OCR
Oxford Cambridge and RSA

Higher

GCSE

Chemistry A (Gateway Science)

J248/02: Paper 2 (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.

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. Work crossed out:

   a. where a candidate crosses out an answer and provides an alternative response, the crossed-out response is not marked and gains no marks

   b. if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed-out answer and award marks appropriately.

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 read.

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).

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.

Level of response question on this paper is **Q22(c)**

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:

	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	A	1	1.2	
2	A	1	1.2	
3	C	1	1.2	
4	D	1	1.1	
5	B	1	1.1	
6	C	1	1.1	
7	C	1	1.1	
8	C	1	1.1	
9	B	1	1.1	
10	C	1	2.1	
11	B	1	1.1	
12	A	1	1.1	
13	A	1	2.2	
14	A	1	1.1	
15	B	1	2.1	

Question			Answer	Marks	AO element	Guidance
16	(a)		Reaction (with magnesium powder) takes less time (than with magnesium ribbon) / **AW** ✓ For a quoted experiment / for all experiments ✓	2	2 x 3.1b	Links result to some aspect of the experiment **ALLOW** both times quoted for the same run without saying which is greater **IGNORE** 'the table shows'
	(b)	(i)	Increases / speeds up / **AW** ✓	1	3.1a	**IGNORE** 'time decreases' – this is about rate
		(ii)	Idea that acid particles are more crowded / more particles in the same volume ✓ Idea of more collisions per second / collisions more often / increased collision frequency / more chance of a collision ✓	2	2 x 2.2	**ALLOW** 'more particles' **ALLOW** 'more acid' **ALLOW** this mark even if first point incorrect e.g., response is written about energy **IGNORE** references to 'faster' collisions **IGNORE** 'more collisions' or 'more successful collisions' without time inference
	(c)		Idea that the mass of the gas is too small (to measure accurately) ✓	1	3.3b	**IGNORE** 'won't be accurate' **IGNORE** 'gas won't weigh anything' **IGNORE** 'difficult to measure' without explaining why
	(d)		Lighted splint ✓ (Makes a squeaky) pop / squeaky pop test ✓	2	2 x 1.2	**ALLOW** 'flammable' for 1 mark **IGNORE '**splint test' If more than one test, list principle

	(e)		**First check the answer on answer line** **If answer = 0.003 (g) award 3 marks** M_r of H_2 = 2.0 ✓ Mass of H_2 = $\frac{2.0}{65.4}$ x 0.1 ✓ = 0.003 (g) ✓	**3**	**3 x 2.2**	

Question			Answer	Marks	AO element	Guidance
17	(a)		**Y** ✓ Because it does not conduct electricity ✓	**2**	**2 x 2.2**	
	(b)		**W** ✓ **AND** Low density / low melting point ✓	**2**	**2.1** **1.1**	 Second mark can only be awarded if first correct **ALLOW** 'low boiling point' instead of melting point
	(c)	**(i)**	**Any two from:** Group 1 metals have a lower density ✓ lower melting point ✓ lower boiling point ✓ are softer ✓ are less strong / hard-wearing ✓ Both Group 1 metals and transition metals conduct electricity ✓ **AND** Group 1 metals are more reactive ✓	**3**	 **2 x 2.1** **1.1**	Assume unqualified answer refers to Group 1 metals **ALLOW ORA** for transition metals **ALLOW** transition metals form coloured compounds / variable valency / catalysts **IGNORE** incorrect or uncertain statements for properties not on the list e.g., 'shinier' Must be a comparison between Group 1 and Transition metals, not an individual element **ALLOW ORA** for transition metals
	(c)	**(ii)**	Substance that speeds up a reaction ✓ (But) is not used up in the reaction / not chemically changed ✓	**2**	**2 x 1.1**	**ALLOW** speeds up reaction time **DO NOT ALLOW** doesn't take part in the reaction **IGNORE** slows down reaction, it's very much a lesser property. **IGNORE** activation energy arguments

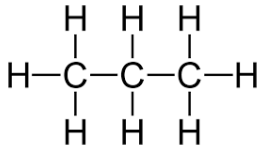
Question			Answer	Marks	AO element	Guidance
	(d)		(By reacting with) carbon✓ (Because carbon) is more reactive that iron / by displacement / **ORA** ✓	**2**	**2.1** **1.1**	 **ALLOW** only elements from the list
	(e)	**(i)**	$Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$ ✓	**1**	**2.1**	**ALLOW** any correct multiple, including fractions **DO NOT ALLOW** and / & instead of '+'
		(ii)	**First check the answer on answer line** **If answer = 71.1(%) award 3 marks** % yield = (am ÷ pm) x 100 **OR** $= \frac{5.4}{7.6} \times 100$ ✓ = 71.05263 (%) ✓ To 1 decimal place = 71.1 (%) ✓	**3**	**2 x 2.2** **1.2**	 **ALLOW ECF** for wrong answer to correct numbers **ALLOW** decimal place mark if an incorrect answer

