OCR
Oxford Cambridge and RSA

Higher

GCSE

Chemistry A (Gateway Science)

J248/01: Paper 1 (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.

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 **19(a).**

11. 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

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**.

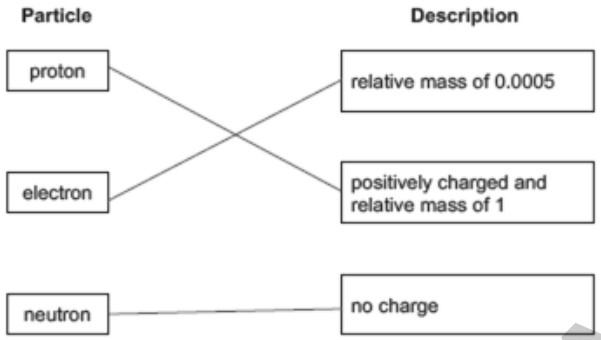
Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

The breakdown of Assessment Objectives for GCSE (9-1) in Chemistry A:

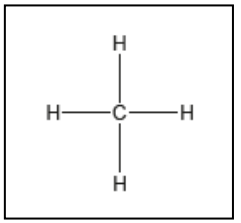
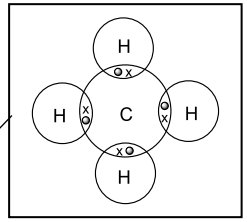
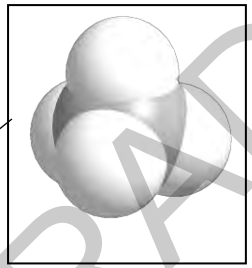
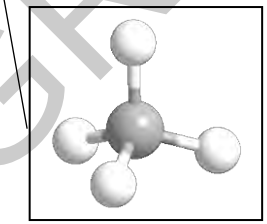
	Assessment Objective
AO1	**Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.**
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
AO2	**Apply knowledge 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	C	1	1.1	
2	B	1	2.1	
3	A	1	2.2	
4	B	1	1.1	
5	C	1	2.1	
6	C	1	1.1	
7	A	1	1.2	
8	B	1	1.1	
9	A	1	1.2	
10	C	1	2.2	
11	B	1	1.1	
12	B	1	2.1	
13	D	1	1.1	
14	D	1	2.1	
15	C	1	2.2	

Question			Answer	Marks	AO element	Guidance
16	(a)	(i)	B ✓	1	1.1	
		(ii)	Any value between -218 and -184 (°C) ✓	1	2.1	
		(iii)	A liquid becoming a solid is called **freezing**. ✓ In a solid, the particles move **less** ✓ than in a liquid. In a solid, the arrangement of particles is **less** ✓ random than in a liquid.	3	3 x 1.1	
	(b)		 ✓✓	2	2 x 1.1	Any one correct = one mark All three correct = two marks
	(c)	(i)	(Isotope) 3 ✓	1	2.1	
		(ii)	(Isotope) 1 ✓	1	2.1	
		(iii)	8 ✓	1	2.1	
	(d)		**First check the answer on answer line** **If answer = 0.204 (%) award 2 marks** 99.759 + 0.037 OR 99.796 ✓ 100 – 99.796 = 0.204 ✓	2	2 x 2.1	

Question			Answer	Marks	AO element	Guidance
17	(a)	(i)	Idea that (a pure substance) is a single element or compound / Idea that (a pure substance) only contains one element or compound ✓	1	1.1	**IGNORE** has no other substance in it **IGNORE** is not mixed with any other substance
		(ii)	(The melting points) are sharp / idea that (the painkillers) do not melt over a range of temperatures ✓	1	2.2	**ALLOW** definite melting point/one melting point/set mpt / specific mpt / exact mpt **IGNORE** look up data
	(b)		2 ✓	1	2.2	
	(c)	(i)	**First check the answer on answer line** **If answer = 0.69 ± 0.01 award 3 marks** Rf = 5.5 (cm) / 8.0 (cm) ✓ Rf = 0.6875 ✓ **significant figures** Rf = 0.69 ✓	3	3 x 2.2	**ALLOW** distance moved by substance = 5.4 – 5.6 (cm) **ALLOW ECF** for significant figure mark
		(ii)	Mobile phase ✓ Stationary phase ✓	2	2 x 1.2	**ALLOW** paper
	(d)		**Any two from:** Idea that it could have more than two **spots** ✓ It depends on how many i**mpurities** are in the painkiller ✓ Could have one spot if R_f of impurity has same R_f as painkiller ✓	2	2 x 3.1b	**ALLOW** may contain many spots **ALLOW** may contain more than 2/many/multiple impurities / don't know how many impurities **ALLOW** 2 or more spots can merge into one spot

Question			Answer	Marks	AO element	Guidance
18	(a)		Ball and stick model Dot and cross diagram 3D Space filling model     ✓✓✓	3	3 x 1.2	

