water forced through membrane at high pressure ✓ Water molecules pass but dissolved salts don't ✓	2	1.2	**IGNORE** 'distillation' with incorrect detail **IGNORE** 'water heated' **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)	 ✓✓✓	3	1.2	

Question			Answer	Marks	AO element	Guidance
2	(a)		**First check answer on answer line** **If answer = 0.02025/2.025 x 10^{-2} award 3 marks** 40.5/2 ✓ = 20.25 ✓ (20.25 ÷ 1000) = 0.02025/2.025 x 10^{-2} ✓	**3**	 **2.2 x 2** **1.2**	**ALLOW** 0.02 **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 ✓ (RHS) silver chloride **AND** nitrate ✓	**2**	**1.2** **2.2**	**ALLOW** ECF from another metal wrongly used for first mark repeated in second.
	(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 ✓ mining ✓	2	2.2	**ALLOW** them in either slot
	(b)		**First check answer on answer line** **If answer = 72(%) award 3 marks** 168 x 100/232 ✓ = 72.41..... ✓ = 72 (to 2 sf) ✓	3	 2.2 x 2 1.2	 **ECF** allow calculated answer to 2 sf.
	(c)		Rusting can be prevented … physical barrier ✓ Rusting is a form of corrosion. ✓ Rusting is a reduction reaction Rusting is caused by oxygen alone 	2	1.1	
	(d)		Iron forms coloured compounds ✓ Iron forms ions with more than one charge. ✓ Iron has a low density Iron has a low melting point	2	1.1	

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 **ORA** ✓	2	1.2	ie links all three reactivities MUST MENTION DISPLACEMENT
	(b)	(i)	Al^{3+} 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	**ALLOW** discussion of hydrogen or H^+

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>5</td><td>(a)</td><td></td><td>
<table>
<tr><th></th><th>Formula</th><th>Melting point</th><th>Does it conduct electricity when molten?</th><th>Does it conduct electricity when solid?</th><th>Structure</th></tr>
<tr><td>Magnesium oxide</td><td>(MgO)</td><td>(high)</td><td>(yes)</td><td>no</td><td>(Giant) ionic ✓</td></tr>
<tr><td>Magnesium</td><td>(Mg)</td><td>(high)</td><td>(yes)</td><td>yes</td><td>Metallic ✓</td></tr>
<tr><td>Silicon dioxide</td><td>(SiO_2)</td><td>high</td><td>no</td><td>(no)</td><td>(giant covalent)</td></tr>
</table>
✓✓
</td><td>4</td><td>2.1</td><td>Any two correct in melting point/conducting electricity columns = 1 mark
All four correct in these columns = 2 marks</td></tr>
<tr><td></td><td>(b)</td><td></td><td>
<table>
<tr><th></th><th>True</th><th>False</th></tr>
<tr><td>Chlorine and silicon dioxide have atoms joined by shared pairs of electrons</td><td>✓</td><td></td></tr>
<tr><td>Forces between chlorine molecules are strong</td><td></td><td>✓</td></tr>
<tr><td>Bonds between silicon atoms and oxygen atoms are strong</td><td>✓</td><td></td></tr>
</table>
✓✓
</td><td>2</td><td>2.1</td><td>Any two correct = 1 mark
All correct = 2 marks</td></tr>
<tr><td></td><td>(c)</td><td></td><td>
<table>
<tr><th></th><th>Particles that conduct electricity</th></tr>
<tr><td>Magnesium oxide</td><td>Ions ✓</td></tr>
<tr><td>Magnesium</td><td>Electrons ✓</td></tr>
</table>
</td><td>2</td><td>1.1</td><td></td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>6</td><td>(a)</td><td></td><td>Greenhouse gases absorb infrared radiation. [3]
Greenhouse gases emit infrared radiation in all directions. [4]
The Earth emits infrared radiation. [2]
The Sun warms the Earth. [(1)]
✓</td><td>1</td><td>1.1</td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td><table><tr><th></th><th>True</th><th>False</th></tr><tr><td>The proportion of greenhouse gases in the atmosphere has increased over the last 200 years</td><td>✓</td><td></td></tr><tr><td>The greenhouse effect is only caused by carbon dioxide and methane</td><td></td><td>✓</td></tr><tr><td>The Earth would be too hot to support life without the greenhouse effect</td><td></td><td>✓</td></tr><tr><td>Most scientists think that recent climate change can be explained by increased greenhouse gas emissions</td><td>✓</td><td></td></tr></table>✓✓✓</td><td>3</td><td>1.1</td><td>Two correct = 1 mark
Three correct = 2 marks
Four correct = 3 marks</td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
7	(a)		Nitrogen and oxygen in the air ✓ React at high 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) ✓ CO_2/carbon dioxide is formed / not removed (which is a greenhouse gas) ✓ Doesn't remove sulfur (dioxide) and/or other particulates ✓	2	3.1b	