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>18</td><td>(a)</td><td></td><td>$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

Formulae ✓
Balancing ✓</td><td>2</td><td>2 x 2.2</td><td>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., $C_3h_8 + 5O_2 \rightarrow 3Co_2 + 4H2O$</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>All points plotted correctly scores 2 marks ✓✓</td><td>2</td><td>2 x 2.1</td><td>ALLOW ± ½ square
3 or 4 points plotted correctly scores 1 mark

<table><tr><th>Alkane</th><th>Energy given out (kJ)</th></tr><tr><td>methane</td><td>55.6</td></tr><tr><td>ethane</td><td>52.6</td></tr><tr><td>propane</td><td>50.4</td></tr><tr><td>butane</td><td></td></tr><tr><td>pentane</td><td>48.7</td></tr><tr><td>hexane</td><td>48.4</td></tr></table></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Curve of best fit through the points ✓</td><td>1</td><td>2.1</td><td>ALLOW correctly drawn curve of best fit through incorrectly plotted points
ALLOW clumsy drawing, allow the line to miss an occasional point by a square or so. If 2 squares out, should be a clear reason. Beware smooth artistic curve which doesn’t represent what figures show.
DO NOT ALLOW straight line dot-to dot.</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>Answer ± 0.1kj of their own graph ✓</td><td>1</td><td>2.1</td><td></td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
		(iv)	Exothermic ✓	1	1.1	
	(c)		 ✓	1	1.1	
	(d)	(i)	**Any one from:** Greenhouse effect / global warming / climate change ✓ An effect of climate change e.g., rising sea levels / melting ice caps / increased flooding (in some areas) ✓ More extreme weather patterns / reduced pH of sea water ✓	1	1.1	**IGNORE** 'causes air pollution' **ALLOW** increase in temperature If more than one effect, list principle
		(ii)	Idea of using renewable energy sources / Reduce use of fossil fuels / Use of carbon capture (and storage) ✓	1	1.1	**ALLOW** named renewable energy source e.g., wind, wave, or solar power **ALLOW** plant more trees **IGNORE** use alternatives (must be specified) **IGNORE** reduce carbon emissions

Question			Answer	Marks	AO element	Guidance
19	(a)		(B) F C A G D (E) ✓✓✓✓	4	4 x 1.2	All 5 in correct order = 4 marks correct sequence of 4 letters = 3 marks correct sequence of 3 letters = 2 marks correct sequence of 2 letters = 1 mark Look for a run of letters, in sequence, even if something missing, e.g., D F C A G has 4 letters in sequence = 3 A F C G D has 4 letters in sequence with a gap = 3 F C A D G has 3 letters in sequence = 2 F C D A G has 2 letters in sequence = 1
	(b)	(i)	Neutralisation ✓	1	1.2	
		(ii)	**First check the answer on answer line** If answer = 76 / 76.47 / 76.5 (%) award 3 marks M_r of NaC*l* = 58.5 and H2O = 18.0 ✓ **OR** 58.5 and 76.5 atom economy = $\frac{58.5}{76.5}$ x 100 ✓ = 76.47 / 76.5 (%) ✓	3	3 x 2.2	**ALLOW ECF** from incorrect M_r **ALLOW** atom economy = $\frac{M_r \text{ of desired products}}{\text{sum of } M_r \text{ of all products}}$ x 100 ✓

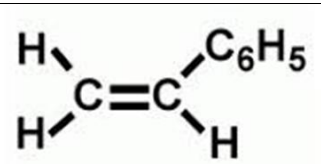
Question			Answer	Marks	AO element	Guidance
20	(a)		Nonane ✓ (Nonane has) the lowest boiling point as it is the smallest molecule ✓ Links position to Boiling Point / (column) temperature ✓	3	2.1 2 x 1.1	 Links Boiling Point to size – even if not nonane **IGNORE** 'low Boiling Point' unless linked to size 'More carbons and hydrogens' = size
	(b)	(i)	Ethene ✓	1	1.1	
		(ii)	C_nH_{2n+2} ✓	1	1.1	**ALLOW** CnH2n+2
	(c)	(i)	5 (%) ✓	1	2.2	
		(ii)	Idea that the supply of fuel oil is larger than the demand so there is unused fuel oil (that can be cracked to provide petrol) / Idea that the demand for diesel oil is higher than the supply so there isn't any spare diesel oil (that can be cracked to provide petrol) ✓	1	2.1	