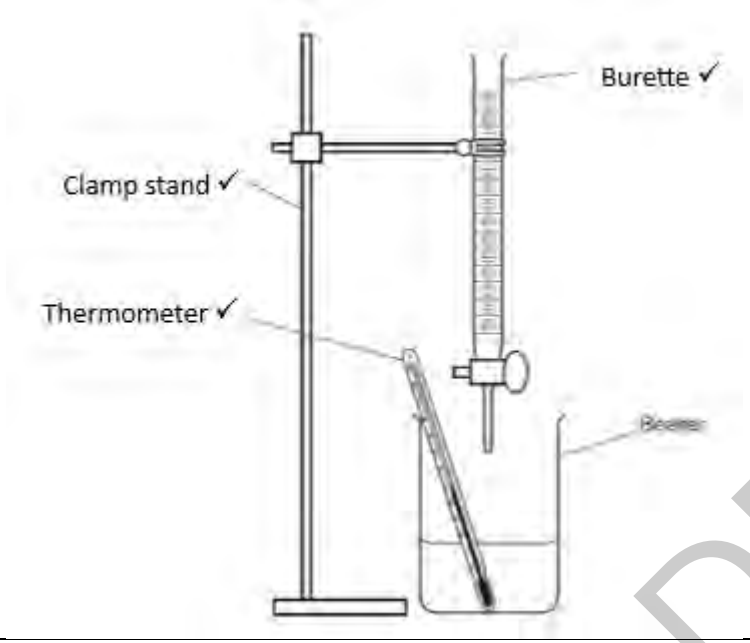
Question			Answer	Marks	AO element	Guidance
	(b)		Electrons can be seen in the bonds/shared electrons in Model 1 / **ORA** ✓ The lone pairs of electrons/unshared electrons can also be seen in Model 1 ✓	**2**	**2 x 3.1b**	If no marks scored **ALLOW** for 1 mark Model 1 shows the number of electrons(in the outer shells)
	(c)	(i)	C_4H_9 ✓	**1**	**2.2**	**DO NOT ALLOW** superscripts
		(ii)	**First check the answer on answer line** **If answer = 114 award 3 marks** (Mass of carbon =) 8 x 12 = 96 ✓ (Mass of hydrogen =) 18 x 1 = 18 ✓ 96 + 18 = 114 ✓	**3**	**3 x 2.1**	**ALLOW ECF** on the mass of carbon and the mass of hydrogen
	(d)	(i)	1.2 (nm) ✓	**1**	**1.2**	
		(ii)	The nanotubes are only bonded by strong (covalent) bonds (which is why the nanotube is strong) ✓ Graphite has weak forces of attraction between the layers/forces between the layers are easily broken (therefore, it is not as strong) ✓	**2**	**2 x 1.1**	**ALLOW all** bonds are strong /**all** the carbon atoms are bonded together **DO NOT ALLOW** stronger intermolecular forces in graphene **ALLOW** the layers in graphite can slide **IGNORE** intermolecular in graphite
		(iii)	**First check the answer on answer line** **If answer = 5 award 2 marks** $1.2 \times 10^{-9} \div 2.4 \times 10^{-10}$ ✓ = 5 ✓	**2**	**2 x 2.1**	

Question			Answer	Marks	AO element	Guidance
19	(a)*		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)** Applies detailed knowledge and understanding to describe the types of bonding and accurately links this to compare the melting points. **AND** Predicts that bromine has the lowest melting point *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)** Applies some knowledge and understanding to describe the types of bonding. Basic comparison made. **AND** Predicts that bromine has the lowest melting point *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)** Attempts to apply knowledge and understanding to describe the types of bonding. Limited or no comparison made. **OR** Predicts that bromine has the lowest melting point.	**6**	**4 x 2.1** **2 x 3.2b**	**AO2.1 Apply knowledge and understanding of scientific ideas** • Ionic bonds / electrostatic forces in NaCl are very strong • Ionic bonds / electrostatic forces in NaCl require a lot of energy to break • Covalent bonds in diamond are very strong • Diamond has many strong covalent bonds • Covalent bonds in diamond require a lot of energy to break • Intermolecular forces in Br_2 are weak • Intermolecular forces in Br_2 require less energy to break **AO3.2b Analyse information to make judgements and draw conclusions** • Bromine has the lowest melting point • Sodium chloride has a higher melting point than bromine • Diamond has a higher melting point than bromine

Question			Answer	Marks	AO element	Guidance
			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.*			
	(b)	**(i)**	A metal alloy has different sized atoms **ORA** ✓ The atoms/ions/particles of the same size can slide over each other more easily **ORA** ✓	**2**	**2 x 1.1**	**ALLOW** different sized particles/ions **IGNORE** has large/giant particles **DO NOT ALLOW** molecules for M1 only **DO NOT ALLOW** different sized elements for M1 only **ALLOW** different sized atoms/ions/particles makes it harder for layers/atoms/ions/particles to slide
		(ii)	Alloy 2 ✓ **Any two from:** It is non-toxic ✓ It has a low/medium density ✓ It is strong ✓	**3**	**3 x 3.2a**	**ALLOW** reverse arguments for why alloys 1 and 3 are not selected **ALLOW** not too dense **ALLOW** it has high tensile strength / doesn't break easily / can support more weight