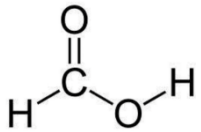
	(c)	**(i)**	**Any three from:** Petrol engines produce more carbon monoxide than nitrogen monoxide ✓ Petrol engines produce 3 times more CO than NO ✓ More CO produced than NO even with catalytic converter ✓ A catalytic converter decreases the concentration of both gases ✓ Any correct calculation ✓	**3**	**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)		N_2O ✓	**1**	**1.2**	**DO NOT ALLOW** superscript

	Question		Answer	Marks	AO element	Guidance
8	(a)		O_2 ✓ $\underline{2}SO_2$ **AND** $\underline{2}SO_3$ ✓	2	1.1 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_2 There will always be some SO_2 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 ✓ Percentage remaining 100 – 17±1 = 83±1 ✓	2	2.2	**ECF** from percentage converted
		(iv)	**First check the answer on answer line** **If answer = 50(%) award 3 marks** Rearrangement % = SO_3 x 80/SO_2 ✓ % = 20 x 80/32 ✓ = 50(%) ✓	3	2.2	Mark point 1 will be scored if mark point 2 is correct.

<table>
<tr><th></th><th>Question</th><th></th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>9</td><td>(a)</td><td></td><td>low boiling/melting point / does not conduct electricity / poor heat conductor / low density / colourless / odourless ✓</td><td>1</td><td>1.1</td><td>IGNORE non-metal / full outer shell
ALLOW gas (at room temperature) / insulator</td></tr>
<tr><td></td><td>(b)</td><td></td><td>Argon has a full outer shell / has 8 electrons in the outer shell / has a stable electronic structure/arrangement ✓

Chlorine gains one electron (to give a full (outer) shell) ✓</td><td>2</td><td>2.1</td><td>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</td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td><table><tr><th></th><th>True</th><th>False</th></tr><tr><td>X is a metal.</td><td>✓</td><td></td></tr><tr><td>X is in the first period of the Periodic Table.</td><td></td><td>✓</td></tr><tr><td>X forms X$^-$ ions.</td><td></td><td>✓</td></tr><tr><td>X loses one electron when it reacts.</td><td>✓</td><td></td></tr></table>✓✓</td><td>2</td><td>3.2a</td><td>All 4 correct = 2 marks
Any 2 correct = 1 mark</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Sodium / potassium ✓</td><td>1</td><td>3.2b</td><td>ALLOW rubidium / caesium /francium
IGNORE hydrogen/ Group II
IGNORE fluorine</td></tr>
<tr><td></td><td>(d)</td><td></td><td>22 ✓</td><td>1</td><td>1.2</td><td>ALLOW 21.9</td></tr>
</table>

	Question		Answer	Marks	AO element	Guidance
10	(a)	(i)	 ✓	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_2 **DO NOT ALLOW** CO^2
		(ii)	$Ca(HCOO)_2$ ✓	1	2.1	**ALLOW** correct formula in any attempt at an equation **ALLOW** $CaH_2C_2O_4$ / $Ca(HCO_2)_2$ / $Ca^{2+}(HCOO^-)_2$
	(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** 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(%) ✓	**3**	**2.2**	**ALLOW (2)** for 60 **ALLOW (2)** for 0.3 **ALLOW (1)** for 0.6

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