Question			Answer	Marks	AO element	Guidance
21*			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)** Analyses the information to give a clear and detailed discussion of the environmental impacts of each container over its lifetime. **AND** Clear evaluation, that supports information from the table, of which container has the smallest environmental impact. *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)** Analyses the information to discuss the possible environmental impacts of each container, but there is limited detail. **AND** Clear evaluation of which container has the smallest environmental impact. *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)** Analyses the information to give a basic discussion of some of the environmental impacts of each container. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.*	6	6 x 3.2a	**AO3.1b Analyse ideas and information to evaluate** **Raw Materials & Manufacture** • the raw materials used to make plastic packets come from crude oil, which is a non-renewable resource • obtaining crude oil from the ground, fractional distillation, cracking and polymerisation requires a lot of energy • mining of aluminium uses up limited resources and damages the environment • extraction of aluminium by electrolysis uses a lot of energy • the energy in both manufacturing processes often comes from burning fossil fuels so causes the release of greenhouse gases **Use & disposal of the product** • both are usually single use which could increase the amount of waste sent to landfill however metal cans are easier to repurpose/upcycle • plastic packets are non-biodegradable so will stay in the environment for a long time if sent to landfill • plastic packets can be recycled, though it is harder to do so, and recycling uses only 10% of the energy needed to make the plastic from crude oil • metal cans are non-biodegradable so will stay in the environment for a long time if sent to landfill

Question			Answer	Marks	AO element	Guidance
			0 marks *No response or no response worthy of credit.*			• metal cans can be more easily recycled, and recycling uses only 5% of the energy needed to extract aluminium from aluminium ore • recycling reduces the use of valuable raw materials

Question			Answer	Marks	AO element	Guidance
22	(a)	(i)	Nitric acid ✓	1	3.3b	**ALLOW** HNO_3 **IGNORE** dilute / concentrated Name takes precedence over formula
		(ii)	Hydrochloric acid contains chloride ions / Cl^- ✓ Idea that these ions would give a precipitate (which would interfere with the test) ✓	2	2 x 3.3b	**IGNORE** chlorine ions **ALLOW** (hydrochloric acid) contains chlorine Mark independently
	(b)		Solution **A** = Bromide ✓ Solution **B** = Sulfate ✓	2	2 x 3.2b	**ALLOW** Br^- **DO NOT ALLOW** bromine **DO NOT ALLOW** silver bromide **ALLOW** SO_4^{2-} **DO NOT ALLOW** sulfur **DO NOT ALLOW** barium sulfate Name takes precedence over formula
	(c)		Cu^{2+} (aq) + $2OH^-$ (aq) $\rightarrow$ $Cu(OH)_2$ (s) Formulae ✓ Balancing ✓ State symbols ✓	3	3 x 2.2	**ALLOW** any correct multiple, including fractions **DO NOT ALLOW** and / & instead of '+' **DO NOT ALLOW** $Cu^{2+}(OH^-)_2$ 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., Cu^{2+} (aq) + $2Oh^-$ (aq) $\rightarrow$ $CU(OH)_2$ (s) Mark for state symbols dependent on correct species
		(d)	**First check the answer on answer line**	3		

Question	Answer	Marks	AO element	Guidance
	If answer = 0.53 (g) award 3 marks Conversion of cm^3 to dm^3: 25 ÷ 1000 = 0.025 dm^3 ✓ mass = concentration x volume = 21 x 0.025 = 0.525 (g) ✓ **OR** Conversion of g/dm^3 to g/cm^3: 21 g/dm^3 = 0.021 g/cm^3 ✓ mass = concentration x volume = 0.021 x 25 = 0.525 (g) ✓ 2 significant figures = 0.53 (g) ✓		**2 x 2.2** **1.2**	**ALLOW ECF** from incorrect volume 0.525 without working scores 2 marks **ALLOW ECF** if significant figures are correct from incorrect calculation of mass

Question			Answer	Marks	AO element	Guidance
23	(a)		B ✓ **Any two from:** Idea that (B) will not soften (when filled with a hot drink) ✓ Idea that (B) will hold its shape ✓ Idea that (B) will not melt (when filled with a hot drink) ✓ Idea that (B) is the strongest / stronger (than others) ✓	3	3 x 3.2a	**Mark is for a valid reason and not just for picking a property from the table** **IGNORE** (B) has a high softening temperature unless qualified **IGNORE** (B) has a high melting point unless qualified **ALLOW** (B) has a high tensile strength / is strong, if qualified **ALLOW** C with idea that (C) will not melt (when filled with a hot drink) for 1 mark only
	(b)		 Double bond between C atoms✓ Rest of structure correct ✓	2	2 x 2.1	**DO NOT ALLOW** multiple double bonds **ALLOW** C_6H_5 group in any position **ALLOW** bond from C to H of C_6H_5 group **IGNORE** any square brackets / n MP2 is dependent on MP1
	(c)		**Monomer** **Polymer**	2	2 x 1.1	All 3 correct = 2 marks

Question			Answer	Marks	AO element	Guidance
			amino acids — DNA nucleotides — proteins sugars — starch ✓✓			1 correct = 1 mark

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