Question			Answer	Marks	AO element	Guidance
20	(a)		4 ➡ 3 ➡ 1 ➡ 5 ✓✓✓	3	3 x 3.3a	4 first ✓ 3 and 1 ✓ 5 last ✓
	(b)		Chlorine forms negative ions. ✓ Chlorine has 3 electrons in its outer shell. ☐ Chlorine has 7 electron shells. ☐ Chlorine has 7 electrons. ☐ Chlorine is a metal. ☐ Chlorine is a non-metal. ✓ ✓✓	2	2 x 2.1	
	(c)	(i)	12.5 ✓	1	2.2	**ALLOW** values between 11.0 and 14.0
		(ii)	The more copper is formed, the more oxygen is formed / **ORA** ✓	1	3.1a	**IGNORE** proportional
	(d)		Ionic ✓	1	1.2	
	(e)		Make sure the electrode is dry / remove the solution from the electrode ✓ Remove the wire/crocodile clip from the electrode ✓	2	2 x 3.3b	**ALLOW** leave to dry before weighing **ALLOW** there is water/solution on the electrode **IGNORE** excess **ALLOW** the wire/crocodile clip are on the electrode/scale/balance **ALLOW** take the mass of the wire/clip away from the mass **ALLOW** weigh only the electrode

Question			Answer	Marks	AO element	Guidance
21	(a)		A reaction between an acid and an alkali is neutralisation. ✓ Acids form OH^- ions in solution. Alkalis have a pH of less than 7. Sodium hydroxide, NaOH, is an example of an acid. ✓	1	1.1	
	(b)	(i)	**First check the answer on answer line** **If answer = 4.35 award 3 marks** 4.37 + 4.31 + 4.38 / 13.06 ✓ 13.06 / 3 = 4.3533… ✓ **3 significant figures:** = 4.35 ✓	3 1.2 1.2 2.1	 **DO NOT ALLOW** 4.37 + 4.38 only **ALLOW ECF** from incorrect total mass **ALLOW ECF** for significant figure mark
		(ii)	H_2O (l) CO_2 (g) Correct formulae ✓ State symbols ✓	2 2.1 1.1	**ALLOW** H_2O (l) or CO_2 (g) for 1 mark if both formulae and state symbols not correct Mark for state symbol dependent on correct formulae
		(iii)	Filtration ✓	1	1.2	**ALLOW** filter **DO NOT ALLOW** sieving
		(iv)	Crystallisation ✓	1	1.2	**ALLOW** evaporation **ALLOW** heat it (so the solvent evaporates) **IGNORE** (simple) distillation

Question			Answer	Marks	AO element	Guidance
22	(a)	(i)		3	3 x 1.2	**ALLOW** retort stand / stand **IGNORE** just clamp
		(ii)	**Any one from:** Use a polystyrene cup (instead of a beaker) / put a lid / covering on the beaker (to keep heat in) / insulate (the outside of) the beaker ✓ Use a digital thermometer / data logger (to measure the temperature) ✓	1	3.3b	**IGNORE** seal the beaker **ALLOW** idea of clamping or holding the thermometer in the middle of the solution / don't let thermometer touch the beaker **ALLOW** stir the solution

<table>
<tr>
<td></td><td>(b)</td><td>(i)</td>
<td>Linear scale on both axes ✓

Points plotted correctly ✓
<table>
<tr><th>Volume of acid (cm^3)</th><th>Temperature (°C)</th></tr>
<tr><td>0</td><td>18</td></tr>
<tr><td>5</td><td>20</td></tr>
<tr><td>10</td><td>23</td></tr>
<tr><td>15</td><td>26</td></tr>
<tr><td>20</td><td>27</td></tr>
<tr><td>25</td><td>26</td></tr>
<tr><td>30</td><td>24</td></tr>
</table>
</td>
<td>2</td><td>2 x 2.2</td>
<td>x-axis must begin from 0

ALLOW ±½ small square
ALLOW bar chart or histogram
MP2 is dependent on MP1

IGNORE any line of best fit</td>
</tr>
<tr>
<td></td><td></td><td>(ii)</td>
<td>(As the acid is added) the temperature increases ✓

Idea that after 20 cm^3 (of acid is added) / after the reaction is complete, the temperature decreases ✓</td>
<td>2</td><td>2 x 3.1a</td>
<td></td>
</tr>
<tr>
<td></td><td></td><td>(iii)</td>
<td>The temperature increases ✓</td>
<td>1</td><td>2.1</td>
<td>ALLOW the reaction gets hotter
IGNORE idea that energy / heat is released</td>
</tr>
<tr>
<td></td><td>(c)</td><td></td>
<td>Idea of the (minimum) amount of energy needed for a reaction to occur ✓</td>
<td>1</td><td>1.1</td>
<td>ALLOW idea of the (minimum) amount of energy for a successful collision (to occur)</td>
</tr>
</table>

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